Hells Canyon Complex
FERC No. 1971
License Application

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Hells Canyon Complex
FERC No. 1971
License Application

Initial Statement

UNITED STATES OF AMERICA

BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

IDAHO POWER COMPANY

HELLS CANYON COMPLEX
FERC Project No. 1971

APPLICATION FOR NEW LICENSE FOR MAJOR PROJECT—

EXISTING DAM

INITIAL STATEMENT

1. Idaho Power Company (the Applicant) will apply to the Federal Energy Regulatory Commission (FERC) for a new license for the Hells Canyon Complex[1] on or before July 31, 2003, as described in the attached exhibits. The project is currently designated as FERC Project No. 1971. The existing FERC license expires on July 31, 2005.

2. The location of the project is

States:	Idaho and Oregon
Counties:	In Idaho, Adams and Washington counties
	In Oregon, Wallowa, Malheur, and Baker counties
Nearby Towns:	Cambridge, Idaho, and Halfway, Oregon
Stream:	Snake River

3. The exact name, business address, and telephone number of the Applicant are

Idaho Power Company
1221 W. Idaho Street
P.O. Box 70
Boise, ID 83707
Telephone: (208) 388-2676

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

The exact name and business address of the person authorized to act as agent for the Applicant in this application are

Mr. Robert W. Stahman
Vice President, Secretary and General Counsel
Idaho Power Company
P.O. Box 70
Boise, Idaho 83707

4. The Applicant is a domestic corporation organized under the laws of the State of Idaho and authorized to do business in the states of Idaho, Oregon, Nevada, and Wyoming and is not claiming preference under section 7(a) of the Federal Power Act. Furthermore, the Applicant does not seek benefit under section 210 of the Public Utility Regulatory Policies Act of 1978, as amended (PURPA).

5. (i) Following are the statutory or regulatory requirements of the states in which the project is located and that affect the project as proposed with respect to bed and banks; to the appropriation, diversion, and use of water for power purposes; and to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purpose of the license under the Federal Power Act:

A. State of Idaho

1. Reference is made to the general laws of the State of Idaho relating to the appropriation of waters and attainment of permits and licenses as contained in Idaho Code Title 42, Chapters 2, 4, and 17. A license to appropriate waters of the State of Idaho for power purposes is required.

2. Reference is made to the general laws of the State of Idaho relating to the acquisition of easements for use of state-owned submerged and formerly submerged lands as contained in Idaho Code Title 58, Chapters 1, 6, and 13 and the Equal Footing Doctrine (Idaho Admission Act of July 3, 1890, 26 Statute 215, Chapter 656).

B. State of Oregon[2]

1. Reference is made to the general laws of Oregon relating to reauthorization of existing hydroelectric projects contained in Oregon Revised Statutes (ORS) Chapter 543A. General provisions and standards are found in ORS 543A.005 through ORS 5432A.025. Specific provisions for the reauthorization of federally licensed projects are found in ORS 543A.060 through 543A. 50. The purpose of the Oregon statutory program is to establish a process for developing a coordinated state position to be reflected in governmental proceedings related to the reauthorization of existing hydroelectric facilities (ORS 543A.015).

2. Specific state regulatory programs with respect to bed and banks; appropriation, diversion, and use of water for power purposes and the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purpose of the license under the Federal Power Act are as follows:

   a. Water right for appropriation and use of water for power purposes. ORS 543A.025, and 543A 120 through ORS 543A.150.

   b. Leases and easements for hydroelectric projects. ORS 274.402 and Oregon Administrative Rules (OAR) 141-087-0001 through OAR 141-087-0050.

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2. The Applicant has previously advised the State of Oregon of its long-standing concerns regarding the applicability and scope of Oregon's hydro reauthorization (HART) process. In light of the FERC regulatory jurisdiction over the project under the Federal Power Act, the specific statutory provisions relating to the HART process, and the unique nature of the HCC due to its location on navigable, interstate boundary waters between the states of Oregon and Idaho, the Applicant continues to question the appropriateness of the HART process for the HCC. Despite these reservations, however,the Applicant elected to seek concurrent FERC relicensing and state reauthorization pursuant to ORS 543A.071 because of the opportunity it affords for cooperation and coordination among the various Oregon agencies and the FERC process. The Applicant is hopeful that these efforts will yield a satisfactory outcome for all involved. At the same time, however, the Applicant reserves the legal option, pursuant to ORS 543A.071(4), to withdraw from the Oregon reauthorization process at any time prior to issuance of a final water right certificate should it determine such action to be in the Applicant's best interest. Consistent with ORS 543.095, neither the Applicant's filing of a notice of intent to seek reauthorization for the HCC, nor its participation in, compliance with, or payment of fees under the HART process, shall preclude it from challenging, constitutionally or otherwise, that process.

(ii) Following are the steps the Applicant has taken or plans to take to comply with each of the laws cited above:

A. State of Idaho

1. The Applicant has acquired water right licenses from the State of Idaho, Department of Water Resources, as required for application of beneficial use of state waters as listed in section E.2. of the final license application. Any water needs beyond those for which the Applicant has received licenses will be filed with the State of Idaho, Department of Water Resources, as required.

2. The State of Idaho, Department of Lands, did not require easements for submerged and formerly submerged lands prior to 1992. The Applicant is aware that such easements are now required. The Applicant has worked with the Department of Lands to acquire the necessary easements pursuant to the rules adopted in 1992. Since the adoption of the rules, the Applicant has acquired easements for its Swan Falls Project (FERC Project No. 503), Milner Project (FERC Project No. 2899), and Twin Falls Project (FERC Project No. 18). The Applicant understands that acquisition of further easements is not necessary until new FERC licenses are issued.

3. A copy of the agreement dated October 25, 1984—commonly referred to as the Swan Falls Agreement—between the Applicant and the State of Idaho will be submitted to FERC. In paragraph 11 of that agreement, the parties acknowledge that the agreement provides a plan best adapted to develop, conserve, and utilize the water resources of the region in the public interest and further agree to present the agreement and the Idaho State Water Plan to FERC as a comprehensive plan for the management of the Snake River watershed.

B. State of Oregon

1. The Applicant has given notice to the State of Oregon of its intent to seek federal relicensing and to participate in the state reauthorization process, pursuant to

ORS 543A.071, to the extent not preempted by federal law. The State of Oregon has formed a Hydroelectric Application Review Team (HART) for the project, pursuant to ORS 543A.400, and the Applicant has participated in meetings with the HART and with individual member agencies. On April 25, 2003, the HART issued a Provisional Unified State Position (PUSP), describing preliminary state comments on the draft license application. Following submission of the final license application, the Applicant will continue meetings with HART agencies, respond to comments, and work with the state toward issuance of a Final Unified State Position and issuance of related state permits and authorizations.

2. The Applicant currently holds state water rights for the Hells Canyon Complex: HE 161 for the Oxbow Project, expiring December 31, 2011; HE 188 for the Brownlee Project, expiring December 12, 2010; and HE 189 for the Hells Canyon project, expiring December 31, 2017. The Applicant is participating in the state HART process, as described above, to renew these water rights for the Hells Canyon Complex. The Applicant also holds additional water rights issued by the State of Oregon, as listed in section E.2. of the final license application. These water rights were issued pursuant to the general laws of Oregon relating to water rights contained in ORS Chapter 537. As such, they do not require renewal through the process for reauthorization of hydroelectric projects as described in ORS Chapter 543A.

3. The Applicant does not currently hold leases or easements from the State of Oregon for the project because such authorization was not required at the time the project was initially licensed and constructed. Administrative rules adopted by the State Land Board in 1986 now require leases or easements to be negotiated at the time of federal relicensing. OAR 147-087-0010. The Applicant met with representatives of the State Land Board and Division of State Lands on March 20, 2003, to begin discussions regarding the process for obtaining leases or easements. Such efforts are coordinated through participation in the state HART process, as described above.

4. The State of Oregon, through the HART process, has not identified the need for any additional state permits, licenses or authorization to engage in the business of developing, transmitting, and distributing power.

6. The Applicant owns and operates the existing project facilities.

The following information is submitted as part of this application for New License Major Project—Existing Dam for the Hells Canyon Complex pursuant to the requirements of 18 CFR § 4.32.

7. To the best of the Applicant's knowledge, no person, citizen, association of citizens, domestic corporation, municipality or state other than the Applicant has or intends to maintain any proprietary rights necessary to operate and maintain the existing project.

8. (i) The names and mailing addresses for every county in which any part of the project is located, and for any federal facilities that would be used by the project, are

Adams County
107 Michigan Avenue
Council, ID 83612-0048

Washington County
P.O. Box 670
Weiser, ID 83672-0670

Malheur County
251 B Street, West
Vale, OR 97918-1357

Wallowa County
101 S. River Street
Enterprise, OR 97828-1300

Baker County
1995 3rd Street
Baker City, OR 97814-3363

The project does not involve the use of any federal facility.

(ii) No part of the project or any federal facilities that are used by the project are located within any city, town, or similar local political subdivision. There is no city, town, or similar local political subdivision that has a population of 5,000 or more people located within 15 miles of the project dam; therefore, no names or mailing addresses are included.

(iii) To the best of the Applicant's knowledge, no irrigation district, drainage district, or similar special purpose political subdivision owns, operates, maintains, or uses any project facilities or any federal facilities; therefore, no names or mailing addresses are included.

(iv) The names and mailing addresses of every other political subdivision in the general area of the project, that there is reason to believe are interested in or affected by the application, are

Baker City
1655 1st Street
Baker City, OR 97814

City of Boise
715 South Capitol Boulevard
Boise, ID 83702

City of Caldwell
621 Cleveland Boulevard
Caldwell, ID 83605

City of Cambridge
80 South Superior Street
Cambridge, ID 83610

City of Clarkston
830 5th Street
Clarkston, WA 99403

City of Council
501 North Galena Street
Council, ID 83612

City of Enterprise
108 Northeast 1st Street
Enterprise, OR 97828

City of Fruitland
200 South Whitley Drive
Fruitland, ID 83619

City of Grangeville
225 West North Street
Grangeville, ID 83530

City of Haines
P.O. Box 208
Haines, OR 97833

City of Halfway
155 East Record Street #B
Halfway, OR 97834

City of Huntington
50 East Adams
Huntington, OR 97907

City of La Grande
1000 Adams Avenue
La Grande, OR 97850

City of Lapwai
315 Main Street
Lapwai, ID 83540

City of Lewiston
1134 F Street
Lewiston, ID 83501

City of Midvale
Midvale, ID 83645

City of Nampa
411 3rd Street South
Nampa, ID 83651

City of New Plymouth
301 North Plymouth Avenue
New Plymouth, ID 83655

City of Ontario
444 Southwest 4th Avenue
Ontario, OR 97914

City of Payette
700 Center Avenue
Payette, ID 83661

City of Richland
104 Walnut Street
Richland, OR 97870

City of Riggins
126 North Main Street
Riggins, ID 83549

City of Weiser
55 West Idaho Street
Weiser, ID 83672

(v) No part of the project is located on tribal land. However, all Native American tribal governmental organizations in the region surrounding the project were invited to participate in the consultation process for the license application. The names and mailing addresses of Native American tribal governmental organizations that there is a reason to believe are interested in or possibly affected by the application are

Burns Paiute Tribe
HC 71, 100 Pasigo Street
Burns, OR 97720

Colville Confederated Tribes
P.O. Box 150
Nespelem, WA 99155

Confederated Tribes and Bands of the Yakama Nation
P.O. Box 151
Toppenish, WA 98948

Confederated Tribes of the Umatilla Indian Reservation
P.O. Box 638
Pendleton, OR 97801

Confederated Tribes of the Warm Springs
P.O. Box 1299
Warm Springs, OR 97761

Nez Perce Tribe
P.O. Box 305
Lapwai, ID 83540

Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, ID 83203

Shoshone-Paiute Tribes
P.O. Box 219
Owyhee, NV 89832

9. The exhibits that are filed as part of this application for New License for Major Project—Existing Dam are

Exhibit A	Description of Project
Exhibit B	Statement of Project Operation and Resource Utilization
Exhibit C	Construction History and Proposed Construction Schedule
Exhibit D	Statement of Costs and Financing
Exhibit E	Environmental Report
Exhibit F	General Design Drawings (withheld for security purposes)
Exhibit G	Maps of the Project
Exhibit H	General Information

The foregoing INITIAL STATEMENT and attached Exhibits are hereby made a part of this Application for New License for Major Project—Existing Dam.

IN WITNESS WHEREOF Applicant has caused its name to be hereunto signed by J. LaMont Keen, its President and Chief Operating Officer, and attested to by Robert W. Stahman, its Vice President, Secretary and General Counsel, all thereunto duly authorized this 21st day of July, 2003.

By ______________________

J. LaMont Keen
President and Chief Operating Officer

ATTEST:

By ______________________

Robert W. Stahman
Vice President, Secretary
and General Counsel

Verification

This Application for New License for Major Project—Existing Dam is executed in the

State of Idaho
County of Ada

By: J. LaMont Keen
President and Chief Operating Officer
Idaho Power Company
P.O. Box 70
Boise, Idaho 83707

being duly sworn, deposes and says that the contents of this Application for New License for Major Project—Existing Dam are true to the best of his knowledge or belief. The undersigned Applicant has signed the Application for New License for Major Project—Existing Dam this 21st day of July, 2003.

IDAHO POWER COMPANY

By ______________________

J. LaMont Keen
President and Chief Operating Officer

SUBSCRIBED AND SWORN to before me, a Notary Public of the State of Idaho, this 21st day of July, 2003.

____

Notary Public for Idaho
Residing at Boise, Idaho

(NOTARIAL SEAL)

MARY GRAY
NOTARY PUBLIC
STATE OF IDAHO

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Hells Canyon Complex
FERC No. 1971
License Application

Executive Summary

EXECUTIVE SUMMARY

Introduction

The Applicant owns and operates 17 hydroelectric projects on the Snake River and its tributaries. All but two of these projects are licensed and regulated by the Federal Energy Regulatory Commission (FERC), in accordance with the Federal Power Act (FPA). The license for the Hells Canyon Complex[1] (FERC No. 1971) will expire at the end of July 2005. Consistent with the FPA and applicable FERC regulations, the Applicant seeks to relicense this project and to continue operating it for the benefit of its owners and customers.

The Hells Canyon Complex

Hells Canyon, on the Oregon/Idaho border, is the deepest canyon in North America and home to the Applicant's largest hydroelectric generating complex, the Hells Canyon Complex. The Hells Canyon Complex includes the Brownlee, Oxbow, and Hells Canyon dams, reservoirs, and power plants. Operations of the three developments of the complex are closely coordinated to generate electricity and serve many other public purposes.

Currently, over 400,000 customers rely on the Applicant's hydro and thermal generation system for power. The Hells Canyon Complex is an integral part of this generation system, providing nearly two-thirds of the hydroelectric generation and 40% of total generation. Its winter and summer operations are particularly important because energy needs are highest during those seasons. In wintertime, customers need extra electricity for lighting and heating. During the summer, they need extra electricity for air conditioning and irrigation pumping.

General Operations

The Applicant operates the Hells Canyon Complex to comply with its existing FERC license, as well as voluntary arrangements to accommodate other interests such as recreational use and environmental resources. Among these arrangements are the fall chinook plan voluntarily adopted

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

by the Applicant in 1991 to protect spawning and incubation of fall chinook below Hells Canyon Dam, a species that is listed as threatened under the Endangered Species Act (ESA), and the cooperative arrangement that the Applicant had with federal interests between 1995 and 2001 to implement portions of the Federal Columbia River Power System (FCRPS) biological opinion flow augmentation program, a reasonable and prudent alternative (RPA) under the biological opinion intended to avoid jeopardy to ESA-listed anadromous species as a result of FCRPS operations below the Hells Canyon Complex.

Brownlee Reservoir is the only one of the three Hells Canyon Complex reservoirs—and the Applicant's only reservoir—with significant storage. It has 101 vertical feet of active storage capacity, which equals approximately 1 million acre-feet of water. On the other hand, Oxbow and Hells Canyon reservoirs have significantly smaller active storage capacities—approximately 0.5 and 1.0% of Brownlee Reservoir's volume, respectively.

Brownlee Reservoir Seasonal Operations

Brownlee Reservoir is a multiple-use, year-round resource for the Northwest. Although its primary purpose is providing a stable power source, Brownlee Reservoir is also used to control flooding, to benefit fish and wildlife resources, and to benefit recreation.

Brownlee Dam is one of several Northwest dams that are coordinated to provide springtime flood control on the lower Columbia River and, between 1995 and 2001, to augment flows in the lower Snake River consistent with the FCRPS biological opinion. For flood control, the Applicant operates the reservoir cooperatively with the U.S. Army Corps of Engineers (ACOE) North Pacific Division, according to article 42 of the existing license.

After flood-control requirements have been met in early summer, the reservoir is refilled to meet peak summer electricity demands and provide suitable habitat for spawning bass and crappie. The full reservoir also offers optimal recreational opportunities through the Fourth of July holiday.

As part of the flow-augmentation (RPA) implemented by the 2000 FCRPS biological opinions, the Bureau of Reclamation (BOR) periodically releases water from BOR storage reservoirs in the upper Snake River in an effort to augment flows in the lower Snake River to help anadromous fish migrate past the FCRPS projects. From 1995 through the summer of 2001, the Applicant cooperated with the BOR and other federal interests by “shaping” (or prereleasing) water from Brownlee Reservoir (and later refilling the drafted reservoir space with water released by the BOR from the upper Snake River reservoirs) and by occasionally contributing water from Brownlee Reservoir to these flow-augmentation efforts. To facilitate the Applicant’s cooperation with the FCRPS flow-augmentation RPA, and in recognition of the federal responsibility for the flow augmentation program, in 1996, the Bonneville Power Administration (BPA) entered into an energy exchange agreement with the Applicant. Through this energy exchange agreement, the Applicant was reimbursed for any energy losses it incurred as a result of its participation in the flow augmentation program, either in the form of shaping upstream BOR storage releases or contributing water through releases from Brownlee Reservoir. The agreement expired in April 2001 and has not been renewed by the BPA, and while the Applicant has expressed a willingness to continue to participate in the FCRPS flow-augmentation program through a similar arrangement with the BPA, the BPA has chosen not to renew the agreement.

Later in the fall, Brownlee Reservoir’s releases are managed to maintain constant flows below Hells Canyon Dam. These flow requirements, which are based on the voluntary fall chinook plan that the Applicant adopted in 1991, as well as the minimum flow required by article 43, help ensure sufficient water levels to protect fall chinook spawning nests, or redds. After fall chinook spawn, the Applicant attempts to have a full reservoir by the first week of December to meet winter peak demands. However, spawning flows are then maintained as a minimum flow below Hells Canyon Dam until fall chinook fry emerge in the spring. These fall chinook operations result in lower reservoir elevations in Brownlee Reservoir, which correspondingly lower the power production capability of the plant. This reduced power production, in turn, may require the Applicant to purchase power from other sources if the load demand cannot be met during this time due to the loss in net head at the reservoir.

Relicensing Schedule

According to FERC regulations, the current licensee of a hydroelectric project must notify FERC five years before a license expires that it intends to apply for a new license. The licensee must then submit its final application for a new license two years before the current license expires. The FERC license for the Hells Canyon Complex expires on July 31, 2005. Therefore, the Applicant filed the Notice of Intent with FERC in July 2000. Because FERC requires that the license application be filed on or before July 31, 2003, the Applicant submitted the draft *New License Application: Hells Canyon Hydroelectric Project* in September 2002 and this final *New License Application: Hells Canyon Hydroelectric Project* in July 2003.

Consultation

FERC regulations also require that the Applicant consult with appropriate state and federal agencies and Indian tribes. Throughout the informal and formal relicensing processes, the Applicant involved these agencies and tribes, as well as any other agencies, tribes, counties, cities, nongovernmental organizations, or groups that expressed interest in the process for relicensing the Hells Canyon Complex.

Anticipating the need for closer interaction with agencies in relicensing the Hells Canyon Complex, the Applicant began developing an informal consultation memorandum of understanding (MOU) in December 1991. The Applicant held several meetings with interested parties in 1992 to work toward this goal; however, there was no consensus on how to proceed with consultation and studies. Because of the importance of relicensing the Hells Canyon Complex, the Applicant decided not to pursue the informal consultation MOU but instead concentrate its efforts on gathering baseline data and formulating study initiatives. On September 7, 1993, the Applicant sent a notice of this decision to interested parties.

Before pursuing additional attempts to engage agencies in informal consultation for relicensing efforts, the Applicant's principal resource investigators reviewed existing environmental literature from the Hells Canyon region—environmental impact statements, environmental assessments, land-use plans, and resource management plans—to identify known natural resource issues associated with the complex. Resource specialists for appropriate management agencies who knew Hells Canyon were also consulted. In addition, the Applicant also extensively reviewed available technical literature and critically evaluated work by previous investigators. This review resulted in a series of resource inventories and descriptive studies that were used to develop a baseline understanding of the Hells Canyon environment. The studies conducted were targeted based on criteria used by FERC for appraising resource values to the public and by recognizing the value of a proposed study with respect to fulfilling general requirements for preparing a license application. These studies were incorporated into the *Formal Consultation Package for Relicensing: Hells Canyon Project* (FCP), the development of which is discussed below.

On February 6, 1996, the Applicant convened a meeting of stakeholders to its ongoing relicensing processes. Participants focused on ways to improve communication and cooperation during the relicensing process. Subsequently, representatives from the U.S. Fish and Wildlife Service, Idaho Office of the Attorney General, Idaho Rivers United, and the Applicant were designated to draft a collaborative process document that the larger group of agencies, tribes, and nongovernmental organizations ultimately endorsed. This document outlined a process that included a policy-level Collaborative Team (CT) and various technical resource work groups (RWGs). The document is included as Attachment D in section I of the Consultation Appendix.

This process was not intended to be an alternative process to relicensing. Instead, it was a modification to the traditional licensing process that incorporated ongoing consultation throughout the first two stages of relicensing. As designed by parties to the collaboration, the process would provide a way to involve stakeholders early in the relicensing process so that issues could be evaluated and addressed effectively. In addition, it was intended to increase the likelihood of consensus on relicensing issues and help strike an appropriate balance between project operations and the protection, mitigation, and enhancement of resource values. The collaborative process was also designed to meet all FERC requirements and enhance the prescribed process by providing more and better opportunities for stakeholders to communicate and cooperate. Under this process, the Applicant is one of many members engaged in the collaborative process. Other members include representatives from federal, state, and local government; tribes; nongovernmental organizations; the public; and the Applicant’s customers.

Several smaller groups with similar representation were charged with providing technical input to be considered by the Applicant. These RWGs provided early and ongoing input on technical studies, analyses, and mitigation measures for the draft license application. The focus of each RWG is described below:

- **Aquatic Resources Work Group (ARWG)**—water quality, quantity, and use; fish and mollusc resources
- **Cultural Resources Work Group (CRWG)**—Native American and Euro-Asian American cultural resources, including archaeological sites, traditional cultural properties, and oral history studies
- **Terrestrial Resources Work Group (TRWG)**—wildlife, soils and geology, botanical, and cultural resources
- **Recreation and Aesthetics Resources Work Group (R/ARWG)**—recreational use and aesthetic qualities

Functioning in a less technical manner, the Economics Work Group (EWG) was established to consider broader economic values associated with relicensing. These values were related to water quality, fish and wildlife, recreation, cultural, and aesthetic resources, as well as developmental values of power generation, irrigation, and flood control.

Several subgroups were formed to address certain aspects of these resources in greater detail, such as white sturgeon, invertebrates, and aesthetics. Agreements and discussions occurring at the work group level were considered in the development of the Applicant's draft license application.

To incorporate a broader perspective and inform the public of relicensing issues, a series of scoping meetings was conducted from January 1996 to January 1997. The purpose of these scoping meetings was to develop a list of issues and concerns surrounding the Hells Canyon Complex. These issues were then combined into problem statements in each resource area to help refine the appropriate focus and scope of resource studies. The RWGs then developed study proposals aimed at investigating problem statements. These study proposals, as well as the resource inventories and descriptive studies developed earlier by the Applicant's principal investigators, were included in the *Formal Consultation Package: Hells Canyon Project* and distributed to the FERC, agencies, tribes, and other interested parties in February 1997 for review and comment.

After the FCP was distributed, joint agency public consultation (JAPC) meetings were held in March 1997 in Lewiston, Boise, and Weiser, Idaho, and in Halfway, Oregon, so that the Applicant could present, discuss, and receive feedback on the study proposals outlined in the document. In addition to providing extensive input into study design and scope within RWG meetings, the federal and state natural resource agencies, Indian tribes, and other interested parties also provided written comment on the FCP. A tracking matrix was developed to capture these comments, which were then assigned to the appropriate RWG for further consideration. Each RWG discussed the individual issues, comparing them against issues originally outlined in the FCP. After reviewing the issues, the RWGs forwarded recommendations for additional studies and/or changes to existing study plans to the Applicant.

After the Applicant evaluated the recommendations, study plans were revised. These revised detailed study plans, including additional studies, were distributed to RWG participants through the following documents:

- *Detailed Aquatic Study Plans* (June 1999)

- *Terrestrial Final Study Plans* (Phase I—November 1998, Phase II—July 1999, Phase III—March 2000)

- *Recreation Detailed Study Plans* (September 1999)

- *Cultural Study Plans* (November 1999)

Relying upon the comprehensive study plans agreed upon during the first stage of consultation, the Applicant initiated and completed more than 100 relicensing studies and reports at a cost to date of approximately $45 million. Additionally, the Applicant conducted 217 meetings over a seven year period through the collaborative process in an attempt to increase the level of understanding of issues among the participants and to reach agreement in as many areas as possible.

While the collaborative process did not lead to agreement on all resource issues, it was successful in providing direct and frequent communication between the Applicant and interested parties. The issues were identified, appropriate studies scoped and conducted, and results discussed by the various groups. Participants gained a better understanding of how each agency and individual viewed project impacts and the appropriateness and desirability of various mitigation measures. Because of the opportunities for early and relatively comprehensive discussion, participants of the collaborative process should experience few surprises when they read the final *New License Application: Hells Canyon Hydroelectric Project.*

Subsequent to submitting the draft *New License Application: Hells Canyon Hydroelectric Project* in September 2002, the Applicant received comment letters from agencies, tribes, and the public regarding the application. Pursuant to FERC regulations, the Applicant conducted meetings with agencies and tribes in an attempt to reach agreements on resource impacts and the Applicant's plan to protect, mitigate impacts to, or enhance the environment affected by its project operations. The Applicant has also responded to comments received on the draft license application. Responses to comments are included in section VII of the Consultation Appendix.

On March 5 and 6, 2003 the Applicant conducted two days of meetings with agencies and tribes to discuss and attempt to reach agreement on its plans per FERC regulations. A list documenting the areas of agreement and disagreement identified at the meeting is included with the concurrent filings accompanying this final license application. The Applicant has provided a detailed explanation for its agreement or disagreement in its responses to comments received on the draft application and in each specific resource area of Exhibit E of the final application. A summary of some of the more significant areas of disagreement is included later in this Executive Summary.

On June 25, 2003 the Applicant conducted another meeting in a further attempt to discuss and reach agreement on the significant issues. Notes from the meeting identifying areas of agreement are also included with the concurrent filings accompanying this final application. The Applicant and agencies and tribes represented at the meeting were able to reach agreement in the following five areas:

1. Agreement was reached to look at injecting dissolved oxygen to deeper levels in Brownlee Reservoir. The Oregon Department of Fish and Wildlife abstained from this agreement.

2. Agreement was reached with the U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, Bureau of Land Management (BLM), U.S. Forest Service (USFS), Environmental Protection Agency, Nez Perce Tribe, and state water quality agencies to meet and review the data on the Oxbow Bypass minimum-flow evaluation. The purpose of the meeting will be to answer questions on the models used in the analysis and to answer questions on the Applicant's decision-making process.

3. A set of talking points for establishing a fish passage technical committee was outlined. While agreement was not reached on establishing such a committee, the Applicant agrees to continue discussions in order to move the committee approach forward.

4. The Applicant, Nez Perce Tribe, Idaho and Oregon agencies, and the BLM agreed to continue discussions of tribal treaty hunting rights on lands acquired and managed by the Applicant. The Confederated Tribes of the Umatilla Indian Reservation expressed interest in being an optional participant.

5. If all agencies can reach agreement on the total acreage of land to be acquired to address impacts from project operations requested and present this unified statement to the Applicant, then the Applicant will engage in further discussions with respect to land acquisition. This may provide the information necessary for the Applicant to consider early land acquisition.

The Application

The final application to license the Hells Canyon Complex is developed and organized according to the relevant sections in 18 CFR Part 16: Procedures relating to the takeover or relicensing of licensed projects. Data that the Applicant collected and analyzed during the studies were used in developing the application, including proposed measures for protecting, mitigating, or enhancing resources. Following is a list of the documents that make up this application:

Exhibit A	Description of Project
Exhibit B	Statement of Project Operation and Resource Utilization
Exhibit C	Construction History and Proposed Construction Schedule
Exhibit D	Statement of Costs and Financing
Exhibit E	Environmental Report
Exhibit F	General Design Drawings (withheld for security purposes)
Exhibit G	Maps of the Project
Exhibit H	General Information

In addition, technical reports (including nonclassified study results), public safety and resource management plans, and details of consultation are appended to this license application.

Protection, Mitigation, and Enhancement Proposals

License applications to FERC include proposed protection, mitigation, and enhancement (PM&E) measures. To ensure their coordinated implementation, the Applicant integrates PM&E measures into its land, or resource, management plans. The *Hells Canyon Resource Management Plan* is appended as Technical Report E.6-1.

The process for developing PM&E measures is a long and complex one, requiring resource studies and agency, tribal, and public input. The Applicant used the CT and its RWGs to help define resource issues, possible impacts, and potential PM&E measures related to its ongoing operation of the Hells Canyon Complex. The issues, possible impacts, and potential measures were evaluated in the context of study results to determine their validity. The Applicant's intent was to identify those areas where consensus could be achieved on resource impacts and measures and to better understand reasons for lack of consensus in other areas. The RWGs played an important role in helping to identify those measures that the Applicant considered for this license application.

In considering this application, it is important to understand that the Applicant is not required to mitigate for every project impact, nor is it required to fund mitigation measures that are unrelated to project impacts or that are attributable to the original construction of the project. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

Given the foregoing, the Applicant has proposed measures that are, first and foremost, intended to offset ongoing project impacts identified from the Applicant's extensive environmental review. Where impacts were clearly identified or the potential for an impact clearly exists, the Applicant has proposed a corresponding measure intended to mitigate the impact (e.g., acquisition of land based on reservoir and river fluctuation, flow deflectors to improve water quality, and development of additional recreation resources). The Applicant has also proposed measures to offset potential impacts that were not clearly identified through studies yet could be reasonably tied to project operations (e.g., weed control, mountain quail habitat development, and certain recreation improvements). The Applicant has proposed additional measures that are not clearly linked to project impacts and, based on study results, cannot be reasonably tied to project operations but have stewardship value nonetheless (e.g., protection of certain cultural sites). Finally, the Applicant considers FERC's directive to balance power and nonpower values a critical element in making decisions that are in the public interest. Therefore, the Applicant's proposed measures take into consideration their impact on power production and are aimed at addressing project-related impacts while preserving the power values of the project. By doing so, the Applicant's plan adequately and equitably protects, mitigates, or enhances the resources affected by Hells Canyon Complex operations. These measures that the Applicant believes are appropriate for addressing ongoing, project-related impacts are identified in the following section, along with a summary of associated benefits and estimated costs.[2]

Water Use and Quality

- E.2.4.1. Existing Measures to be Continued (Oxbow Bypass 100-cfs Minimum Flow, Recreation Waste Disposal, and Preferential Use of the Upper Spillgates at Brownlee Dam during Periods of Spill)
- E.2.4.2.1. Brownlee Reservoir Aeration
- E.2.4.2.2. Brownlee Powerhouse Units 1 through 4 Turbine Venting
- E.2.4.2.3. Brownlee Powerhouse Unit 5 Turbine Venting
- E.2.4.2.4. Hells Canyon Dam Spillway Flow Deflectors

WATER USE AND QUALITY PM&E MEASURES

Existing		**Total Cost**
Oxbow Bypass 100 cfs Minimum Flow		See Footnote a
Recreation Waste Disposal		See Footnote a
Preferential Use of the Upper Spillgates at Brownlee Dam During Periods of Spill		See Footnote a
Proposed	**Associated Benefits**	**Total Cost**
Brownlee Reservoir Aeration	Aquatics	See Footnote a

2. For those people using this document electronically, the section number and title for each measure serve as a link to the full details of that measure.

WATER USE AND QUALITY PM&E MEASURES

Proposed	Associated Benefits	Total Cost
Brownlee Powerhouse Units 1 through 4 Turbine Venting	Aquatics	See Footnote a
Brownlee Powerhouse Unit 5 Turbine Venting	Aquatics	See Footnote a
Hells Canyon Dam Spillway Flow Deflectors	Aquatics	See Footnote a
Total		Total Cost[a]

a. The Applicant did not include costs for water quality PM&E measures for two reasons. First, §4.51(f)(2)(iv) does not identify cost or design drawings as a pertinent or necessary item to be included in the license application. Second, the Applicant is proposing that details of each proposed measure will be developed through consultation with Oregon and Idaho during the 401 certification process. For example, the draft Snake River-Hells Canyon TMDL, (which will define the Applicant's responsibility in improving oxygen conditions in Brownlee Reservoir) has not yet been approved by EPA. To present costs prior to approval of the TMDL and the 401 process would be premature.

Fish and Snail Resources

- E.3.1.3.1.1. Fall Chinook Plan
  - E.3.1.3.1.1.1. Fall Chinook Salmon Spawning and Incubation Protection
  - E.3.1.3.1.1.2. Fall Chinook Salmon Redd and Temperature Monitoring
  - E.3.1.3.1.1.3. Costs of the Fall Chinook Plan
- E.3.1.3.1.2. Anadromous Mitigation Hatchery Facilities
  - E.3.1.3.1.2.1. Oxbow Fish Hatchery
  - E.3.1.3.1.2.2. Rapid River Fish Hatchery
  - E.3.1.3.1.2.3. Niagara Springs Fish Hatchery
  - E.3.1.3.1.2.4. Pahsimeroi Fish Hatchery
  - E.3.1.3.1.2.5. Costs of Existing Mitigation Hatchery Facilities

FISH AND SNAIL PM&E MEASURES

Existing	**Total Cost[a]**
The Fall Chinook Plan	
• Fall Chinook Spawning and Salmon Incubation Protection	$75,000,000
• Fall Chinook Salmon Redd and Temperature Monitoring	$3,750,000
Anadromous Mitigation Hatchery Facilities	
• Oxbow Fish Hatchery	$9,425,000
• Rapid River Fish Hatchery	$18,850,000
• Niagara Springs Fish Hatchery	$25,375,000
• Pahsimeroi Fish Hatchery	$16,225,000
Warmwater Fish Plan	
• Resident Centrarchid Spawning Protection	TBD

FISH AND SNAIL PM&E MEASURES		
Existing	**Associated Benefits**	**Total Cost[a]**
• Warmwater Fish Population Monitoring		$1,500,000
Total		$150,125,000
Proposed	**Associated Benefits**	**Total Cost**
Native Salmonid Plan		
• Pathogen Survey in Pine-Indian-Wildhorse Core Area	Fisheries, Water Quality	$1,200,000
• Hells Canyon Fish Passage Plan	Fisheries, Recreation, Terrestrial	$23,600,000
• Tributary Habitat Enhancements	Water Quality, Fisheries, Recreation, Terrestrial	$8,500,000
• Marine-Derived Nutrient Supplementation		Included in measures • E.3.1.3.2.2.2. • E.3.1.3.2.2.4.
• Eagle Creek Presence/Absence Survey		$600,000
• Permanent Monitoring Weir at Pine Creek	Fisheries	$5,400,000
• Long-Term Monitoring and Brook Trout Suppression in Indian Creek	Fisheries	$1,500,000
Anadromous Mitigation Hatchery Facility Upgrades and Enhancements		
• Improvements to Pahsimeroi Fish Hatchery	Water Quality, Fisheries	$8,123,000
• Improvements to Oxbow Fish Hatchery	Fisheries, Terrestrial, Recreation, Aesthetics	$7,806,000
• Improvements to Niagara Springs Fish Hatchery	Fisheries	$4,910,000
• Improvements to Rapid River Fish Hatchery	Fisheries, Terrestrial	$5,751,000
Snake River White Sturgeon Conservation Plan		
• Assessment of Water Quality-Related Impacts on Early Life Stages of White Sturgeon in the Swan Falls Dam-Brownlee Reach	Fisheries, Water Quality	$326,000

FISH AND SNAIL PM&E MEASURES

Proposed	Associated Benefits	Total Cost
• Translocation of Reproductive-Sized White Sturgeon to Increase Spawner Abundance and Population Productivity	Fisheries, Water Quality, Terrestrial	$552,000
• Development of Experimental Conservation Aquaculture Plan	Fisheries	$840,000
• Periodic Population Assessments		$2,465,000
• Monitoring of Genotypic Frequencies		$68,000
Total		$71,641,000

a. Total nonescalated 2003 dollars over an assumed 30-year license period. The Applicant is not proposing a 30-year period for the new license. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC's discretion for setting a new license term.

Wildlife Resources

- E.3.2.3.2.1. Hells Canyon Complex Reservoirs and Downstream of Hells Canyon Dam
  - E.3.2.3.2.1.1. Acquisition of Upland and Riparian Habitat
  - E.3.2.3.2.1.2. Enhancement of Habitat on Four Snake River Islands in Cooperation with the Idaho Department of Fish and Game (Gold Island) and the Oregon Department of Fish and Wildlife (Hoffman, Patch, and Porter islands)
  - E.3.2.3.2.1.3. Cooperative Enhancement of Low-Elevation Riparian Habitat and Reintroduction of Mountain Quail in Areas Adjacent to the Hells Canyon Complex Reservoirs
  - E.3.2.3.2.1.4. Management of Wildlife Resources on Applicant-Owned Lands Associated with the Hells Canyon Complex
- E.3.2.3.2.2. Transmission Lines and Associated Service Roads

– E.3.2.3.2.2.1. Development and Implementation of Transmission-Line Operation and Maintenance Plan

WILDLIFE PM&E MEASURES

Proposed	Associated Benefits	Total Cost
Hells Canyon Complex Reservoirs and Downstream of Hells Canyon Dam		
• Acquisition of Upland and Riparian Habitat	Wildlife	$28,932,000
• Enhancement of Habitat on Four Snake River Islands in Cooperation with the Idaho Department of Fish and Game (Gold Island) and Oregon Department of Fish and Wildlife (Hoffman, Patch, and Porter islands)	Wildlife	$780,000
• Cooperative Enhancement of Low-Elevation Riparian Habitat and Reintroduction of Mountain Quail in Areas Adjacent to the Hells Canyon Complex Reservoirs	Wildlife, Botanical, Aquatic	$100,000
• Management of Wildlife Resources on Applicant-Owned Lands Associated with the Hells Canyon Complex[a]	Wildlife, Land Management	$4,370,000
• Transmission Lines and Associated Service Roads		
• Development and Implementation of Transmission-Line Operation and Maintenance Plan	Aquatic, Aesthetic, Botanical	$165,000
Total		$34,347,000

a. This measure applies only to Applicant-owned lands that are nonflooded, for which the Applicant owns all rights, and that are designated in the Hells Canyon Resource Management Plan.

Botanical Resources

- E.3.3.3.2.1. HCC Reservoirs and the Reach Downstream of Hells Canyon Dam
  - E.3.3.3.2.1.1. Acquisition of Upland and Riparian Habitat
  - E.3.3.3.2.1.2. Cooperative Noxious Weed Control, Site Monitoring, and Reseeding
  - E.3.3.3.2.1.3. Cooperative Protection and Monitoring of Sensitive Plant Sites

- E.3.3.3.2.2.1. Development and Implementation of Transmission-Line Operation and Management Plan

- E.3.3.3.2.2.2. Cooperative Project Associated with Transmission-Line Operation and Maintenance Plan

BOTANICAL PM&E MEASURES

Proposed	Associated Benefits	Total Cost
HCC Reservoirs and the Reach Downstream of Hells Canyon Dam		
• Acquisition of Upland and Riparian Habitat	Wildlife	Refer to Wildlife Measure
• Cooperative Noxious Weed Control, Site Monitoring, and Reseeding	Botanical, Wildlife, Aquatic, Recreation Aesthetics, Cultural	$1,500,000
• Cooperative Protection and Monitoring of Sensitive Plant Sites	Botanical	$180,000
• Transmission Lines and Associated Service Roads		
• Development and Implementation of Transmission-Line Operation and Maintenance Plan	Botanical, Wildlife, Aquatic	$125,000
• Cooperative Project Associated with Transmission-Line Operation and Management Plan	Botanical, Wildlife, Aquatic	Costs incorporated in measure above
Total		$1,805,000

Historical and Archaeological Resources

- E.4.2.5.1.1. Monitoring of Eligible Sites along Transmission Line 945

- E.4.2.5.1.2. Monitoring of Known Burial Site on Oxbow Reservoir

- E.4.2.5.1.3. Monitoring of Known Eligible Sites on Oxbow and Hells Canyon Reservoirs

- E.4.2.5.1.4. Monitoring of Known Eligible Sites on Brownlee Reservoir
- E.4.2.5.1.5. Monitoring of Known Eligible Sites below Hells Canyon Dam
- E.4.2.5.1.6. Stabilization of Sites below Hells Canyon Dam
- E.4.2.5.2.1. Stabilization of Sites on Brownlee Reservoir
- E.4.2.5.2.2. Data Recovery at Four Archaeological Sites on Brownlee Reservoir
- E.4.2.5.3.1. Native American Interpretive Sites on Brownlee Reservoir
- E.4.2.5.3.2. Native American Interpretive Sites on Oxbow and Hells Canyon Reservoirs
- E.4.2.5.3.3. Euro-American Interpretive Sites on Brownlee, Oxbow, and/ or Hells Canyon Reservoirs
- E.4.2.5.3.4. Asian-American Interpretive Sites on Brownlee, Oxbow, and/ or Hells Canyon Reservoirs
- E.4.2.5.3.5. Euro- and Asian-American Interpretive Projects
- E.4.2.5.3.6. Native American Programs: Burns Paiute Tribe
- E.4.2.5.3.7. Native American Programs: Confederated Tribes of the Warm Springs Indian Reservation (Warm Springs Tribes)
- E.4.2.5.3.8. Native American Programs: Nez Perce Tribe
- E.4.2.5.3.9. Native American Programs: Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes)
- E.4.2.5.3.10. Native American Programs: Shoshone-Paiute Tribes

- E.4.2.5.3.11. Native American Programs: Shoshone-Bannock Tribes

- E.4.2.5.4. Additional Section 106 Projects

HISTORICAL AND ARCHAEOLOGICAL PM&E MEASURES

Proposed	Associated Benefits	Total Cost
Monitoring of Eligible Sites along Transmission Line 945	Recreation	$75,000
Monitoring of Known Burial Site on Oxbow Reservoir	Wildlife, Botanical	$22,500
Monitoring of Known Eligible Sites on Oxbow and Hells Canyon Reservoirs	Wildlife, Botanical	$597,500
Monitoring of Known Eligible Sites on Brownlee Reservoir	Wildlife, Botanical	$563,000
Monitoring of Known Eligible Sites below Hells Canyon Dam	Wildlife, Botanical	$1,950,000
Stabilization of Sites below Hells Canyon Dam	Wildlife, Botanical	$3,200,000
Stabilization of Sites on Brownlee Reservoir	Wildlife, Botanical	$520,000
Data Recovery at Four Archaeological Sites on Brownlee Reservoir	Recreation	$710,000
Native American Interpretive Sites on Brownlee Reservoir	Recreation, Wildlife, Botanical	$88,000
Native American Interpretive Sites on Oxbow and Hells Canyon Reservoirs	Recreation, Wildlife, Botanical	$44,000
Euro-American Interpretive Sites on Brownlee, Oxbow, and/or Hells Canyon Reservoirs	Recreation, Wildlife, Botanical	$88,000
Asian-American Interpretive Sites on Brownlee, Oxbow, and/or Hells Canyon Reservoirs	Recreation, Wildlife, Botanical	$88,000
Euro- and Asian-American Interpretive Projects	Cultural	$174,990
Native American Programs: Burns Paiute Tribe	Cultural	$1,000,000

HISTORICAL AND ARCHAEOLOGICAL PM&E MEASURES		
Proposed	**Associated Benefits**	**Total Cost**
Native American Programs: Confederated Tribes of the Warm Springs Indian Reservation (Warm Springs Tribes)	Cultural	$1,000,000
Native American Programs: Nez Perce Tribe	Cultural	$1,000,000
Native American Programs: Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes)	Cultural	$1,000,000
Native American Programs: Shoshone-Paiute Tribes	Cultural	$1,000,000
Native American Programs: Shoshone-Bannock Tribes	Cultural	$1,000,000
Additional Section 106 Projects	Cultural	TBD
Total		$14,120,990

Recreational Resources

- E.5.4.1.1. Monitors for Flow Information Downstream of Hells Canyon Dam
- E.5.4.1.2. Memorandum of Understanding between the U.S. Forest Service and the Applicant
- E.5.4.3.1. Existing General Measures for All Zones
  - E.5.4.3.1.1. Continuation of Litter and Sanitation Plan
  - E.5.4.3.1.2. Continuation of Public Safety Programs
  - E.5.4.3.1.3. Continuation of Aid to Local Law Enforcement
  - E.5.4.3.1.4. Continuation of Road Maintenance

RECREATIONAL PM&E MEASURES		
Existing		**Total Cost**
Monitors for Flow Information Downstream of Hells Canyon Dam		$1,500,000
Memorandum of Understanding between the U.S. Forest Service and the Applicant		$2,400,000
Existing General Measures for All Zones		
• Continuation of Litter and Sanitation Plan		$750,000
• Continuation of Public Safety Program		$300,000
• Continuation of Aid to Local Law Enforcement		$1,800,000
• Continuation of Road Maintenance		$3,000,000
• Continuation of Operation and Maintenance of Applicant-Managed Parks and Recreation Facilities		$18,000,000
Total		$27,750,000
Proposed	**Associated Benefits**	**Total Cost**
Provision of Boat Moorage on HCC Reservoirs	Recreation	$300,000
Enhancement of Litter and Sanitation Plan	Recreation, Aesthetics	$1,710,000
Information and Education (I&E) Plan	Recreation, Cultural	$2,100,000
Law Enforcement Program	Recreation	$450,000
Recreation Adaptive Management Plan	Recreation	$3,000,000
Enhancement of Road Maintenance	Recreation, Cultural, Wildlife, and Botanical	$860,000
Performance of Operation and Maintenance at Applicant-Enhanced BLM and USFS Reservoir-Related Recreation Sites	Recreation	$2,800,000
Enhancement of Eagle Bar Dispersed Recreation Site	Recreation	$150,000
Development of Site Plan for Big Bar Recreation Site	Recreation, Cultural	$50,000

RECREATIONAL PM&E MEASURES

Proposed	Associated Benefits	Total Cost
Enhancement of Boat Ramp and Associated Facilities at Big Bar Section D Recreation Site	Recreation, Cultural	$250,000
Development of Site Plan and Enhancement of Eckels Creek Dispersed Recreation Site	Recreation	$30,000
Enhancement of Operation and Maintenance of Applicant-Managed Parks and Recreation Facilities	Recreation	$2,800,000
Enhancement of Copper Creek Dispersed Recreation Site	Recreation, Cultural	$50,000
Reconstruction of Hells Canyon Park	Recreation	$2,000,000
Development of Airstrip A&B Dispersed Recreation Site	Recreation	$40,000
Enhancement of Bob Creek Section A Dispersed Recreation Site	Recreation	$50,000
Enhancement of Bob Creek Section B Dispersed Recreation Site	Recreation	$25,000
Enhancement of Bob Creek Section C Dispersed Recreation Site	Recreation	$50,000
Enhancement of Westfall Dispersed Recreation Site	Recreation	$60,000
Enhancement of Copperfield Boat Launch Area	Recreation	$100,000
Enhancement of Oxbow Boat Launch	Recreation	$80,000
Enhancement of Carters Landing and Old Carters Landing Recreation Sites	Recreation	$80,000
Reconstruction of McCormick Park	Recreation	$3,000,000
Enhancement of Hewitt and Holcomb Parks	Recreation	$100,000
Development of Low-Water Boat Launch at or near Swedes Landing	Recreation	$250,000
Enhancement of Swedes Landing	Recreation	$75,000
Enhancement of Spring Recreation Site	Recreation	$500,000
Total		$20,960,000

Land Management and Aesthetics Resources

- E.6.1.6. Existing Transmission Lines and Associated Service Roads
- E.6.2.2. Existing Measures or Facilities to be Continued or Maintained (Hells Canyon Resource Management Plan Implementation)
- E.6.4. Buffer Zone for Protecting Recreational and Aesthetic Values
  - E.6.4.1. Public Access
  - E.6.4.2. Recreation
  - E.6.4.3. Aesthetic Values
    - E.6.4.3.1. Design Standards and Guidelines for Physical Structures
    - E.6.4.3.2. Design Standards and Guidelines for Landscaping
    - E.6.4.3.3. General Aesthetic Clean-Up Plan and Implementation
    - E.6.4.3.4. Replacement of Guardrails and Jersey Barriers
    - E.6.4.3.5. Mitigation of Contrast from Project Facilities
    - E.6.4.3.6. Enhancement of Others' Facilities
    - E.6.4.3.7. Information and Education
  - E.6.4.4. Natural and Cultural Resources

LAND MANAGEMENT AND AESTHETICS PM&E MEASURES		
Existing		**Total Cost**
Hells Canyon Resource Management Plan Implementation		N/A
Proposed	**Associated Benefits**	**Total Cost**
Existing Transmission Lines and Associated Service Roads		$70,000
Design Standards and Guidelines for Physical Structures	Cultural	$35,000
Design Standards and Guidelines for Landscaping	Recreation, Botanical	$20,000
General Aesthetic Clean-Up Plan and Implementation	Recreation	$360,000
Replacement of Guardrails and Jersey Barriers		$160,000
Mitigation of Contrast from Project Facilities	Recreation, Botanical, Aesthetic	$382,000
Enhancement of Others' Facilities	Recreation, Aesthetic	$10,000
Information and Education	Recreation, Aesthetic	$11,000
Natural and Cultural Resources	Aquatics, Botanical, Wildlife, Cultural	$2,100,000
Total		$3,148,000

All Measures

ALL MEASURES (Existing and Proposed)	Total Cost
Total	**$323,896,990**

As previously discussed, the Applicant held meetings with agencies and tribes to attempt to reach agreement on its plans for PM&E measures. Notes from these meetings are included with the concurrent filings accompanying this final application. While some measures were revised based on feedback from the comments and meetings, such as more frequent monitoring of cultural sites and provision of operation and maintenance funds to recreational sites on federal lands proposed to be improved by the Applicant, substantive disagreements remain. Some remaining areas of disagreement include the control of water temperature downstream of Hells Canyon Dam; minimum flows in the Oxbow Bypass reach; downstream native fish passage; reintroduction and passage of anadromous fish above the Hells Canyon Complex; replacement of permanently inundated habitat; impact of project operations on downstream sediment features, including beaches, terraces, and spawning gravels; modified operations to reflect a "natural" river system; and flows for anadromous fish (flow augmentation) impacted by downstream federal projects on the lower Snake and Columbia rivers.

Resource Management Plan

The *Hells Canyon Resource Management Plan* (Technical Report E.6-1) represents a comprehensive, coordinated approach to managing the Applicant's land and the resources found on that land. It includes policies that guide the use of land and water within project boundaries, as defined in the FERC licenses, and on other Applicant-owned property. It also contains policies for promoting cooperation and coordination with other land-management entities. Because of its emphasis on resource management, the *Hells Canyon Resource Management Plan* supports the relicensing process by demonstrating responsible stewardship. The Applicant used a geographic information system to evaluate the suitability of the land for various uses and to more clearly identify landowners and managers. Then policies were developed for the Hells Canyon Complex that would balance competing land uses. The Applicant coordinated and cooperated with agencies and the public during the entire process.

Conclusion

The Applicant recognizes that developing an application to license the Hells Canyon Complex with FERC is an important undertaking. The Applicant believes that it is the appropriate entity to advance and promote the elements of this application to agencies, tribes, nongovernmental organizations, and the affected public. In addition, the Applicant is committed to meeting FERC requirements, balancing resource values, and demonstrating sound environmental stewardship by implementing corporate environmental policies.

Furthermore, the Applicant recognizes the need to continue developing and implementing the PM&E measures of the license and policies of the *Hells Canyon Resource Management Plan*. Such development and implementation would be planned with appropriate agency, tribal, and public input. The Applicant will devote time and resources necessary to comply with the terms of a new license while providing its owners with a reasonable return for their investment and its customers with safe, reliable, and economical electricity.

Hells Canyon Complex
FERC No. 1971
License Application

Exhibit A
Description of Project

The *Code of Federal Regulations* below—18 CFR § 4.51(b)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(b) *Exhibit A* is a description of the project. This exhibit need not include information of project works maintained and operated by the U.S. Army Corps of Engineers, the Bureau of Reclamation, or any other department or agency of the United States, except for any project works that are proposed to be altered or modified. If the project includes more than one dam with associated facilities, each dam and the associated component parts must be described together as a discrete development. The description for each development must contain:
>
> (1) The physical composition, dimensions, and general configuration of any dams, spillways, penstocks, powerhouses, tailraces, or other structures, whether existing or proposed, to be included as part of the project;
>
> (2) The normal maximum surface area and normal maximum surface elevation (mean sea level), gross storage capacity, and usable storage capacity of any impoundments to be included as part of the project;
>
> (3) The number, type, and rated capacity of any turbines or generators, whether existing or proposed, to be included as part of the project;
>
> (4) The number, length, voltage, and interconnections of any primary transmission lines, whether existing or proposed, to be included as part of the project (see 16 U.S.C. 796(11));
>
> (5) The specifications of any additional mechanical, electrical, and transmission equipment appurtenant to the project; and
>
> (6) All lands of the United States that are enclosed within the project boundary described under paragraph (h) of this section (Exhibit G), identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence of a public land survey, by the best available legal description. The tabulation must show the total acreage of the lands of the United States within the project boundary.

A.1. General Description and Location of the Hells Canyon Complex

The Hells Canyon Complex[1] consists of three hydroelectric projects (dams, reservoirs, and powerhouses) on the segment of the Snake River forming the border between Idaho and Oregon. These three projects are the Brownlee, Oxbow, and Hells Canyon projects. River mile 247 of the Snake River below Hells Canyon Dam and river mile 343 just above the upstream margin of Brownlee Reservoir mark the downstream and upstream boundaries of the complex. The complex lies approximately 20 miles northwest of Cambridge, Idaho; 90 miles northwest of Boise, Idaho; and 45 miles east of Baker City, Oregon. Brownlee Dam is farthest upstream at river mile 284.6. Flow past Brownlee Dam discharges into Oxbow Reservoir. Oxbow Dam is about 12 miles downstream of Brownlee Dam, at river mile 272.5. Flow past Oxbow Dam discharges into Hells Canyon Reservoir. Hells Canyon Dam is about 25 miles downstream of Oxbow Dam, at river mile 247.6. The river below Hells Canyon Dam is unobstructed by artificial structures until it reaches the headwaters of Lower Granite Reservoir approximately 100 miles downstream of Hells Canyon Dam. Each of the three dams and associated components is described in the sections of this exhibit.

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

The normal maximum water level[2] in Brownlee Reservoir is at an elevation of 2,077 feet above mean sea level (msl). No change to this normal maximum level is proposed for future operations. The normal maximum water level in Oxbow Reservoir and the tailwater at Brownlee Dam is 1,805 feet msl. The normal maximum water level of Hells Canyon Reservoir and the tailwater at Oxbow Powerhouse is 1,688 feet msl. Although the tailwater level at Hells Canyon Powerhouse is dependent on the flow past Hells Canyon Dam, it averages about 1,475 feet msl.

A.2. BROWNLEE PROJECT

A.2.1. Brownlee Dam and Powerhouse

Brownlee Dam is a clay-core, earth- and rockfill structure measuring 1,380 feet long, with a maximum structural height of 395 feet. The maximum reservoir depth, from the bottom of the original river channel to the normal maximum reservoir elevation of 2,077 feet msl, is approximately 300 feet. The minimum reservoir elevation at which the powerhouse is operated is 1,976 feet msl. The crest of the dam is slightly arched, or cambered, from 2,090 feet msl at the abutments to approximately 2,097 feet msl at the original center of the river channel, for a minimum freeboard of 13 feet above the normal maximum reservoir elevation of 2,077 feet msl. The upstream rock shell and the clay core and filters are founded on the river channel bed, which is composed of monolithic, metamorphic basalt. The center portion of the dam rests on native streambed sands, gravels, and boulders. The toe of the downstream rock shell is also founded on the underlying monolithic basalt. A single concrete spillway structure is constructed into the left[3] abutment of the dam. The spillway structure contains seven radial gates, comprising four crest gates and three low-level outlet gates. The powerhouse intake and penstocks, as well as the powerhouse itself, are constructed into the right abutment of the dam. Both abutments are composed of largely impermeable and insoluble Columbia River basalt flows.

2. Throughout this exhibit, the Applicant refers to “normal maximum water level,” “normal high water level,” “normal maximum reservoir elevation,” and “full pool elevation.” Although these phrases are synonymous, the Applicant chose the alternative that best reflected the emphasis within the given context.
3. In accordance with standard practice, all location descriptions are based on a perspective looking downstream, which is generally north/northeast.

A.2.1.1. Brownlee Spillway

The reinforced concrete spillway is constructed into the left abutment of the dam. The spillway contains seven steel radial gates, which include four crest gates and three low-level outlet gates. Downstream of the radial gates, a 173-foot-wide reinforced concrete-lined chute discharges into the river channel below the dam. The calculated spillway capacity is 307,300 cubic feet per second (cfs) at the normal maximum reservoir elevation of 2,077 feet msl. The spillway gates are lifted and closed with electric motor-driven chain and cable hoists mounted on the concrete spillway deck. These motors can be operated with local power via any one of the five turbine generators. In addition, backup power can be supplied by a 69-kilovolt (kV) powerline from the Oxbow Switchyard or by an emergency diesel generator stationed on the powerhouse.

The four upper radial gates, the crest gates, are 32 feet wide and 50 feet high. Steel splash boards welded to the top of the crest gates above the gate truss arms reduce the amount of water splashed onto the gate truss arms from reservoir waves. The concrete piers and concrete abutments on each side of the spillway structure support the precast concrete bridge deck and gate-hoisting equipment. The three low-level outlet gates are 23 feet wide and 23 feet 4 inches high.

A.2.1.2. Brownlee Intake and Penstocks

The powerhouse intake channel was excavated into the right rock abutment located on the Idaho side of the Snake River. The channel length from the edge of the reservoir to the concrete intake structure is approximately 500 feet. This intake structure contains five arched steel trash racks, headgates, and connections to the five steel penstocks leading to the turbines in the powerhouse. A 16-foot-wide by 30-foot-high sliding headgate at the entry to each penstock allows dewatering of the penstock when needed.

The penstocks are embedded in the rock abutment between the intake and the powerhouse. The steel penstocks were dragged in sections into tunnels excavated through the rock abutment and welded together in place. The open spaces between the steel penstocks and the tunnel walls were then filled with concrete grout.

A.2.1.3. Brownlee Powerhouse

The Brownlee Powerhouse was constructed in two different periods. The section containing units 1 through 4 was constructed as part of the original construction from 1955 through 1958. The section containing unit 5 was constructed between 1976 and 1980. The entire powerhouse site was excavated from the rock abutment on the Idaho side. The section of the powerhouse with units 1 through 4 is nearer to the center of the original river channel, while the section with unit 5 is farther into the rock abutment. The powerhouse is constructed of reinforced concrete, measures approximately 390 feet long, and varies in width from 104 feet at units 1 through 4 to 137 feet at unit 5. From the bottom of the concrete under the draft tubes to the top of the concrete structure, the section of the powerhouse with units 1 through 4 is approximately 85 feet high. The height of the concrete structure in the section with unit 5 is approximately 140 feet. The structure is deeper at the sump in each section because the lowest elevations of the sumps are below the bottoms of the draft tubes.

A.2.1.4. Brownlee Tailraces

The Brownlee Project has two separate tailrace channels, one carrying flow from the powerhouse section containing turbine generator units 1 through 4, and the other, from the powerhouse section containing turbine generator unit 5. Both tailrace channels are unlined and were excavated through the original rock abutment from the powerhouse sections to the original river channel. The tailrace from the section with units 1 through 4 is approximately 800 feet long, averages 250 feet wide, and was excavated to an elevation of 1,780 feet msl. The normal water depth in the channel is between 20 and 25 feet. The tailrace from unit 5 is approximately 1,350 feet long from the powerhouse to the original edge of the river and varies in width and depth. At the outflow from unit 5, the tailrace floor is at 1,728 feet msl, approximately 75 feet below the normal water level for Oxbow Reservoir, and approximately 46 feet wide. Where the unit 5 tailrace intersects the river's edge, the tailrace is approximately 130 feet wide and 35 feet deep, with a bottom elevation of 1,770 feet msl.

A.2.2. Brownlee Reservoir

Brownlee Reservoir extends from Brownlee Dam to just below the upstream end of the project boundary (at approximately river mile 344). Characteristics of the reservoir are summarized below:

Length	57 miles (58 miles to the project boundary)
Water surface elevations	
Normal maximum water level	2,077 feet msl
Minimum operating level	1,976 feet msl
Surface area at full pool (2,077 feet msl)	14,621 acres
Total storage at full pool	1,420,062 acre-feet
Usable storage	975,318 acre-feet

The reservoir surface area and volume at 1-foot increments over the full range of operating reservoir levels are shown in Table A-1.

A.2.3. Brownlee Turbine Generators

The Brownlee Powerhouse contains five vertical-shaft turbine generators. Each vertical Francis-type (fixed-blade impeller) turbine is directly connected by a vertical shaft to a three-phase generator that operates at 60 cycles per second. The turbine generators for units 1 through 4 are all of the same size and rating. The unit 5 turbine generator is larger.

Water flow through each turbine is controlled by governor-actuated wicket gates surrounding the turbine runner. Units 1 and 2 are controlled by a dual cabinet actuator, and units 3 and 4 are controlled by a second dual cabinet actuator. Unit 5 is controlled by a single electro-mechanical cabinet actuator governor. When shut down for annual maintenance or major repairs, each unit's penstock and draft tube can be dewatered by closing the headgate and draft tube gate and then draining the water from the unit via the plant sump.

The unit 1 through 4 generators are semi-outdoor style and enclosed in removable, cylindrical steel shelters on the powerhouse generator deck. The unit 5 generator is inside the powerhouse on the mezzanine deck of the unit 5 section of the powerhouse, 36 feet below the roof of the powerhouse. Unit 5 is accessed by removing the generator cover hatch on the roof of the powerhouse. This one-piece hatch is made of plate steel.

Each of the unit 1 through 4 generators was rewound between 1971 and 1974 (see section C.1.). The unit 4 generator was rewound again in 2000; and unit 1, in 2001. Plans exist to rewind units 2 and 3 within the next several years, depending on their condition. Turbines and other associated equipment are repaired as needed during each annual maintenance outage. They are also repaired as needed in the event of an unscheduled equipment outage. Characteristics for the five turbine generators are summarized below:

Turbine	**Units 1 through 4**	**Unit 5**
Type	Vertical Francis	Vertical Francis
Nameplate head	250 feet	240 feet
Nameplate output, per unit	144,000 horsepower	322,000 horsepower
Hydraulic capacity at nameplate head and capacity, per unit	5,675 cfs	11,800 cfs
Turbine speed	128.6 revolutions per minute (rpm)	100 rpm
Turbine diameter	15 feet 8.5 inches	23 feet
Turbine buckets (vanes, blades)	15	15

The space between the outer edge of each bucket vane and the inside edge of the nearest structure—the edge of the wicket gate when fully open—is more than 12 inches.

Generator	**Units 1 through 4**	**Unit 5**
Nameplate kilovolt amperes (kVA), per unit	100,111 kVA	250,000 kVA
Rated capacity, per unit	90,100 kilowatts (kW)	225,000 kW
Power factor	90%	90%
Voltage	13,800 kV	13,800 kV

A.2.4. Brownlee Primary Transmission Lines and Switchyard

Primary transmission lines associated with the Hells Canyon Complex are described in section A.5. The Brownlee Switchyard contains the electrical breakers for the generators of the Brownlee Project, the transmission-system monitoring equipment, and breakers and system voltage support capacitors for the transmission lines served by the switchyard.

A.2.5. Brownlee Appurtenant Equipment

Appurtenant equipment associated with the Brownlee Project includes five main power transformers, two gantry cranes, and a standby diesel generator. Details of this equipment, as well as the intake trash racks, are provided in this section.

A.2.5.1. Transformers

The Brownlee Project is served by five main power transformers. The transformers for the unit 1 through 4 generators are mounted outdoors on the plant transfer deck on the downstream side of that powerhouse section. The transformer for unit 5 is mounted outdoors on the downstream side of the top deck of the powerhouse above the unit 5 tailrace. The overhead high-voltage lines from each of the primary transformers span to the Brownlee Switchyard just downstream of the powerhouse. Characteristics of the transformers are listed below:

Units 1 through 4	13,800/230,000-volt, three-phase, rated at 116,000 kVA
Unit 5	13,800/230,000-volt, three-phase, rated at 256,700 kVA at 55 °C temperature rise and 287,500 kVA at 65 °C temperature rise

The local service transformers for units 1 through 4 are rated at 500 kVA each. The local service transformer for unit 5 is rated at 1,000 kVA. Standby local service is provided by one three-phase, 2,500-kVA, 12,500/480-volt transformer served by a distribution line originating at the Oxbow Switchyard.

A.2.5.2. Gantry Cranes

There are two rail-mounted electric gantry cranes on the Brownlee Powerhouse: one is a 300-ton crane, while the other is a 400-ton crane. These cranes can be positioned over each of the generators, as well as over other primary equipment, by running them on steel rails that are mounted on top of the powerhouse.

A.2.5.3. Standby Diesel Generator

A 200-kW diesel generator is stationed on the powerhouse to provide power for critical loads—such as emergency lighting, unit start up, and spillway gate-hoist motors—in the event of a power outage. This standby generator is connected to the critical loads via a combination of automatic and manual transfer switches.

A.2.5.4. Intake Trash Racks

For the Brownlee Project, the trash racks at the penstock intakes are semicircular steel frameworks that lay against the face of the concrete penstock intake structure at an angle of approximately 15 degrees from vertical. The radius of the outermost part of each semicircular trash rack is approximately 14 feet. The “roof” of each trash rack has screening similar to that for the face of the trash rack.

The screen on the faces of the unit 1 through 4 trash racks is welded 3/8-inch round bar mesh, constructed in panels, with a maximum opening approximately 3.625 inches wide by 7.625 inches high. After deducting the space obstructed by the screening and structural members, the unobstructed open space through the unit 1 through 4 trash racks is calculated to be approximately 1,840 square feet. This amount of unobstructed open space leads to an estimated peak water velocity at the faces of these trash racks of approximately 3 feet per second. Any debris that accumulates on a trash rack reduces the net open space, increasing the velocity of the flow through the rack. Accumulation of debris has not been a problem to date on the Brownlee trash racks.

The screen on the face of the unit 5 trash rack is a welded steel grid of 1-inch-wide horizontal bars and 1.5-inch- and 2.5-inch-wide vertical bars and 2-inch-wide diagonal bars on the structural steel framework. The maximum opening is 16.25 inches wide by 12 inches high. The unobstructed open space through the unit 5 trash rack is calculated to be approximately 1,630 square feet. This amount of unobstructed open spaces leads to an estimated peak water velocity at the face of the rack of approximately 7.3 feet per second. Any debris that accumulates on a trash rack reduces the net open space, increasing the velocity of the flow through the rack. Since modifications to the unit 5 trash rack shortly after construction, accumulation of debris on this rack has not been a problem.

The peak velocity of the water approaching the intake trash racks for the Brownlee Project, based on the minimum dimensions of the intake channel upstream of the trash racks, is calculated to be approximately 8.5 feet per second.

A.3. Oxbow Project

A.3.1. Oxbow Dam and Powerhouse

The Oxbow Project consists of an earth- and rockfill dam (see Exhibit F) at river mile 272.5, a 12-mile-long reservoir that extends up to the toe of Brownlee Dam, and an intake structure and water tunnels to a powerhouse separated from the dam and reservoir by a natural rock ridge in a bend of the Snake River. The long, narrow hairpin bend of the river channel around this rock ridge is referred to as "the oxbow." Water from Oxbow Reservoir is carried through the rock ridge to the powerhouse via two concrete-lined power tunnels. In accordance with the current license and as proposed by the Applicant for future operations, a minimum flow of 100 cfs is spilled past Oxbow Dam at all times to maintain a flow in the original river channel around the oxbow between the dam and the powerhouse. This approximately 2-mile-long "Oxbow Bypass" reach is normally submerged by Hells Canyon Reservoir except during low-flow periods when Hells Canyon Reservoir is drafted.

A.3.1.1. Oxbow Dam

Oxbow Dam is a clay-core, earth- and rockfill structure measuring 960 feet long, with a maximum structural height of 209 feet. The maximum reservoir depth, from the deepest point in the reservoir in front of the dam to the normal maximum reservoir elevation of 1,805 feet msl, is approximately 130 feet. The crest of the dam is cambered from 1,820 feet msl at the abutments to approximately 1,825 feet msl at the original center of the river channel. The upstream rock shell and the clay core and filters are founded on the river channel bed, which is composed of monolithic, metamorphic basalt. The center portion of the dam rests on native streambed sands, gravels, and boulders. A toe trench at the downstream toe of the dam was excavated through the streambed alluvium to the underlying metamorphic rock, and the toe of the outer rock shell of the dam is founded on the bedrock at the bottom of this trench.

A.3.1.2. Oxbow Spillways

The two spillways at Oxbow Dam—called the Oregon spillway and the Idaho spillway—have a combined capacity of 300,000 cfs when the reservoir elevation is surcharged to 1,810 feet msl, 5 feet above the normal maximum reservoir level.

The Oregon spillway, the principal spillway associated with the Oxbow Project, was excavated into the left rock abutment, which is located on the Oregon side of the Snake River. This spillway is a reinforced concrete structure containing three side-by-side 32-foot-wide by 50-foot-high radial gates separated by 8-foot-wide concrete piers and a 112-foot-wide concrete-lined chute that carries spill to the river channel below the dam. The overall width of the Oregon spillway is approximately 128 feet, and the spillway has a foundation elevation of 1,720 feet msl and a top bridge deck elevation of 1,820 feet msl. Steel splash plates welded to the tops of the gates above the gate truss arms minimize the amount of wave splash on the gate truss arms. The precast concrete bridge deck provides vehicle access across the spillway to the dam and supports the gate-hoisting equipment. The top of the bridge deck is at 1,820 feet msl, 15 feet above the normal high reservoir level. Each of the three gates has an electric gate hoist, and two alternative powerlines are available to serve the hoist motors. A gas-powered hoist motor can also lift one of the three gates if both alternative powerlines experience simultaneous outages, and a 100-kW diesel generator is stationed at the Oxbow Project to provide yet another power source if needed.

The current minimum streamflow of 100 cfs below the dam is carried around the primary spillway radial gates via a buried steel pipe that is 5 feet in diameter. This pipe runs along and under the right training wall of the spillway. The minimum bypass flow is released into the spillway chute via a 30-inch steel pipe, located aboveground, that is connected to the buried pipe.

The Oregon spillway is used to pass flow in excess of flow through the powerhouse. The capacity of this principal spillway is 150,000 cfs with the reservoir at 1,810 feet msl.

The Idaho spillway serves as a secondary, emergency spillway at the Oxbow Project. This spillway was excavated into the right rock abutment, which is located on the Idaho side of the Snake River. This spillway was constructed to ensure that the probable maximum flood of 300,000 cfs could pass Oxbow Dam without threatening the stability of the structure. The emergency spillway consists of a 450-foot-long erodible “fuse plug” embankment and a 75-foot-wide concrete-lined chute that discharges to the Snake River. The emergency spillway fuse plug was designed and constructed to wash out if inflows to Oxbow Reservoir exceeded the capacity of the powerhouse and the Oregon spillway. If sustained river flows exceed the 150,000-cfs capacity of the principal spillway, the emergency spillway washes out and creates an open channel capable of passing 150,000 cfs with the reservoir at an elevation of 1,810 feet msl, thereby preventing a risk of overtopping the dam. The bottom of the fuse plug on the concrete sill is at 1,785 feet msl, 20 feet below the normal high water level. The top of the fuse plug embankment varies from 1,812 to 1,814 feet msl, or 7 to 9 feet above the normal high water level. A pilot channel adjacent to the far right abutment on the Idaho side measures 10 feet wide at an elevation of 1,810 feet msl. This pilot channel is designed to start the erosion of the fuse plug if the reservoir surcharges above 1,810 feet msl, which is 5 feet above the normal high water level.

A.3.1.3. Oxbow Intake, Power Tunnels, Surge Tanks, and Penstocks

The Oxbow Project is unusual in that the powerhouse is separated from the dam and reservoir by a natural rock ridge in a bend of the Snake River. The water from the reservoir is carried through the rock ridge to the powerhouse via two power tunnels measuring 36 feet in diameter. The intake to these submerged tunnels is located approximately 2,400 feet upstream of the dam.

The intake site for the power tunnels was excavated into the rock abutment on the left river bank upstream of the dam. The intake is a 106-foot-high reinforced concrete structure containing upstream steel trash racks; stoplog slots; and separated, flared openings to the two power tunnels (see Exhibit F).

The horseshoe-shaped power tunnels were excavated through the rock ridge between the reservoir and powerhouse site. These power tunnels, which have minimal slope, are 781 and 841 feet long. Each power tunnel discharges into its own concrete surge tank. The surge tanks are recessed into the rock abutment above the powerhouse on the far side of the rock ridge from the intake. At each surge tank, the flow from the associated power tunnel is divided into two steel penstocks leading to the powerhouse. The surge tank structures contain steel penstock intake headgates that can be shut to dewater each penstock. These headgates are 18 feet wide by 30 feet high.

The penstocks are 23 feet in diameter and 173 feet long, and they are made of concrete-encased steel. Each steel penstock leads from the associated surge tank to the powerhouse turbine. Sections of these penstocks were dragged into tunnels excavated through the rock abutment and welded together in place. The annular space between the steel penstocks and tunnel walls was then filled with concrete grout.

A.3.1.4. Oxbow Powerhouse

The reinforced concrete powerhouse, containing four generating units, is located on the left side of the Snake River immediately below the surge tanks. The powerhouse is recessed into an excavation in the rock riverbank and measures approximately 276 feet long and 106 feet wide. From the bedrock under the draft tubes to the top of the concrete structure, the powerhouse is approximately 85 feet high, although it is deeper at the sump.

A.3.1.5. Oxbow Tailrace

Because the Oxbow Powerhouse releases water directly into the side of the river, there is negligible tailrace (see Exhibit F).

A.3.2. Oxbow Reservoir

Oxbow Reservoir extends from Oxbow Dam upstream to the toe of Brownlee Dam. Characteristics of the reservoir are summarized below:

Length	12 miles
Water surface elevations	
Normal maximum water level	1,805 feet msl
Typical minimum operating level	1,800 feet msl
Minimum operating level	1,795 feet msl
Surface area at full pool (1,805 feet msl)	1,150 acres
Total storage at full pool	58,385 acre-feet
Typical usable storage	5,694 acre-feet
Maximum usable storage	10,857 acre-feet

The reservoir surface area and volume at 1-foot increments over the full range of operating reservoir levels are shown in Table A-2.

A.3.3. Oxbow Turbine Generators

The Oxbow Powerhouse contains four vertical-shaft turbine generators. Each vertical Francis-type (fixed-blade impeller) turbine is directly connected by a vertical shaft to a three-phase generator that operates at 60 cycles per second. The turbine generators are all of the same size and rating.

Water flow through each turbine is controlled by governor-actuated wicket gates surrounding the turbine runner. Units 1 and 2 are controlled by a dual cabinet actuator, and units 3 and 4 are controlled by a second dual cabinet actuator. When shut down for annual maintenance or major repairs, each unit's penstock and draft tube can be dewatered by closing the headgate and draft tube gate and then draining the water from the unit via the plant sump.

The four generators are semi-outdoor style and enclosed in removable, cylindrical steel shelters on the powerhouse generator deck. The generator breakers are also mounted on the powerhouse.

The unit 2, 3, and 4 generators were each rewound in 1990, 1989, and 1988, respectively, to prevent untimely failure due to age-related deterioration of the insulation. After insulation failure, unit 1 was rewound starting in 1990 (see section C.1.). Turbines and other associated equipment are repaired as needed during each annual maintenance outage and in the event of an unscheduled equipment outage. Characteristics for the four turbine generators are summarized below:

Turbine	Units 1 through 4
Type	Vertical Francis
Nameplate net head	115 feet
Nameplate output	73,000 horsepower
Hydraulic capacity at nameplate net head and capacity	6,100 cfs
Turbine speed	94.7 rpm
Turbine diameter	16 feet 9.5 inches
Turbine buckets(vanes, blades)	15

The space between the outer edge of each bucket vane and the inside edge of the nearest structure—the edge of the wicket gate when fully open—is more than 12 inches.

Generator	Units 1 through 4
Nameplate kVA	52,778 kVA
Rated capacity (calculated)	47,500 kW
Power factor	90%
Voltage	13,800 kV

A.3.4. Oxbow Primary Transmission Lines and Switchyard

The primary transmission lines associated with the Hells Canyon Complex are described in section A.5. The Oxbow Switchyard contains the electrical breakers for the transmission lines served by the switchyard, as well as the power switches and transformers. The generator breakers are mounted on the Oxbow Powerhouse.

A.3.5. Oxbow Appurtenant Equipment

Appurtenant equipment associated with the Oxbow Project includes two main power transformers and a gantry crane. Details of this equipment, as well as the intake trash racks, are provided in this section.

A.3.5.1. Transformers

The Oxbow Project is served by two main power transformers. The transformers are mounted outdoors on the downstream side of the powerhouse's top deck. One transformer serves units 1 and 2, while the second transformer serves units 3 and 4. The overhead high-voltage lines from the transformers span to the Oxbow Switchyard just downstream of the powerhouse. The three-phase, 13,800/230,000-volt main power transformers are rated at 122,000 kVA at 55 °C temperature rise.

In addition, a local service transformer is connected to each generator. These three-phase, 13,800/480-volt transformers are rated at 750 kVA each. Standby local service is provided by one three-phase, 500-kVA, 12,500/480-volt transformer served by a distribution line originating at the Oxbow Switchyard.

A.3.5.2. Gantry Crane

A 230-ton, rail-mounted gantry crane is located on the Oxbow Powerhouse. This crane can access all of the plant equipment by running on the rails that are mounted on top of the powerhouse.

A.3.5.3. Intake Trash Racks

The trash racks at the Oxbow Project are at the face of the power tunnel intake structure on the bank of the Oxbow Reservoir. The trash racks are in 17.5-foot-high by 10-foot, 10-inch-wide steel panels that are stacked up on the sloping face of the concrete and steel intake structure. There are 24 trash rack panels covering the intake to each of the two power tunnels. The bottoms of the trash racks are at an elevation of 1,725.5 feet, or 74.5 feet below the minimum reservoir elevation, while the tops of the trash racks are at an elevation of 1,794 feet, or 1 foot below the minimum reservoir elevation.

The face of each trash rack panel is 3/8-inch by 3-inch-deep steel bars on edge, spaced 4.75 inches apart on a structural steel framework. The maximum opening is 4.75 inches wide by 20 inches high. The unobstructed open space in the trash racks is calculated to be approximately 3,990 square feet per power tunnel. This amount of unobstructed open space leads to an estimated peak water velocity at the faces of the trash racks of approximately 3 feet per second. Any debris that accumulates on a trash rack reduces the net open space, increasing the velocity of the flow through the rack. Historically, accumulation of trash on the trash racks of the Oxbow Project has been minimal. Additionally, these trash racks can be, and occasionally are, cleaned using a scraper device and a mobile crane.

Because the intake for the Oxbow Project is on the bank of the Oxbow Reservoir, the peak velocity of the water approaching the trash racks is much lower than the velocity of the water passing through the trash racks.

A.4. Hells Canyon Project

A.4.1. Hells Canyon Dam and Powerhouse

The Hells Canyon Project, the third development in the Hells Canyon Complex, is also the one farthest downstream on the Snake River. It consists of a concrete gravity dam and integral spillway, intake, and powerhouse at river mile 247.6 (see Exhibit F). Hells Canyon Dam impounds a 25-mile reservoir that extends up to the toe of Oxbow Dam.

A.4.1.1. Hells Canyon Dam

Hells Canyon Dam is a 910-foot-long cast-in-place concrete gravity dam with integral spillway, intake, and powerhouse sections. The dam has a maximum structural height of 330 feet. The maximum reservoir depth, from the deepest point in Hells Canyon Reservoir just upstream of the dam to the normal maximum reservoir elevation of 1,688 feet msl, is approximately 240 feet.

A.4.1.2. Hells Canyon Spillway

The spillway is constructed into the center right section of the concrete dam. It contains five radial gates, which include three crest gates and two low-level outlet gates. The capacity of the spillway, with the reservoir surcharged to 5 feet above the normal maximum operating level, is 300,000 cfs. The spillway gates are lifted and closed with electric motor-driven cable hoists mounted on platforms at the top of the piers separating the radial gates. These motors can be operated with local power via either of two of the turbine generators, with backup power supplied via a 69-kV powerline from the Oxbow Switchyard or from an emergency diesel generator stationed on the dam.

A reinforced concrete basin, also called a roller bucket or flip bucket, is located at the bottom of the spillway chute at the toe of the dam. This basin redirects the spillway flow upward and back on itself to dissipate the hydraulic energy of the spillway flows and protect the dam foundation from the scouring effect of spillway flows.

The three crest gates are 43 feet wide and 50 feet high. The crest gates are separated by 15-foot-wide reinforced concrete piers. The two low-level outlet gates are 23 feet wide and 25 feet high.

A.4.1.3. Hells Canyon Intake and Penstocks

Similar to the spillway, the turbine intake section is contained within the center left section of the concrete dam, adjacent to the spillway section. A steel trash rack is located in front of the entire intake section. One vertical sliding headgate is positioned above each flared penstock opening to allow the associated penstock to be dewatered. Steel penstocks, measuring 24 feet in diameter and 164 feet long, lead from the intake to each of the three turbines. The three steel penstocks are encased in the concrete dam.

A.4.1.4. Hells Canyon Powerhouse

The reinforced concrete powerhouse was constructed against the downstream face of the dam on the Oregon side of the Snake River. The powerhouse, which contains three generating units, is approximately 196 feet long. From the bedrock under the draft tubes to the top of the concrete structure, the powerhouse is approximately 110 feet high, although it is deeper at the sump.

A.4.1.5. Hells Canyon Tailrace

The tailrace for the Hells Canyon Powerhouse was excavated into the original river channel and bedrock of the left bank. Therefore, the powerhouse releases water directly into the preexisting river channel. The tailrace is unlined.

A.4.1.6. Hells Canyon Fish Trap

The fish trap at Hells Canyon Dam is a reinforced concrete structure excavated into the bedrock of the left river bank immediately downstream of the powerhouse (see Exhibit F). It was constructed in 1983 and 1984.

A.4.2. Hells Canyon Reservoir

Hells Canyon Reservoir extends from Hells Canyon Dam upstream to the toe of Oxbow Dam. Characteristics of the reservoir are summarized below:

Length	25 miles
Water surface elevations	
Normal maximum water level	1,688 feet msl
Typical minimum operating level	1,683 feet msl
Minimum operating level	1,678 feet msl
Surface area at full pool (1,688 feet msl)	2,412 acres
Total storage at full pool	167,720 acre-feet
Typical usable storage	11,795 acre-feet
Maximum usable storage	23,060 acre-feet

The reservoir surface area and volume at 1-foot increments over the full range of operating reservoir levels are shown in Table A-3.

A.4.3. Hells Canyon Turbine Generators

The Hells Canyon Powerhouse contains three vertical-shaft turbine generators. Each vertical Francis-type (fixed-blade impeller) turbine is directly connected by a vertical shaft to a three-phase generator that operates at 60 cycles per second. The turbine generators are all of the same size and rating.

Water flow through each turbine is controlled by governor-actuated wicket gates surrounding the turbine runner. One cabinet actuator governor serves each unit. When shut down for annual maintenance or major repairs, each unit's penstock and draft tube can be dewatered by closing the headgate and draft tube gate and draining the water from the unit via the plant sump.

The three generators are semi-outdoor style and enclosed in removable, cylindrical steel shelters on the powerhouse generator deck. The generator breakers are in the switchyard on the downstream face of the dam above the powerhouse. The units 1, 2, and 3 generators were rewound in 1987, 1985, and 1986, respectively (see section C.1.). Units 2 and 3 were rewound after insulation failure, while unit 1 was rewound to prevent untimely insulation failure. Turbines and other associated equipment are repaired as needed during each annual maintenance outage and in the event of an unscheduled equipment outage. Characteristics for the three turbine generators are summarized below:

Turbine	**Units 1 through 3**
Type	Vertical Francis
Nameplate head	210 feet
Nameplate output	195,000 horsepower
Hydraulic capacity at nameplate head and capacity	9,000 cfs
Turbine speed	120 rpm
Turbine diameter	17 feet 6.5 inches
Turbine buckets (vanes, blades)	15

The space between the outer edge of each bucket vane and the inside edge of the nearest structure—the edge of the wicket gate when fully open—is more than 12 inches.

Generator	Units 1 through 3
Nameplate kVA	145,000 kVA
Rated capacity	130,500 kW
Power factor	90%
Voltage	14,400 kV

A.4.4. Hells Canyon Primary Transmission Lines and Switchyard

Primary transmission lines associated with the Hells Canyon Complex are described in section A.5. The Hells Canyon Switchyard is mounted on a structural steel framework on the downstream face of the dam above the powerhouse at an elevation of 1,617 feet msl. The Hells Canyon Switchyard contains electrical breakers for the transmission lines served by the switchyard, as well as power switches and transformers.

A.4.5. Hells Canyon Appurtenant Equipment

Appurtenant equipment associated with the Hells Canyon Project includes three main power transformers, a gantry crane, and a standby diesel generator. Details of this equipment, as well as the intake trash racks, are provided in this section.

A.4.5.1. Transformers

Each of the three Hells Canyon generators is served by a separate main power transformer located outdoors on the upstream side of the powerhouse's top deck. The three-phase, 14,400/230,000-volt main power transformers are rated at 166,667 kVA at 55 °C temperature rise and 186,667 kVA at 65 °C temperature rise.

Local service is supplied to the powerhouse from two three-phase, 14,400/480-volt transformers rated at 1,000 kVA. One of these transformers is energized by generator 1 and the other by generator 2. Standby local service is provided via one three-phase, 1,000-kVA, 69,000/480-volt transformer that is energized by a 69-kV overhead distribution line from the Oxbow Switchyard.

A.4.5.2. Gantry Crane

A 400-ton, rail-mounted gantry crane is located on the Hells Canyon Powerhouse. This crane can access all of the plant equipment by running on the rails that are mounted on top of the powerhouse.

A.4.5.3. Standby Diesel Generator

A 200-kW diesel generator is housed in a concrete and steel shelter on the intake deck of the dam to provide power for critical loads—such as emergency lighting, unit start up, and spillway gate-hoist motors—in the event of a power outage. This standby generator is connected to the critical loads via a combination of automatic and manual transfer switches.

A.4.5.4. Intake Trash Racks

The intake trash racks at Hells Canyon Dam rest in concrete and steel slots on the face of the concrete Hells Canyon Dam. The trash racks are in 10-foot-high by 20-foot-wide steel panels that are stacked up in the trash rack slots on the face of the concrete intake structure. There are 16 trash rack panels covering the intake to each of the three turbine generator units. The bottoms of the trash racks are at an elevation of 1,538 feet, or 145 feet below the minimum reservoir elevation, while the tops of the trash racks are at an elevation of 1,618 feet, or 65 feet below the minimum reservoir elevation.

The face of each trash rack panel is 1/2-inch by 5-inch-deep steel bars on edge, spaced 5.5 inches apart on a structural steel framework. The maximum opening is 5.5 inches wide by 17 inches high. The unobstructed open space in the trash racks is calculated to be approximately 2,500 square feet per penstock. This amount of unobstructed open space leads to an estimated peak water velocity at the faces of the trash racks of approximately 3.6 feet per second. Any debris that accumulates on a trash rack reduces the net open space, increasing the velocity of the flow through the rack. Historically, accumulation of trash on the trash racks of the Hells Canyon Project has been minimal. Additionally, these trash racks can be cleaned using a scraper device and a mobile crane.

Because the intake for the Hells Canyon Project is on the upstream face of the dam, the peak velocity of the water in the reservoir upstream of the trash racks is much lower than the velocity of the water passing through the trash racks.

A.5. Hells Canyon Complex Primary Transmission Lines

Twelve transmission lines were included in the draft *New License Application: Hells Canyon Hydroelectric Project*. All but one of those lines have been excluded from this final license application. The remaining transmission line is the Pine Creek–Hells Canyon 69-kV line (Line 945). This line runs from the Oxbow Switchyard to the Pine Creek Substation and to the Hells Canyon Substation.

A.6. Federal Land

There are 5,270 acres of federal lands within the proposed project boundary. Table A-4 through Table A-6 list these federal lands by section. Table A-7 lists the federal land within the transmission-line easement by section.

When the project boundary for the Hells Canyon Complex was originally established, in addition to including all of the Applicant's lands used for project purposes, the project boundary on private land was established at a reservoir elevation (contour line). However, on federal lands, the project boundary generally followed boundary lines of (aliquot) parts of sections established by public land survey and thereby included more land than was needed for the project. Included are approximately 3,800 acres of federal land above the countour line (300 to 400 acres on both Oxbow and Hells Canyon reservoirs and the remainder on Brownlee Reservoir). According to Federal Energy Regulatory Commission (FERC) regulations, unless the land is needed for project purposes, the project boundary must be located no more than 200 feet (horizontal measurement) from the exterior margin of the reservoir. Therefore, in this license application, the Applicant proposes to use the same contour line on federal lands that is used on private land for the project boundary. The land that is currently within the project boundary but not within the proposed project boundary is not necessary for project purposes such as public recreation, shoreline control, or protection of environmental resources. The proposed project boundary would have no effect on mitigation of project impacts on any lands in the vicinity of the project. It would also eliminate any constraints on land use or management of those federal lands excluded from the project that might occur as a result of those lands being within the project boundary.

A.7. Fish Hatcheries

Fish hatcheries provided by the Applicant are described in section E.3.1.3.1.2. and in Technical Report E.3.1-4. The Applicant proposes to continue operating four fish hatcheries and four adult fish traps as ongoing mitigation for the effects of the Hells Canyon Complex on anadromous fish. These facilities, from downstream to upstream, are summarized below:

- The Hells Canyon adult upstream migrant fish trap is immediately downstream of Hells Canyon Dam on the Oregon side of the Snake River. Hatchery-produced adult spring chinook salmon and steelhead migrating upstream to spawn are captured at this trap and transported to the Oxbow Fish Hatchery. As a condition of the 1980 *Hells Canyon Settlement Agreement*, a floating barge trap is also maintained by the Applicant at Hells Canyon Dam. It serves as a backup to the permanent Hells Canyon trap and supplements collection of adult spring chinook and steelhead, as necessary, to fulfill agency requests.

- The Oxbow Fish Hatchery is also on the Oregon side of the Snake River, at the confluence of Pine Creek and the Hells Canyon Reservoir, just downstream of the Oxbow Powerhouse. Spring chinook salmon caught at the Hells Canyon trap are kept at the Oxbow Fish Hatchery only temporarily, and then they are transported to the Rapid River Fish Hatchery for spawning, incubation, and rearing. Adult steelhead are kept at the Oxbow Fish Hatchery until spawning. After spawning, the eggs are incubated through the eye-up or swim-up fry stage, at which time they are transferred to the Niagara Springs Fish Hatchery for rearing.

Additionally, fall chinook are incubated and reared at the Oxbow Fish Hatchery, using eggs from the Lyons Ferry Hatchery in Washington, if fall chinook eggs are available.

- The Rapid River fish trap is located approximately 1.5 miles downstream of the Rapid River Fish Hatchery on the Rapid River, a tributary to the Little Salmon River, and upstream of Riggins, Idaho. Adult spring chinook salmon that were spawned, incubated, and reared at the Rapid River Fish Hatchery and have completed their round-trip migration to the ocean are captured at this trap at the end of their upstream migration to spawn. These adults are then kept and spawned at the Rapid River Fish Hatchery.

- The Rapid River Fish Hatchery is on the northwest side of the Rapid River, a tributary to the Little Salmon River, and located approximately 20 miles northeast and on the far side of the Seven Devils Mountains from Hells Canyon Dam. The Rapid River Fish Hatchery is approximately 3 miles upstream of the confluence of the Rapid and Little Salmon rivers and 7 miles upstream (southwest) of Riggins, Idaho. Spring chinook salmon captured at the Rapid River and Hells Canyon fish traps are spawned at the Rapid River Fish Hatchery, and the eggs are incubated and the fry reared to migration stage at the hatchery before they are released into the Rapid River and Snake River downstream of Hells Canyon Dam.

- The Niagara Springs Fish Hatchery is used to rear steelhead to smolt stage before they are released into the Snake River downstream of Hells Canyon Dam, into the Pahsimeroi River upstream of the Salmon River near the Pahsimeroi Fish Hatchery, and into other streams as directed by the Idaho Department of Fish and Game.

- The Pahsimeroi Fish Hatchery consists of facilities at two locations about 13 miles apart on the north bank of the Pahsimeroi River, a tributary to the Salmon River near Montana. This fish hatchery is located approximately 150 miles east of the Hells Canyon Complex. The Pahsimeroi Fish Hatchery has facilities to trap, spawn, and incubate steelhead, as well as facilities to trap, spawn, incubate, rear, and release summer chinook salmon. Currently, to limit the effects of whirling disease on fish reared at the Pahsimeroi Fish Hatchery, summer chinook eggs produced there are incubated to the eyed stage on pathogen-free well water at the Pahsimeroi Fish Hatchery and then transferred the Idaho Department of Fish and Game's Sawtooth Fish Hatchery near Stanley, Idaho, for hatching and early rearing on well water.

After early rearing at the Sawtooth Fish Hatchery, the summer chinook salmon are returned to the Pahsimeroi Fish Hatchery for final rearing before they are released into the Pahsimeroi River in April. After being incubated at the Oxbow Fish Hatchery, the steelhead spawned at the Pahsimeroi Fish Hatchery are reared at the Niagara Springs Fish Hatchery before they are released into the Pahsimeroi River at the lower facility approximately 1 mile above its confluence with the Salmon River.

- The Pahsimeroi upstream migrant fish trap is at the lower Pahsimeroi Fish Hatchery facility approximately 1 mile upstream of the confluence of the Pahsimeroi and Salmon rivers.

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Table A-1 Surface area and volume relative to reservoir elevation for Brownlee Reservoir

Elevation (feet msl NGVD[a])	Calculated Reservoir Surface Area (acres)	Calculated Reservoir Volume (ac-ft)
1,976	6,410	444,744
1,977	6,470	451,220
1,978	6,530	457,749
1,979	6,580	464,333
1,980	6,640	470,974
1,981	6,700	477,667
1,982	6,760	484,417
1,983	6,820	491,222
1,984	6,880	498,084
1,985	6,940	505,002
1,986	6,990	511,976
1,987	7,050	519,008
1,988	7,110	526,096
1,989	7,170	533,242
1,990	7,230	540,445
1,991	7,290	547,706
1,992	7,340	555,026
1,993	7,400	562,403
1,994	7,460	569,839
1,995	7,520	577,334
1,996	7,570	584,887
1,997	7,630	592,500
1,998	7,680	600,172
1,999	7,740	607,904
2,000	7,800	615,696
2,001	7,850	623,545
2,002	7,910	631,448

Table A-1 Surface area and volume relative to reservoir elevation for Brownlee Reservoir

Elevation (feet msl NGVD[a])	Calculated Reservoir Surface Area (acres)	Calculated Reservoir Volume (ac-ft)
2,003	7,960	639,405
2,004	8,020	647,418
2,005	8,070	655,485
2,006	8,130	663,607
2,007	8,180	671,784
2,008	8,230	680,017
2,009	8,290	688,306
2,010	8,340	696,650
2,011	8,390	705,050
2,012	8,450	713,507
2,013	8,500	722,020
2,014	8,560	730,589
2,015	8,610	739,215
2,016	8,660	747,899
2,017	8,720	756,639
2,018	8,770	765,437
2,019	8,820	774,292
2,020	8,880	783,201
2,021	8,930	792,172
2,022	8,990	801,200
2,023	9,040	810,286
2,024	9,100	819,430
2,025	9,150	828,632
2,026	9,210	837,892
2,027	9,270	847,211
2,028	9,330	856,588
2,029	9,380	866,025

Table A-1 Surface area and volume relative to reservoir elevation for Brownlee Reservoir

Elevation (feet msl NGVD[a])	Calculated Reservoir Surface Area (acres)	Calculated Reservoir Volume (ac-ft)
2,030	9,440	875,521
2,031	9,500	885,076
2,032	9,560	894,690
2,033	9,620	904,364
2,034	9,690	914,098
2,035	9,750	923,892
2,036	9,820	933,746
2,037	9,880	943,660
2,038	9,950	953,635
2,039	10,020	963,671
2,040	10,090	973,769
2,041	10,160	983,940
2,042	10,230	994,200
2,043	10,310	1,004,549
2,044	10,390	1,014,987
2,045	10,460	1,025,515
2,046	10,550	1,036,132
2,047	10,630	1,046,840
2,048	10,710	1,057,639
2,049	10,800	1,068,529
2,050	10,890	1,079,511
2,051	10,980	1,090,585
2,052	11,080	1,101,751
2,053	11,170	1,113,010
2,054	11,270	1,124,361
2,055	11,380	1,135,807
2,056	11,480	1,147,346

Table A-1 Surface area and volume relative to reservoir elevation for Brownlee Reservoir

Elevation (feet msl NGVD[a])	Calculated Reservoir Surface Area (acres)	Calculated Reservoir Volume (ac-ft)
2,057	11,590	1,158,979
2,058	11,700	1,170,707
2,059	11,820	1,182,530
2,060	11,940	1,194,454
2,061	12,060	1,206,494
2,062	12,180	1,218,684
2,063	12,310	1,231,025
2,064	12,450	1,243,516
2,065	12,580	1,256,159
2,066	12,720	1,268,955
2,067	12,870	1,281,905
2,068	13,020	1,295,010
2,069	13,170	1,308,270
2,070	13,330	1,321,687
2,071	13,500	1,335,262
2,072	13,670	1,348,995
2,073	13,840	1,362,887
2,074	14,020	1,376,939
2,075	14,200	1,391,153
2,076	14,390	1,405,529
2,077	14,620	1,420,062

a. National Geodetic Vertical Datum

Table A-2 Surface area and volume relative to reservoir elevation for Oxbow Reservoir

Elevation (feet msl NGVD[a])	Calculated Reservoir Surface Area (acres)	Calculated Reservoir Volume (acre-ft)
1,795	1,060	47,528
1,796	1,070	48,558
1,797	1,080	49,590
1,798	1,090	50,622
1,799	1,090	51,656
1,800	1,100	52,691
1,801	1,110	53,727
1,802	1,120	54,764
1,803	1,130	55,802
1,804	1,140	56,841
1,805	1,150	58,385

a. National Geodetic Vertical Datum

Table A-3 Surface area and volume relative to reservoir elevation for Hells Canyon Reservoir

Elevation (feet msl NGVD[a])	Calculated Reservoir Surface Area (acres)	Calculated Reservoir Volume (acre-ft)
1,678	2,200	144,660
1,679	2,220	146,870
1,680	2,240	149,100
1,681	2,260	151,355
1,682	2,280	153,630
1,683	2,310	155,925
1,684	2,330	158,240
1,685	2,350	160,580
1,686	2,370	162,940
1,687	2,390	165,320
1,688	2,410	167,720

a. National Geodetic Vertical Datum

Table A-4 Federal land within the Brownlee Project of the Hells Canyon Complex

Township and Range	Section	Area in Acres PSR[a]	U.S.[b]
IDAHO			
T17N-R5W	Section 1		20.00
	Section 11	44.76	0.60
	Section 14	64.03	
	Section 23		2.48
	Section 27	38.14	
	Section 28	55.48	5.12
	Section 29	6.16	
	Section 31	20.99	
	Section 32	72.58	
	Section 33	27.69	
T16N-R5W	Section 6	15.74	
T16N-R6W	Section 1	45.69	
	Section 2	16.05	
	Section 10	23.07	
	Section 15	26.61	
	Section 21	24.89	
	Section 22	21.23	
	Section 28	29.36	
	Section 33	70.20	
T15N-R6W	Section 4	8.44	
	Section 5	104.20	
	Section 8	56.08	
	Section 17	30.29	
	Section 18	19.31	
	Section 19	63.32	
	Section 30	57.04	0.22
	Section 31	3.62	0.72

Table A-4 Federal land within the Brownlee Project of the Hells Canyon Complex

Township and Range	Section	Area in Acres	
		PSR[a]	U.S.[b]
T15N-R7W	Section 25	5.72	
T14N-R6W	Section 6		10.44
T14N-R7W	Section 13	6.50	
	Section 14	15.52	
	Section 23	35.31	
	Section 24	0.18	
	Section 26	9.29	
	Section 27	7.68	0.97
	Section 28	16.50	
	Section 33	43.63	
T13N-R7W	Section 4	9.69	
	Section 5	29.99	
	Section 6	0.23	
	Section 7	31.94	4.89
	Section 8	17.14	
	Section 17	37.33	
	Section 20	18.51	
	Section 29	15.32	
	Section 32	0.66	
T12N-R7W	Section 6	65.75	
	Section 7	0.32	
	Section 18	14.27	
	Section 28	2.42	
	Section 32		0.48
	Section 33	30.11	
T11N-R7W	Section 4	3.21	
	Section 8	35.97	0.19
	Section 17		14.52
	Section 21	0.69	

Table A-4 Federal land within the Brownlee Project of the Hells Canyon Complex

		Area in Acres	
Township and Range	**Section**	**PSR[a]**	**U.S.[b]**
	Section 24	7.32	
	Section 25	0.86	
	Section 28	3.06	
T11N-R6W	Section 18	0.14	0.80
	Section 19	4.39	
Idaho Subtotals		1,414.62	61.43
Total Idaho	1,476.05 acres		
OREGON			
T8S-R48E	Section 19	25.60	
	Section 30	51.69	
T8S-R47E	Section 25	92.30	
	Section 36		9.10
	Section 35		0.76
T9S-R47E	Section 1	12.88	
	Section 2	106.24	
	Section 11	108.97	
	Section 15	30.89	16.44
	Section 16	41.30	
	Section 20	16.87	
	Section 21	32.57	
	Section 30	31.00	
T9S-R46E	Section 20		1.95
	Section 21	61.81	
	Section 22	14.94	
	Section 23	29.90	
	Section 25	15.24	1.50
	Section 26	35.38	
	Section 35	26.39	
T10S-R46E	Section 2	31.83	

Table A-4 Federal land within the Brownlee Project of the Hells Canyon Complex

		Area in Acres	
Township and Range	**Section**	**PSR[a]**	**U.S.[b]**
	Section 3	47.86	
	Section 10	127.20	1.38
	Section 15	117.31	
	Section 21	39.79	
	Section 22	22.79	
	Section 28	95.08	
	Section 29	0.68	
	Section 32	20.21	
	Section 33	75.20	
T11S-R46E	Section 4	73.43	
	Section 5	9.05	
	Section 8	21.79	
	Section 17	17.55	
	Section 18	14.58	
	Section 20	18.46	
	Section 30	8.21	
T11S-R45E	Section 36	23.69	
T12S-R45E	Section 1	35.54	1.33
	Section 11	2.80	
	Section 12	5.82	
	Section 14	11.06	0.43
	Section 33	5.95	0.35
T13S-R45E	Section 9	37.13	
	Section 16	42.05	
	Section 21	24.75	
	Section 29	12.12	
	Section 32	40.53	
T14S-R45E	Section 5	4.85	16.23
	Section 7	0.17	

Table A-4 Federal land within the Brownlee Project of the Hells Canyon Complex

Township and Range	Section	Area in Acres PSR[a]	U.S.[b]
	Section 8	29.90	
	Section 9	4.54	
	Section 15	12.02	
	Section 16	15.48	
	Section 17	1.26	3.76
	Section 22	12.04	
	Section 27	4.10	
T15S-R45E	Section 10	12.47	
	Section 15	4.56	
	Section 24	5.52	
T15S-R46E	Section 18	2.61	
	Section 19	3.41	
Oregon Subtotals		1,829.36	53.23
Total Oregon	1,882.59 acres		
Total Federal Land, Brownlee Project			3,358.64

a. Power Site Reserve: federally administered land set aside in the early 1900s for power production development.

b. Federal land, not subject to a power site reserve, administered by the Bureau of Land Management or the United States Forest Service.

Table A-5 Federal land within the Oxbow Project for the Hells Canyon Complex

		Area in Acres	
Township and Range	**Section**	**PSR[a]**	**U.S.**
IDAHO			
T19N-R4W	Section 20		21.91
	Section 21		37.56
	Section 29		27.29
	Section 32		1.99
T18N-R4W	Section 4		4.57
	Section 8		20.72
	Section 9		13.97
	Section 17		35.99
	Section 19		0.39
	Section 20		23.63
	Section 30	14.57	14.32
	Section 31		3.23
Idaho Subtotals		14.57	205.57
Total Idaho	220.14 acres		
OREGON			
T7S-R48E	Section 21	20.40	0.11
	Section 22	40.57	
	Section 27	39.17	
	Section 28	1.71	
	Section 33	31.77	
	Section 34	1.35	
T8S-R48E	Section 4	56.63	
	Section 8	11.34	
	Section 9	46.81	
	Section 17	9.84	16.47

Table A-5 Federal land within the Oxbow Project for the Hells Canyon Complex

		Area in Acres	
Township and Range	Section	PSR[a]	U.S.
	Section 19	20.89	10.25
	Section 20	2.80	
Oregon Subtotals		283.28	26.83
Total Oregon	310.11 acres		
Total Federal Land, Oxbow Project			530.25

a. Power Site Reserve: federally administered land set aside in the early 1900s for power production development.

Table A-6 Federal land within the Hells Canyon Project of the Hells Canyon Complex

		Area in Acres	
Township and Range	**Section**	**PSR[a]**	**U.S.**
IDAHO			
T22N-R3W	Section 15	20.43	
	Section 16	10.58	
	Section 21	54.45	
	Section 28	46.84	
	Section 33	57.46	
T21N-R3W	Section 4	85.49	
	Section 5	1.64	
	Section 8	94.19	
	Section 9	10.62	
	Section 17	74.68	1.02
	Section 20	41.32	
	Section 29	2.41	
	Section 31	27.74	
T21N-R4W	Section 36	20.59	
T20N-R4W	Section 1	26.66	
	Section 2	11.10	
	Section 11	46.98	
	Section 12	0.15	
	Section 14	22.87	
	Section 22	15.57	
	Section 23	8.66	
	Section 27	0.77	
	Section 28	15.76	
	Section 32	28.05	
	Section 33	23.58	

Table A-6 Federal land within the Hells Canyon Project of the Hells Canyon Complex

Township and Range	Section	Area in Acres PSR[a]	Area in Acres U.S.
T19N-R4W	Section 5		28.86
	Section 8		35.11
	Section 17		47.26
Idaho Subtotals		748.59	112.25
Total Idaho	860.84 acres		
OREGON			
T4S-R49E	Unsurveyed		
	Sheets 2,3,4	261.33	
T5S-R49E	Unsurveyed		
	Sheets 5,6	188.18	
T6S-R48E	Section 1	26.95	
	Section 11	1.89	
	Section 12	4.42	
	Section 14	6.20	
	Section 15	7.97	
	Section 21	0.96	
	Section 22	2.66	
	Section 28	12.06	
	Section 33	7.56	
T7S-R48E	Section 4	2.57	
Oregon Subtotals		522.75	
Total Oregon	522.75 acres		
Total Federal Land, Hells Canyon Project			1,383.59

a. Power Site Reserve: federally administered land set aside in the early 1900s for power production development.

Table A-7 Federal land encumbered by the Oxbow–Hells Canyon transmission line

All sections containing federal land encumbered by the transmission line:

Township and Range	Section
IDAHO	
T22N-R3W	Section 15
	Section 16
	Section 21
	Section 28
	Section 33
T21N-R3W	Section 4
	Section 5
	Section 8
	Section 9
	Section 15
	Section 20
	Section 29
	Section 30
	Section 31
T21N-R4W	Section 36
T20N-R4W	Section 1
	Section 2
	Section 11
	Section 14
	Section 23
	Section 22
	Section 27
	Section 28
	Section 32

Table A-7 Federal land encumbered by the Oxbow–Hells Canyon transmission line

All sections containing federal land encumbered by the transmission line:

Township and Range	**Section**
	Section 33
T19N-R4W	Section 5
	Section 8
	Section 17

Length and Area, Oxbow–Hells Canyon transmission line, by county:

County	**Length (feet)**	**Federal Land (acres)**
Adams County, Idaho	100,578.72	115.5

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Hells Canyon Complex
FERC No. 1971
License Application

Exhibit B
Statement of Project Operation and Resource Utilization

The *Code of Federal Regulations* below—18 CFR § 4.51(c)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(c) *Exhibit B* is a statement of project operation and resource utilization. If the project includes more than one dam with associated facilities, the information must be provided separately for each such discrete development. The exhibit must contain:
>
> (1) A statement whether operation of the power plant will be manual or automatic, an estimate of the annual plant factor, and a statement of how the project will be operated during adverse, mean, and high water years;
>
> (2) An estimate of the dependable capacity and average annual energy production in kilowatt-hours (or a mechanical equivalent), supported by the following data:
>
> (i) The minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the power plant intake or point of diversion, with a specification of any adjustments made for evaporation, leakage, minimum flow releases (including duration of releases), or other reductions in available flow; a flow duration curve indicating the period of record and the gauging stations used in deriving the curve; and a specification of the period of critical streamflow used to determine the dependable capacity;
>
> (ii) An area-capacity curve showing the gross storage capacity and usable storage capacity of the impoundment, with a rule curve showing the proposed operation of the impoundment and how the usable storage capacity is to be utilized;
>
> (iii) The estimated hydraulic capacity of the power plant (maximum flow through the power plant) in cubic feet per second;
>
> (iv) A tailwater rating curve; and
>
> (v) A curve showing power plant capability versus head and specifying maximum, normal, and minimum heads;
>
> (3) A statement, with load curves and tabular data, if necessary, of the manner in which the power generated at the project is to be utilized, including the amount of power to be used on-site, if any, the amount of power to be sold, and the identity of any proposed purchasers; and
>
> (4) A statement of the applicant's plans, if any, for future development of the project or of any other existing or proposed water power project on the stream or other body of water, indicating the approximate location and estimated installed capacity of the proposed developments.

B.1. Brownlee Project

B.1.1. Brownlee Plant Operations

The three-dam, three-reservoir Hells Canyon Complex[1] (HCC) is operated to optimize its power and energy production value subject to compliance with all license requirements, such as flood-control mandates, and other discretionary criteria adopted by the Applicant to foster recreational uses and to provide adequate protection of environmental resources related to the complex. This exhibit provides operational objectives and describes typical operating limits and restrictions proposed by the Applicant as part of the integrated hydrologic and hydraulic modeling platform described in Chapter 1 of Technical Report E.1-4. More detailed information about modeled proposed operations of the complex is included in Chapter 3 of Technical Report E.14.

Table B-1 illustrates the distinction among constraints under the Applicant's current license, proposed license, and modeled proposed operations for the Brownlee Project. Modeled proposed

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

operations constraints represent the typical operating limits for the purposes of comparative resource analysis between the two operational scenarios described in Chapter 3 of Technical Report E.14. The constraints defined for the Applicant's proposed license are intended for the purposes of accommodating atypical conditions and maintaining operational flexibility such that system stability can be achieved. The Applicant has operated the HCC to comply with the constraints in the current license and to accommodate various interests, such as recreational use and protection of environmental resources.

Because most of the usable reservoir capacity in the HCC is contained in Brownlee Reservoir, operations of all three powerhouses and dams are driven by operations at Brownlee Dam.

Operations at Brownlee Dam are designed to meet the following objectives:

- Maximize the power reliability and energy production value of the complex and river.
- Provide springtime flood control under direction from the U.S. Army Corps of Engineers (ACOE).
- Provide storage capacity to minimize the potential impact of project operations on anadromous fish propagation and survival downstream of the HCC.
- Minimize reservoir drafts during the spawning period and recreation season to minimize impacts to the resident fishery in Brownlee Reservoir and maximize the recreational benefits provided by the reservoir.

Over the course of a year, these operations typically cause the following fluctuations in Brownlee Reservoir and flows:

- Starting in mid-January, Brownlee Reservoir is drafted, in accordance with the ACOE's direction, to provide flood-control space. In accordance with its current FERC license and section 7 of the Flood Control Act of 1944, Brownlee Reservoir is operated to help control flooding in the lower Columbia River and, if needed, to regulate flows in the lower Snake River. The current FERC license requires the reservoir to be no higher than an elevation of 2,034 feet (ft) above mean sea level (msl) by March 1 of each year to provide 500,000 acre-feet of storage space for flood control. By March 31, the reservoir is to provide up to an additional 500,000 acre-feet, if necessary, to help control flooding in the lower Columbia River, as determined by the ACOE. Initially, the timing and amount of the March evacuation were determined each year on an ad-hoc basis.

In the mid-1980s, the ACOE examined the reservoir's flood-control operation with the purpose of relaxing the FERC requirements where feasible and formalizing the seasonal operating rules. In 1983 (later revised in 1987), a tabular procedure was introduced to determine the flood-control draft, based on seasonal forecasts of water supply for the April–July period at Brownlee Reservoir and for the April–August period at The Dalles Reservoir. It became apparent during real-time operations that the 1987 procedure could be improved by providing a smoother transition between the stepped levels of water-supply forecasts and the necessary flood-control drafts. At times, small changes in the water-supply forecast at either Brownlee Reservoir or The Dalles Reservoir caused a significant change in the amount of draft for flood control that was difficult to implement at Brownlee Reservoir. This problem was compounded when water-supply forecasts varied through the season and caused the necessary flood-control draft to bounce from one step to the next. For these reasons, the Applicant requested that the ACOE reexamine the 1987 procedure to find a smoother flood-control operation.

In 1998, the rule-curve procedure was examined and improved by the ACOE. This modified rule-curve procedure delivered the same level of flood-control protection, was easier to implement, and provided a smoother real-time reservoir operation than the previous procedure allowed. The Applicant implemented the 1998 modified rule-curve procedure, developed by the ACOE, for water year 2000 flood-control requirements and has continued to use it since. Figure B-1 and Figure B-2 illustrate the 1998 modified rule-curve procedure. Historical flood-control requirements are also presented in Table B-2. The two figures are part of a graphic file available at the ACOE's website (ACOE 2000).

The official target dates for flood control at Brownlee Reservoir are February 28, March 31, April 15, and April 30. The monthly final water-supply forecasts produced by the Northwest River Forecast Center (NWRFC) are used to derive the “official” draft needed by the target dates. The early-bird and midmonth water-supply forecasts that are published by the NWRFC are used in real-time operations to indicate the trend in the water-supply forecast. The amount of flood-control space required on each date is determined by that month’s final first-of-the-month runoff forecast produced by the NWRFC. For example, the February 28 flood-control space is determined by the February 1 runoff forecast, the March 31 flood-control space is determined by the March 1 runoff forecast, and so on. The updated forecasts continue to refine the flood-control space required in Brownlee Reservoir and, at times, differ from previous months’ forecasts due to changing hydrologic and climatic conditions. Therefore, the flood-control volume stipulated for an April 15 target date, based on a February 1 water-supply forecast, is modified as subsequent forecasts are developed.

Although there are no official refill target elevations for Brownlee Reservoir, the ACOE controls how quickly the reservoir can be refilled once flood-control requirements are met. Therefore, depending on the water year and ACOE mandates, flood-control requirements for Brownlee Reservoir may continue through June. To meet mandated target elevations for flood control, the Applicant may need to spill water through the HCC.

According to the ACOE, flooding in the Columbia River downstream of the mouth of the Snake River begins when the river reaches an elevation of 17.8 ft National Geodetic Vertical Datum (NGVD) (1959 U.S. Geological Survey [USGS] adjustment) at Vancouver, Washington (16 ft, Columbia River Datum). The corresponding flow measured at The Dalles, Oregon, is approximately 450,000 cubic feet per second (cfs). Significant damage begins at an elevation of 24 ft NGVD (22.2 ft, Columbia River Datum). The corresponding flow at The Dalles is approximately 600,000 cfs. Because large floods cannot be regulated to 450,000 cfs, the desired goal is to control major floods to 600,000 cfs in the lower Columbia River at The Dalles. Damage commences in the mid-Columbia River area in the vicinity of Hanford, Washington, when flows reach 400,000 cfs, as measured at the Priest Rapids Project. The regulation required for The Dalles Reservoir normally achieves the desired protection in the mid-Columbia River area. Usually, with little modification, the flood-control requirement at

Brownlee Reservoir protects areas of major damage identified downstream while also protecting local areas against flood damage.

Although the ACOE cannot specify the economic benefit attributable solely to flood-control storage in Brownlee Reservoir, the ACOE believes that the HCC plays an imperative role in the flood-control plan for the Columbia and Snake river systems. In a comment letter, dated January 10, 2003, and written in response to the Applicant's draft license application, the ACOE states that it is crucial that current flood-control requirements (based on the 1998 modified rule curve) be maintained in the new license. The Applicant is working with the ACOE to complete a flood-control article for the new license. Both parties intend to use the 1998 modified rule-curve procedure for the flood-control requirements in the new license article.

The Applicant is not compensated in any way by the federal government for the provision of flood control. However, providing flood-control space in Brownlee Reservoir was one of the requirements for project approval. As part of the federal main water-control plan presented to the 81st Congress in 1950, the ACOE and U.S. Bureau of Reclamation proposed a number of projects, including specifically the High Hells Canyon Dam that would provide 2.3 million acre-feet (MAF) of flood-control storage for the middle Snake River. The 81st Congress defeated the authorization of the High Hells Canyon Project in 1950. In 1955, the Federal Power Commission approved construction of Brownlee Dam with the understanding that Brownlee Reservoir space would substitute 1.0 MAF of flood-control storage for the defeated High Hells Canyon Project. It would still be necessary to obtain an additional 1.3 MAF of flood-control storage elsewhere on the Snake River above the mouth of the Salmon River. In 1955, the U.S. Bureau of Reclamation proposed the Mountain Sheep and Pleasant Valley dams on the middle Snake River above the Salmon River but downstream of the HCC, owned by the Applicant. These projects were never built and, of the 2.3 MAF of flood-control storage planned for the middle Snake River, only Brownlee Reservoir's 1.0 MAF storage was constructed. Currently, Brownlee Reservoir serves as the lone flood-control project on the middle Snake River.

- After the Applicant has met its flood-control requirements, it attempts to fill Brownlee Reservoir by the end of June to maximize recreational opportunities and resident fish spawning success at Brownlee Reservoir. Whether the Applicant is able to fill Brownlee Reservoir by this time depends on the amount of spring runoff entering the reservoir, as well as the Applicant's maintenance of minimum flows below Hells Canyon Dam throughout the incubation period to protect fall chinook salmon redds.

- Starting in September, Brownlee Reservoir is drafted or maintained below full pool to provide storage for inflows above discharges throughout the fall chinook salmon spawning period. This drafting typically requires that flows past Brownlee Dam be increased during this period.

- Beginning in mid-October and lasting through early December, the Applicant maintains a constant flow, normally between 8,000 and 13,000 cfs below Hells Canyon Dam, to ensure that fall chinook salmon construct their redds below a certain target flow elevation. This operation ensures that the redds remain submerged during spawning and through fry emergence in the spring. It also requires that inflows to Brownlee Reservoir in excess of the constant flow below Hells Canyon Dam be retained in Brownlee Reservoir, so Brownlee Reservoir refills during this period. The spawning season and associated minimum flows vary from year to year. The Applicant establishes the spawning flows below the dam based on hydrologic conditions and forecasts.

- From the time the fall chinook spawning period ends in early December through fry emergence in the spring, flows past Hells Canyon Dam are maintained to keep the river below Hells Canyon Dam above the target flow elevation selected in the fall. The effect of these maintained flows on Brownlee Reservoir depends on the amount of runoff received. With medium and higher-than-normal inflows, minimum target flows below Hells Canyon Dam can be maintained without drafting Brownlee Reservoir before the spring flood-control draft. Under drought conditions, Brownlee Reservoir might be drafted during this period to provide the minimum target flow below Hells Canyon Dam.

Historically, in accordance with a National Marine Fisheries Service biological opinion, the operators of the Federal Columbia River Power System (FCRPS) have attempted to enhance the survival of juvenile salmon migrating downstream through the federal Snake River dams downstream of the HCC by arranging for increased flow in the lower Snake River from July through September. The Applicant assisted these efforts by scheduling increased flow through the

HCC. The Applicant also drafted Brownlee Reservoir, typically starting in July, to further augment river flows below the HCC, again to help FCRPS operators moderate the impacts of the federal lower Snake River dams on migrating fish. These drafts to augment flows through the federal dams have typically been concluded by the end of August. To facilitate the Applicant's cooperation with the flow augmentation program, the Bonneville Power Administration (BPA) entered into annual agreements with the Applicant in the late 1980s, at the request of the Northwest Power Planning Council (NPPC). In 1996, BPA entered into a five-year agreement with the Applicant. The agreement reimbursed the Applicant through an energy exchange mechanism for any energy losses it incurred as a result of participation (see Technical Report H.1-1). The agreement expired in April 2001. Although the Applicant has made attempts to enter into a new agreement with BPA, such attempts have not been successful to date.

On a daily basis, the Applicant operates the Brownlee Powerhouse to meet the flow and reservoir targets described above while maximizing the power and energy production value of the HCC. Normally, flow through the powerhouse is ramped up and down over the course of each day to follow regional electricity demands. Peak flow through the Brownlee Powerhouse is 35,000 cfs. Minimum flow may fall to zero during the middle of the night when regional electrical loads are at their minimum. Minimum flow periods at the Brownlee Project do not have a significant environmental impact because the river channel below Brownlee Dam is submerged by Oxbow Reservoir. When flow exceeds the hydraulic capacity of the powerhouse, flow below Brownlee Dam is relatively constant and does not fluctuate significantly. This situation occurs when the reservoir is full but more than approximately 35,000 cfs of water enters the reservoir. It can also occur when the Applicant is drafting Brownlee Reservoir to create space for flood control or other purposes.

B.1.1.1. Brownlee Plant Supervision

The Brownlee Power Plant is operated both manually and automatically. The five turbine generators are normally remotely operated from the Applicant's Generation Dispatch Center in Boise, Idaho. Alternatively, all of the powerhouse equipment can be, and often is, operated manually by personnel on site. Also, each of the turbine generators can be set to be operated automatically to follow minor variations in systemwide power demand. This mode of operation is called "automatic generator control," abbreviated as AGC.

B.1.1.2. Brownlee Estimated Annual Plant Factor

The Brownlee Project's unit 5 turbine generator went into service on March 31, 1980. From the first full year after unit 5 went into service (starting January 1, 1981) through December 31, 2001, the plant factor was 53.3%. The future plant factor is expected to approximate this historical plant factor unless implementation of new license requirements reduces the generating efficiency of the power plant.

B.1.1.3. Brownlee Operations During Low, Mean, and High Water Years

The Brownlee Power Plant can be operated at any reservoir elevation between full pool, at an elevation of 2,077 ft msl, down to the minimum operating reservoir elevation of 1,976 ft msl (see section A.2.2.).

The Brownlee Power Plant is operable at all expected flows for the Snake River. When flows are low or average, flow through the powerhouse is ramped up each day to follow the regional demand for electricity and then ramped down in the evenings as the regional demand declines, thus saving water for the next day's generation. Because Oxbow Reservoir extends to the toe of Brownlee Dam, even with no flow through the Brownlee Powerhouse, the tailrace and river channel below Brownlee Dam stay submerged. The lowest calculated daily average inflow to Brownlee Reservoir since the dam was constructed is 4,172 cfs (July 1977), while the highest calculated daily average inflow during the same period is 93,029 cfs (January 1997).

Flow through the Brownlee Powerhouse and the operating status of each of the five units during any period are determined by the Applicant's need for generation and the following power system benefits, generally called "ancillary services":

- Load shaping—operation of units necessary to follow regional electrical demand (also called "load")
- Load following—operation of units necessary to respond to unscheduled real-time changes in system load
- Voltage control—operation of units necessary to maintain a constant voltage throughout the regional power system
- Generating reserves—to comply with regional and continental power reliability standards, Brownlee Powerhouse is operated below the immediately available peak generating capacity to ensure that there is an "operating cushion" available to respond to unscheduled changes in system load or system disturbances

Turbine generators at the Brownlee Powerhouse are often run "condensed" for voltage support. When condensed, the water around the turbine runner is forced out of the spiral case surrounding the runner (or "depressed" into the space below the runner) using compressed air. The turbine generator continues to spin, driven by the generator, using power from the regional power grid. The turbine generator becomes a massive electric motor, or condenser, that helps to stabilize the voltage in the regional power grid.

B.1.2. Brownlee Dependable Capacity and Average Annual Generation

For the HCC, dependable capacity is defined as the peak capacity available for a one-hour period from each of the three projects under critical water or reservoir elevation conditions. As a result of Brownlee Reservoir's size, the limiting factor at the Brownlee Project is considered to be the reservoir elevation because one hour of peak flows through the Brownlee Powerhouse does not significantly affect the reservoir elevation and therefore does not affect the availability of water and hydraulic head, regardless of the amount of inflow to the reservoir.

As mentioned in the paragraph above, the dependable capacity of the Brownlee Project depends on the reservoir elevation. When the reservoir is full, or at 2,077 ft msl, and all generating units are available and not restricted because of maintenance or protective derating, the peak generating capacity of the Brownlee Power Plant is 728 megawatts (MW). This capacity is based on the Applicant's current operating limits established to protect the generators from damage from overheating. At the minimum operating reservoir level of 1,976 ft msl, again with all units fully available, the peak generating capacity of the Brownlee Power Plant is 220 MW. Therefore, the dependable capacity of the Brownlee Power Plant can be said to range from 220 to 728 MW, depending on reservoir elevation. Under the minimum inflow conditions to Brownlee Reservoir (4,172 cfs) and a maximum plant discharge of 35,000 cfs, Brownlee Power Plant can generate 728 MW for one hour, and because ample water and storage are available in this situation, reservoir elevation drops approximately 0.2 ft from full pool (2,077 ft msl). The Applicant is able to manage its electrical system to accommodate this range of dependable generating capacity at the Brownlee Project because the reservoir elevation can be fairly accurately estimated some weeks—or in some cases, some months—in advance.

The last of the first four generating units at the Brownlee Project went into service on January 22, 1959, and unit 5 went into service on March 31, 1980. The average annual generation at the Brownlee Power Plant—for the period from January 1, 1959, through December 31, 1979—was 2,181,017 megawatt hours (MWh). The average annual generation at the Brownlee Power Plant from the first full year that unit 5 was in service (starting January 1, 1981) through December 31, 2001, was 2,734,300 MWh. The average annual generation of the entire HCC from January 1, 1981, through December 31, 2001, was 6,053,129 MWh.

B.1.2.1. Brownlee Flow Data and Flow-Duration Curve

Inflow to Brownlee Reservoir is not measured directly, but is calculated from streamflow records of the Snake River below Hells Canyon Dam, Pine Creek below Oxbow Dam, and the Wildhorse River below Brownlee Dam and from daily changes in reservoir storage within the three-dam complex.

The period of record used is from 1965 through the end of calendar year 2000. The minimum, mean, and maximum daily average Brownlee Reservoir inflows for this period are 4,172 cfs, 20,640 cfs, and 93,029 cfs, respectively.

A flow-duration curve for the calculated Brownlee Reservoir inflow is shown in Figure B-3. The calculation used to derive daily inflows to Brownlee Reservoir is as follows:

Brownlee Average Daily Inflow	=	flow below Hells Canyon Dam (in cfs)
	+	change in Hells Canyon Reservoir storage (converted to cfs)
	–	Pine Creek discharge (cfs)
	+	change in Oxbow Reservoir storage (converted to cfs)
	–	Wildhorse River discharge (cfs)
	+	change in Brownlee Reservoir storage (converted to cfs)

The Brownlee Reservoir inflow calculations are performed and archived by Applicant personnel and transmitted to the ACOE for use in flood-control planning.

The flow below Hells Canyon Dam is measured at the U.S. Geological Survey (USGS) gauging station 13290450, which is located 0.6 miles below Hells Canyon Dam. This Hells Canyon Dam gauge has been in operation since July 1965, and published data have been available since October 1968. A flow-duration curve is provided as Figure B-4 for this gauge.

Pine Creek discharge is measured at USGS gauging station 13290190, which is located 1.8 miles south of Oxbow Power Plant and 1.9 miles upstream of the mouth of Pine Creek. This recording gauge has been in operation since November 1966.

Wildhorse River discharge is measured at USGS gauging station 13289960, which is located about 300 ft upstream of the mouth of the Wildhorse River and 1.1 miles downstream and north of Brownlee Dam. This recording gauge has been in operation since October 1978.

Prior to the installation of the recording gauges on Pine Creek and Wildhorse River, flows were determined by the Applicant personnel using staff gauges and USGS stage-discharge tables. The staff gauges were read once a week unless more frequent readings were requested.

Daily changes in reservoir storage are based on changes in reservoir elevation from midnight of one day to midnight of the next day. Since 1982, the Applicant has used an automated electronic data collection and transmission system (often referred to as a “SCADA system,” which is a common abbreviation for an electronic supervisory control and data acquisition system) to record data for Brownlee, Oxbow, and Hells Canyon reservoirs. However, before 1982, reservoir data were recorded on handwritten log sheets at each plant.

B.1.2.2. Brownlee Reservoir Operation Curves

Area and capacity curves for Brownlee Reservoir are shown in Figure B-5. Brownlee Reservoir rule curves are shown in Figure B-6, Figure B-7, and Figure B-8. These curves show modeled proposed reservoir operations for a low inflow year (Figure B-6), medium inflow year (Figure B-7), and high inflow year (Figure B-8), based on typical modeled operations described in section B.1.1. and Chapter 3 of Technical Report E.1-4.

B.1.2.3. Brownlee Plant Hydraulic Capacity

At a gross hydraulic head of 273 ft, the hydraulic capacity at peak generating capacity is 35,000 cfs.

B.1.2.4. Brownlee Tailwater Rating Curve

Since the Brownlee Powerhouse discharges into the headwaters of Oxbow Reservoir, the tailwater elevation at Brownlee Dam is largely controlled by operations at Oxbow Dam. However, there is some hydraulic gradient between the Brownlee Dam discharge and Oxbow Dam, as illustrated by the approximate tailwater curves shown in Figure B-9.

B.1.2.5. Brownlee Power Plant Capacity Versus Head Curve

A curve showing power plant capacity versus head is displayed in Figure B-10. The maximum normal gross hydraulic head is 277 ft, while the minimum operating hydraulic head is 171 ft.

B.2. OXBOW PROJECT

B.2.1. Oxbow Plant Operations

Because of the limited usable capacity in Oxbow Reservoir and because the hydraulic capacity of the Oxbow Power Plant is less than the hydraulic capacity at both Brownlee and Hells Canyon power plants, daily operations at the Oxbow Project are largely controlled by operations at Brownlee Dam and by limitations on operations at Hells Canyon Dam. Normally, Oxbow Reservoir is drafted late in the day. This drafting enables the Applicant to synchronize flows with those through the Brownlee Project, providing reservoir space for higher flows past Brownlee Dam during daily periods of heavy load, and to comply with minimum-flow, ramp-rate, and other restrictions at the downstream Hells Canyon Dam. In concert with the ramping up of flows through the Brownlee Powerhouse, flows through the Oxbow Powerhouse are ramped up as loads climb early in the day. To balance the volume of water passed at Brownlee Dam, high flows at the Oxbow Project are often continued after flows at the Brownlee Project are ramped down, depending on the amount of water available for generating electricity each day.

Table B-3 illustrates the distinction among constraints under the Applicant’s current license, proposed license, and modeled proposed operations for the Oxbow Project. Modeled proposed operations constraints represent the typical operating limits for the purposes of comparative resource analysis between the two operational scenarios described in Chapter 3 of Technical Report E.1-4. The constraint limits defined for the Applicant’s proposed license are intended for the purposes of accommodating atypical conditions and maintaining operational flexibility such that system stability can be achieved.

B.2.1.1. Oxbow Plant Supervision

The Oxbow Power Plant is operated both manually and automatically. The four turbine generators are normally remotely operated from the Applicant’s Generation Dispatch Center in Boise.

However, all of the powerhouse equipment can be, and often is, operated by personnel on site. Also, each of the turbine generators can be set to be operated automatically, or in AGC mode, to follow minor variations in systemwide power demand.

B.2.1.2. Oxbow Estimated Annual Plant Factor

The last Oxbow Project unit went into service on November 18, 1961. From the first full year after all four units went into service (starting January 1, 1962) through December 31, 2001, the plant factor of the Oxbow Project was 66.7%. The future plant factor is expected to approximate the historical plant factor of 66.7%, unless new conditions causing a reduction in generating efficiency are implemented at relicensing.

B.2.1.3. Oxbow Operations During Low, Mean, and High Water Years

The Oxbow Power Plant is operable at all expected flows for the Snake River. During periods of low and mean inflows, flow through the powerhouse, together with flow at Brownlee Dam, is ramped up each day to follow the regional demand for electricity and then ramped down late in the evenings as the regional electrical demand declines, thus saving water for the next day's generation. Because Hells Canyon Reservoir extends to the toe of Oxbow Dam and because there is a minimum flow of 100 cfs passed at Oxbow Dam, even with zero flow through Oxbow Powerhouse, the tailrace and river channel below Oxbow Dam stay submerged.

As with operations at the Brownlee Power Plant, flow through the Oxbow Powerhouse and the operating status of each of the generating units during any period are determined by the Applicant's need for generation and ancillary services as described in section B.1.1.3.

The turbine generators at the Oxbow Powerhouse are often run condensed for voltage support. When condensed, the water surrounding the turbine runner is forced out of the spiral case surrounding the runner using compressed air, and the turbine generator continues to spin, driven by the generator using power from the regional power grid. The turbine generator becomes a massive electric motor, or condenser, that helps to stabilize the voltage in the regional power grid.

B.2.2. Oxbow Dependable Capacity and Average Annual Generation

As mentioned earlier, dependable capacity is defined as the peak capacity available for a one-hour period from each of the three projects under critical water or reservoir elevation conditions. Except during maintenance and repair periods when not all units may be fully available, the limiting factor at the Oxbow Power Plant is the peak generator loading, by which the Applicant limits the load on each unit to prevent overheating and damage to the generator. Because this peak generator load limit of 220 MW can be reached at both the maximum and the minimum gross operating head, the reservoir operating elevation limits do not limit the project dependable capacity. Therefore, the dependable capacity at the Oxbow Power Plant is 220 MW. This dependable capacity would be significantly reduced if a ramp-rate restriction were imposed for the Oxbow Project.

The average annual generation at the Oxbow Power Plant—from the first full year that all four units were in service (starting January 1, 1962) through December 31, 2001—was 1,111,246 MWh. The last major capacity upgrade at the HCC was completed when Brownlee unit 5 went on line on March 31, 1980. During the period from January 1, 1981, through December 31, 2001, the average annual generation for the Oxbow Power Plant was 1,082,796 MWh.

B.2.2.1. Oxbow Flow Data and Flow-Duration Curve

The Applicant does not measure the inflow to Oxbow Reservoir because most inflow to the reservoir is controlled by operations at Brownlee Dam: since such measurements would only reflect the Applicant's operations at Brownlee Dam and Brownlee Reservoir, they would not properly represent natural streamflows. However, a flow-duration curve is provided as Figure B-4 for the flow measured below Hells Canyon Dam. Because of the available reservoir capacity in Brownlee and Oxbow reservoirs, calculation of the dependable capacity of the Oxbow Project does not depend on streamflows. Therefore, derivation of the median inflow and flow-duration curve is unnecessary for calculating the project's dependable capacity.

B.2.2.2. Oxbow Reservoir Operation Curves

Area and capacity curves for Oxbow Reservoir are shown in Figure B-11. However, there is no rule curve for Oxbow Reservoir since it is not used for long-term water storage. Typically, under the proposed future operations, the elevation of Oxbow Reservoir would be cycled daily within a 5 vertical-ft operating range to manage load-following flows through the Brownlee, Oxbow, and Hells Canyon power plants. However, the Applicant proposes to use up to an additional 5 vertical ft, as noted in Table B-3, when necessary to accommodate atypical conditions.

B.2.2.3. Oxbow Plant Hydraulic Capacity

The peak hydraulic capacity of the Oxbow Powerhouse is estimated at 29,500 cfs.

B.2.2.4. Oxbow Tailwater Rating Curve

Since the Oxbow Powerhouse discharges directly into Hells Canyon Reservoir, the tailwater at the Oxbow Powerhouse is controlled by the Hells Canyon Reservoir, rather than by flows through the powerhouse. Unlike flow through the Brownlee Powerhouse, flow through the Oxbow Powerhouse does not create a measurable hydraulic gradient between the Oxbow Powerhouse and Hells Canyon Dam. Therefore, a tailwater curve does not apply to the Oxbow Project.

B.2.2.5. Oxbow Power Plant Capacity Versus Head Curve

The peak generating capacity of the Oxbow Power Plant can be reached at the entire range of operating heads, from the minimum to the maximum operating heads. The current and proposed normal maximum reservoir elevation at Oxbow Reservoir is 1,805 ft msl, while the proposed minimum reservoir elevation is 1,795 ft msl. The current and proposed normal maximum reservoir elevation at Hells Canyon Reservoir is 1,688 ft msl, while the proposed minimum reservoir elevation is 1,678 ft msl. Therefore, the maximum normal head at Oxbow Powerhouse is 127 ft, while the minimum normal head is 107 ft. The normal (average) over the last five years was 114 ft.

B.3. HELLS CANYON PROJECT

B.3.1. Hells Canyon Plant Operations

Because of the limited usable capacity in Hells Canyon Reservoir, daily operations at the Hells Canyon Project are substantially controlled and limited by operations at Brownlee Dam and by operating restrictions at the Hells Canyon Power Plant and the HCC. The Applicant proposes a license minimum flow of 5,000 cfs (established by legislative adoption of the State Water Plan in 1992) and a ramp-rate limit of 1 ft per hour measured at Johnson Bar, located about 18 river miles downstream of Hells Canyon Dam.

Under normal hydrologic conditions, flows through Hells Canyon Powerhouse are ramped up in the morning—concurrently with the ramping up of flows at the Brownlee and Oxbow powerhouses, to follow the regional electrical load—and ramped down late in the evening to retain as much inflow as possible to use for generating electricity during heavy load periods. Existing and proposed operating restrictions limit the extent and speed of flow changes through the Hells Canyon Powerhouse.

During spring runoff when flow through the Hells Canyon Complex exceeds the hydraulic capacity of the power plants, the flow below Hells Canyon Dam is controlled by the amount of flow through the complex and is not varied by powerhouse operations.

The Applicant works closely with the navigation interests and the ACOE to establish navigation flows in the reach below Hells Canyon Dam to promote boater access and safety. Article 43 of the current license states that the project will be operated in the interest of navigation to maintain 13,000-cfs flow in the Snake River at Lime Point (river mile [RM] 172) a minimum of 95% of the time, when determined by the ACOE to be necessary for navigation. Regulated flows of less than 13,000 cfs at Lime Point will be limited to July, August, and September, during which time operation of the project will be in the best interest of power and navigation, as mutually agreed to by the Applicant and the ACOE. The ACOE does not require the Applicant to draft Brownlee Reservoir to meet the 13,000-cfs Lime Point flow requirement. In addition, the minimum flow during a period of low flow or normal minimum plant operations will be 5,000 cfs at Johnson Bar, at which point the maximum variation in river stage will not exceed 1 foot per hour.

The significance of the 13,000-cfs flow requirement at Lime Point originated when Lower Granite Dam was constructed. In hearings held in Boise, Idaho, on June 22, 1944, two separate limestone companies—owners of large lime deposits near the Snake River above Lewiston, Idaho—submitted statements that development of their resources awaited a satisfactory water channel through Lewiston. As a result, a minimum flow of 13,000 cfs at Lime Point was determined to be necessary 95% of the time to allow lime, copper, and iron ore to be shipped downstream to Portland, Oregon.

Per article 43 of the current license, navigation conditions are subject to review from time to time as requested by either party. In September 1988, the ACOE and Applicant reviewed the minimum-outflow requirement and agreed that 6,500 cfs should be maintained as the normal operating minimum flow for safe navigation. This criterion was based on the ACOE's July 1988 field investigation, the results of which indicated that operating conditions for jet boats were better when the minimum navigable flow was limited to 6,500 cfs for the Snake River above the confluence with the Salmon River. Depending on water conditions downstream of the HCC, flows less than 6,500 cfs may be released from Hells Canyon Dam if 13,000 cfs is maintained at Lime Point or the ACOE issues a temporary variance. The agreement to use 6,500 cfs as a normal operating minimum does constrain operation of the HCC since the current license stipulates a minimum flow of 5,000 cfs below Hells Canyon Dam at Johnson Bar.

For simulations using the CHEOPS™ operations model (see section E.0.3.), the Applicant assumed a normal operating minimum flow of 6,500 cfs, based on the agreement between the ACOE and Applicant that was initially dated September 1988. In the modeling effort, it was assumed that either the 13,000-cfs flow target at Lime Point was met or that the ACOE granted a temporary variance from that requirement. It was also assumed that, if inflows to the project were below 6,500 cfs, Brownlee Reservoir would not be drafted to maintain a minimum Hells Canyon outflow of 6,500 cfs. In these instances, the project passed inflow.

In 2001 and 2002, in cooperation with the ACOE and the Northwest Professional Passenger Vessel Association, the Applicant developed and coordinated minimum-flow release schedules that were in the best interest of power generation and navigation. These schedules consisted of providing timed releases of 8,500 cfs. These timed pulses met upstream and downstream needs for the commercial navigation community, while still maintaining the normal operating minimum flow of 6,500 cfs that allowed the Applicant to retain as much inflow as possible for generating electricity during heavy load periods. While these flow schedules constrained operation of the HCC, the ACOE and the Applicant agreed that these timed flow pulses were an effective balance between the need for power generation and navigation and that they served the overall public interest.

The Applicant is working with the ACOE's Walla Walla District, the Northwest Professional Passenger Vessel Association, and other interested parties to update navigation criteria for the new license. There are three goals of the new criteria:

- Define safe flow criteria for current navigation needs
- Eliminate confusion and uncertainty in the application of navigation criteria
- Balance power generation and navigation for the public good in a way that does not impact the overall public interest.

Maintaining desirable navigation flow targets in low water years will be difficult. In those instances, the Applicant would continue to coordinate with the ACOE, the Northwest Professional Passenger Vessel Association, and other interested parties on a case-by-case basis. At this time, proposed language for an updated navigation article has not been developed.

To inform the navigation and recreating public about forecasted operations of HCC, the Applicant has installed six electronic flow monitors in Hells Canyon below the project (see section E.5.4.1.1.). These monitors, which are operational year-round, are updated hourly during the day for the entire recreation season. The monitors provide an hourly Hells Canyon outflow projection for the next 24 hours and are located at the Hells Canyon Creek Recreation Site, Oregon (RM 247); Pittsburg Landing (RM 215), Idaho; Cache Creek Administrative Site, Oregon (RM 177); Heller Bar, Washington (RM 168); Hells Gate Marina, Lewiston, Idaho (RM 143); and the U.S. Forest Service Clarkston office, Washington (RM 142). Every effort is made to keep these monitors updated with as accurate information as the Applicant can provide. In addition, the Applicant's website and toll-free recreation line are updated each weekday afternoon with current outflow projections.

Table B-4 illustrates the distinction between the Applicant's current license constraints, proposed license constraints, and modeled proposed operations for the Hells Canyon Project. Modeled proposed operations constraints represent the typical operating limits for the purposes of comparative resource analysis between the two proposed operational scenarios described in Chapter 3 of Technical Report E.1-4. The constraints defined for the Applicant's proposed license are intended for the purposes of accommodating atypical conditions and maintaining operation flexibility such that system stability can be achieved.

B.3.1.1. Hells Canyon Plant Supervision

The Hells Canyon Power Plant is operated both manually and automatically. The three turbine generators are normally remotely operated from the Generation Dispatch Center in Boise. Alternatively, all of the powerhouse equipment can be, and often is, operated by personnel on site.

B.3.1.2. Hells Canyon Estimated Annual Plant Factor

The last Hells Canyon unit went into service on December 28, 1967. From the first full year after all three units went into service (starting January 1, 1968) through December 31, 2001, the plant factor of the Hells Canyon Project was 67.6%. The future plant factor is expected to approximate this historical plant factor, unless implementation of new license requirements reduces the generating efficiency of the power plant.

B.3.1.3. Hells Canyon Operations During Adverse, Mean, and High Water Years

The Hells Canyon Power Plant is operable at all expected Snake River flows. During periods when inflow is below the hydraulic capacity of the power plant, flow through the powerhouse, together with flow at Brownlee and Oxbow dams, is ramped up each day to follow the regional electrical demand and ramped down late in the evenings as the regional demand declines, thus saving water for the next day's generation.

During periods of very low flow through the HCC, the minimum flows below Hells Canyon Dam may reach 5,000 cfs to avoid drafting Brownlee Reservoir, so that critical water can be retained to meet system load requirements. During periods of very low flow, the ramp-rate restriction further limits how much the flow through Hells Canyon Powerhouse can fluctuate, leading to fairly moderate variations in flow through Hells Canyon Powerhouse during periods of very low flows.

During spring runoff periods when flow through the HCC exceeds the hydraulic capacity of the power plants, the flow below Hells Canyon Dam is controlled by the amount of flow through the complex and not varied by powerhouse operations.

B.3.2. Hells Canyon Dependable Capacity and Average Annual Generation

Dependable capacity is defined as the peak capacity available for a one-hour period from each of the three projects under critical water or reservoir elevation conditions.

Because of the reservoir storage available upstream of Hells Canyon Dam, generation at Hells Canyon Dam is not limited by concurrent inflows into the HCC. Also, operations at Hells Canyon Dam can be scheduled in advance to operate at peak capacity while still complying with the current and proposed new license restrictions. For these reasons, the dependable capacity at Hells Canyon Powerhouse, except during maintenance and repair periods when all units may not be fully available, is 450 MW.

The average annual generation at the Hells Canyon Power Plant—from the first full year that all three units were in service (starting January 1, 1968) through December 31, 2001—was 2,319,456 MWh. The last major capacity upgrade at the HCC was completed when Brownlee unit 5 went on line on March 31, 1980. During the period from January 1, 1981, through December 31, 2001, the average annual generation for the Hells Canyon Power Plant was 2,236,036 MWh.

B.3.2.1. Hells Canyon Flow Data and Flow-Duration Curve

The Applicant does not measure the inflow to Hells Canyon Reservoir because most inflow to the reservoir is controlled by operations at Brownlee and Oxbow dams: since such measurements would only reflect the Applicant's operations at Brownlee Dam and Reservoir, they would not properly represent natural streamflows. However, a flow-duration curve is provided as Figure B-4 for the flow measured below Hells Canyon Dam. Because of the available reservoir capacity of the three reservoirs, calculation of the dependable capacity of the Hells Canyon Project does not depend on streamflows. Therefore, derivation of the median inflow and flow-duration curve is unnecessary for calculating the project's dependable capacity.

B.3.2.2. Hells Canyon Reservoir Operation Curves

Area and capacity curves for Hells Canyon Reservoir are shown in Figure B-12. However, there is no rule curve for Hells Canyon Reservoir since it is not used for long-term water storage. Currently, and for proposed operations, the elevation of Hells Canyon Reservoir is typically cycled daily within a 5 vertical-ft operating range to manage load-following flows through the Brownlee, Oxbow, and Hells Canyon power plants. However, the Applicant proposes to use up to an additional 5 vertical ft, as noted in Table B-4, to accommodate atypical conditions. Because the limited storage capacity in Hells Canyon Reservoir is used to synchronize flows and power production in the HCC, any new restrictions on operation of Hells Canyon Reservoir could have a significant impact on the Applicant's ability to maximize the power benefits of the HCC.

B.3.2.3. Hells Canyon Plant Hydraulic Capacity

The peak hydraulic capacity of the Hells Canyon Powerhouse is approximately 30,500 cfs.

B.3.2.4. Hells Canyon Tailwater Rating Curve

A tailwater rating curve, illustrating tailwater elevation versus powerhouse discharge, is shown in Figure B-13.

B.3.2.5. Hells Canyon Power Plant Capacity Versus Head Curve

Figure B-14 shows a curve for power plant capacity versus head for the Hells Canyon Project. The normal maximum reservoir elevation at Hells Canyon Reservoir is 1,688 ft msl, while the proposed minimum reservoir elevation is 1,678 ft msl. The tailwater for Hells Canyon Dam ranges from a low of 1,469 ft msl at 5,000 cfs to a peak since construction of Hells Canyon Dam of 1,494 ft msl at approximately 103,000 cfs. The maximum head at Hells Canyon Powerhouse is 219 ft, while the minimum head is 184 ft. The normal (average) over the last five years was 210 ft.

B.4. Power Utilization

All generation at the HCC is used to meet the Applicant’s system load requirements.

B.5. Future Development

The Applicant proposes no further development associated with the HCC at this time.

Literature Cited

U.S. Army Corps of Engineers [ACOE]. March 6, 2000. Procedure for Determining Flood Control Draft at Brownlee Reservoir, November 1998. ACOE, North Pacific Region, Water Management Division. <www.nwd-wc.usace.army.mil/cafe/forecast/SRD/BRN1998table.pdf>. Accessed on: March 2003.

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Table B-1 Constraints for current license, proposed license, and modeled proposed operations for the Brownlee Project, located within the HCC

	Constraints		
Brownlee Project	**Current License**	**Proposed License**	**Modeled Proposed Operations**
Maximum reservoir elevation	2,077 ft msl	2,077 ft msl	2,077 ft msl
Minimum reservoir elevation	1,976 ft msl	1,976 ft msl	1,976 ft msl
Flood-control requirements[a b]			
Brownlee Reservoir official target elevations specified for February 28, March 31, April 15, and April 30	ACOE flood-control rule curve requirements[a b]	ACOE flood-control rule curve requirements[a b]	ACOE flood-control rule curve requirements[a c]
Daily reservoir-level fluctuation			
January 1 through May 20	None	3 ft	3 ft
May 21 through June 21 for resident fish spawning	None	1 ft	1 ft
June 22 through December 31	None	3 ft	3 ft
Reservoir target elevation			
June 7	None	2,069 ft msl or higher[d]	2,069 ft msl or higher[e]
June 8 through July 5	None	2,075 ft msl[f]	2,075 ft msl[f]
August 31[g]			
High water year	None	None[h]	2,059 ft msl[g]
Medium water year	None	None[h]	2,069 ft msl[g]
Low water year	None	None[h]	2,072 ft msl[g]
October 21	None	Fall chinook program time period[i]	2,040 ft msl or higher[j]
December 11 through 31	None	None[k]	2,075 ft msl[k]

a. Article 42—Flood control at the HCC is coordinated with and mandated by the ACOE. Although the role of the HCC for flood control has not changed, the method for determining how much flood-control space is required at Brownlee Reservoir has evolved over time. Currently, flood control is based on the ACOE 1998 modified rule curve procedure. The most recent rule curve methodology is presented in Figure B-1 and Figure B-2.

b. The official target dates for flood control at Brownlee Reservoir are February 28, March 31, April 15, and April 30. The amount of flood-control space required on each date is determined by that month's final first-of-the-month runoff forecast produced by the NWRFC. For example, the February 28 flood-control space is determined by the February 1 runoff forecast, the March 31 flood-control space is determined by the March 1 runoff forecast, and so on. Flood-control requirements may extend into June, depending on forecasted inflow.

c. Reservoir target elevations calculated in the model use the 1998 modified rule curve procedure and are based on observed inflows (not monthly forecasts). Flood-control requirements are not modeled past the last April 30 target date.

d. The elevation of 2,069 feet msl or higher is targeted for the first week in June for resident fish spawning requirements. Elevation at this time is a function of flood-control requirements and water year conditions.

e. The elevation of 2,069 feet msl or higher is set as a target in the model for June 7 for resident fish spawning requirements.

f. A full reservoir during this period helps the Applicant meet peak summer load demands. The dates specified are for modeling purposes only and would vary as a function of the Applicant's system needs and water conditions.

g. This target is only specified in the model for this date as a means of modeling power needs of the system by drafting Brownlee Reservoir. The specified target is also a function of water year type.

h. Reservoir elevation between June 21 and the initiation of flows under the fall chinook plan would vary and are a function of the Applicant's system or load needs and water conditions.

i. The HCC would be operated to accommodate the fall chinook plan, and the exact start and end times would vary from year to year. The date specified is for modeling purposes only. The reservoir elevation at the initiation of flows under the plan is a function of flow forecasts.

j. Reservoir elevation for modeling purposes was calculated as a function of the specified fall chinook flow for water year type for Hells Canyon Project discharge (see Table B-4). This calculation resulted in reservoir elevations typically 2,040 feet msl or higher, except under extremely high water conditions for the model runs.

k. In the late fall, the reservoir is operated to accommodate the fall chinook program, and in early December, the Applicant attempts to have a full reservoir, typically around 2,075 feet msl, to help it meet peak winter load conditions. The exact elevation during this time is a function of inflow and system or load needs during the winter months. December 11 was specified for modeling purposes only.

Table B-2 Historical flood-control target end-of-month elevations for Brownlee Reservoir[a]

Water Year	Jan	Feb	Mar	Apr	May[b]
1982	2,077.0	2,034.0	c	c	c
1983	2,077.0	2,034.0	2,018.9	1,994.3	c
1984	2,077.0	2,034.6	2,034.6	2,034.0	c
1985	2,077.0	2,034.6	2,018.5	c	c
1986	2,077.0	2,034.6	c	2,044.0	c
1987	2,077.0	2,062.1	c	2,077.0	2,077.0
1988	2,077.0	2,062.1	2,073.5	2,077.0[d]	c
1989	2,077.0	2,053.6	2,049.1	2,044.5[d]	2,045.2
1990	2,077.0	2,053.6	2,053.6	2,077.0[d]	2,077.0
1991	2,077.0	2,062.1	2,069.9	2,077.0[d]	2,077.0
1992	2,077.0	2,062.1	2,069.9	2,077.0[d]	2,077.0
1993	2,077.0	2,053.6	2,062.1	2,077.0[d]	2,073.5
1994	2,077.0	2,069.9	2,062.1	2,077.0[d]	2,077.0
1995	2,077.0	2,044.5	2,062.1	2,044.5[d]	2,057.9
1996	2,077.0	2,044.5	2,034.6	2,024.1[d]	2,012.8
1997	2,077.0	2,034.6	2,006.8	1,976.0[d]	1,976.0
1998	2,077.0	2,044.5	2,049.1	2,073.5[d]	2,073.5
1999	2,077.0	2,044.5	2,006.8	1,976.0[d]	2,012.8
2000	2,077.0	2,056.7	2,053.1	2,056.2[d]	2,053.7
2001	2,077.0	2,077.0	2,077.0	2,077.0[d]	2,077.0
2002	2,077.0	2,051.1	2,052.8	2,064.4[d]	2,064.4

a. Flood-control target elevations (end-of-month) based on first-of-month forecasts (except May lookback). These target elevations do not necessarily reflect deviations granted by the ACOE.

b. Lookback elevations for May 1 forecast pertain to April 30 target.

c. Indicates that target elevations were not determined.

d. Target elevation for April 15.

Table B-3 Constraints for current license, proposed license, and modeled proposed operations for the Oxbow Project, located within the HCC

	Constraints		
Oxbow Project	**Current License**	**Proposed License**	**Modeled Proposed Operations**
Maximum reservoir elevation	1,805 ft msl	1,805 ft msl	1,805 ft msl
Minimum reservoir elevation	None	1,795 ft msl[a]	1,800 ft msl
Daily reservoir-level fluctuation (January 1 through December 31)	None	10 ft[a]	5 ft
Bypass flow (January 1 through December 31)	100 cfs	100 cfs	100 cfs

a. A maximum draft of 10 ft is proposed for atypical conditions: that is, when the Applicant determines that operation of the Oxbow Project, which operation may occur automatically or manually, is needed to 1) protect the performance, integrity, reliability or stability of the Applicant's electrical system or any electrical system with which it is interconnected; 2) compensate for any unscheduled loss of generation; 3) provide generation during severe weather or extreme market conditions; 4) inspect, maintain, repair, replace, or improve the Applicant's electrical system or facilities related to the HCC; 5) prevent injury to people or damage to property; or 6) assist in search-and-rescue activities. The typical operating limit would be 5 ft.

Table B-4 Constraints for current license, proposed license, and modeled proposed operations for the Hells Canyon Project, located within the HCC

	Constraints		
Hells Canyon Project	**Current License**	**Proposed License**	**Modeled Proposed Operations**
Maximum reservoir elevation	1,688 ft msl	1,688 ft msl	1,688 ft msl
Minimum reservoir elevation	None	1,678 ft msl[a]	1,683 ft msl
Daily reservoir-level fluctuation (January 1 through December 31)	None	10 ft[a]	5 ft
Ramp-rate restriction[b]			
Ramp-rate up	1 ft per hour	1 ft per hour	1 ft per hour
Ramp-rate down	1 ft per hour	1 ft per hour	1 ft per hour
Daily limit between minimum and maximum flows			
December 12 through May 31	none	none	none
June 1 through September 30	none	10,000 cfs 16,000 cfs[c]	10,000 cfs[d]
October 1 to October 20[e]	none	none	none
October 21 through December 11[e]	none	no load following	no load following
Minimum flows			
December 12 through May 31			
Low	5,000 cfs[f]	Dependent on the most critical shallow redd[g]	8,500 cfs
Medium	5,000 cfs[f]		10,500 cfs
High	5,000 cfs[f]		12,000 cfs
June 1 through October 20			
Low	5,000 cfs[f]	6,500 cfs 5,000 cfs[h]	6,500 cfs[i]
Medium	5,000 cfs[f]	6,500 cfs 5,000 cfs[h]	6,500 cfs[i]

Table B-4 Constraints for current license, proposed license, and modeled proposed operations for the Hells Canyon Project, located within the HCC

	Constraints		
Hells Canyon Project	**Current License**	**Proposed License**	**Modeled Proposed Operations**
High	5,000 cfs[f]	6,500 cfs 5,000 cfs[h]	6,500 cfs[i]
October 21 through December 11		8,000–13,000 cfs[j]	
Low	5,000 cfs[f]		9,000 cfs
Medium	5,000 cfs[f]		11,000 cfs
High	5,000 cfs[f]		13,000 cfs

a. A maximum draft of 10 ft is proposed for atypical conditions: that is, when the Applicant determines that operation of the Hells Canyon Project, which operation may occur automatically or manually, is needed to 1) protect the performance, integrity, reliability or stability of the Applicant's electrical system or any electrical system with which it is interconnected; 2) compensate for any unscheduled loss of generation; 3) provide generation during severe weather or extreme market conditions; 4) inspect, maintain, repair, replace, or improve the Applicant's electrical system or facilities related to the HCC; 5) prevent injury to people or damage to property; or 6) assist in search-and-rescue activities. The typical operating limit would be 5 ft.

b. Compliance would be measured at Johnson Bar, located approximately 18 miles downstream of Hells Canyon Dam.

c. A limit of 16,000 cfs is proposed for atypical conditions: that is, when the Applicant determines that operation of the Hells Canyon Project, which operation may occur automatically or manually, is needed to 1) protect the performance, integrity, reliability or stability of the Applicant's electrical system or any electrical system with which it is interconnected; 2) compensate for any unscheduled loss of generation; 3) provide generation during severe weather or extreme market conditions; 4) inspect, maintain, repair, replace, or improve the Applicant's electrical system or facilities related to the HCC; 5) prevent injury to people or damage to property; or 6) assist in search-and-rescue activities. The typical daily operating limit would be 10,000 cfs.

d. A limit of 10,000 cfs was modeled during this time frame to represent typical operations.

e. For modeling purposes only, flows under the fall chinook plan began October 21 and ended December 11. Under the new license, the beginning and ending dates of the fall chinook program would vary.

f. Minimum instantaneous flow below Hells Canyon Dam is 5,000 cfs, with 13,000 cfs maintained at Lime Point 95% of the time between July and September.

g. Releases under the fall chinook plan are reduced such that the most critical shallow redd is still protected under load-following conditions below the HCC. The December 12 date was specified for modeling purposes only, since the actual date that fall chinook spawning is completed can vary.

h. The 5,000-cfs minimum flow is proposed for atypical conditions: that is, when the Applicant determines that operation of the Hells Canyon Project, which operation may occur automatically or manually, is needed to 1) protect the performance, integrity, reliability or stability of the Applicant's electrical system or any electrical system with which it is interconnected; 2) compensate for any unscheduled loss of generation; 3) provide generation during severe weather or extreme market conditions; 4) inspect, maintain, repair, replace, or improve the Applicant's electrical system or facilities related to the HCC; 5) prevent injury to people or damage to property; or 6) assist in search-and-rescue activities. The typical minimum flow is 6,500 cfs and is coordinated with the ACOE.

i. Minimum flow modeled was 6,500 cfs or project inflow during this period to avoid drafting Brownlee Reservoir.

j. The constant fall chinook flow releases can vary between 8,000 cfs and 13,000 cfs, depending on water year conditions, forecasts, or turbine performance to minimize unnecessary wear during operation.

Procedure for Determining Flood Control Draft at Brownlee Reservoir, November 1998

Tabular Format

	Volume Forecast (MAF)			
	TDA ≤ 75			
Space Required (KAF)	Brn ≤ 3	Brn = 4	Brn = 5	Brn ≥ 6
28 Feb	0	200	300	400
31 Mar	0	100	200	350
15 Apr	0	50	150	250
30 Apr	0	0	50	150
	TDA = 85			
Space Required (KAF)	Brn ≤ 3	Brn = 4	Brn = 5	Brn ≥ 6
28 Feb	150	300	350	400
31 Mar	100	300	400	450
15 Apr	50	250	400	500
30 Apr	0	250	400	500
	TDA = 95			
Space Required (KAF)	Brn ≤ 3	Brn = 4	Brn = 5	Brn ≥ 6
28 Feb	200	300	350	400
31 Mar	150	300	400	500
15 Apr	100	300	425	550
30 Apr	50	300	450	600
	TDA = 105			
Space Required (KAF)	Brn ≤ 3	Brn = 4	Brn = 5	Brn ≥ 6
28 Feb	300	400	400	400
31 Mar	200	425	475	500
15 Apr	150	450	525	600
30 Apr	100	450	550	700
	TDA ≥ 115			
Space Required (KAF)	Brn ≤ 3	Brn = 4	Brn = 5	Brn ≥ 6
28 Feb	300	400	500	500
31 Mar	250	450	600	750
15 Apr	200	500	650	850
30 Apr	150	550	750	980

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Figure B-1 Brownlee Reservoir flood-control requirements, in tabular format[2]

2. This information was obtained from the ACOE website.

Notes. The procedure for determining flood control draft at Brownlee is applicable from January 31–April 30 to facilitate regulation of the spring flood season on the lower Snake and lower Columbia Rivers. Forecasts from both The Dalles and Brownlee are used to specify draft volumes at designated time periods throughout the spring runoff season. Interpolation may be necessary at both The Dalles and Brownlee with respect to their forecasts. If a forecast at The Dalles is less than 75 MAF, equal to 85, 95 or 105 MAF, or greater than 115 MAF, then interpolation is necessary only at Brownlee. If Brownlee's forecast is less than 3 MAF, equal to 4 or 5 MAF, or greater than 6 MAF, then interpolation is necessary only at The Dalles. If the forecast does not lie at either of the volumes specified above, then interpolation is necessary at both projects. The following is an example of the interpolation process when necessary at both projects:

1. Detemine the 4 lines of interpolation from the forecasts of The Dalles and Brownlee at a specified date. For example, a 30 April forecast of 88 MAF at The Dalles and 4.2 MAF at Brownlee would produce the 4 following interpolation lines:
   a. TDA=85, BRN=4, FC=250
   b. TDA=85, BRN=5, FC=400
   c. TDA=95, BRN=4, FC=300
   d. TDA=95, BRN=5, FC=450

2. Interpolate between the two different The Dalles runoff volumes for the same Brownlee runoff volume. For example, interpolate between TDA=85, BRN=4 and TDA=95, BRN=4:

   (88-85/95-85)*(300-250)+250=265kaf

3. Interpolate between the same two runoff volume values at The Dalles in step 2, but use the higher Brownlee runoff volume than in step 2. For example, interpolate between TDA=85, BRN=5 and TDA=95, BRN=5:

   (88-85)/(95-85)*(450-400)+400=415kaf

4. Interpolate between the values obtained from step 2 and step 3 to determine the space required at Brownlee. For example:

   (4.2-4.0)/(5.0-4.0)*(415-265)+265=295kaf

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Figure B-2 Brownlee Reservoir flood-control requirements, procedural information[3]

3. This information was obtained from the ACOE website.

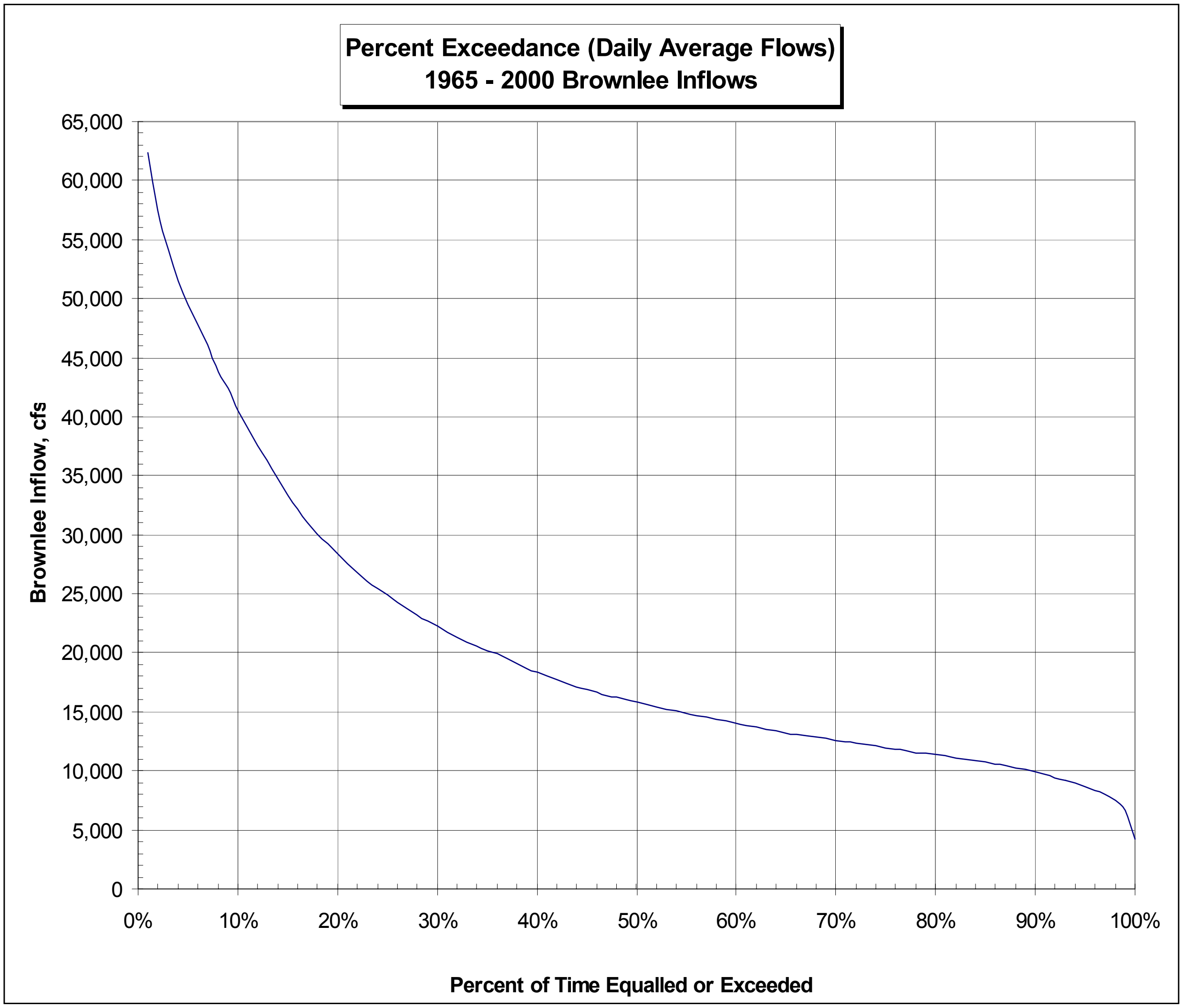

Figure B-3 Flow-duration curve for inflow to Brownlee Reservoir, based on calculated average daily flows, for the period January 1965 through December 2000

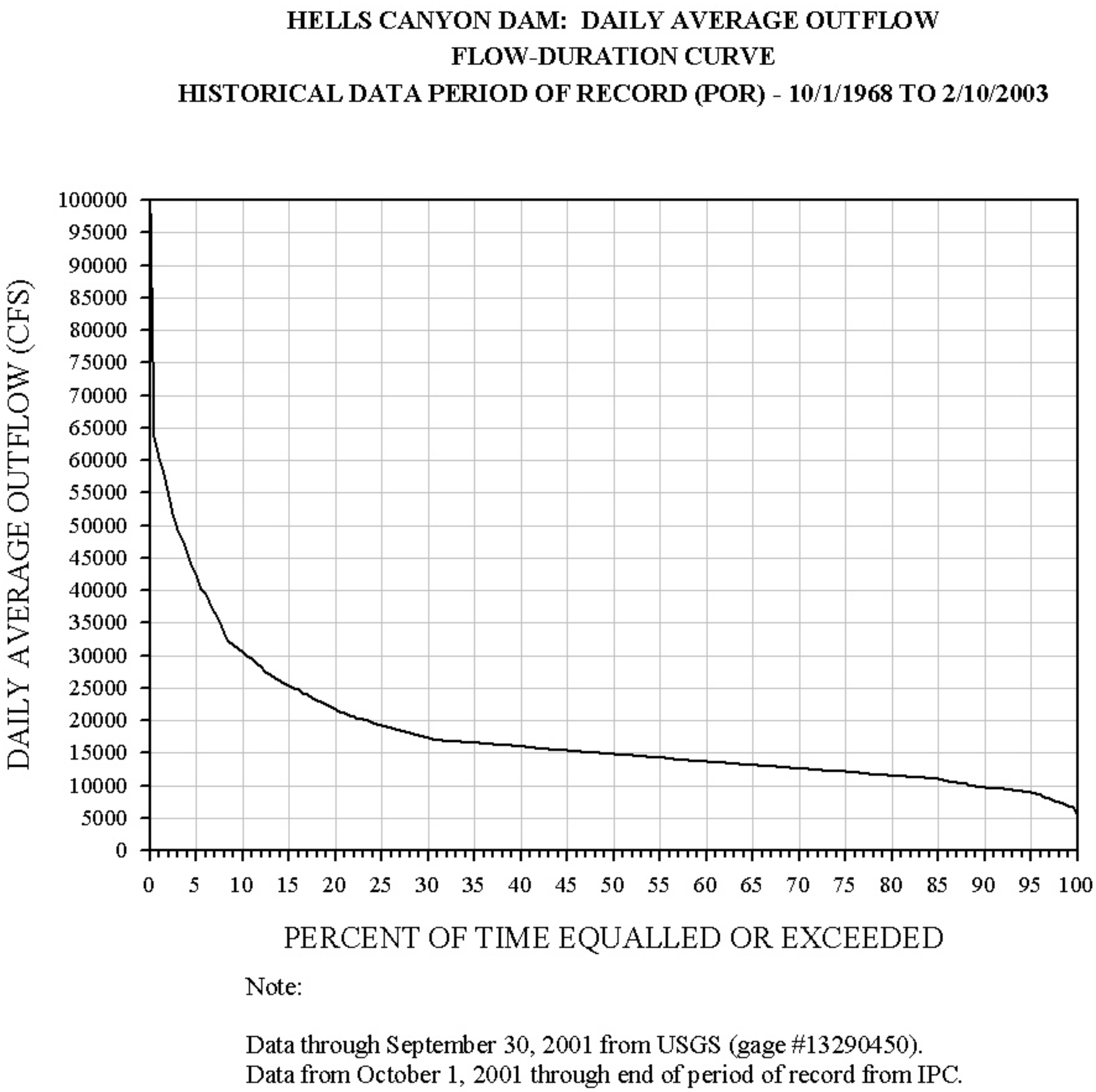

Figure B-4 **Flow-duration curve for the daily average outflow from Hells Canyon Dam for the period of record from October 1, 1968, to February 10, 2003**

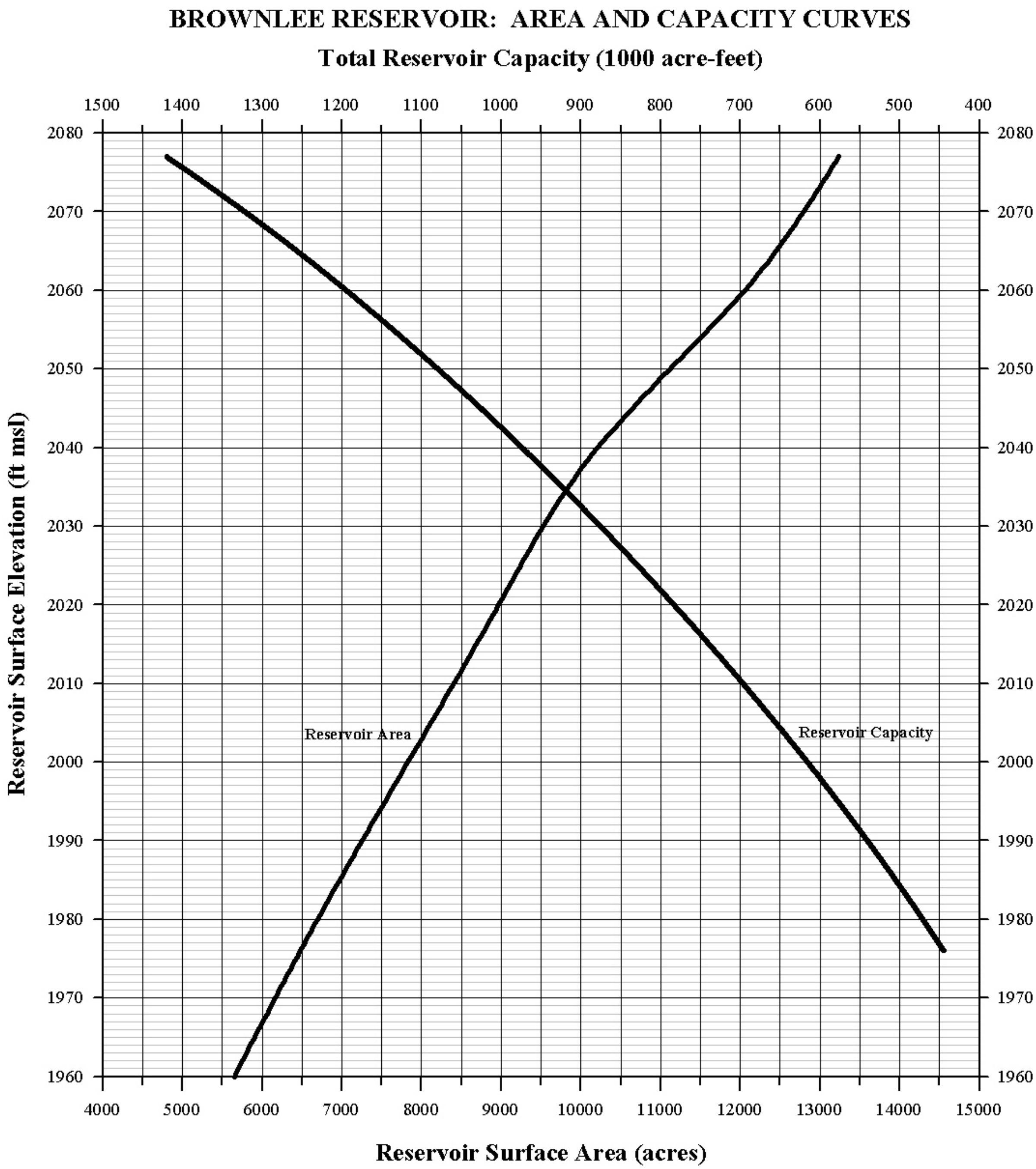

Figure B-5 Area-capacity curve for Brownlee Reservoir

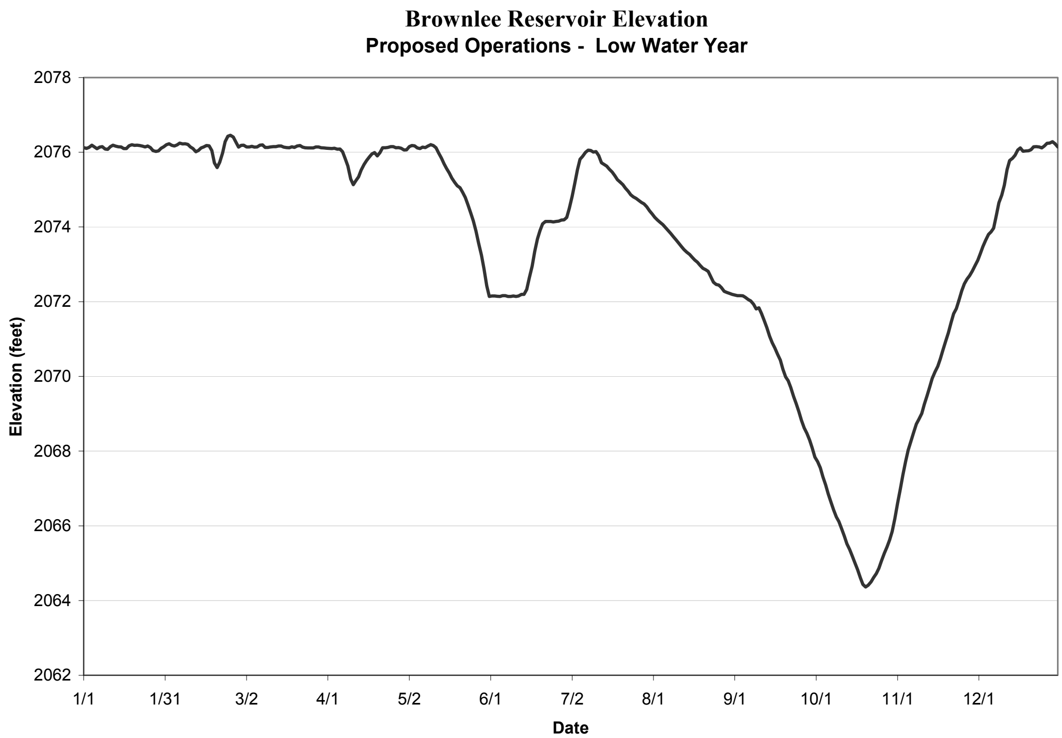

Figure B-6 **Example of a modeled proposed rule curve for a low inflow year for Brownlee Reservoir**

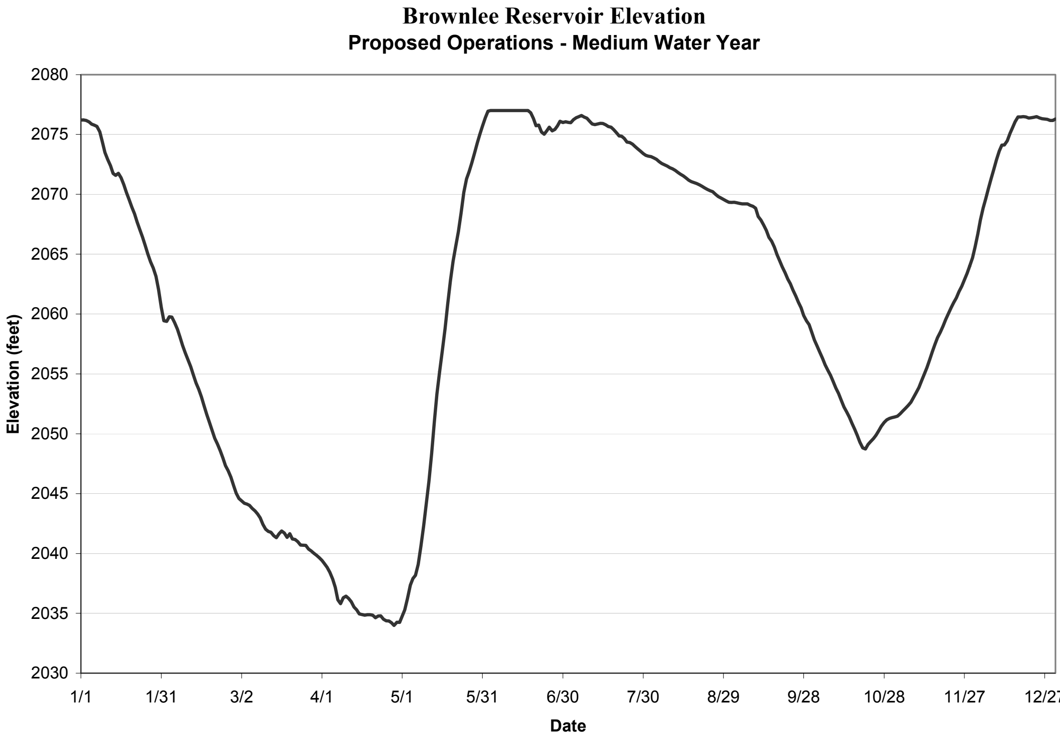

Figure B-7 **Example of a modeled proposed rule curve for a medium inflow year for Brownlee Reservoir**

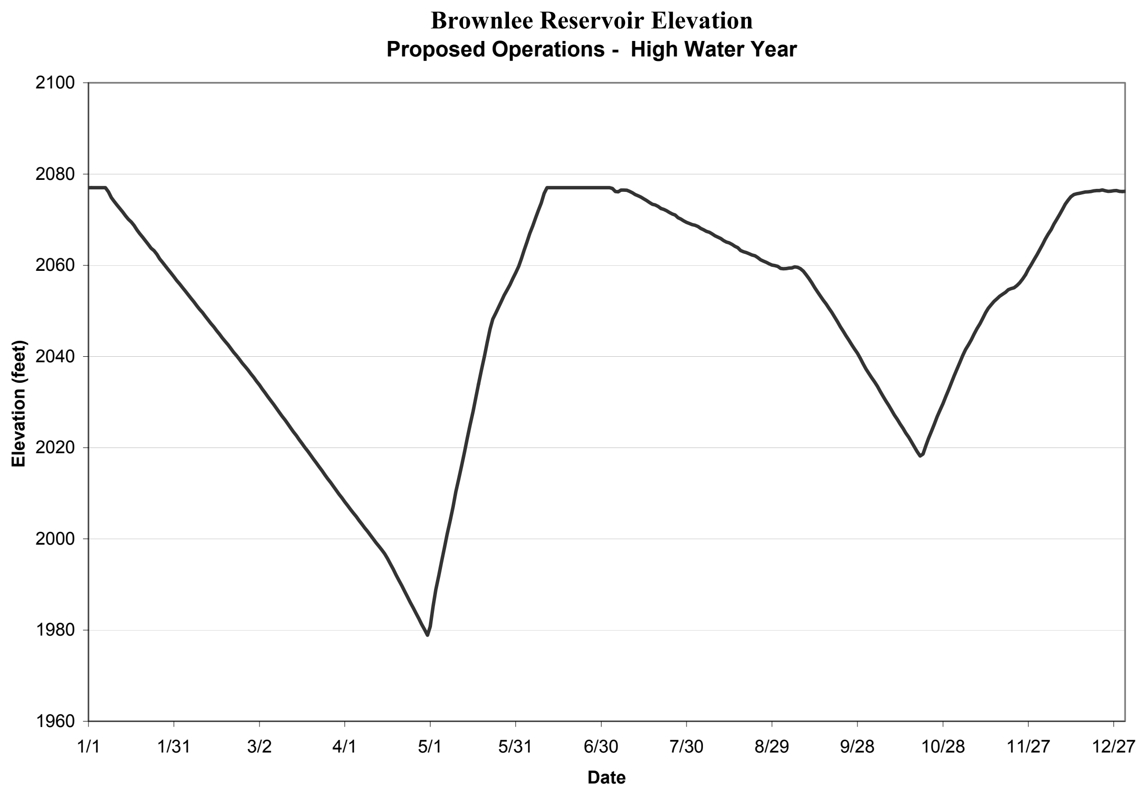

Figure B-8 Example of a modeled proposed rule curve for a high inflow year for Brownlee Reservoir

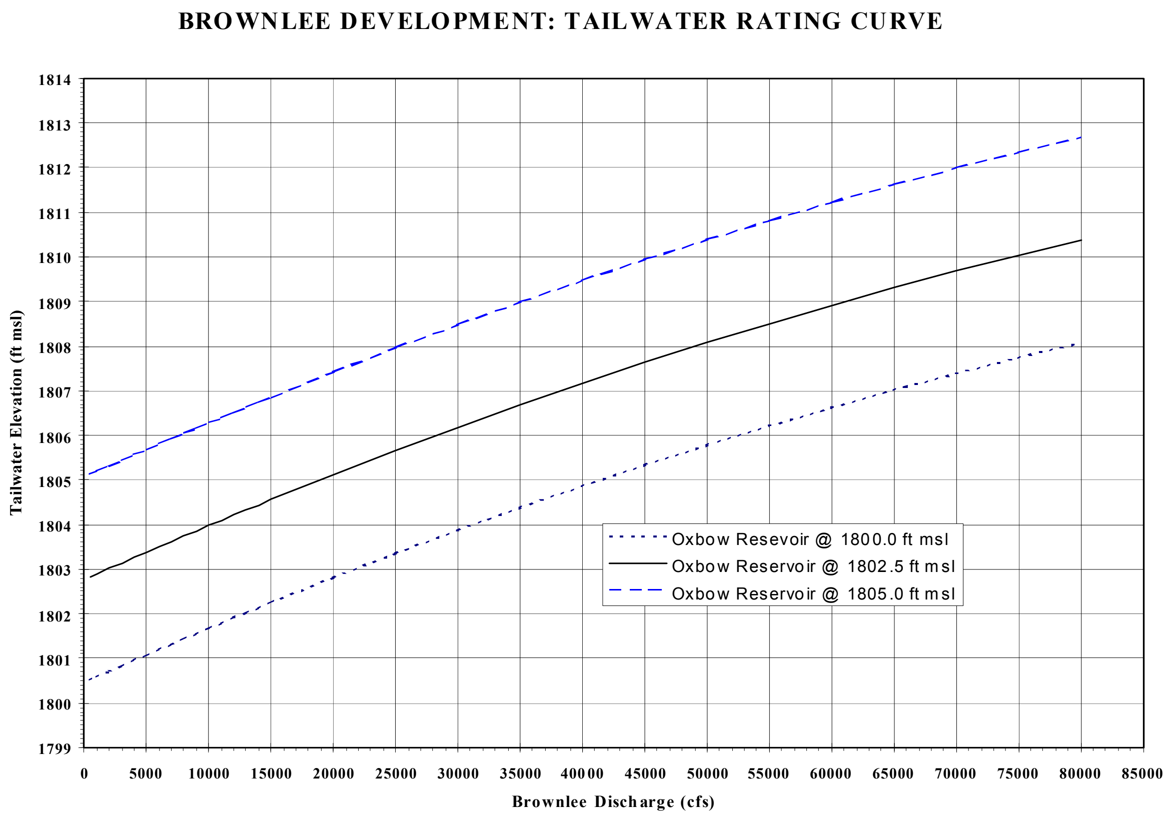

Figure B-9 Tailwater curves for the Brownlee Project

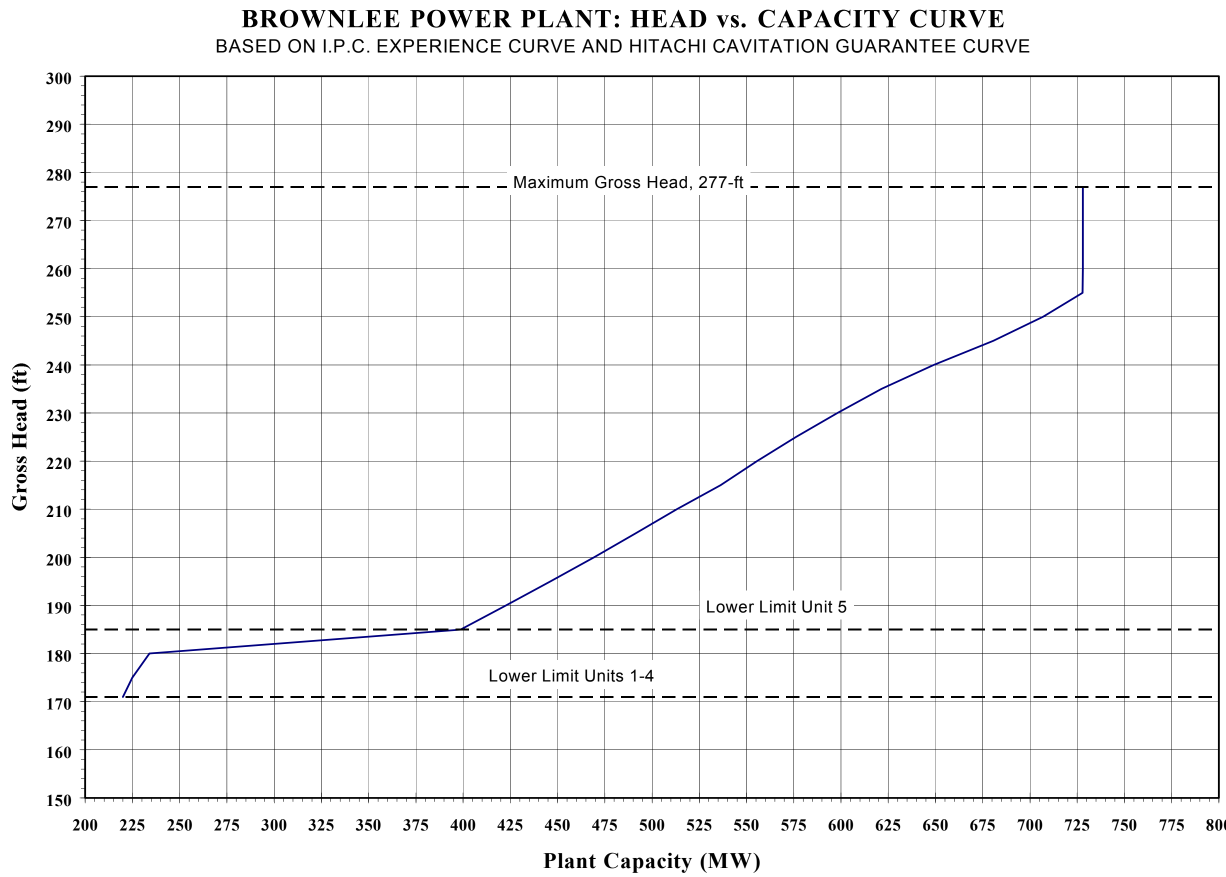

Figure B-10 Brownlee Power Plant capacity versus head curve

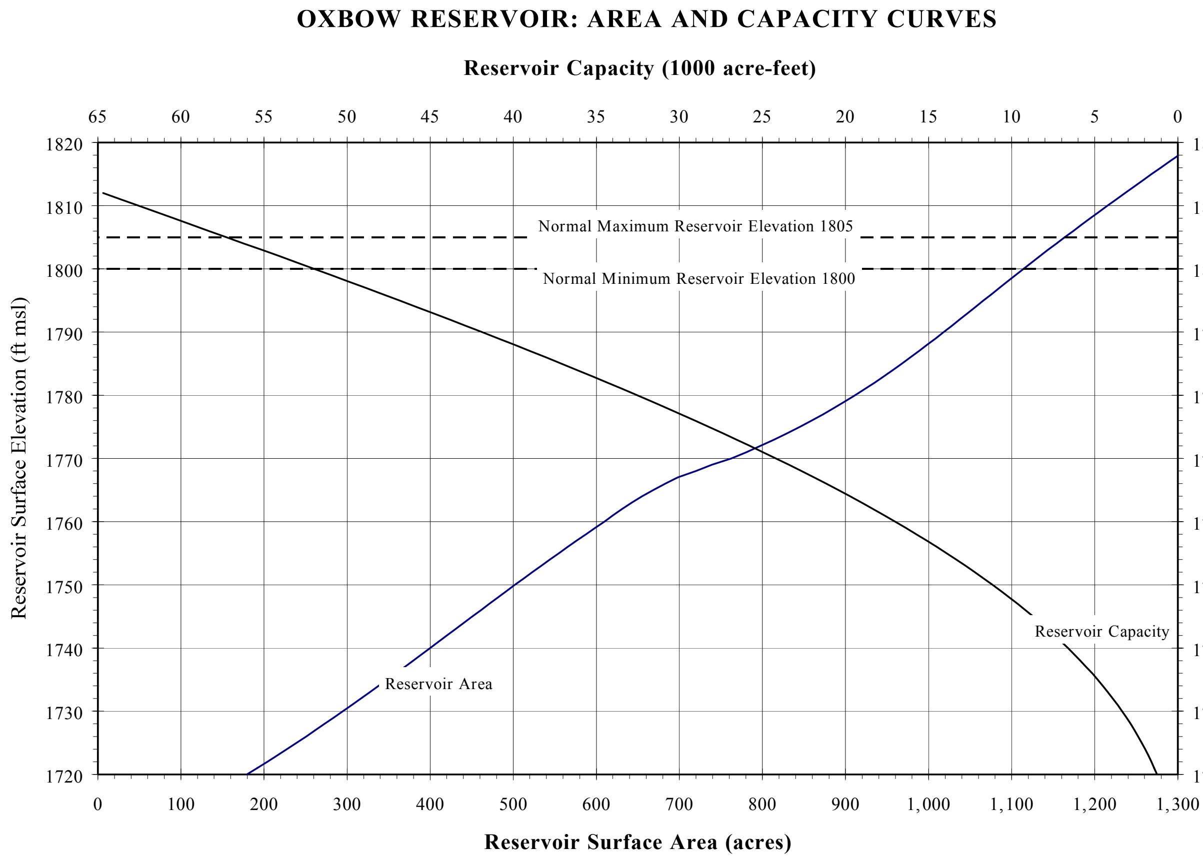

Figure B-11 Area and capacity curves for Oxbow Reservoir

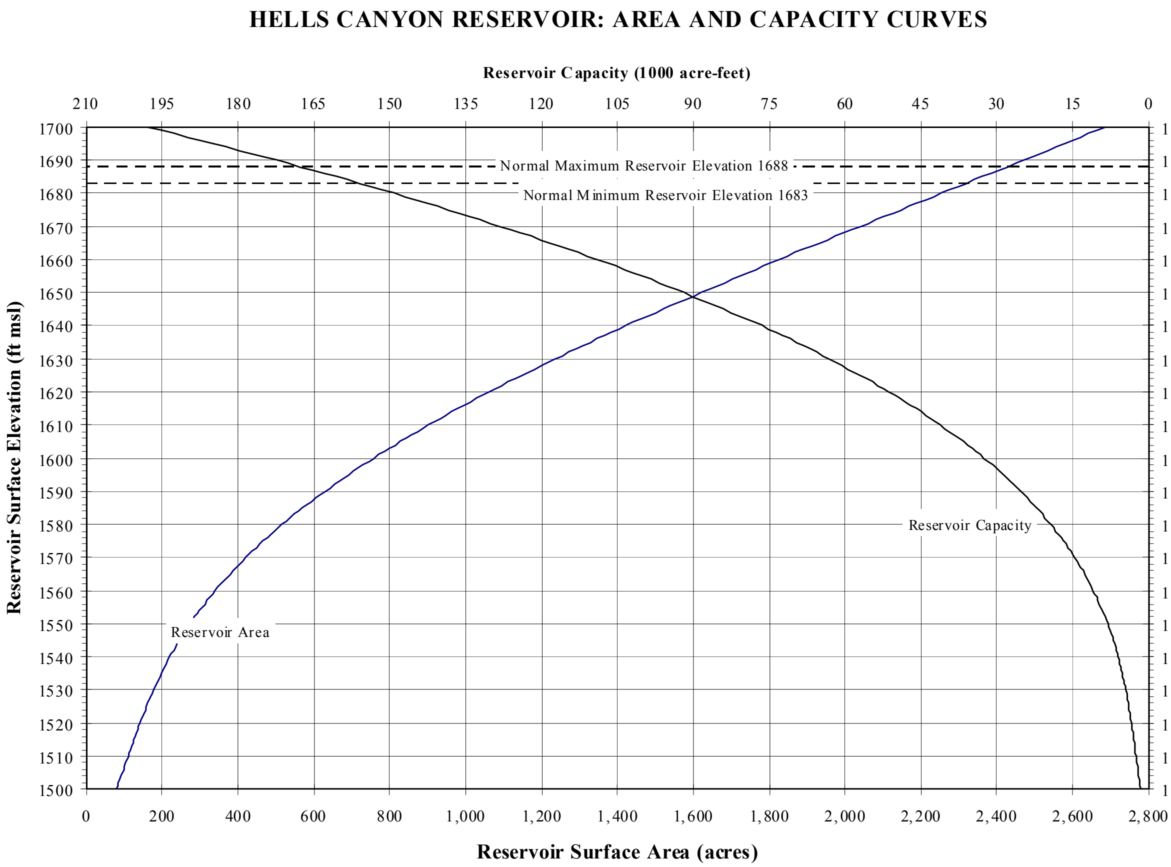

Figure B-12 Area and capacity curves for Hells Canyon Reservoir

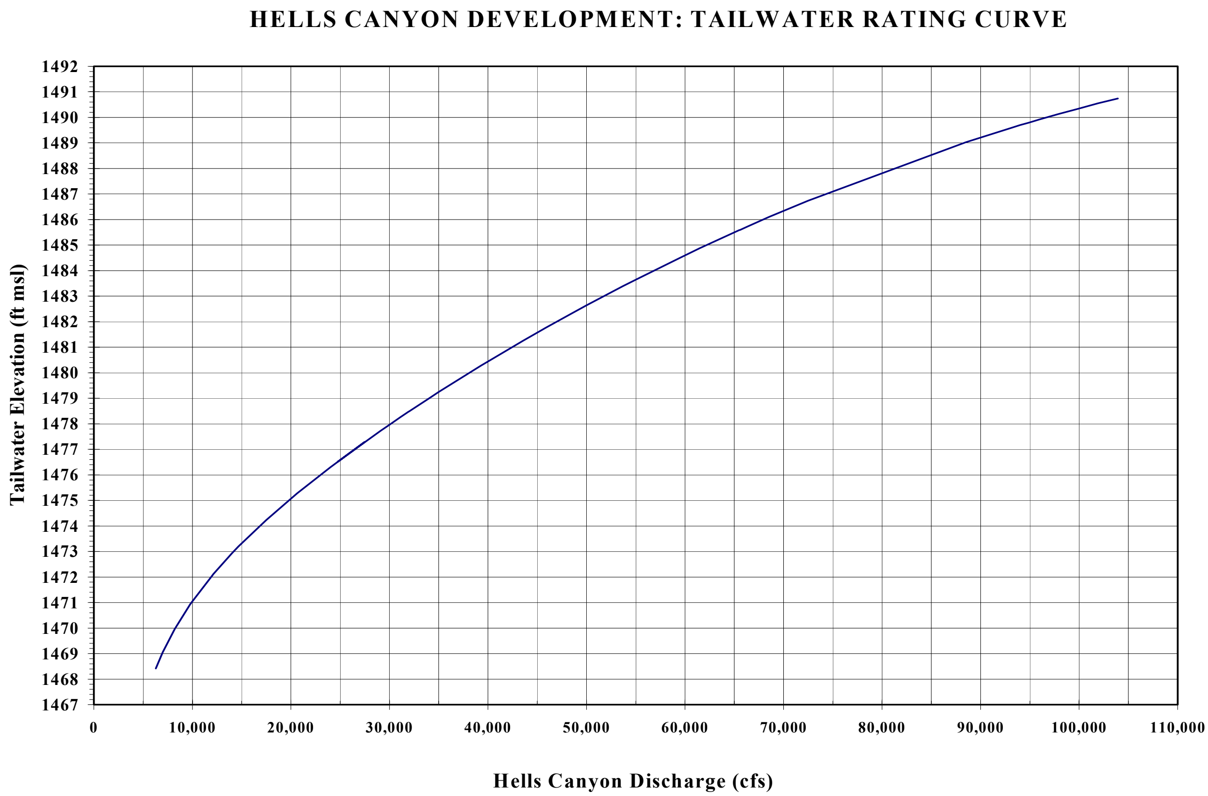

Figure B-13 Tailwater rating curve for the Hells Canyon Project

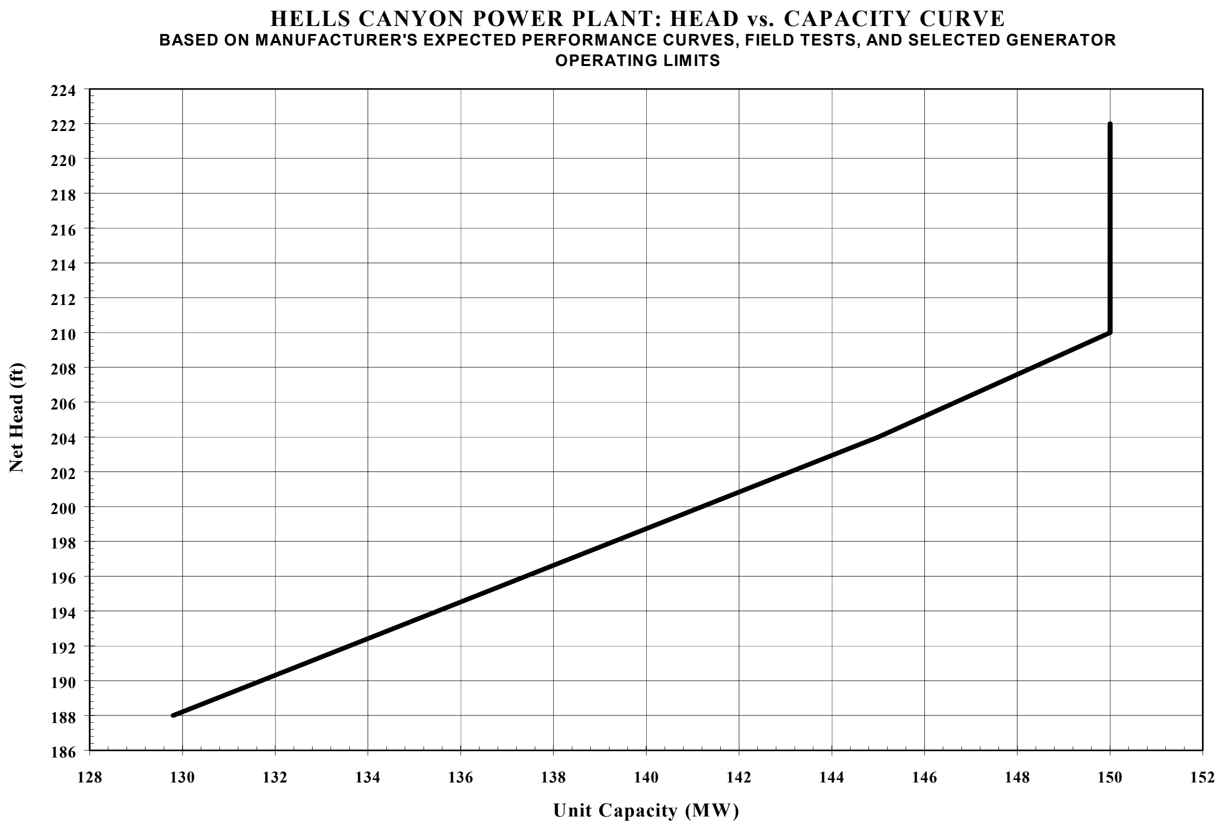

Figure B-14 Hells Canyon Power Plant capacity versus head curve

Hells Canyon Complex
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Exhibit C
Construction History and Proposed Construction Schedule

The *Code of Federal Regulations* below—18 CFR § 4.51(d)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(d) *Exhibit C* is a construction history and proposed construction schedule for the project. The construction history and schedules must contain:
> (1) If the application is for an initial license, a tabulated chronology of construction for the existing project's structures and facilities described under paragraph (b) of this section (Exhibit A), specifying for each structure or facility, to the extent possible, the actual or approximate dates (approximate dates must be identified as such) of:
> (i) Commencement and completion of construction or installation;
> (ii) Commencement of commercial operation; and
> (iii) Any additions or modifications other than routine maintenance; and
> (2) If any new development is proposed, a proposed schedule describing the necessary work and specifying the intervals following issuance of a license when the work would be commenced and completed.

C.1. Construction History

The tremendous potential for generating electric power in the Snake River through Hells Canyon[1] was recognized soon after power plant developers began to develop hydroelectric power sites throughout the United States. Construction of the first hydroelectric plant in the Hells Canyon reach was started in 1908 at the bend in the river called the oxbow by a predecessor to the Applicant, the Idaho–Oregon Light and Power Company. As with the later Oxbow Project, the early project was designed to use a tunnel through the oxbow to a power plant on the west side of the oxbow, with a dam across the river on the east side to raise the water upstream of the powerhouse. However, the project was not completed because of the difficulty of successfully damming the river. Ultimately, a wing dam was constructed to divert part of the river flow into the power tunnel. The power plant was thus able to exploit only the 22 feet of fall around the oxbow. The wing dam was intermittently damaged by high flows and then expanded between 1915 and 1922.

The original Oxbow Project was only marginally successful and not profitable. The original developers had underestimated the extraordinary effort and cost required to construct power plants and transmission systems in Hells Canyon, a remote and rugged region. Because of these challenges, the availability of more easily developed power production sites in the region, and limited demand for the power, no further development of Hells Canyon was seriously proposed for nearly two decades following completion of the original Oxbow Power Plant. However, the power-generating potential of the Hells Canyon reach was well known and expected to be

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

developed, either privately or by a government agency, once the regional power demand made further development economically feasible.

Various development plans for the Snake River through Hells Canyon were considered by the Applicant, the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers (ACOE), and others throughout the 1930s. In the early 1940s, the Applicant began to more seriously evaluate the possibilities for economic hydroelectric development of the Snake River in Hells Canyon and in June 1947, submitted a preliminary permit application to the Federal Power Commission (FPC) for expansion of the Oxbow Project.

Two weeks later, in early July 1947, the first of many public hearings was held in Lewiston, Idaho, to solicit public comment on various schemes of development for the Snake River through Hells Canyon. This hearing was held by the ACOE, and an ACOE plan for a federal Hells Canyon project was presented as an alternative to the Applicant's proposed development. From June 1947 until after the Applicant had started construction of the complex in November 1955, various organizations competed in forums throughout the United States for the authority to develop the hydroelectric potential of the Snake River through Hells Canyon. The choice of who would develop this resource was debated in special hearings in the U.S. Senate and House of Representatives, as well as in presidential campaigns, and was ultimately appealed to the U.S. Supreme Court. Throughout these debates, the principal question was not whether the hydroelectric potential of the Snake River through Hells Canyon should be developed, but rather who should be authorized to develop and which configuration was preferable. The record indicates that development was a foregone conclusion from the beginning to the end of the debates.

The preferred federal plan of development was one 740-foot-tall dam, the plan referred to as the "high Hells Canyon Dam," and not a series of smaller dams, the plan proposed by the Applicant. The high dam was to be constructed immediately downstream of the site of the present-day Hells Canyon Dam. The federal dam would have impounded a 95-mile-long reservoir, had a usable storage capacity of nearly 4 million acre-feet, and submerged the entire canyon from the present-day headwaters of Brownlee Reservoir to the present-day location of Hells Canyon Dam. In 1955, the cost of this project was estimated to be $500 million, approximately three times the cost of the

Applicant's plan for a series of dams. This federal project would have been taxpayer funded and become part of the Federal Columbia River Power System under the Bonneville Power Administration. The high Hells Canyon Dam was promoted by public power advocates as an integral part of a much larger scheme of development for all of the Columbia River basin. This federal hydroelectric development scheme included a network of flood-control dams on most of the Northwest's rivers. Additionally, some of the federal plan's most influential supporters believed that the power and the income from the power sales from a high Hells Canyon dam could be allocated to a project to subsidize pumping water out of the Snake River upstream of Hells Canyon to irrigate the desert surrounding Mountain Home, Idaho. The electrical energy production from the federal dam would have been roughly equal to the energy production from the Applicant's proposed complex.

Subsequent to its initial permit application in 1947, the Applicant conducted studies and assessments as specified by the implementing regulations of the Federal Power Act and on December 15, 1950, submitted an application for an FPC project license for the Oxbow Project. In Exhibit Q of the 1950 license application, the Applicant indicated its intent to comprehensively develop the Hells Canyon reach of the Snake River with a series of five dams with powerhouses: Oxbow and Hells Canyon dams, a small Brownlee Dam, and the Sturgill and Bayhorse Rapids dams upstream of the small Brownlee Dam. After nearly five more years of national debate about how to best develop the Snake River in Hells Canyon, the FPC issued the project license on August 4, 1955, for the three-dam complex that now exists.

The license order summarized the conclusions of extensive analyses by the FPC and Congress of the two principal proposed Hells Canyon development plans. In the license order, the FPC suggested that there were not significant differences between the two plans of development on the expected impacts to fish and wildlife resources or on the expected cost to mitigate the impacts to the fish and wildlife resources, including anadromous fish. Additionally, the 1955 FPC order stated: "We conclude that the public purposes such as flood control, navigation, and recreation could be effectuated to about the same extent under either plan of development." The FPC discounted the conceptual irrigation benefits of the federal project by noting that "[w]hether irrigation should be subsidized and, if so, the method of subsidy is a matter for Congress to decide and not the Commission."

The public power advocates unsuccessfully appealed the FPC license order to the U.S. Court of Appeals for the District of Columbia and to the U.S. Supreme Court.

Shortly after license issuance, and as required by the new license, the Applicant submitted Brownlee Project design drawings to the FPC, and the Brownlee spillway design to the ACOE for approval. On November 3, 1955, the FPC approved the Brownlee design drawings, and seven days later the Applicant started access and site preparation work for Brownlee Dam. Excavation for the Brownlee diversion tunnel started in December 1955. Brownlee Dam was substantially completed, and reservoir filling begun, on May 9, 1958. The first Brownlee generating unit went into operation on August 27, 1958. The last Hells Canyon Complex generator, Brownlee unit 5, went into service on March 31, 1980.

A list of project benchmarks and their dates are listed below.

August 4, 1955	License was granted for the Hells Canyon Complex.
November 10, 1955	Construction on Brownlee Dam began.
December 11, 1957	Excavation for Oxbow Dam began.
May 9, 1958	Brownlee Dam was completed, and reservoir fill began.
August 27, 1958	Brownlee unit 4 turbine generator went into service.
October 3, 1958	Brownlee unit 3 turbine generator went into service.
December 17, 1958	Brownlee unit 2 turbine generator went into service.
January 22, 1959	Brownlee unit 1 turbine generator went into service.
March 12, 1961	Oxbow Dam was completed, and reservoir fill began.
June 9, 1961	Oxbow unit 1 turbine generator went into service.
June 30, 1961	Oxbow unit 2 turbine generator went into service.
July 27, 1961	Construction of the road to Hells Canyon Dam began.
September 8, 1961	Oxbow unit 3 turbine generator went into service.
November 18, 1961	Oxbow unit 4 turbine generator went into service.
August 27, 1964	Excavation for Hells Canyon Dam began.
October 10, 1967	Hells Canyon Dam was completed, and reservoir fill began.
October 23, 1967	Hells Canyon unit 3 turbine generator went into service.

December 16, 1967	Hells Canyon unit 2 turbine generator went into service.
December 28, 1967	Hells Canyon unit 1 turbine generator went into service.
December 1976	Construction for Brownlee unit 5 began.
March 31, 1980	Brownlee unit 5 turbine generator went into service.

The environmental and recreation facilities associated with each project, including temporary and permanent fish traps and Woodhead, McCormick, Copperfield, and Hells Canyon parks, were constructed concurrently with dams and powerhouses. Throughout the life of the project, upgrades and improvements have been made because of advances in industry operating standards, equipment manufacturing, and communications and monitoring technology and because of changes in liability standards and in regulatory requirements and recommendations. The following list summarizes the major repairs and upgrades, as well as the dates of those improvements:

Spring 1972	Brownlee unit 1 generator was rewound due to repeated failures and to correct a design deficiency.
Fall 1972	Brownlee unit 2 generator was rewound due to repeated failures and to correct a design deficiency.
Spring 1973	Brownlee unit 4 generator was rewound to correct a design deficiency and to reduce the risk of failure.
Fall 1973	Brownlee unit 3 generator was rewound to correct a design deficiency and to reduce the risk of failure.
Spring 1983–Fall 1984	The new Hells Canyon fish trap was constructed.
Fall 1985	Hells Canyon unit 2 generator was rewound due to failure.
Spring 1986	Hells Canyon unit 3 generator was rewound due to failure.
Summer 1987	Hells Canyon unit 1 generator was rewound to reduce the risk of failure.
Spring 1988	Oxbow unit 4 generator was rewound to reduce the risk of failure.
Spring 1988–Fall 1989	Copperfield Park near the Oxbow Project was reconstructed.
Fall 1988–Spring 1989	Oxbow unit 3 generator was rewound to reduce the risk of failure.
Spring 1989	Backup generator was installed at the Brownlee Project’s spillway.
Fall 1989–Spring 1990	Oxbow unit 2 generator was rewound to reduce the risk of failure.
Fall 1990–Spring 1991	Oxbow unit 1 generator was rewound due to failure.
1993	The U.S. Forest Service reconstructed the Hells Canyon Launch and interpretive site downstream of Hells Canyon Dam.

Spring 1991–Fall 1994	Woodhead Park on Brownlee Reservoir was reconstructed.
Fall 1992 and 1993	New recreation boat ramp and parking area were constructed on Hells Canyon Reservoir near Copperfield Park.
Spring 1995	New RV dump station was constructed at Hells Canyon Park.
Fall 1997–Spring 1998	Control system upgrades were made at Oxbow Powerhouse.
Fall 1998–Spring 1999	Control system upgrades were made at Brownlee Powerhouse.
Fall 1999–Spring 2000	Control system upgrades were made at Hells Canyon Powerhouse.
Fall 1999–Spring 2000	Brownlee unit 4 generator was rewound due to limited winding failure and to reduce the risk of additional failure.
Fall 2000–Spring 2001	Brownlee unit 1 generator was rewound to reduce the risk of failure.
Fall 2002–Spring 2003	Brownlee unit 2 generator was rewound to reduce the risk of failure.

The control system upgrades referred to in the list above are ongoing projects. The control upgrades provide the Applicant greater control over the projects from the Generation Dispatch Center in Boise. Also, the generator for Brownlee unit 3 is tentatively scheduled for rewind in the next two to three years to reduce the risk of failure caused by normal wear of the equipment. In addition, Hells Canyon unit 2 will be rewound in 2003 because of a coil short in January 2003.

C.2. New Development

Excluding protection, mitigation, and enhancement measures, proposed in Exhibit E, the Applicant proposes no further development associated with the Hells Canyon Complex. However, if new restrictions on operations that would reduce the power production value of the project are mandated as conditions of a new license, the Applicant may propose project modifications to allow compliance with such restrictions while regaining some of the lost power production value.

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Exhibit D
Statement of Costs and Financing

The *Code of Federal Regulations* below—18 CFR § 4.51(e)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(e) *Exhibit D* is a statement of costs and financing. The statement must contain:
> (1) If the application is for an initial license, a tabulated statement providing the actual or approximate original cost (approximate costs must be identified as such) of:
> (i) Any land or water right necessary to the existing project; and
> (ii) Each existing structure and facility described under paragraph (b) of this section (Exhibit A).
> (2) If the applicant is a licensee applying for a new license, and is not a municipality or a state, an estimate of the amount which would be payable if the project were to be taken over pursuant to section 14 of the Federal Power Act upon expiration of the license in effect [*see* 16 U.S.C. 807], including:
> (i) Fair value;
> (ii) Net investment; and
> (iii) Severance damages.
> (3) If the application includes proposals for any new development, a statement of estimated costs, including:
> (i) The cost of any land or water rights necessary to the new development; and
> (ii) The cost of the new development work with a specification of:
> (A) Total cost of each major item;
> (B) Indirect construction costs such as costs of construction equipment, camps, and commissaries;
> (C) Interest during construction; and
> (D) Overhead, construction, legal expenses, taxes, administrative and general expenses, and contingencies.
> (4) A statement of the estimated average annual cost of the total project as proposed, specifying any projected changes in the costs over the estimated financing or licensing period if the applicant takes such changes into account, including:
> (i) (equity and debt);
> (ii) Local, state, and federal taxes;
> (iii) Depreciation or amortization; and
> (iv) Operation and maintenance expenses, including interim replacements, insurance, administrative and general expenses, and contingencies.
> (5) A statement of the estimated annual value of project power, based on a showing of the contract price for sale of power or the estimated average annual cost of obtaining an equivalent amount of power (capacity and energy) from the lowest cost alternative source, specifying any projected changes in the cost of power from that source over the estimated financing or licensing period if the applicant takes such changes into account.
> (6) A statement specifying the source and extent of financing and annual revenues available to the applicant to meet the costs identified in paragraphs (e)(3) and (4) of this section.

D.1. Original Cost of the Hells Canyon Complex

Because this application is not the initial license application, no statement of original cost is required.

D.2. Amount Payable If the Hells Canyon Complex Is Taken Over

Estimates of fair value, net investment, and severance damages are provided below. The estimates of fair value and severance damages are preliminary and subject to revision as necessary to reflect changing conditions and the results of analyses that cannot be performed at this time. The measure of compensation that would be paid to the Applicant if the Hells Canyon Complex[1] were

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

taken over is uncertain because no project has been taken over since enactment of the Federal Water Power Act, so there is no precedent to guide this determination. The Applicant believes that, under applicable law, it should be entitled to just compensation or fair value if the project were taken over. However, the Applicant believes that a takeover would be detrimental to both the Applicant and its customers, regardless of compensation received.

D.2.1. Fair Value

In determining fair value, courts generally consider such criteria as the cost of reproducing the property, its market value, and the resulting damage to the remaining property of the owner. The market value should be determined at the time of the taking and reflect the highest price for which the property, considered at its best and most profitable use, can be sold by a willing seller to a willing buyer in an open market. The fair value of an electric generating project may be influenced by a number of factors, including the replacement cost of equivalent capacity, the cost of purchasing an equivalent amount of power under contract, and any operating limitations that may affect output.

Transactions under current market conditions indicate that short-term purchases of energy can be made for an estimated $30 per megawatt hour (MWh). The market price for capacity can be estimated by using the capital cost for constructing a gas-fired turbine. Long-term power supply commitments would cost substantially more. Replacement cost would be a function of the type of generating capacity and fuel costs. Estimates prepared by the Federal Energy Regulatory Commission (FERC) in other Pacific Northwest relicensing proceedings indicate that current replacement power cost, based on gas-fired generation, would be $26.60 per MWh for energy (annual weighted average of on-peak and off-peak prices) and $114 per kilowatt (kW) for capacity (see FERC 2002). The Applicant’s current estimate of the cost of replacement power based on gas-fired generation is $4.6 billion. However, the Applicant believes that a definitive estimate of fair value should be deferred until it becomes apparent that a recommendation for federal takeover will be made in this proceeding. If such a recommendation were made, the Applicant would prepare a final estimate based on the facts and circumstances at that time. In addition, the Applicant believes that FERC would be required to conduct an evidentiary hearing to support any determination of fair value, net investment, and severance damages.

D.2.2. Net Investment

Typically defined as the net book value, net investment includes historical costs minus the accumulated depreciation. By this definition, upon expiration of the initial license in 2005, the estimated net investment of the Hells Canyon Complex will be approximately $182.8 million. This estimate includes the actual net investment balance at the end of 2002 and the estimated net investment expected for the period between 2003 and 2005.

D.2.3. Severance Damages

Severance damages may exceed $4.4 billion, which includes the present value to obtain replacement power over the new license period minus the present value of the estimated cost to continue operating the existing complex over the same period. This estimate also includes $81.7 million incurred in the years leading up to 2005 to prepare the application for new license. The Applicant would expect to be compensated for these costs if the complex were to be taken over upon expiration of the license.

The estimate for severance damages is a partial estimate because it does not include costs associated with the decreased value of replacement power sources to the Applicant's remaining system or the decrease in the Applicant's current competitive advantage caused by its reliance on higher marginal-cost resources for replacement power. The cost of each of these factors may be substantial. The Applicant did not attempt to estimate these costs at this time because to do so would require assumptions and projections as to future conditions, which are subject to change. As explained above, if a federal takeover recommendation were made, the Applicant would prepare a more definitive estimate of all severance damages for consideration at a hearing.

D.3. Estimated Cost for New Development

Because the Applicant proposes no new development, no estimated costs are applicable.

D.4. Estimated Average Annual Cost of the Hells Canyon Complex

The estimated average annual cost of the complex includes cost of capital, operation and maintenance (O&M), property taxes, and other expense components. The annual estimated cost of capital component for the HCC represents levelized costs over an assumed 30-year period[2] (2005–2034) and is the Applicant's estimated annual revenue requirement. Estimated annual O&M, property taxes, and other expenses are derived from the averages of the annual escalated cash outflows expected over the license period. Because these estimates are based on current information, they could change as new information is obtained. The economic parameters used in the estimations are 1) an escalation rate of 2.50%, based on an annual trend forecast of consumer price inflation; 2) a discount rate of 7.13%, based on the Applicant's authorized capital structure; and 3) an assumed 30-year license period.

D.4.1. Cost of Capital

The Applicant's historical weighted average cost of capital, 8.48%, is based on a capital structure and rate of return as set forth in Idaho Public Utilities Commission Order No. 25880. The components of annual carrying charges; depreciation; and state and federal income taxes are summed to figure cost of capital. These components are based on an estimate of 1) remaining net project investment at the time when the original license expires, 2) capital costs accumulated to prepare the application for new license, and 3) capital costs for proposed protection, mitigation, and enhancement (PM&E) measures[3]. The annual levelized cost of capital for proposed PM&E measures, is $6.2 million (in 2005 dollars). Descriptions for proposed PM&E measures are included in sections E.2.4.2., E.3.1.3.2., E.3.2.3.2., E.3.3.3.2., E.4.2.5.1., E.4.2.5.2., E.4.2.5.3., E.5.4.4.1., E.5.4.4.2., E.5.4.4.3., E.5.4.4.4., E.5.4.4.5., and E.6.4.3. Given the costs of the various

2. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of Federal Energy Regulatory Commission's discretion for setting a new license term.
3. The Applicant did not include costs for water quality PM&E measures for two reasons. First, §4.51(f)(2)(iv) does not identify cost or design drawings as a pertinent or necessary item to be included in the license application. Second, the Applicant is proposing that details of each proposed measure will be developed through consultation with Oregon and Idaho during the section 401 certification process. In addition, the draft Snake River–Hells Canyon TMDL (which will define the Applicant's responsibility in improving oxygen conditions in Brownlee Reservoir) has not yet been approved by EPA. To present costs prior to approval of the TMDL and completion of the 401 process would be premature.

components, the annual levelized cost of capital for the HCC is approximately $31.3 million (in 2005 dollars) over the assumed 30-year period.

The Applicant has also provided the total cost of capital, with no assumed escalation, over the assumed 30-year license period. The base year used for cost-estimating purposes is 2005. Table D-1 summarizes the various components of total cost of capital for the complex.

D.4.2. Local, State, and Federal Taxes

The amounts for local, state, and federal income taxes, which are figured in the cost of capital (see section D.4.1.), have been calculated using 20-year modified accelerated cost recovery system (MACRS) depreciation with a composite income tax rate of 39.1%.

Local property and kilowatt-hour (kWh) taxes are paid to taxing authorities in Idaho and Oregon. The basis used to determine property taxes is assessed property value. The Applicant estimated the average annual property taxes for the complex using a 0.5% property tax rate applied to project investment. The results were then escalated at an annual trend of consumer price inflation. Average annual estimated property taxes, based on existing investment and proposed PM&E measures, is $2.3 million. The Applicant anticipates the jurisdictional composition of this average annual property tax estimate to be $1.1 million for Idaho and $1.2 million for Oregon.

The Applicant is also subject to a kWh tax, which is assessed on all electricity generated by means of hydropower in Idaho. The Brownlee Power Plant is the only facility in the HCC for which generation is subject to the Idaho kWh tax. The Applicant estimated annual kWh taxes based on the average annual amounts paid over the last five operating years (1998–2002). The average annual kWh taxes paid to the state of Idaho that are attributed to generation within the HCC are $0.9 million. No escalation has been applied to this estimate because the tax is based on a fixed rate set by Idaho law.

D.4.3. Depreciation

The annual cost of capital includes a depreciation component to account for recovery of investment (see section D.4.1.). All new investments are being depreciated over the minimum term for a new license (2005–2034).

D.4.4. Expenses

Expenses for the complex are composed of normal O&M expenses, insurance cost, and annual FERC charges. Average annual escalated expenses, including estimated PM&E expenditures, are $18.2 million for O&M, $1.3 million for insurance, and $2.7 million for annual FERC charges. In addition, the Applicant expects to incur annual opportunity costs (lost generation) of $2.5 million for the continuing operation of the fall chinook plan (see section E.3.1.3.1.1.). The total annual estimate of future expenses and lost generation over the assumed 30-year license period is therefore $24.7 million (in 2005 dollars) per year.

The Applicant estimated annual O&M expense for the HCC by averaging actual expenses from the previous five operating years (1998–2002). The resulting value was then escalated at an annual trend forecast rate of consumer price inflation. The average annual escalated O&M outlays expected from the proposed PM&E measures were then added to this number to determine the total average annual O&M expense for the complex. Insurance estimates are based on the 2003 premium amounts also escalated at an annual trend forecast rate of consumer price inflation. Estimated annual fees to FERC are based on the average annual fees paid over the last five operating years and escalated at an annual trend forecast rate of consumer price inflation. Estimates of annual opportunity costs incurred by the fall chinook plan are based on short-term market price estimates for both peak and off-peak times. Escalation was not applied to opportunity cost estimates (the cost of lost generation) because of the lack of reliable forward-looking energy price information over the assumed 30-year license period.

The Applicant has also provided total expenses over a 30-year period, with no assumed inflation. The base year used for cost-estimating purposes is 2005. Table D-2 summarizes the various expense components for the complex.

D.5. Value of the Hells Canyon Complex's Power

One way of calculating the annual value of project power can be based on the estimated cost of procuring an equivalent amount of power (capacity and energy) within the Applicant's service territory. This cost, based on current costs for new gas-fired generating resources, is estimated to be $393 million per year. This amount includes the levelized cost of capital and annual average escalated fuel and other expenses for the gas-fired turbine facilities over a 30-year period.

A second calculation of the annual value of project power can be based on long-term power purchases similar to the Garnet Power Purchase Agreement, which the Applicant entered into with Ida-West Energy in December 2001, and subsequently terminated in March of 2003. Under this agreement, the Applicant, beginning in 2005, would have purchased 250 megawatts of capacity and associated energy for a term of five years, with an option for five additional years, at a price of $33.94 per MWh for energy and $16.63 per kW-month for capacity.

An alternative valuation for the complex can be based on the price that the Applicant receives for the sale of the power to its customers. Since the Applicant's rates are set by the Idaho Public Utilities Commission based on the cost of service, the value of power generated by the HCC can be equated with the annual capital and O&M costs identified above, i.e., the costs that the Applicant is allowed to recover from its customers.

D.6. Sources of Financing and Annual Revenues

Past performance has proven that the Applicant's sources of financing and annual revenues are sufficient to meet the continuing O&M requirements of the HCC. A copy of the Applicant's annual report to its shareholders is included in Technical Report H.9-1. Also, the Applicant submits the FERC Form 1 annually.

LITERATURE CITED

Federal Energy Regulatory Commission [FERC]. May 2002. Draft environmental impact statement for hydropower license: C.J. Strike—FERC Project No. 2055, Idaho. FERC, Office of Energy Projects, Division of Environmental and Engineering Review, Washington, DC. 264 p.

Table D-1 Total cost of capital (30 years) in millions of dollars

	Without PM&E's		With PM&E's	
(in millions)	Escalation Applied @ 2.5%	No Escalation	Escalation Applied @ 2.5%	No Escalation
Existing Investment	407.9	407.3	407.9	407.3
Relicensing Costs	211.0	208.5	211.0	208.5
Proposed PM&E's	N/A	N/A	159.7	146.3
Total Cost of Capital	618.8	615.8	778.5	762.1

Table D-2 Total expenses (30 years) in millions of dollars

	Total Ongoing Expenses without PM&E's (30 Years)		Total Ongoing Expenses with PM&E's (30 Years)	
(in millions)	Escalation Applied @ 2.5%	No Escalation	Escalation Applied @ 2.5%	No Escalation
O & M	398.0	255.7	545.0	347.6
FERC Fees	80.4	51.6	80.4	51.6
Insurance	36.6	23.5	38.4	24.6
Property Taxes	59.7	48.4	70.3	55.6
kWh Taxes	27.1	27.1	27.1	27.1
Opportunity Cost	75.0	75.0	75.0	75.0
Total Expenses	676.8	481.4	836.1	581.5

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Hells Canyon Complex
FERC No. 1971
License Application

Exhibit E
Environmental Report

The *Code of Federal Regulations*—18 CFR § 4.51(f)—specifies the content of Exhibit E, the environmental report. Although the regulations clearly specify placement of information about water use and quality; fish, wildlife, and botanical resources; historical and archaeological resources; recreational resources; and land management and aesthetics, they are less clear about placement of integration discussions. For that reason, the Applicant has included this section to provide background information on the approach used to evaluate the integration of resources and project impacts.

> § 4.51(f) *Exhibit E* is an environmental report. Information provided in the report must be organized and referenced according to the itemized subparagraphs below. See § 4.38 for consultation requirements.

E.0. Conceptual Overview of Integration

Current environmental conditions in Hells Canyon are the result of complex interactions among past and ongoing natural processes (such as geology and climate) and anthropogenic processes (such as land use, resource extraction, and energy development). In addition, the hydrology of the Snake River, as affected by upstream development, influences natural processes (such as water quality and sediment transport) and the condition of many natural resources (such as fish and wildlife) in Hells Canyon. Therefore, water flows in the Snake River are a primary ecosystem process that influences the function and condition of the Hells Canyon ecosystem.

The Hells Canyon Complex (HCC),[1] owned and operated by the Applicant, is situated on the Snake River in Hells Canyon. The Applicant operates the complex in accordance with the criteria of the Federal Energy Regulatory Commission (FERC) license, and certain voluntary arrangements to accommodate the public interest in recreational use, the protection of natural resources, and other factors. Among these criteria and arrangements are the 1980 *Hells Canyon Settlement Agreement*; the fall chinook plan adopted in 1991; and from 1995 through 2001, the cooperative arrangement between the Applicant and federal interests in implementing certain flow augmentation measures that are part of the biological opinion for the Federal Columbia River Power System (FCRPS) and intended to avoid jeopardy to listed salmonids as a result of the FCRPS operations below the HCC.

The Applicant modeled two operational scenarios: proposed operations and full pool run-of-river operations. For comparison purposes, operational analyses use the proposed operations scenario of the HCC as the base case scenario. It defines the operational parameters under which the

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

complex would typically operate. The other operational scenario analyzed is the full pool run-of-river operations scenario, for which inflows to the HCC, as well as tributary inflows, equal outflows from the complex, with water-surface elevations of the three reservoirs held constantly at full pool (that is, no load following would occur). The full pool run-of-river operations scenario does not necessarily reflect conditions that would be most beneficial to environmental resources. Rather, it allows the Applicant to analyze impacts with the project in place but without project operations influencing the outflow hydrograph. A complete description of input parameters for each scenario of the operations model is presented in Chapter 3 of Technical Report E.1-4.

Proposed operations for the HCC would provide for flood control in the spring, water releases for fall chinook salmon, and other constraints to operations, such as reservoir fluctuation limits. Proposed operations of the HCC may also influence environmental conditions and natural resources. Although operations of the complex would affect many of these resources simultaneously, specific resources may be affected in different ways. Therefore, the Applicant conducted a series of integrated resource-specific studies to evaluate both positive and negative impacts of two operational scenarios for managing water flows and reservoir levels in the HCC. These studies are referred to as flow-related studies.

The operational scenarios that the Applicant evaluated (see section E.0.1.), as well as information about the hydrologic characteristics of the Snake River, provided direct and indirect links for integrating results of the flow-related studies. Specifically, the Applicant investigated influences of operational scenarios on aesthetic, wildlife, aquatic, botanical, and cultural resources, as well as effects on recreation, sediment, and water quality (Figure E.0-1).

Consistent with FERC regulations, the intent of these studies was to identify operational impacts to natural resources from the Applicant's proposed operations of the HCC. Results of these studies were then used to develop protection, mitigation, and enhancement (PM&E) measures. The Applicant has included this conceptual overview to describe how studies across several resource disciplines were designed and integrated. This conceptual overview provides the following:

- Description of two operational scenarios—proposed operations and full pool run-of-river operations—that were developed for identifying and comparing effects of operations to natural resources (section E.0.1.)

- Discussion of the analytical process and simulation modeling used for evaluating the potential impacts of proposed operations to natural resources (section E.0.2. and section E.0.3.)

E.0.1. Scenario Development

The Applicant proposes to operate (proposed operations) the HCC according to a number of operating objectives or constraints over the period of the new license, assumed to be 30 years for the purpose of environmental analysis.[2] These constraints, combined with inflow conditions, ultimately create the boundary conditions representing the components of the physical environment within and downstream of the HCC. Operational and natural resource analyses use the proposed operations of the HCC as the base case scenario, which defines the operational parameters under which the complex would typically operate. Varying hydrologic conditions and numerous other factors influence the way hydroelectric projects operate. Daily operations are influenced by many factors, which may include project inflow, energy demand, market conditions, and emergency situations and are difficult to predict on a long-term basis with any certainty. In addition, constraints may be imposed on a hydroelectric project to provide for benefits other than electricity. Examples include operations for flood control, requirements for the operating reserve, navigation, and protection of natural resources. When defining operation rules for proposed operations, the Applicant considered and attempted to balance these constraints. Operating rules for the Applicant's proposed operations are presented in Exhibit B and in Chapter 3 of Technical Report E.1-4.

Parameters of the proposed operations scenario for the HCC are similar to those of the current operations, but they differ considerably from the operating parameters of the original license. The reason for these differences is that, over time, energy and environmental conditions have altered how the HCC is operated. For example, after fall chinook salmon were designated as threatened

2. The Applicant is not proposing a 30-year period for the new license. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC's discretion for setting a new license term.

under the Endangered Species Act, the Applicant modified its operations. In the fall of 1991, the Applicant started a program to protect the fall chinook salmon spawning and incubation period. The Applicant's proposed operations would continue this special program.

The Applicant's proposed operations scenario looks forward into the new license term and provides a general point of comparison for other potential operating scenarios. To determine the potential impacts of the project, the Applicant compared the full pool run-of-river operational scenario with the base case scenario (proposed operations). Differences in resource conditions—such as the extent of fish and wildlife habitat availability—between these two operational scenarios constitute a measure of potential impacts and can assist in developing PM&E measures.

E.0.2. Analytical Process

Because many natural resources, such as riparian habitat, have lengthy response periods to manipulations of river flows, empirical investigations were not feasible for understanding integrated impacts. Therefore, in cooperation with state and federal agencies and nongovernmental organizations, the Applicant developed an integrated, ecosystem-level process to evaluate how hydrology and project operations influence river flows and reservoir levels and, in turn, resources associated with the HCC. This analytical process allows the Applicant to identify potential effects occurring simultaneously to various natural resources under the two operational scenarios. In addition, the analytical process sequentially links several simulation models for projecting environmental conditions that could result if the proposed operations scenario were implemented.

The Applicant's analytical process—which integrates hydrology, operational scenarios, simulation models, and resource-specific evaluations—consists of seven components: 1) hydrology, 2) operational scenarios, 3) river process models, 4) physical characteristics of Hells Canyon, 5) resource-evaluation studies and models, 6) impact evaluations, and 7) development of PM&E measures.

The Applicant developed a process that hierarchically linked several simulation models for projecting river processes (such as hydrology, water quality, and sediment) as they related to individual hydrologic characteristics of the two operational scenarios. The analysis incorporated physical characteristics—such as topography, bathymetry, geology, geomorphology, land covers, and land uses—of Hells Canyon and the Snake River (see Figure E.0-1). After defining the hydrologic conditions, the two operational scenarios, and the projected conditions—such as water levels and flows—of the HCC reservoirs and the Snake River in Hells Canyon, the Applicant incorporated resource-specific models into the analytical process so that resource conditions under the operational scenarios could be estimated. Finally, the Applicant identified general effects and developed PM&E measures. PM&E measures also were developed based on the results of other studies unrelated to hydrology and reservoir and river operations (Figure E.0-1).

The Applicant's relicensing studies, and therefore the analytical process, spanned multiple levels of resolution, from the ecosystem level to individual species level. This approach enhanced the evaluation with the simultaneous integration of resource studies evaluated under the two operational scenarios (Figure E.0-1). Incorporating results of simulation models into the process further allowed the Applicant to evaluate effects of the HCC to numerous natural resources under the operational scenarios.

E.0.3. Simulation Modeling

As mentioned earlier, the Applicant identified impacts of the HCC by modeling river processes that were expected to occur if operational scenarios were implemented. The identification of potential project impacts involved an analytical process consisting of two phases of simulation modeling. During the first phase, reservoir and river processes were modeled; during the second phase, resources affected by flows or reservoir levels were modeled. Modeling of reservoir and river processes comprised hydrologic, sediment, and water quality models (Figure E.0-1). Then, simulated data from the reservoir and river process models were incorporated into resource-specific models being used for flow-related studies. Because these studies used common and consistent data sets for hydrologic, sediment, and water quality modeling, the Applicant was better able to evaluate effects of operational scenarios to the resources. Detailed descriptions of the reservoir and river process models and interfaces with models for flow-related resource studies and impact evaluations are presented in a series of technical reports listed in Figure E.0-1.

In addition, Chapter 1 of Technical Report E.1-4 provides summary information about the models used and their relationships.

Toward the end of the process, the Applicant identified and quantified the effects of the HCC as differences between resource conditions resulting from the proposed operations and full pool run-of-river operations scenarios. Given this common foundation for analysis, the Applicant could combine results of many resource evaluations for an overall evaluation of each resource discipline and then propose relevant PM&E measures (Figure E.0-1).

In the following sections, models used to simulate river processes relating to hydrology, sediment, and water quality are described.

E.0.3.1. Hydrology

The following series of sequential hydrologic models, as well as available data, formed the basis for all of the Applicant's flow-related studies:

- Inflows to the Weiser reach (upstream of Brownlee Reservoir to the bridge near Weiser) of the Snake River—available through Idaho Department of Water Resources depleted-flow computations for the Snake River (for more detail on inflow hydrology, see Chapter 1 of Technical Report E.1-4)
- River flows and stage within the Weiser reach—modeled using the FEQ model (for more detail on this model, see Technical Report E.3.3-3)
- Inflows to Brownlee Reservoir—available through Idaho Department of Water Resources depleted-flow computations for the Snake River (for more detail on inflow hydrology, see Chapter 1 of Technical Report E.1-4)
- Reservoir headwater elevations for the three reservoirs of the HCC—modeled using the CHEOPS™ operations model and inflows (for more detail on this model, see Chapter 3 of Technical Report E.1-4)

- Outflows from Hells Canyon Dam—modeled using CHEOPS operations model (for more detail on this model, see Chapter 3 of Technical Report E.1-4)

- Snake River flow and stage downstream of Hells Canyon Dam—modeled using MIKE 11®, MIKE 21C®, and FEQ (for more information on these models, see Chapters 5, 6, and 7 of Technical Report E.1-4 and Technical Report E.3.3-3)

Although not affected by the HCC, several components of its inflows—reservoir and river processes such as water quantity, sediment loads, and water quality—directly affect many natural resources in Hells Canyon. Furthermore, the timing and magnitude of inflows directly affect operations of the HCC. Therefore, inflow parameters, which are influenced by the entire Snake River basin, create constraints for the HCC and, in turn, upstream boundary conditions for the modeling of the two operational scenarios. The inflow hydrology to the HCC was developed based on historical flows into Brownlee Reservoir that were measured at the U.S. Geological Survey gauge at Weiser (Chapter 2 of Technical Report E.1-4). The development of this hydrograph was based on Idaho Department of Water Resources depleted-flow computations for the 1928–1991 period and historical data for the 1992–1999 period. For some resource analyses, such as the botanical resources, the 1928–1999 record was used. For other resource analyses, more recent historical data were used. Historical data sets from the 1992–1999 period were chosen to represent a range of hydrologic conditions that corresponded to empirical data sets of water quality and meteorologic boundary conditions that were used to calibrate the water quality models. Five years were chosen from this period to represent an extreme-low (1992), low (1994), medium (1995), high (1999), and extreme-high (1997) set of hydrologic conditions. Because the assessment of aquatic resources is so closely integrated with water quality models, the Applicant used these five years as the basis for comparisons between the proposed operations and full pool run-of-river operations scenarios for water quality and aquatic resources.

The inflow hydrology provides boundary conditions for the CHEOPS reservoir operation model. Designed by Duke Engineering & Services, CHEOPS is a hydropower-system model that allows evaluation of physical and operational changes at multiple-development hydroelectric projects. The model is custom-configured with project-specific physical constraints, operating constraints, and equipment characteristics to ensure that the critical aspects of a project are accurately simulated.

Output from CHEOPS is also used in flow-related studies. Such output includes reservoir elevations, turbine discharges, and spill. In turn, simulated project outflows become time-series boundary conditions to the Snake River downstream of Hells Canyon Dam. Spatial and temporal characteristics of both river flow and stage in the Snake River are simulated with one- and two-dimensional hydraulic models. The MIKE 11 model is a one-dimensional hydrodynamic model for simulating river stage and discharge functions in river systems (Chapter 5 of Technical Report E.1-4). The one-dimensional FEQ model functions similarly to MIKE 11, but it provides stage-discharge information in a format usable by HC_REM, another model used for evaluating botanical resources. Results of these hydraulic models are also combined with physical data for Hells Canyon, such as cross-section channel geometry and downstream slope (Technical Report E.1-3). In addition, the MIKE 11 model generates boundary conditions for the MIKE 21C model, which was used for detailed resource-specific evaluations (Chapter 7 of Technical Report E.1-4 and Technical Report E.2.3-2).

Chapter 1 of Technical Report E.1-4 summarizes the various models, including how they were parameterized, calibrated, and interconnected. Other chapters within that report discuss the models in more detail.

E.0.3.2. Sediment and Water Quality

Models characterizing sediment loads also were applied to the Snake River and the reservoirs of the HCC (Technical Report E.1-1). In addition, a series of models simulating water quality parameters were applied sequentially using inflow boundary conditions from the Snake River into the HCC, through the reservoirs (CE-QUAL-W2), and then into the Snake River between Hells Canyon Dam and Asotin, Washington (MIKE 11 WQ) (Technical Report E.2.2-4 and Chapters 4 and 6 of Technical Report E.1-4) (Figure E.0-1). The water quality models were used for detailed resource-specific evaluations (Technical Report E.3.1-1).

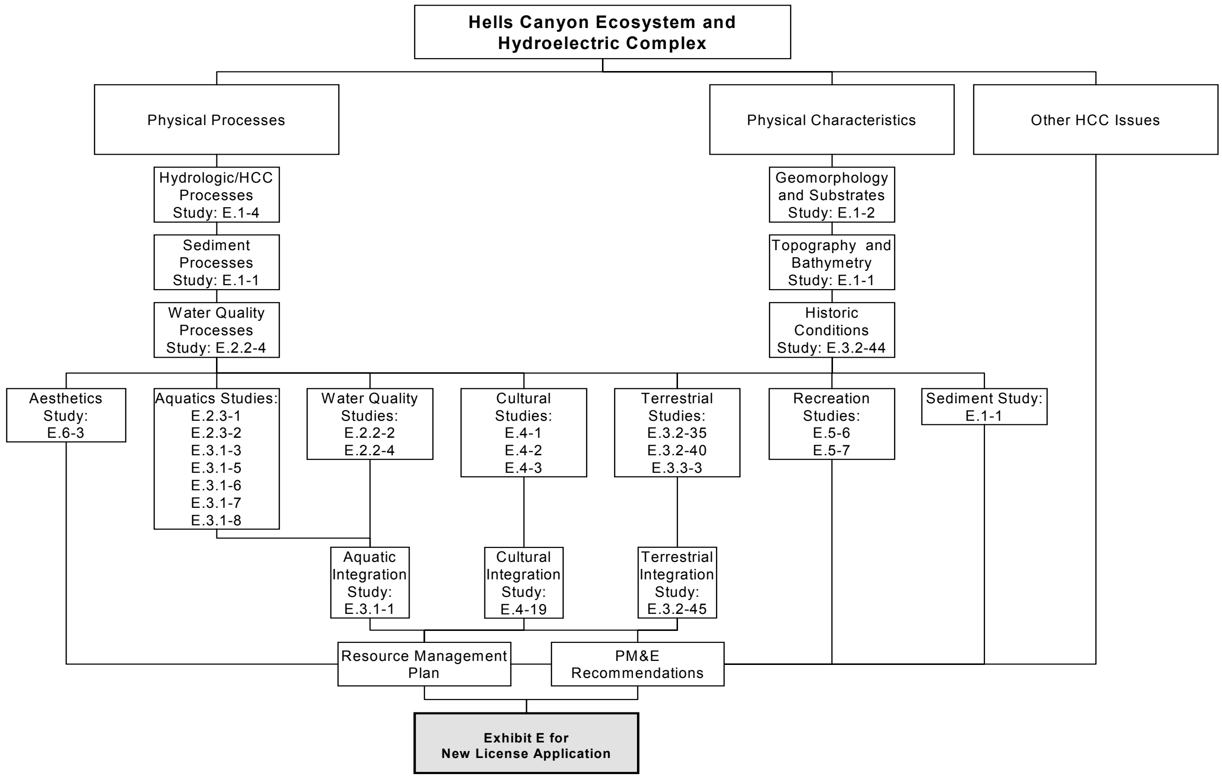

Figure E.0-1 Conceptual approach for an integrated evaluation of how natural resources are affected by operations of the Hells Canyon Complex

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The *Code of Federal Regulations* below—18 CFR § 4.51(f)(1)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(f) *Exhibit E* is an environmental report. Information provided in the report must be organized and referenced according to the itemized subparagraphs below. *See* § 4.38 for consultation requirements. The Environmental Report must contain the following information, *commensurate with the scope of the proposed project*:
> (1) *General description of the locale*. The applicant must provide a general description of the environment of the project and its immediate vicinity. The description must include general information concerning climate, topography, wetlands, vegetative cover, land development, population size and density, the presence of any floodplain and the occurrence of flood events in the vicinity of the project, and any other factors important to an understanding of the setting.

E.1. General Description of Locale

E.1.1. Study Area

E.1.1.1. Hydroelectric Facilities

The Hells Canyon reach of the Snake River is situated in west-central Idaho and northeastern Oregon (Figure E.1-1). The study area for most studies conducted in support of relicensing efforts is located between the city of Weiser and the confluence of the Salmon and Snake rivers (from approximately river mile [RM] 351 to RM 188). The Snake River, a major tributary to the Columbia River, is the focal point of Hells Canyon. Its generally northward flow forms part of the boundary between Idaho and Oregon. The Hells Canyon Complex (HCC)[1] is located on the Snake River in the southern portion of Hells Canyon and includes three reservoirs—Brownlee, Oxbow, and Hells Canyon. The reach below Hells Canyon Dam, which is influenced by operations of the HCC, is designated in the National Wild and Scenic Rivers System.

On the Idaho side of Hells Canyon, population centers located within a 100-mile (mi) radius include Boise, Cambridge, Council, Fruitland, Grangeville, Lapwai, Lewiston, Nampa, Payette, Riggins, and Weiser. Baker City, Enterprise, Halfway, Huntington, La Grande, Ontario, and Richland are located within 100 mi on the Oregon side.

The HCC is situated within and across the political boundaries of Idaho, Adams, and Washington counties in Idaho and of Wallowa, Malheur, and Baker counties in Oregon. State agencies with direct responsibility for fish and wildlife management are the Idaho Department of Fish and

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Game and the Oregon Department of Fish and Wildlife. These agencies also administer several areas within Hells Canyon specifically for wildlife habitat.

Federal agencies, including the Bureau of Land Management (BLM) and U.S. Forest Service (USFS), are responsible for managing the majority of public land in Hells Canyon. These areas fall within the jurisdictional boundaries of the Wallowa–Whitman National Forest, Oregon; Payette National Forest, Idaho; Nez Perce National Forest, Idaho; Four Rivers Field Office of the Lower Snake River District, BLM–Idaho; Cottonwood Field Office of the Upper Columbia–Salmon Clearwater District, BLM–Idaho; and Baker Field Office and Malheur Field Office of the Vale District, BLM–Oregon. Other agencies with natural resource jurisdiction in the greater project area include the National Marine Fisheries Service (NOAA) within the U.S. Department of Commerce; the Bureau of Indian Affairs (BIA) within the U.S. Department of the Interior (USDI); and the U.S. Fish and Wildlife Service (FWS) within the USDI.

Several special management areas also occurring in Hells Canyon are directly administered by the USFS or BLM. These management areas include the Eagle Cap Wilderness in Oregon, the Hells Canyon Wilderness in Idaho and Oregon, the Hells Canyon National Recreation Area (HCNRA) in Idaho and Oregon, the Wild and Scenic Imnaha River in Oregon, the Seven Devils Scenic Area in Idaho, and the Wild and Scenic Snake River.

The area upstream and downstream of Hells Canyon Dam can be broadly divided into five reaches, based on legal project boundaries and river designations:

- Upstream of Brownlee Reservoir to the bridge near Weiser (approximately 12 mi; RM 351.2 to 339.2)
- Brownlee Reservoir (approximately 55 mi; RM 339.2 to 284.6)
- Oxbow Reservoir (approximately 12 mi; RM 284.6 to 272.5)
- Hells Canyon Reservoir (approximately 25 mi; RM 272.5 to 247.6)

- Downstream of Hells Canyon Dam to the confluence of the Snake and Salmon rivers (approximately 59 mi; RM 247.6 to 188.2)

Generally, for study purposes, the lateral extent of these reaches includes all land within 0.5 mi of each shoreline above Hells Canyon Dam and all land within 0.25 mi of each shoreline below Hells Canyon Dam. However, the lateral extent of the study area varies, depending on which resources are being studied. The study area below Hells Canyon Dam is extremely difficult to access.

In the upstream reach, the Snake River is a low-gradient (0.2 to 0.4 meters/kilometer [m/km]) river with several island complexes. Impacts from land use development, including those from agriculture and urbanization, are apparent: large numbers of water returns cause higher turbidities and increased nutrient loading. This reach is surrounded by farmland and rural development on flat to gentle topography. Stream substrates are small, with fines and sand to medium-sized cobbles prevalent throughout (Johnson et al. 1992). Flows in the Snake River are regulated by several irrigation projects (for example, Palisades, American Falls, and Milner) above RM 458 and by three major tributary rivers:

- The Boise River, which enters the Snake River at RM 394 and is regulated by two flood-control dams

- The Payette River, regulated by Cascade Reservoir, Deadwood Reservoir, and Black Canyon Dam, which enters the Snake River at RM 365.5

- The Weiser River, which enters just upstream of the Weiser Reach at RM 351.8

Although this reach is geomorphically distinct and surrounded by land uses that are different from those adjacent to the other study reaches, its inclusion in the study area may provide insight into some of the physical and biological factors possibly influencing downstream reaches.

Brownlee Reservoir is a steep-sided reservoir with a maximum depth approaching 300 feet (ft) near the dam. Large rock outcrops are found throughout the entire length. Shoreline substrates are often complex and quite variable. Some areas are dominated by sand; other areas are characterized by bedrock and small to medium-sized cobbles and boulders of angular basalt. Shoreline slopes in the range of 20 to 30% are most common. Brownlee Reservoir can be drafted up to 101 ft. One of the most dominant habitat features of Brownlee Reservoir is the transition zone from riverine habitat to lacustrine habitat, typical of large mainstem storage reservoirs. The zone is especially pronounced by the reduction in turbidities along a longitudinal gradient through the reservoir. Essentially, Brownlee Reservoir serves as a sedimentation basin, with waters of notably lower turbidity leaving the Hells Canyon system.

Oxbow Reservoir is a small re-regulating reservoir surrounded by moderate to steep topography (20 to 75% slopes). The Snake River from the tailrace of Brownlee Dam to the mouth of Wildhorse River (1 mi downstream) is a high-velocity narrow channel. The rest of Oxbow Reservoir is also relatively narrow and shallow, with maximum depths approaching 100 ft. Shorelines are primarily basalt outcrops and talus, except where small tributaries have created alluvial fans.

Hells Canyon Reservoir is also a re-regulating reservoir, with maximum depths approaching 200 ft. The design of the Oxbow Project is unique since the powerhouse is separated from the dam and reservoir by a natural rock ridge in the bend of the Snake River, a natural feature known as an oxbow. Water from Oxbow Reservoir is carried through the rock ridge to the powerhouse via two tunnels. This water reenters the Snake River 2.5 river miles downstream of Oxbow Dam. A minimum flow of 100 cubic feet per second (cfs) is maintained through this 2.5-mi stretch of the original river channel referred to as the Oxbow Bypass. This bypassed reach is a backwater-type area that is relatively shallow and has low velocities. Indian Creek enters the Snake River in the Oxbow Bypass. Shorelines all along Hells Canyon Reservoir are generally very steep, with substrates consisting primarily of basalt outcrops and talus slopes.

The Snake River below Hells Canyon Dam is a high-gradient river (1.8 m/km) with a wide diversity of aquatic habitat, including numerous large rapids, shallow riffles, and deep pools. Substrates are highly diverse, ranging from large basalt outcrops and boulders to cobble/sandbars. This unimpounded reach of Hells Canyon, considered to be the deepest gorge in North America, is surrounded at the upstream end by nearly vertical cliff faces. At the mouth of Granite Creek, approximately 7 mi below Hells Canyon Dam, the river elevation is 1,480 ft (451 m) above mean sea level (msl), and the canyon depth is 7,913 ft (2,412 m). The canyon becomes somewhat wider near Johnson Bar (RM 230), with moderate to steep topography continuing to the Salmon River.

E.1.1.2. Transmission Lines

One transmission line is associated with FERC Project No. 1971. The Applicant operates and maintains the Pine Creek–Hells Canyon 69-kV line (Line 945) on 22 mi (36.5 km) of rights-of-way with less than 1 mi of service roads. These 50-ft-wide rights-of-way extend from the Pine Creek Substation at Oxbow, Oregon, to Hells Canyon Dam and run alongside a paved road on the Idaho side of Hells Canyon Reservoir (Figure E.1-2). The study area for the transmission line is limited to public land under the jurisdiction of state and federal agencies. About 93% of the line is located on public land.

E.1.2. Climate

Regional climate and the resulting hydrology interact closely with the geology and geomorphic processes that characterize a river system. The characteristics that define the Snake River system have changed over geologic time, requiring that climatic conditions also be considered over a similar period. Therefore, climatic conditions for the current, recent historical, Holocene, and Pleistocene time periods are described. Much of the fluvial geomorphology associated with the current Snake River system was formed by processes driven by cooler and wetter conditions. These conditions provided higher river discharges during the Pleistocene and Holocene epochs than seen currently.

E.1.2.1. Current Climate

The current climate in the Snake River basin is influenced primarily by Pacific maritime polar air masses that travel eastward over the continent (Abramovich et al. 1998). Hells Canyon itself is significantly influenced by the rain shadow of mountain ranges to the west. The basin tends to have warm, dry summers from the western desert continental climate and cold, moist winters from prevailing westerly coastal storms (Abramovich et al. 1998). Mean annual temperatures in the valleys and regional lowlands (such as the Snake River Plain) are about 10 °C (50 °F). At higher elevations, average temperatures are about 2 °C (36 °F) (WRCC 2001). Minimum temperatures less than –40 °C (–40 °F) occur in the mountains, and maximum temperatures greater than 43 °C (109 °F) occur in the lowlands. Annual precipitation extremes are also common between the valley and mountain areas because of significant elevation differences. The normal annual precipitation ranges from less than 10 inches in the western and eastern Snake River Plain to more than 50 inches (1,270 millimeters [mm]) in the Sawtooth Mountains located north of the plain (University of Idaho 1995). In most areas of the basin, the highest monthly precipitation occurs in December and January. Monthly totals decrease irregularly until July and August, which are the driest months (Abramovich et al. 1998). The heaviest precipitation occurs in the Sawtooth Mountains, where a snowpack of several feet accumulates and remains year-round in some areas (Lipscomb 1998). For those mountainous areas in central Idaho that receive 30 inches (762 mm) or more of annual precipitation, 59% of the precipitation drains to the Salmon River to the north, while 41% drains to the tributaries along the Snake River Plain to the south (such as the Payette, Boise, Wood, and Lost river watersheds). Snowline elevations in the basin range between 3,500 and 9,000 ft (1,067 and 2,743 m), depending on the annual climate patterns and topographic influences (WRCC 2001). Average annual snowfall depths range from less than 1 ft (0.3 m) around Lewiston to about 10 ft (3 m) along the Idaho–Wyoming border (Abramovich et al. 1998).

Climatological information is summarized for Weiser, Richland, Brownlee, and Lewiston in Figure E.1-3. The average annual precipitation ranges from about 280 to 450 mm (11 to 18 inches), depending on elevation. It is lowest at the southern end of the study area (Weiser, 286 mm or 11.3 inches), increases northward (Richland, 298 mm or 11.7 inches), peaks around Brownlee Dam (445 mm or 17.5 inches), and declines toward Lewiston (326 mm or 12.8 inches). Nearly 45% of the average annual precipitation at the Brownlee weather station falls between November and January, a pattern that strongly contrasts with the 9% that falls between July and September. Thus, most precipitation occurs in the spring and winter (Tisdale et al. 1969, Tisdale 1986, Johnson and Simon 1987), and little or no precipitation falls during the hottest months of summer. Average annual evapotranspiration is estimated to be about 1,300 mm (52 inches).

Mean annual temperatures are similar among the four weather stations. Generally, the climate tends to become drier and warmer downstream of Brownlee Reservoir. Climatological information from Brownlee Dam (RM 284.6) is probably characteristic of the central section of the study area. Mean temperatures above 2,000 m (6,562 ft msl) range from –9 °C (16 °F) in January to 13 °C (55 °F) in July. In contrast, mean temperatures below 1,000 m (3,281 ft msl) range from 0 °C (32 °F) in January to between 28 °C (82 °F) and 33 °C (91 °F) in July (Johnson and Simon 1987). The canyon bottom area is dry, with seasonal temperatures ranging from about –5 °C (23 °F) in January to about 35 °C (95 °F) in July (Figure E.1-3). Temperatures may fall below freezing between mid-November and mid-April. As a general rule, winters in the canyons are mild, while summers on the canyon floor are hot.

E.1.2.2. Recent Historical Climate

Global and regional climate conditions during the last 1,000 years are believed to have been relatively similar to conditions under the present regime (Skinner and Porter 1987, Hydrocomp 1990). Pearson (1978) documented periodic drought periods both regionally and throughout the Snake River Plain by using tree-ring growth records for the last 900 years. These results suggest that the Snake River area followed other regional trends because major drought periods in the region are similar to tree-ring growth patterns elsewhere in the western United States (Hydrocomp 1990). In general, the trends suggest that the regional climate has fluctuated around, and been similar to, current conditions since 1100 AD.

E.1.2.3. Holocene Climate

The Holocene Epoch, which includes the present time, is generally considered to have begun about 10,000 to 12,000 years ago, when the last glacial ice age (in the Pleistocene Epoch) ended. Holocene climate conditions have generally been warmer and drier; however, within this general warming trend, interglacial periods have been identified that resulted in higher surface discharges than those seen today (Othberg 1994). Throughout these alternating temperature cycles, Holocene floods occurred. Evidence of such flood events can be found in numerous hillslope features, such as landslides and slumps, and alluvial features, such as river terraces and alluvial fans, in present-day Snake River Plain river channels (Pierce and Scott 1982).

E.1.2.4. Pleistocene Climate

Prior to the glacial Pleistocene Epoch (starting about 1.8 million years ago), the global climate was typically warmer than it currently is (Skinner and Porter 1987). Polar regions were not covered in ice, and extensive tropical climates were common. Since the onset of the Pleistocene, global climate has been characterized by alternating glacial and interglacial episodes. The regional climate between 10,000 and 1,800,000 years ago may have been an average of 5 to 6 °C (41 to 43 °F) cooler than present conditions, based on lapse-rate calculations (Flint 1976, as cited in Pierce and Scott 1982) and macrofossil analysis (Thompson et al. 1999). Other studies that account for precipitation gradients indicate that mean annual temperatures in the Idaho region during glacial episodes may have been as much as 10 to 15 °C (50 to 60 °F) colder than present conditions (Pierce and Scott 1982). Pierce and Scott (1982) suggest that lower temperatures probably increased snow accumulations and delayed seasonal snowmelt, resulting in more concentrated spring runoff periods with higher peak discharges than those experienced currently.

E.1.3. Topography

The study area includes Hells Canyon in west-central Idaho and the northeastern corner of Oregon. Hells Canyon is the deepest and one of the most rugged river gorges in the continental United States, lying between the Wallowa Mountains of Oregon to the west and the Seven Devils Mountains of Idaho to the east. The topography gradually changes from steep, rolling, grassy mountainsides at the south end of the reservoirs to sheer basaltic rock cliffs north of Hells Canyon Dam. Elevations in the study area vary greatly from the subalpine summits of the Seven Devils (above 9,000 ft [2,743 m] msl) to the canyon bottom (below 2,000 ft [610 m] msl).

Hells Canyon is formed from a series of folded and faulted metamorphosed sediments and volcanics overlain unconformably by nearly horizontal flows of Columbia River basalt. The older rocks are Permian to Jurassic in age and represent at least two episodes of island arc volcanism and adjacent marine sedimentation similar to what is found today in the Aleutian Islands west of Alaska. These rock units represent old island arc chains that were sequentially “welded” to the west coast of North America during the late Paleozoic and early to mid-Mesozoic eras by subduction of a tectonic plate beneath the North American continent (Vallier 1998).

E.1.4. Soils

The soils throughout Hells Canyon are derived primarily from Columbia River basalt, covered in most areas with a thin mantle of residual soils from weathered native rock. Isolated areas contain deposits of windblown silt. Unconsolidated materials include river sands and gravel deposited during the Bonneville Flood about 14,500 years ago, ash-loess from the Mount Mazama eruption 6,900 years ago, and colluvium and talus deposited more recently. The amount of soil cover declines northward through Hells Canyon. Near Hells Canyon Dam (RM 247.6), most rock faces are nearly vertical with little soil cover (USFS 1994). Most soil complexes are well drained and vary from very shallow to moderately deep. Loams are the dominant textural class and vary from very stony to silty, often with a clay subsoil component (NRCS 1995).

E.1.5. Geomorphology and Sediment

E.1.5.1. General

As mentioned earlier, the Snake River originates high in the mountains of western Wyoming and eastern Idaho; flows westerly through the Snake River Plain of southern Idaho; turns north, forming Idaho's western border; and then flows west after Lewiston, Idaho. The HCC is located on the border between Oregon and Idaho at the upstream end of the reach known as Hells Canyon. Elevations in the basin range from 735 ft msl (224 m) at Lewiston to over 12,000 ft (3,658 m) msl in eastern Idaho. No major tributaries enter the Snake River for much of the river's course through southern Idaho. However, just upstream of the HCC, five major tributaries—the Owyhee, Boise, Malheur, Payette, and Weiser rivers—join the Snake River. Within Hells Canyon, many local tributaries drain several small subbasins. Two large tributaries, the Imnaha and Salmon rivers, join the mainstem Snake River approximately 60 mi downstream of Hells Canyon Dam. Inflows from the Salmon and Imnaha rivers are unregulated and increase the annual discharge in the Snake River by approximately 40%.

Current peak discharges are not markedly different from flows before construction of the HCC (or preproject flows) because the complex can only store about 11% of the river's average annual flow. However, usable storage (also called active storage) is an even smaller percentage of the river's average annual flow. The HCC, therefore, is unable to significantly shape monthly, annual, or peak flows that control the channel form in Hells Canyon (Technical Report E.1-2).

In a classical alluvial river, sediments are regularly eroded from one area and transported to and deposited in other areas, and floodplains and channels are spatially and temporally dynamic. However, the Snake River cannot be categorized as a classical alluvial river for much of the study area through which it passes. The catastrophic Bonneville Flood approximately 14,500 years ago left a substantial sediment imprint on the system that has changed little in the intervening years. For the past 1,000 years, local and regional climate conditions have remained essentially unchanged (Skinner and Porter 1987, Hydrocomp 1990). Therefore, it is reasonable to assume that natural streamflows in the Snake River have also changed little during the same period. Most hillslope, valley, and channel morphology features appear to be relics associated with geologic and hydrologic events predating regulation. In addition, human-caused, or anthropogenic, influences over the past 150 years appear to have initially increased and subsequently decreased sediment loads. However, these sediments apparently passed through the existing river channel with only minor changes to the channel (that is, changes resulting from accretion and erosion). Therefore, recent changes to the Snake River system should be evaluated in the context of a much longer time frame, extending far before the completion of the HCC. Although conditions of the Snake River prior to Euro-Asian settlement are poorly known, existing information strongly suggests that Hells Canyon has been a largely static river system for at least 10,000 years.

In the following sections, the geomorphology and sediments are described for several areas: the Snake River basin overall, the reach upstream of the HCC, the reach that includes the reservoirs, and the reach downstream of Hells Canyon Dam.

E.1.5.2. The Snake River Basin

The HCC is located downstream of most of the development in the Snake River basin. Anthropogenic disturbances over the past 150 years have affected physical processes throughout the Snake River watershed generally and in the Hells Canyon reach specifically. By the 1880s, land uses (that is, beaver trapping, mining, logging, fires, agriculture, grazing, and urbanization) substantially increased sediment supplies over conditions existing before Euro-Asian settlement. Widespread and intensive beaver trapping in the 1800s nearly decimated beaver populations: beaver dams failed, releasing trapped sediment and sending sediment pulses downstream (Spence et al. 1996). By the 1860s, large dredge and hydraulic mining operations resulted in sediment loads up to 1,500 times higher than loads caused by natural processes (Technical Report E.1-2). Also, by the 1860s, logging and associated road construction increased sediment loads significantly (to between 26 and 346 times the sediment loads produced in undisturbed areas) (Technical Report E.1-2). Fire generally increased erosion into adjacent creeks and rivers. However, the effect of fire's removal of vegetative cover on increased sediment loads in the Snake River is not well documented. Also, from 1890 to 1992, Idaho's irrigated acreage increased from 0.2 to more than 3 million acres. Poor irrigation practices during the early 1900s accelerated erosion considerably on agricultural land within the Snake River Plain. In addition, livestock grazing during the late 1800s and early 1900s was unrestricted and caused surface erosion and mass wasting (processes by which large masses of earth are moved by gravity, either quickly or slowly) in riparian zones throughout the Snake River basin.

Water storage and regulation are currently the most significant anthropogenic disturbances in the Snake River basin, affecting both streamflows and sediment loads and supplies. Between 1901 and 1969, more than 10 mainstem and 35 tributary dams were constructed on the Snake River system. When Brownlee Dam was completed in 1958, 87% of the drainage basin above the HCC was already blocked from supplying sediment to the HCC reach, and 92% of the available sediment was effectively trapped. Significantly, the areas cut off from supplying sediment were in the upper parts of watersheds that contributed the highest sediment loads, particularly the Boise River and Payette River watersheds originating in the Idaho Batholith. In addition, upstream water diversions decrease the annual flow. During dry years, almost half of the estimated naturally occurring volume of the Snake River is diverted for agriculture; and during wet years, approximately one-third is diverted.

E.1.5.3. The Reach Upstream of the Hells Canyon Complex

The reach of the Snake River upstream of the HCC is located in a relatively flat alluvial plain, where coarse sediment is deposited before it reaches the complex. The upstream water-regulation projects have reduced peak flows that transport most of the sediment load. Therefore, the river's capacity to transport available sediment has continued to decline, not only compared with its prehistoric capacity (driven by climatic and hydrologic changes), but also compared with its capacity under recent settlement and development of the Snake River basin (Technical Report E.1-2).

During the past 70 years, the potential bedload upstream of the HCC has largely been restricted to sand and gravel sizes, with a size of 30 mm (1.2 inches) or smaller (Technical Report E.1-2), because the river above the HCC cannot mobilize larger particles. In contrast, the average median size of surface layer materials is 144 mm (5.7 inches) in the reach downstream of Hells Canyon Dam to the confluence with the Salmon River. The Applicant calculated that flows in the Snake River must exceed 200 ft in depth to move material this large through the reach located between the confluence of the Snake and Weiser rivers and Brownlee Reservoir. Given current hydrological conditions in the Snake River upstream of the HCC, materials of the sizes that dominate the river downstream of the complex cannot be transported. This finding is reinforced by provenance analysis that indicates that spawning-size gravels (25–152 mm [1–6 inches]) in Hells Canyon are of local origin. The stability of the Snake River is further illustrated at the U.S. Geological Survey gauge at Weiser. At this location, the cross sections that were initially surveyed when the gauge was installed in 1910, as well as the rating curves to estimate flow, show that the river channel has experienced minor changes but no substantial degradation, aggradation, or lateral movement (Technical Report E.1-1).

Sediment chemistry (x-ray diffraction) analyses have been conducted on bed material samples downstream of the HCC. Bed material samples, including spawning gravels, from the mainstem Snake River have been collected over the last several years for various purposes. Samples from a terrace relic of the Bonneville Flood (Big Bar) were taken. Coarser-grained material (between 0.125 and 4.76 mm) and larger, based on visual analysis, from Big Bar appear to be all locally derived from bedrock below the HCC. In sharp contrast, the finer-grained fraction (< 0.125 mm) has a signature close to that of the sediments above the HCC. This lithological and mineralogical data for the Big Bar are limited, but the coarser-grained sediment data indicate that most of the coarser-grained material is from the bedrock exposed in Hells Canyon, with limited contributions from upstream sources. The data imply that the larger grain-size particles that were contributed by erosion of the ancient Bonneville terrace sediments have a signature of bedrock exposed below the HCC. Therefore, in addition to sediments derived from the current tributaries below the HCC, the sediments derived from the Bonneville terraces probably contribute sediments with a local signature to features such as the spawning gravels. These data and analyses suggest that the HCC has had only minimal influence on the composition of spawning gravels in the reach downstream of the HCC. They also support the conclusions that upstream material (now trapped by Brownlee Reservoir) historically did not contribute to the spawning gravel resources and that the influence on spawning gravels from the trapping of coarser local tributary sediments with the HCC reservoirs is probably minimal.

E.1.5.4. The Reach Through the Hells Canyon Complex

The Weiser River is the only major tributary to the Snake River downstream of Swan Falls Dam and upstream of the HCC that is not blocked by a major dam. About 81% of the suspended sediment in the Snake River near Weiser is smaller than 0.062 mm (0.002 inches) and composed mainly of silts and clays (fractions smaller than very fine sand) (Technical Report E.1-1). Approximately 86% of the sediment trapped in Brownlee Reservoir is in the silt/clay fraction. Further, 96% of the sediment trapped in Brownlee Reservoir consists of fine sand, very fine sand, and silt/clay. Tributaries to Oxbow and Hells Canyon reservoirs also produce sediments. Materials from these tributaries probably contain a relatively higher proportion of sands and gravels than those trapped in Brownlee Reservoir. Most of the fine-grained materials trapped in Brownlee Reservoir would flush through the Hells Canyon reach if the HCC did not exist: the transport capacity of the Snake River is much higher in Hells Canyon because of the steeper gradient than in the unimpounded reach above Brownlee Reservoir.

E.1.5.5. The Reach Downstream of the Hells Canyon Complex

Sediments—Many of the tributaries below Hells Canyon Dam supply sediment to the mainstem river. The Applicant calculated sediment loads of 17 tributaries to the Snake River, accounting for approximately 348 square miles of a total watershed area of 540 square miles between the HCC and the confluence with the Salmon River, but not including the Imnaha River drainage (Technical Report E.1-1). Note that two of the tributaries (Cherry and Cook creeks) are just below the Salmon River. The average sediment yield from the 17 tributaries is 19,200 tons per square mile per year. Applying this average sediment yield to the remaining area (not included in the calculated tributaries) produces a total estimated sediment supply of 8.60 million tons per year. Similar calculations for sand and spawning-size gravels indicate 1.44 million tons per year (17%

of the total) and 4.14 million tons per year (48% of the total), respectively. It should be noted that the numbers presented above likely represent an upper bound of sediment supplies below Hells Canyon Dam. While there are no definitive ways to estimate how much these numbers should be reduced for a reasonable supply estimate, some preliminary information based on reservoir trapping indicates that a lower bound may be approximately one order of magnitude lower. This indication for a lower bound would produce estimates for total sediment, sand, and spawning-size gravel of 0.86, 0.144, and 0.414 million tons per year, respectively. The average annual quantity of sand that the tributaries supply would range between about one-quarter of the average annual load of sand-size material trapped in Brownlee Reservoir to almost four times the trapped sand quantity.

Analyses indicate that sediments from bed materials downstream of the HCC have a distinctly different mineralogy than those collected upstream of the HCC. The most distinctive difference is the lack of acidic-intrusive bed material, such as granite or granodiorite, in the coarse fraction and the lack of potash feldspar in the finer-grained fraction in the downstream reach than in the reach above the complex (Technical Report E.1-2). These differences suggest that most of the bed materials (including spawning gravels) downstream of the Hells Canyon Dam are derived from local canyon sources, not from sources upstream of the HCC. Evidence of these sediments being transported to the river can be found on the tributary alluvial fans below the HCC.

Riverbed—The Applicant used two approaches to evaluate bed stability in the Snake River below Hells Canyon Dam (Technical Report E.1-1). The first method used cross sections at flow measurement sites. Changes in the river bottom were not detected by evaluating the actual measurements of the cross section or the rating curves used for gauge operation. The second method applied incipient motion calculations to bed-material particles. These studies indicate that in some reaches bed material may move under the current flow regime but that most of the bed materials appear to be stable. The channel stability can be attributed to the armored[2] surface that may have been established by prehistoric high-flow events. During these high-flow events, an armor layer consisting of large material was developed along the river channel: current flow conditions lack sufficient energy to move this established layer of surface armor. This supposition

2. Armoring is the layer of larger material on the surface of a gravel-bed river. See Technical Report E.1-1 for a more complete description of armor and its formation.

suggests that the abovementioned reaches of mobile material are mobile because the local tributaries supply sediments to the mainstem during high-flow events. Materials supplied to the mainstem river by the tributaries may move along the river over the older armor layer until they are deposited in either deeper pools downstream or at some of the large downstream bars.

Because the channel is largely stable (Technical Report E.1-1), riverbed material does not appear to produce substantial quantities of sediment for river processes and is not extensively reworked during peak flow events. Importantly, the riverbed is armored, meaning that many of the sands and spawning-size gravels are buried beneath larger materials that can only be mobilized under extreme flow conditions. The weathering patterns on the gravel bars suggest that these bars have been armored for hundreds to thousands of years. Furthermore, the lithology and mineralogy of armored surface and subsurface sediments indicate that the majority of bed materials below Hells Canyon Dam have also been locally derived.

Sandbars—An analysis of particle size of sandbars showed that most sediments are within the sand-size range (0.062 to 2 mm [0.002 to 0.079 inches]), with less than 7% of the material smaller than 0.074 mm (0.003 inches). The size distributions and provenance of the sands are remarkably consistent throughout the depth of sandbars. The provenance of the sands is largely the Idaho Batholith, which was cut off before HCC construction. To maintain these sandbars, materials in similar fractions have to be supplied by the system. However, over 96% of the sediments trapped in Brownlee Reservoir are composed of fine sand fractions and smaller (≤ 0.25 mm). Therefore, sediments deposited in Brownlee Reservoir do not have the size range of sediments required to maintain sandbars downstream of Hells Canyon Dam.

Starting in 1997, after the largest flow on record occurred in January of that year, the Applicant monitored sandbars at four locations between Hells Canyon Dam and the confluence with the Salmon River. Monitoring included measuring the size and shape of the sandbars, as well as using aerial photographs as part of a historical evaluation of these sandbars. Survey data, together with the aerial photography, indicate that sandbars have been, and will continue to be, dynamic features of the river system, responding in size and shape to varying flows and sediment loads in the river (Technical Report E.1-1). Analysis of aerial photos from 1955 through 1997 indicates that, over at least the last 20 years, the number of sandbars has been stable or increasing.

In general, the dramatic changes over the past 150 years in the Snake River basin suggest that sandbars described in historical accounts were not in dynamic equilibrium with the overall system. More likely, these features have been greatly modified as a result of anthropogenic factors operating from the mid-1800s through the mid-1900s, coupled with the geomorphic and channel characteristics that allowed these sandbars to develop (Technical Report E.1-2). There are photos from the 1940s (before HCC construction) that show erosion of sediment features, indicating that construction and operation of the HCC are not the only factors that have caused erosion in Hells Canyon.

Spawning Gravel—The incipient motion methodology was also used to evaluate the stability of 17 spawning sites for fall chinook salmon (Technical Report E.1-1). Typical spawning gravels range in size from between 25 and 152 mm (1 and 6 inches), but gravel sizes of 25 and 51 mm (1 and 2 inches) were used in the analyses because if these sizes do not move, larger sizes would also be stable. For the 25-mm size class, results indicate that most of the spawning sites are stable for flows experienced in the study area. All sites were stable for the 51-mm size class. Technical Report E.1-1 includes a detailed discussion of spawning site stability.

Rapids—Bedrock and debris flows are geomorphic features that contribute to the stability of the river channel. When debris flows occur, both large and small materials are washed into the river channel. Small materials are washed downstream, but larger materials that cannot be mobilized create a stable, armored channel. Such armoring is particularly evident at Wild Sheep, Granite, and Rush Creek rapids, as well as at numerous small rapids along the river.

Riverbanks—Except at a few locations, riverbanks in Hells Canyon are very stable. Results of a study of shoreline erosion (Technical Report E.3.2-42) indicate that the Hells Canyon reach is one of the most stable reaches studied. Erosion occurred at 60 sites, or in 2.44 of 125 mi (on both sides of the river). This area accounts for less than 2% of the reach.

E.1.6. Vegetative Cover

The types of vegetation growing along the canyon slopes of the middle Snake River are the result of three primary ecological factors: climate, topography, and soils. Climate exerts the strongest influence on the development of plant life. The relatively mild winters below the canyon rim have allowed the development of disjunct species. For example, netleaf hackberry (*Celtis reticulata*), which is most often found in the southwestern states, commonly occurs in the middle and lower Snake River area (Tisdale 1979, DeBolt 1992).

Within the context of regional climate, topography is a major influence on the development and distribution of vegetation (Tisdale et al. 1969; Tisdale 1979, 1986). The topographical complexity of Hells Canyon has produced a mosaic of vegetation types (Tisdale 1979, U.S. Department of Energy 1984). Grassland, shrubland, riparian (or wetland), and coniferous forest communities exist in close proximity. For example, interfingering of grassland and forest occurs at a number of sites throughout the canyon because of variations in aspect (Tisdale 1979).

Twenty-six cover types—for natural features, land use, and vegetation—were identified along the Snake River in the Hells Canyon vicinity (Technical Report E.3.3-1). The area that was classified covered up to approximately 0.5 mi on both sides of the Snake River or associated reservoirs and extended from above Brownlee Reservoir at the town of Weiser, Idaho (RM 351.2), downstream to the confluence with the Salmon River (RM 188.2). The dominant cover types were *Grassland* (35.5%), *Shrub Savanna* (21.0%), *Lotic* (16.1%), *Shrubland* (6.6%), and *Cliff/Talus* (5.6%). All remaining cover types covered less than 5% of the area classified.

E.1.6.1. Wetland and Riparian Communities

A narrow band of diverse riparian communities intermittently follows the course of the Snake River and its many tributaries. The mosaic of channel and floodplain structures creates a constantly changing habitat template for a variety of vegetation resources that have discrete or patchy distributions within the heterogeneous landscape. Although limited in geographic area, this riparian zone is vital because of its biological diversity. Emergent wetland communities are composed mostly of broad-leaved pepperweed (*Lepidium latifolium*), marsh grass (*Heleochloa alopecuroides*), purple loosestrife (*Lythrum salicaria*), common cocklebur (*Xanthium strumarium*), hemp dogbane (*Apocynum cannabinum*), alkali saltgrass (*Distichlis stricta*), and purslane (*Portulaca oleracea*). Predominant shrub species in riparian areas include netleaf hackberry, false indigo (*Amorpha fruticosa*), coyote willow (*Salix exigua*), common chokecherry

(*Prunus virginiana*), western poison ivy (*Toxicodendron rydbergii*, formerly *T. radicans*), syringa (or mock orange, *Philadelphus lewisii*), Himalayan blackberry (*Rubus discolor*), and tamarisk (*Tamarix* species). Predominant tree species include water birch (*Betula occidentalis*), white alder (*Alnus rhombifolia*), black cottonwood (*Populus trichocarpa*), silver maple (*Acer saccharinum*), peachleaf willow (*Salix amygdaloides*), and Siberian elm (*Ulmus pumila*).

Many shoreline sections have no riparian vegetation. Rather, upland vegetation on steep canyon slopes simply meets the rocky shoreline. Grassland and shrubland communities are common along the Snake River and its tributaries.

Many riparian plant assemblages in the canyon are dominated by introduced weeds, including many species designated as noxious weeds by Idaho and Oregon state agencies. Weedy riparian species dominate some of the most common plant assemblages in each riparian cover type (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland*) and include species such as false indigo, tamarisk, broad-leaved pepperweed, purple loosestrife, and poison hemlock (*Conium maculatum*) (Table 9 in Technical Report E.3.3-1). Most of these weedy riparian assemblages occur in the upstream Weiser reach and along the headwaters of the Brownlee Reservoir reach. The reach below Hells Canyon Dam has few weedy riparian assemblages (see section E.3.3.1.1.2.).

Similar to the occurrence of weedy riparian assemblages, most riparian noxious weed populations occur in the upstream Weiser reach and along the headwaters of the Brownlee Reservoir reach (see section E.3.3.1.1.2. and Figures 3–21 in Technical Report E.3.3-2). Systematic-random surveys indicate that about 70% of the weed populations were riparian species in the Weiser reach, or about 13.6 populations per river mile. This percentage can be compared with about 45% (6.4 populations per river mile) on Brownlee Reservoir, about 30% (4.4 populations per river mile) on Oxbow Reservoir, about 30% (4.9 populations per river miles) on Hells Canyon Reservoir, and 10% (0.5 populations per river mile) in the reach below Hells Canyon Dam (see section E.3.3.1.1.2.)

E.1.6.2. Herbaceous-Dominated Vegetation Types

The dry climate and typically stony, shallow soils of the canyon have favored the development of grassland steppe communities at the lower and middle elevations (Tisdale 1979, 1986). Commonly occurring grass species in the study area include bunchgrasses and annual grasses (Garrison et al. 1977, U.S. Department of Energy 1984, Tisdale 1986, Franklin and Dyrness 1988). The bunchgrasses include bluebunch wheatgrass (*Pseudoroegneria spicata*, formerly *Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*), while the annual grasses include cheatgrass (*Bromus tectorum*) and medusahead wildrye (*Taeniatherum caput-medusae*) (Technical Report E.3.3-1). Other grasses, such as sand dropseed (*Sporobolus cryptandrus*) and Fendler threeawn (*Aristida purpurea* var. *longiseta*), are locally common (U.S. Department of Energy 1984, Tisdale 1986).

E.1.6.3. Shrub-Dominated Vegetation Types

Shrub species constitute a large segment of the canyon's overall vegetation composition. Shrub-steppe vegetation types occur at mid-elevations in the study area, especially in its southern region (U.S. Department of Energy 1984). Commonly occurring shrubs include big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), rubber rabbitbrush[3] (*Ericameria nauseosa*), netleaf hackberry, serviceberry (*Amelanchier alnifolia*), and bitter cherry (*Prunus emarginata*) (U.S. Department of Energy 1984, Tisdale 1986, Technical Report E.3.3-1). For the most part, sagebrush stands are limited to the area around Brownlee Reservoir. In these stands, the herbaceous layer is dominated by cheatgrass, with a variety of forbs also occurring.

Stands of netleaf hackberry can be found throughout the study area, either on lower slopes with rocky residual/colluvial soil or on alluvial terraces with sandy soil (Tisdale 1986). In these stands, hackberry is often mixed with a number of other shrub and tree species, including antelope bitterbrush, blue elderberry (*Sambucus cerulea*), and ponderosa pine (*Pinus ponderosa*) (U.S. Department of Energy 1984). Poison ivy is also abundant. The herbaceous layer is most often dominated by bluebunch wheatgrass, with cheatgrass dominant in those areas moderately to heavily disturbed by past livestock use.

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3. Rubber rabbitbrush was formerly called gray rabbitbrush (*Chrysothamnus nauseosus*).

E.1.6.4. Tree-Dominated Vegetation Types

Although coniferous forest communities are generally restricted to the higher elevations of steep canyon slopes, they do reach down as far as the river at certain locations. For example, stands of ponderosa pine or Douglas-fir (*Pseudotsuga menziesii*), typically with a common snowberry (*Symphoricarpos albus*) understory, extend to the river on north-facing slopes at sites around the main bodies of Oxbow and Hells Canyon reservoirs, as well as at sites downstream of Hells Canyon Dam (Technical Report E.3.3-1).

E.1.7. Land Development

Earliest known inhabitants of the Hells Canyon Region were Native American hunters and gatherers. However, after Congress passed the Homestead Act in 1862, the canyon saw substantial homesteading activity (Carrey et al. 1979).

Further development—including communities of Copperfield, Robbinette, and Homestead—was connected to the development of mining, railroads, and early hydropower in the canyon. During this period, many more people lived in the canyon than do today. Communities ranged in size from a few people to around 500. Mining was common in the canyon by the 1880s, and several historical mines can still be seen (IPC 1997). Kleinschmidt Grade, a steep, rocky road entering the canyon near Hells Canyon Park, was constructed in 1891 so that ore could be carried down from the mines in Idaho to steamboats that would ship it upriver to railheads near the upper end of the project area (Carrey et al. 1979). Agriculture also flourished in the canyon during this time to provide food to the miners, and remnant orchards can still be seen. By the twentieth century, the age of electricity had arrived. The settlement at the oxbow was one of the earliest sites on the Snake River to be identified for power development, and construction of the first generating plant at the oxbow was undertaken in 1908.

A number of smaller electric power companies consolidated in 1913 and 1914 to form the Idaho Power Company. In 1955, after a long struggle over development of public power versus private power in Hells Canyon, the Applicant was issued a license to construct a three-dam complex. Brownlee Dam was completed in 1958, Oxbow Dam in 1961, and Hells Canyon Dam in 1967 (see section C.1.).

In 1975, Congress established the Hells Canyon National Recreation Area (HCNRA), which begins upstream of Hells Canyon Dam near Copper Creek and extends nearly to the border between Oregon and Washington. The 67.5-mi reach of the Snake River within the HCNRA that runs from below Hells Canyon Dam to the northern end of the HCNRA was also designated as a wild and scenic river under the 1968 National Wild and Scenic Rivers Act. In addition, approximately 220,000 acres of the HCNRA were designated as wilderness under the 1964 Wilderness Act.

The topography and history of the area summarized above suggest much about the land ownership status and development in the canyon. Approximately 34% of the land (or 5,600 acres) within the proposed project boundary is federally owned and managed by the USFS or the BLM. The Applicant owns and manages just over 58% (9,660 acres). Private ownership by owners other than the Applicant accounts for about 6% of the total (980 acres). Less than 2% of the land within the project boundary (340 acres) is owned and managed by the states of Idaho or Oregon.

At the upstream end of the study area near Weiser, private ownership and agriculture are extensive. Interstate Highway 84 (I-84) cuts through this area, along with other primary and secondary roads. Rural residential units are sparsely scattered through the area, and a few commercial establishments adjoin I-84, as does Farewell Bend State Park on the Oregon side of the river. As the canyon steepens on Brownlee Reservoir, federal ownership increases, with land managed by the BLM intermixed with privately owned land used for grazing. About midpoint on the reservoir, significant amounts of land on the Oregon side are under private ownership, and a number of private residences lie between the shoreline and the county road accessing the area. Downstream, BLM lands are again interspersed with private grazing lands.

On the Idaho side, road access is limited, and only a few cabins lie along the shoreline, except for a lodge that was built as a commercial concession but that now serves as a private ranch. State ownership associated with the Cecil D. Andrus Wildlife Management Area occurs on the Idaho side just upstream of Brownlee Dam. The Applicant's Woodhead Park, along with the yard associated with the Brownlee Project, is located close to the dam. On the Powder River arm of the reservoir, the BLM and private grazing lands are interspersed, but westward around the community of Richland, Oregon, private ownership and agriculture predominate. A small area of private residential development lies just downstream of Richland on the south side of the reservoir on the Powder River arm.

Along Oxbow Reservoir, most land is managed by the BLM or owned by the Applicant. Several nodes of development on the Oregon side are associated with the hydroelectric projects. These nodes include Brownlee Village; a small trailer park; several undeveloped (or “impromptu”) recreation sites; and Oxbow Village, which is the primary residential and administrative area for the HCC. On the Idaho side of Oxbow Reservoir, McCormick Park, which lies just downstream of Brownlee Dam, and the dam and spillway for the Oxbow Project are the only developments in this virtually roadless reach.

On the Idaho side just downstream of Oxbow Village, the Payette National Forest reaches down to Hells Canyon Reservoir and continues on to Hells Canyon Dam, where the HCNRA begins. On the Oregon side of the reservoir, private ownership predominates, although a few larger parcels of BLM-managed land are interspersed down to Copper Creek, the southern boundary of the HCNRA and Hells Canyon Wilderness. Most of the private ownership is associated with the community of Homestead, a historical mining area. This private ownership is evidenced by small cabins and private residences.

The remainder of the study area below Hells Canyon Dam lies within the HCNRA, which is managed by the Wallowa–Whitman National Forest. The Hells Canyon Visitors Center, managed by the USFS, lies a short distance downstream of the dam on the Oregon side. The only other development in this area includes a few ranches and cabins on enclaves of private land, as well as the USFS administrative sites at Pittsburg Landing and Dug Bar.

With the exception of the HCRNA, the region containing the project area is still dominated by the land uses established at the turn of the century: irrigated and nonirrigated agriculture, livestock grazing, mining, large areas of open space, and scattered rural development. The bottomlands adjacent to the reservoirs are generally used for grazing, some farming, and recreational purposes.

The region is also crossed by an excellent system of federal and state highways. Secondary roads, owned and maintained either by the Applicant or various counties, provide access to more remote areas of the project. I-84 crosses the region from northwest to southeast and provides access to the southern portion of the project near Huntington, Oregon. Oregon Highway 86 connects with I-84 at Baker City, Oregon, and then travels 70 mi to the northeast where it terminates at Oxbow, Oregon. Baker County owns and maintains a 40-mi gravel-surfaced road that provides access to the west side of Brownlee Reservoir between Huntington and Richland. Travelers can reach Hells Canyon Dam via a 23-mi paved two-lane highway that is owned by the Applicant and the federal government and maintained by the Applicant. In addition, the Applicant owns and maintains a 12-mi stretch of roadway running between Oxbow and the Oregon state line near Brownlee Dam. The main line of the Union Pacific Railroad crosses the upper end of Brownlee Reservoir near Huntington. On the Idaho side, Idaho Highway 71 provides access from Brownlee Dam to Cambridge, Idaho.

The predominant source of electricity is a regionwide grid system of public and private hydroelectric and thermal power plants coordinated under the Pacific Northwest Coordination Agreement. The principal electric power utilities within the region are the Applicant, Avista Corporation, Oregon Trail Electric Consumers Cooperative, and Bonneville Power Administration.

E.1.8. Human Population Size and Density

Hells Canyon straddles the boundaries of Oregon, Idaho, and Washington in the Pacific Northwest. These states had a combined population of 8,715,747 in the 1990 U.S. census, increasing to 10,609,473 in the 2000 census, for an increase of 21.7%. Compared with the national growth rate of 13.1% between 1990 and 2000, these relatively sparsely populated western states are growing significantly. In 2000, population density in Idaho was 15.6 people per square mile; in Oregon, 35.6 people per square mile; and in Washington, 88.6 people per square mile, for a regional average of about 43.2 people per square mile. In the same year, the overall population density in the United States was 79.6 people per square mile. The population of these three states together is expected to increase by about 31% between 2000 and 2025. Their largest population centers are within about an eight-hour drive of Hells Canyon.

Within about an hour's drive are Ada, Adams, Canyon, Gem, Idaho, Latah, Lewis, Nez Perce, Payette, Valley, and Washington counties in Idaho. In Oregon, Baker, Malheur, Union, and Wallowa counties lie within the same proximity, as do Asotin, Garfield, and Whitman counties in Washington. The population in this region was about 554,189 in 1990, increasing to 724,611 in 2000, for a growth rate of about 30.7%. People living in the vicinity contribute the majority of the recreational use occurring in the study area (Technical Reports E.5-4 and E.5-5). Except for Ada and Canyon counties in Idaho, most of these counties had very low population densities, averaging 17.4 people per square mile in 2000. Ada County had a density of 285.2 people per square mile, while Canyon County had a density of 222.9 people per square mile. Located in Ada County, Boise is the only major population center in this region; it had a 2000 population of 185,787 people. In Idaho, other larger communities in the vicinity include Meridian (34,919), Nampa (51,867), Caldwell (25,967), Lewiston (30,904), and Moscow (21,291). In Oregon, larger communities include Baker City (9,860), La Grande (12,327), and Ontario (10,985). Also in the vicinity, Pullman, Washington, has 24,675 people.

Bordering the canyon are Washington, Adams, Idaho, and Nez Perce counties in Idaho; Baker and Wallowa counties in Oregon; and Asotin County in Washington. These counties had a combined total population of 110,892 people in 2000, up from 99,159 in 1990, for an increase of 11.8%. Their average population density was 5.83 people per square mile in 2000. Communities in the local area are Weiser (5,343) and Lewiston (30,904) in Idaho; Halfway (337), Huntington (515), and Richland (147) in Oregon; and Clarkston (7,337) and Asotin (1,095) in Washington. Locations of many of these communities are shown in Figure E.1-1.

E.1.9. Floodplain and Occurrence of Flood Events in the Project Vicinity

Upstream of the project area between the city of Weiser, Idaho, and Cobb Rapids (RM 343) at the head of Brownlee Reservoir, a relatively broad floodplain exists due to the geomorphic conditions of the area. However, within the project area, the floodplain is entrenched within the relatively narrow canyon of the Snake River. Downstream of the project area, the floodplain is similar, generally entrenched between the walls of the canyon, all the way to Lewiston, Idaho.

In the northwestern United States, the Pleistocene and early Holocene epochs had much wetter climates than the current climate. The resulting prehistoric hydrology and floods (such as the Bonneville Flood) formed the bed and channel shape of the Snake River upstream and downstream of the HCC that we see today. As mentioned earlier, the climate over the last 1,000 years has been drier, and there have been no floods of the magnitude of those experienced previously. As a result, the channel has changed little since it was formed and is very stable under recent flows. Although it is a gravel-bed river, the Snake River through most of the study area does not act as a classical alluvial river (with occasional flooding over low-lying areas broader than itself) because the current river form was developed under significantly higher flow regimes than those produced under current hydrologic conditions (Technical Report E.1-2).

Upstream, Weiser is located on the broad floodplain at the confluence of the Weiser and Snake rivers. The Weiser River has no control structures and often floods along its course; it also causes local flooding where it enters the Snake River. Only a few small communities, including those associated with the project, lie within or near the floodplain of the Snake River. In fact, somewhat fewer than 200 full-time residents live in the floodplain area. Besides these communities and the Applicant's project facilities, the only other developments within or near the floodplain area are some cultivated acreage, recreation facilities, and several working ranches. The numerous dams and hydroelectric projects upriver on the mainstem and most of the major tributaries have kept flooding on the Snake River from being a significant problem for residents. But flooding of undeveloped tributaries and the resulting backup of water in the mainstem Snake River has caused extensive damage, even in recent years.

For example, in the winter of 1996–1997 and spring of 1997, heavy rainstorms on many of the tributaries flowing into all three of the project reservoirs caused "blowouts" at the mouths of many of these side canyons, demonstrating the type of flood damage that can be experienced. The steep topography and narrow tributary channels coming into the broader river channel of the Snake River result in high volumes of fast-flowing water. These flows pick up debris in their paths and "blow out" at the tributary mouths, spewing debris over the alluvial fans that have formed at the confluences. Since these alluvial fans provide much of the level land in the canyon, development has occurred on and near a number of them.

A study conducted by the U.S. Geological Survey defines the 100-year flood on the Snake River at Hells Canyon Dam as being 111,000 cfs. On two of the larger tributaries within the project area, the 100-year flood is defined as 4,680 cfs for the Wildhorse River, which enters the Snake River at McCormick Park on Oxbow Reservoir, and 10,400 cfs for Pine Creek, which enters the river at Oxbow Village on Hells Canyon Reservoir (USGS 1996). Relatively recent flooding from both of these tributaries has substantially damaged facilities at McCormick Park and Oxbow Village. The peak flows recorded for these two tributaries occurred in the 1996–1997 high-flow period. The Wildhorse River experienced flows of about 4,202 cfs; and Pine Creek, 11,600 cfs, the latter exceeding the 100-year flood (USGS 1996). The spillways at all three power plants of the HCC are designed to pass a much greater flow than the 100-year flood for the Snake River (see section A.2.1.1., section A.3.1.2., and section A.4.1.2. for spillway information about Brownlee, Oxbow, and Hells Canyon dams, respectively).

In the vicinity of the HCC, flood insurance rate mapping of the Snake River has been prepared by the Federal Emergency Management Agency only for Malheur and Baker counties in Oregon and Washington County in Idaho. A small area of Wallowa County (located at the very north end of the study area near the Oregon–Washington border) has also been mapped. Downstream of the HCNRA and a considerable distance from the project area, some reaches in Idaho and Nez Perce counties (Idaho) are also mapped. Since all of the counties adjacent to the Snake River in the vicinity of the project—including Adams County in Idaho—do participate in the National Flood Insurance Program, the fact that some areas of the Snake River are not mapped is presumably because the federal government owns and manages most of the land adjoining the Snake River. At Weiser, the floodplain shown on the flood insurance rate mapping is about 1.25 mi wide. For Cobb Rapids at the upstream end of the project, the floodplain is about 1,500 ft wide, while the floodplain at Brownlee Dam is just under 2,000 ft wide. The floodplain near the midpoint of Oxbow Reservoir is about 700 ft wide; at Oxbow Village and the confluence of Pine Creek and the Snake River, the floodplain is somewhat more than 1,000 ft wide. The floodplain on Hells Canyon Reservoir downstream of Oxbow Village is narrower due to the vertical cliff walls and narrowing canyon. However, since no flood insurance rate mapping of this area is available, no documented estimate is possible. The distance between canyon walls at Hells Canyon Dam is estimated to be about 900 ft.

E.1.10. Project Operation

Detailed information about proposed and historical operations of the HCC is included in Exhibit B.

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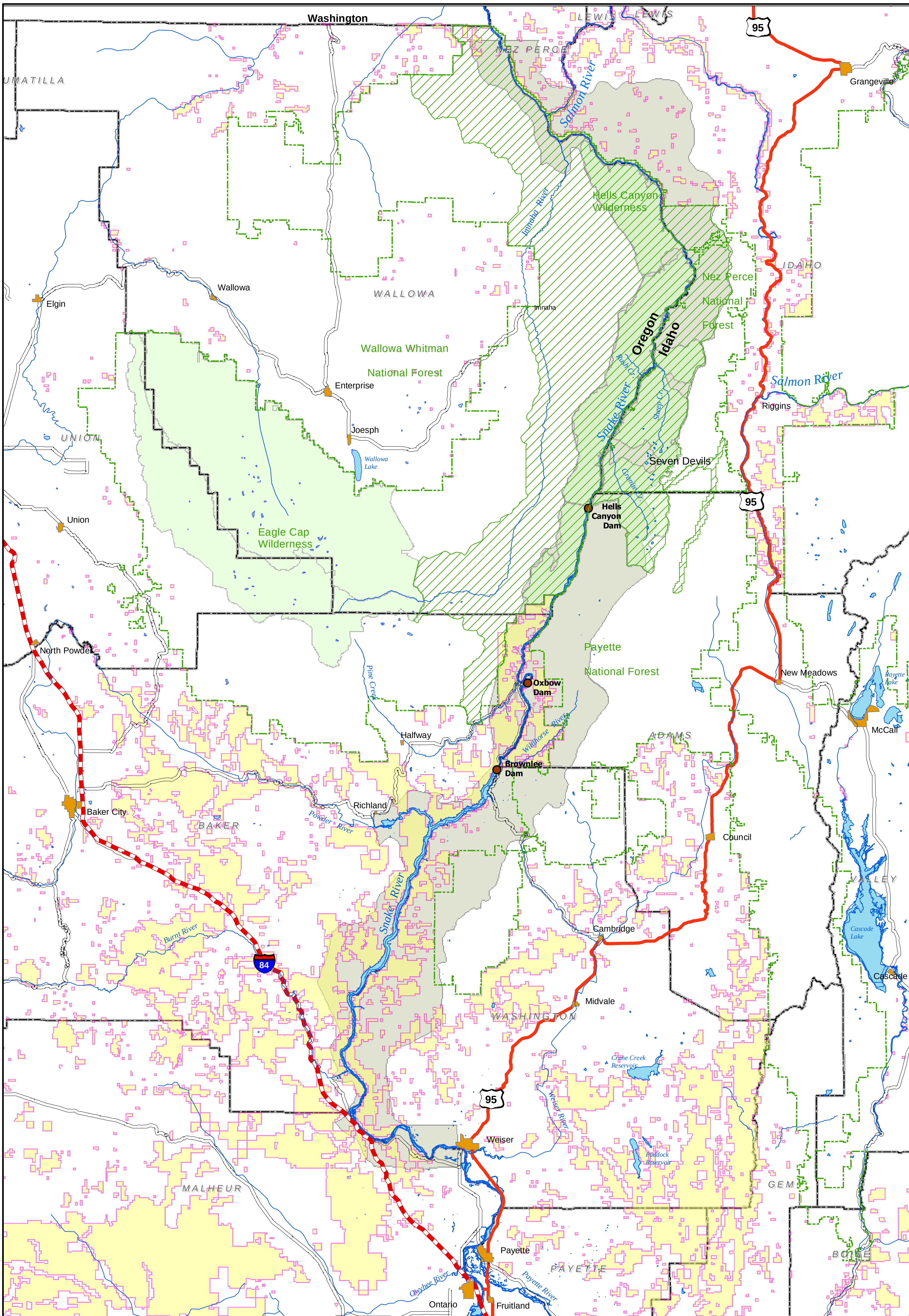

Vicinity Map

Legend

Interstate		County Boundaries		Rim-to-Rim Study Area (Tier 2)	
State Hwy		Urban Areas		BLM	
U.S. Hwy		Rivers and Lakes		Wilderness Area	
River				Forest Service Boundaries	
Idaho Power Facility				Hells Canyon N.R.A.	

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E1-1

Location of the Hells Canyon Complex Study Area

Scale 1:650,000

0 2.5 5 10 15 20 Miles

IDAHO POWER
An IDACORP Company

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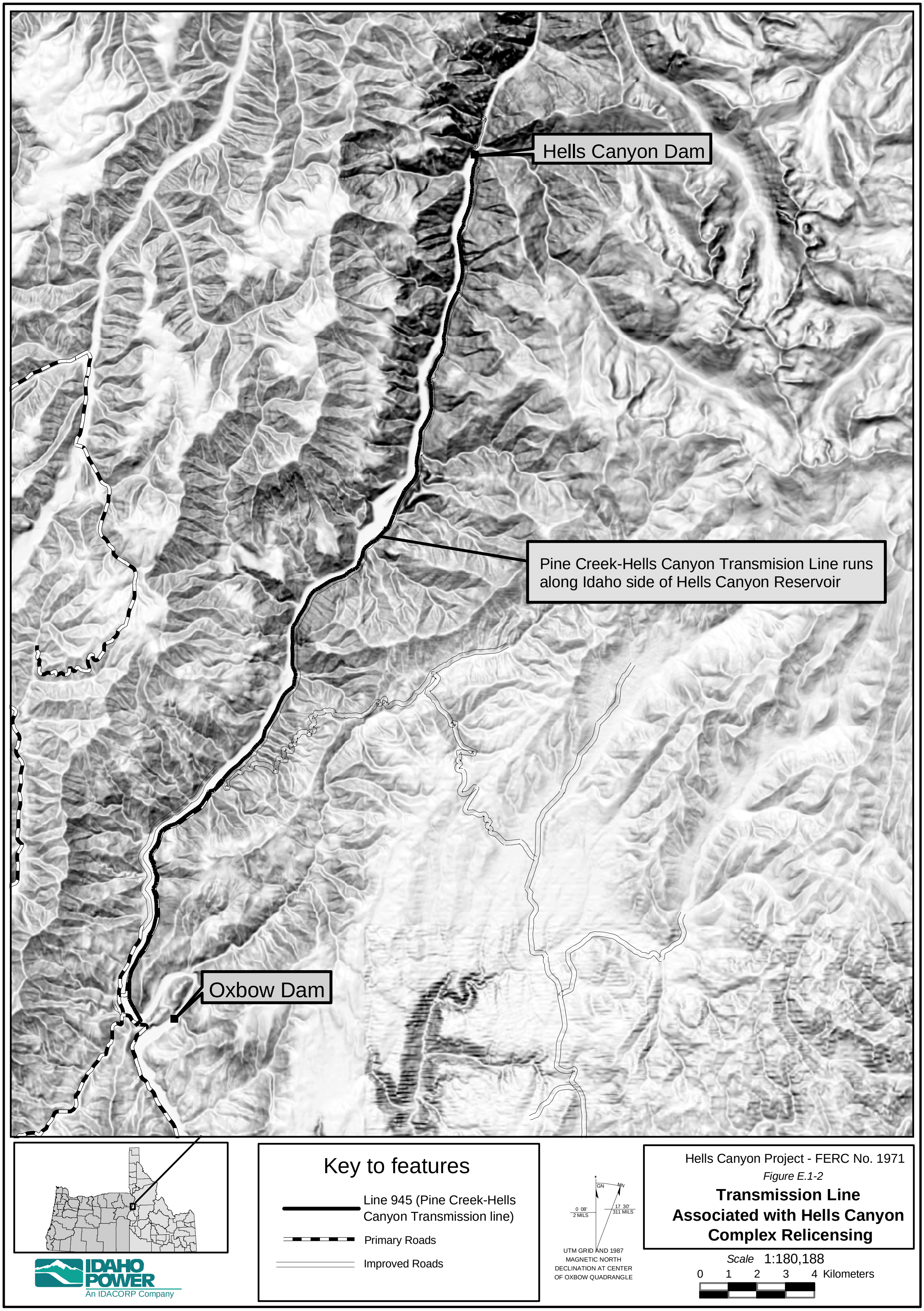
Hells Canyon Dam
Pine Creek-Hells Canyon Transmision Line runs along Idaho side of Hells Canyon Reservoir
Oxbow Dam
Key to features
Line 945 (Pine Creek-Hells Canyon Transmission line)
Primary Roads
Improved Roads
IDAHO POWER
An IDACORP Company
GN
MN
0 08'
2 MILS
17 30'
311 MILS
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE
Hells Canyon Project - FERC No. 1971
Figure E.1-2
Transmission Line Associated with Hells Canyon Complex Relicensing
Scale 1:180,188
0 1 2 3 4 Kilometers

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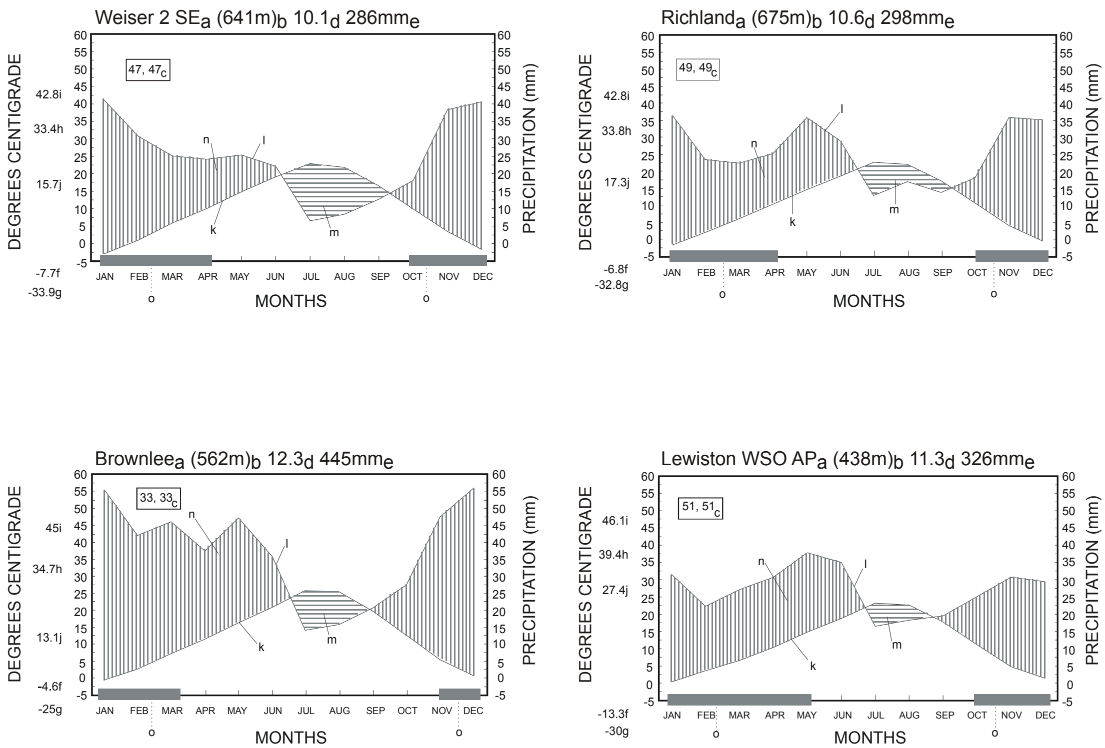

a: Station
b: Elevation
c: Number of years of observation (temperature, precipitation)
d: Mean annual temperature in °C
e: Mean annual precipitation in millimeters
f: Mean daily minimum of the coldest month
g: Lowest recorded temperature
h: Mean daily maximum of the hottest month
i: Highest recorded temperature
j: Mean daily temperature range
k: Monthly means of temperature in °C
l: Monthly means of precipitation in millimeters
m: Arid period (horizontal hatched)
n: Humid period (vertical hatched)
o: Months with an absolute minimum below 0 °C

Figure E.1-3 Köppen climate diagrams for the Weiser, Richland, Brownlee, and Lewiston weather stations, Hells Canyon Study Area, Idaho–Oregon border

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The *Code of Federal Regulations* below—18 CFR § 4.51(f)(2)—specifies the content ofme this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(f)(2) *Report on water use and quality.* The report must discuss the consumptive use of project waters and the impact of the project on water quality. The report must be prepared in consultation with the state and Federal agencies with responsibility for management of water quality in the affected stream or other body of water. Consultation must be documented by appending to the report a letter from each agency consulted that indicates the nature, extent, and results of the consultation. The report must include:
>
> (i) A description (including specified volume over time) of existing and proposed uses of project waters for irrigation, domestic water supply, steam-electric plant, industrial, and other consumptive purposes;
>
> (ii) A description of existing water quality in the project impoundment and downstream water affected by the project and the applicable water quality standards and stream segment classifications;
>
> (iii) A description of any minimum flow releases specifying the rate of flow in cubic ft per second (cfs) and duration, changes in the design of project works or in project operation, or other measures recommended by the agencies consulted for the purposes of protecting or improving water quality, including measures to minimize the short-term impacts on water quality of any proposed new development of project works (for any dredging or filling, refer to 40 CFR Part 230 and 33 CFR §§ 320.3(f) and 323.3(e));
>
> (iv) A statement of the existing measures to be continued and new measures proposed by the applicant for the purpose of protecting or improving water quality, including an explanation of why the applicant has rejected any measures recommended by an agency and described under paragraph (f)(2)(iii) of this section; and
>
> (v) A description of the continuing impact on water quality of continued operation of the project and the incremental impact of proposed new development of project works or changes in project operation.

E.2. Report on Water Use and Quality

E.2.1. Consumptive Water Use

Consumptive water use is authorized in Idaho and Oregon through water rights acquired pursuant to state law, or as otherwise allowed as exempt water uses.

E.2.1.1. Oregon Consumptive Use

E.2.1.1.1. Applicant's Consumptive Use

1. *Hydropower Project/State Licenses*—Most consumptive uses of surface water associated with the project are currently authorized in Oregon under three individual project licenses issued by the State of Oregon: License No. 161 (Oxbow); License No. 188 (Brownlee), and License No. 189 (Hells Canyon). Each license includes a state water right authorizing use of water for hydropower development and for operation of the hydropower project. The term "project" is broadly defined to include all aspects of project-related activities, including but not limited to powerhouses; waterwheels; conduits or pipes; dams and appurtenant works and structures; storage or diverting reservoirs connected therewith; primary lines transmitting power to the point of junction with a distributing system or with any interconnected primary system; miscellaneous works and structures used in connection with the unit or part thereof; rights of way, including lands, flowage rights, and all other properties; and rights and structures

necessary or appropriate in the use, operation, and maintenance of such project. The Applicant proposes continuation of these project uses upon relicensing by FERC and in state water rights issued pursuant to Oregon Revised Statutes (ORS) Chapter 543A (see section 5[i]).

2. *Other State Water Rights*—In addition to authorization provided under license and state water rights, the Applicant has also obtained ten individual water rights for surface and ground water uses, as identified in Table E.2-1.

3. *Exempt Ground Water Uses*—The following additional groundwater uses are allowed as exempt uses under Oregon law (ORS 537.545).

   Brownlee Trailer Court—Group domestic well serving seven residences

   Oxbow/Copperfield Village—Exempt commercial use and group domestic (recreational vehicle park)

E.2.1.1.2. Other Consumptive Uses

Records of the Oregon Water Resources Department show a total of 30 existing and proposed water rights within project boundaries, using a total of 48.47 cfs of water for out-of-stream beneficial uses, as identified in Table E.2-2.

E.2.1.2. Idaho Consumptive Use

E.2.1.2.1. Applicant's Consumptive Use

The Applicant has obtained eight State of Idaho water rights for consumptive uses at the project, as identified in Table E.2-3.

E.2.1.2.2. Other Consumptive Uses

Records of the Idaho Department of Water Resources show a total of 240 existing and proposed water rights within project boundaries, using water for out-of-stream beneficial uses as follows: 14.46 cubic feet per second (cfs) for existing rights, 18.92 cfs for proposed private rights, and

911,300 cfs for U.S. and Nez Perce Tribe overlapping adjudication claims for federal reserved instream flow rights. All are identified in Table E.2-4.

E.2.2. Existing Water Quality

E.2.2.1. Applicable Water Quality Criteria and Stream Segment Classification

The Snake River within the project area is a navigable water of the United States. It is also boundary water, meaning that the river forms a state boundary, in this case between Idaho and Oregon. In addition, segments of the Snake River have been designated either as wild or scenic according to the Wild and Scenic Rivers Act of 1968 (Public Law 90-542), as amended in 1975 when Congress created the Hells Canyon National Recreation Area (Public Law 94-199). The Snake River from Hells Canyon Dam (river mile [RM] 247.6) downstream to Pittsburg Landing (RM 215) is designated a wild river, while the river from Pittsburg Landing downstream to the Salmon River inflow is designated a scenic river.[1] Designated river segments receive special protection for the values that make them outstanding and, therefore, eligible for inclusion in the National Wild and Scenic Rivers System. The values that contributed to designations for the Snake River corridor include scenic, recreational, geologic, wildlife, fisheries, cultural, vegetation/botanical, and ecological resources (USFS 1999). Other than the Federal Water Pollution Control Act (Public Law 92-500), referred to in this exhibit as the Clean Water Act, and applicable state standards for either designated segment, no further water quality protection measures apply.

Because the Snake River is a boundary water, both the states of Idaho and Oregon have identified designated uses for the river. The Idaho Department of Environmental Quality (IDEQ) has designated aquatic life, wildlife habitats, recreation, aesthetics, water supply, and special resource water uses for the Snake River from its confluence with the Salmon River upstream to the Scott Creek inflow near Weiser, Idaho (Table E.2-5) (IDAPA 58.01.02. n.d.). A designation of special resource water is applied to waters recognized as needing intensive protection to maintain current uses or to preserve outstanding or unique characteristics.

1. The actual designation encompasses the Snake River farther downstream than the confluence with the Salmon River; however, the remainder of that segment lies outside the study area for water use and quality.

The Oregon Department of Environmental Quality (ODEQ) has designated similar uses for the Snake River from its confluence with the Salmon River upstream to Farewell Bend State Park (Table E.2-6) (OAR 340-041 n.d.). In addition, anadromous fish passage, commercial navigation, and transportation are designated uses for the Snake River from the mouth of the Salmon River upstream to the lower half of Hells Canyon Reservoir (RM 260). Hydropower is a designated use for the Snake River upstream to Farewell Bend State Park.

The Snake River has been identified as water quality limited under § 303(d) of the Clean Water Act (33 U.S.C. § 1313[d]). This designation indicates that the appropriate agencies have identified the water quality in the segment as not meeting applicable water quality standards (ODEQ 1998, IDEQ 1999, USEPA 2001a). Table E.2-5 and Table E.2-6 list the pollutants identified as limiting water quality in the Snake River. A total maximum daily load for this segment of the Snake River (referred to in this exhibit as the draft Total Maximum Daily Load [TMDL])[2] is pending before the IDEQ and the ODEQ (IDEQ and ODEQ 2001). When this draft TMDL is final, it will be used as an informational tool by Idaho and Oregon, and relevant stakeholders, to develop appropriate implementation and management plans to provide reasonable assurances that water quality standards for the water body will be achieved and the designated beneficial uses protected.

Because the Snake River is boundary water, the draft TMDL is intended to address the regulatory needs of both Idaho and Oregon. The approach taken to meet both states' needs was to use the most conservative standard from either state, when a standard applied, or a mutually agreed upon proposed target to identify a level at which water quality may be limited. Table E.2-7 lists these levels. The draft TMDL contemplates both quantitative and qualitative levels that may apply since both states have numeric and narrative standards. The draft TMDL assumes that attainment of these levels will support all designated uses, including irrigation; water supply for livestock, agriculture, and industry; wildlife; hunting and angling; boating; aesthetics; commercial navigation and transportation; and hydropower.

2. All references to the TMDL are based on the December 2001 draft.

In Idaho, nonpoint sources management, including the use of best management practices (BMPs) and voluntary control measures, is intended to protect designated beneficial uses. Violations of water standards that occur in spite of the implementation of BMPs or control measures are not subject to enforcement action (IDAPA 58.01.02.350, 01). Idaho regulations provide that water released from any hydropower generation facility must have dissolved oxygen (DO) concentrations of at least 3.5 milligrams per liter (mg/L), as measured every 10 minutes; a 7-day mean minimum of 4.7 mg/L; and a 30-day mean of 6.0 mg/L between June 15 and October 15 (IDAPA 58.01.02 n.d.). This regulation applies only to Idaho. The Applicant chose not to evaluate existing water quality relative to this standard, but instead used the draft TMDL targets.

E.2.2.2. Existing Water Quality Conditions Within and Downstream of the Hells Canyon Complex

E.2.2.2.1. Water Body Delineation

The Hells Canyon Complex (HCC)[3] comprises five distinct reaches: Brownlee Reservoir (RM 343.0 to 284.6), Oxbow Reservoir (RM 284.6 to 272.5), the bypassed reach below Oxbow Dam (RM 272.5 to 270.0), Hells Canyon Reservoir (RM 270.0 to 247.6), and the Snake River below Hells Canyon Dam (RM 247.6 to 168.4) (Figure E.2-1). In addition, Brownlee Reservoir exhibits three longitudinal zones. The first of these zones is the riverine zone, located farthest upstream. This zone is highly influenced by inflow from the Snake River. Another zone is the lacustrine zone, located farthest downstream. This zone exhibits properties most characteristic of a lake, including thermal stratification. The last zone, the transition zone, is located between the lacustrine and riverine zones. Unless otherwise noted, statements and conclusions concerning water quality in these five reaches and three zones are based on technical data presented in Technical Report E.2.2-2.

E.2.2.2.1.1. Brownlee Reservoir

As mentioned, Brownlee Reservoir exhibits three longitudinal zones. Longitudinal delineation of these zones varies due to changes in inflow and reservoir stage (or the elevation of the water

3. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

surface). Brownlee Reservoir often shows strong thermal stratification during the summer. Location of the thermal strata is based on temperatures of the water and elevation of the outlet.

E.2.2.2.1.1.1. Riverine Zone

The riverine zone of Brownlee Reservoir generally extends downstream to RM 325 and has characteristics similar to the inflowing Snake River. Water flows through this zone with relatively high velocities and turbulence, and the water column typically remains well mixed.

E.2.2.2.1.1.2. Transition Zone

The transition zone of Brownlee Reservoir is deeper, slower, and less turbulent than the riverine zone. Because of a combination of characteristics, incoming particles settle; however, this zone is generally still mixed. The upstream and downstream boundaries of the transition zone vary, but the zone is generally located between RM 325 and 308.

E.2.2.2.1.1.3. Lacustrine Zone

The lacustrine zone of Brownlee Reservoir exhibits a strong thermal stratification during the summer that is represented by the classic strata: the epilimnion, metalimnion, and hypolimnion. The epilimnion, located nearest the surface, is most influenced by meteorological conditions. The metalimnion is a relatively thin zone located between the epilimnion and the deeper hypolimnion. Metalimnions are often characterized as having steep temperature gradients (Goldman and Horne 1983). In addition, the vertical location of Brownlee Reservoir's metalimnion seems to be strongly controlled by the elevation of the penstock intake, forming near the centerline elevation of the penstocks (1,948 feet [ft] mean sea level [msl]). The hypolimnion is located at the bottom of the reservoir, and its waters are isolated during stratification. The lacustrine zone typically characterizes the reservoir between RM 308 downstream to Brownlee Dam (RM 284.6).

E.2.2.2.1.2. Oxbow Reservoir

Most water entering Oxbow Reservoir enters from either the Brownlee Powerhouse or the spillway (RM 284.6). Wildhorse River (RM 283.3), the only significant tributary, typically contributes less than 1% of the inflow to Oxbow Reservoir (Table 2 in Technical Report E.2.2-1).

The Oxbow Reservoir outlets are unique: the intakes to the powerhouse are located about 0.4 mile (mi) upstream of Oxbow Dam (RM 272.5). Throughout most of the year, the majority of water is released through the powerhouse rather than through the Oxbow Dam spillways. However, a minimum flow of 100 cubic feet per second (cfs) is maintained through the spillway by drawing water from approximately 30 feet below full pool at an elevation of about 1,776 ft msl.

In general, water flows through Oxbow Reservoir with relatively high velocity and thorough mixing. Although thermal stratification is virtually nonexistent during medium- and high-flow years, a weak stratification structure may develop during the summer of low-flow years.

The hydrodynamics of Oxbow Reservoir between the powerhouse intakes and the dam (in the 0.4-mi section) differ notably from hydrodynamics for the rest of the reservoir. Water resides in this part of the reservoir for about 20 days, while water upstream of the intakes resides in the reservoir 1.4 days. The extended retention time in this portion of the reservoir is related to the increased depth (about 130 ft at full pool) and the 100-cfs flow that is being spilled through the dam. These two factors result in thermal stratification each summer. The stratification is typified by a deep metalimnion at about an elevation of 1,700 to 1,720 ft msl. The deep metalimnion results in a relatively large epilimnion and small hypolimnion.

E.2.2.2.1.3. Oxbow Bypass

The Oxbow Bypass receives water from the 0.4-mi section of Oxbow Reservoir between the powerhouse intakes and the dam. This reach extends from Oxbow Dam (RM 272.5) downstream to the powerhouse (RM 270.0). As mentioned earlier, the minimum flow requirement into this 2.5-mi reach from the Oxbow Dam is 100 cfs. However, the bypass reach is also subject to inundation due to the backwater effect of Hells Canyon Dam and Reservoir. Indian Creek (RM 271.3) is the only perennial tributary.

E.2.2.2.1.4. Hells Canyon Reservoir

Releases from Oxbow Reservoir enter Hells Canyon Reservoir at two locations: through the Oxbow Dam spillways and through the powerhouse (RM 270). The majority of inflow is generally released through the powerhouse, except during high-runoff events. A 100-cfs minimum flow is always released into the bypass reach between Oxbow Dam and the powerhouse outlet. The amount of water in the bypass reach is also affected by the backwater effect of Hells Canyon Reservoir. The main part of Hells Canyon Reservoir begins at the Oxbow Powerhouse outlet and extends downstream to Hells Canyon Dam. Pine Creek, the only significant tributary to Hells Canyon Reservoir, contributes less than 2% of the inflow (Table 2 in Technical Report E.2.2-1).

The hydrodynamics of the upstream section of Hells Canyon Reservoir are similar to those for Oxbow Reservoir and the riverine zone of Brownlee Reservoir. Water enters Hells Canyon Reservoir with relatively high velocity and turbulence, largely because of the narrow, relatively shallow morphology. In addition, wind helps maintain mixed conditions throughout the water column. Even though thermal stratification is not prevalent, it can develop in Hells Canyon Reservoir within 3 to 6 mi of the dam because decreased velocity and increased depth change the hydrodynamics. As in Brownlee Reservoir, the metalimnion develops at about the same depth as the penstock intake. However, for the lacustrine zone of Hells Canyon Reservoir, stratification is relatively weak and only persists for short periods of time. Thermal gradients are more likely to form and persist during low-flow years when residence times increase but in-reservoir velocities decrease.

E.2.2.2.1.5. Snake River below Hells Canyon Dam

The Snake River downstream of Hells Canyon Dam has a high gradient and is turbulent. The water quality in the reach from Hells Canyon Dam to the Salmon River is determined by the quality of the water that enters and is subsequently released from Brownlee Reservoir.

E.2.2.2.2. Temperature

Water temperatures change longitudinally as water passes through the HCC. Outflow from Hells Canyon Dam is cooler than the Snake River inflow, meaning that the complex has an overall cooling effect during the summer (Table E.2-8). Most of this summer cooling can be attributed to Brownlee Reservoir. As the Snake River continues to flow through Oxbow and Hells Canyon reservoirs, it warms slightly. This trend reverses in the fall when outflow is warmer than inflow. Again, most of the delayed cooling is related to Brownlee Reservoir, but the other reservoirs account for a small part of the delayed downstream cooling. In the spring, similar to the summer, outflow from Hells Canyon Dam is cooler than the Snake River inflow. Therefore, the overall benefit of the HCC on water temperature results in fewer days exceeding temperature criteria for both coldwater biota and salmonid spawning downstream of Hells Canyon Dam.

Generally, temperatures in the Hells Canyon Dam outflow vary less than Snake River inflow temperatures, and fall outflow temperatures are remarkably consistent. Longitudinal temperature changes continue downstream of Hells Canyon Dam. In summer, the water warms slightly as it flows downstream to the confluence with the Salmon River. This trend is reversed in fall, showing a slight cooling. In addition to the longitudinal temperature changes through the HCC, certain locations within the complex exhibit some level of thermal stratification in the water column.

E.2.2.2.2.1. Brownlee Reservoir

Although thermal stratification begins to become evident in Brownlee Reservoir near the end of the transition zone, the lacustrine zone is strongly stratified during the summer. The epilimnion exhibits either relatively isothermal conditions or a gradual temperature decrease with depth down to about 35 meters (m) (115 ft) from full pool (or at a depth of 1,962 ft msl). August temperatures in the epilimnion generally ranged from 25 °C at the surface to 18 °C at the bottom of the stratum. As previously mentioned, the metalimnion forms near the centerline elevation of the powerhouse penstock intakes (at 1,948 ft msl) and extends about 25 mi upstream of the dam. The thermal gradient is steep, with August temperatures generally ranging from about 17 to 8 °C from the top to the bottom of the 8.6-m-thick metalimnion.

The location of the thermocline (or layer of the metaliminion that exhibits the greatest temperature change) is relatively consistent between low-, medium-, and high-flow years, while water temperature and thermal structure vary. In low- to moderate-flow years, water temperatures at the surface reached 28 °C, while water temperatures in the hypolimnion were generally less than 10 °C. In high-flow years, none of the water in Brownlee Reservoir is cooler than 10 °C. Likewise, the change in water temperatures in the thermocline is not as great, exhibiting only a 4 °C difference.

E.2.2.2.2.2. Oxbow Reservoir

As mentioned earlier, the thermal structure in Oxbow Reservoir differs between the main part of the reservoir and the section between the powerhouse intakes and Oxbow Dam. Most of Oxbow Reservoir remains well mixed, with similar temperatures throughout the reservoir. Even under extreme low-flow conditions, there is only a slight temperature gradient through the water column. In contrast, part of Oxbow Reservoir, the section between the powerhouse intakes and Oxbow Dam, exhibits a more complex thermal structure. Generally, this section is thermally stratified during summer and into fall in all years, with water temperatures in the epilimnion measuring about 23 °C and temperatures typically decreasing about 5 °C through the 6-m-thick metalimnion. A much larger difference between the temperatures of the epilimnion and hypolimnion occurs in low-flow years than in medium- or high-flow years.

E.2.2.2.2.3. Oxbow Bypass

Water temperatures did not differ greatly through the Oxbow Bypass. This finding indicates the strong influence of Oxbow Reservoir's releases on water temperature within the bypassed reach, as well as the minimal warming occurring within the reach (Technical Report E.2.3-1). During high-flow years, daily fluctuations in water temperature are more evident near the end of the Oxbow Bypass than near Oxbow Dam. This difference is largely attributable to fluctuations in the elevation of Hells Canyon Reservoir, fluctuations that in turn cause reservoir water to pool in the Oxbow Bypass.

During 100-cfs minimum flows, stratification of the water column was evident at a deep-water site approximately 0.2 river miles downstream of Oxbow Dam (Technical Report E.2.3-1). The pool that contains the deep-water area comprises approximately 4 hectares of the total 50-hectare bypass reach. Because the stratified area is very small in relation to the entire Oxbow Bypass, it probably had a minimal effect on water quality. The water column became fully mixed at flows of 1,350 cfs; however, within 25 hours of flows returning to the 100-cfs minimum, it restratified.

E.2.2.2.2.4. Hells Canyon Reservoir

Generally, Hells Canyon Reservoir does not stratify except under low-flow conditions when a weak thermocline forms at a depth of about 45 m within 10 mi of the dam. Also, under low-flow conditions, isolated areas within several meters of the water surface can become notably warmer.

E.2.2.2.2.5. Snake River below Hells Canyon Dam

The overall thermal regime of the Snake River downstream of Hells Canyon Dam is dominated by the seasonal temperature changes reflecting seasonal climate conditions. Maximum summer temperatures peak between 20 and 25 °C. Summer temperatures are coolest immediately below Hells Canyon Dam but become warmer as the water flows downstream. Releases from Hells Canyon Dam have relatively similar temperatures among years, but local air temperatures increase the variability with distance downstream of the dam. In general, the presence of the HCC tends to moderate the seasonal temperatures in the river. Therefore, summer temperatures in the Snake River downstream of the HCC are cooler than temperatures of inflow to Brownlee Reservoir (Figure 4 in Chapter 1 of Technical Report E.3.1-3). The river downstream of the HCC exhibits slightly delayed fall cooling and delayed spring warming, compared with seasonal changes in the river upstream of the complex.

E.2.2.2.3. Dissolved Oxygen

Physical, chemical, and biological processes control the oxygen content of water. Changes in seasonal water temperatures substantially change the saturation point for DO concentrations in the HCC. The solubility of DO decreases as water temperature increases. More importantly, DO is used during decomposition of organic matter, as well as during respiration by the biological communities.

Generally, DO concentrations in the HCC decrease throughout the summer and early fall, but levels are higher throughout the rest of the year. Although water temperatures can somewhat control DO concentrations, data clearly show that other mechanisms, such as organic matter processing, are controlling concentrations throughout the HCC. There is also a relatively strong longitudinal trend through the HCC: water entering the complex has higher DO concentrations than water leaving the complex. Most of these changes in DO concentrations occur in Brownlee Reservoir.

E.2.2.2.3.1. Brownlee Reservoir

DO is generally higher, up to 18 mg/L, in the riverine zone of Brownlee Reservoir. The supersaturated DO levels (those over 100% saturation) are attributable to extremely high phytoplankton levels—and therefore the photosynthesis occurring during the daylight hours—in the inflowing Snake River and the riverine zone of Brownlee Reservoir. Respiration and decomposition in the riverine zone do not typically result in a demand for oxygen that exceeds the sources.

Areas of the transition zone, however, regularly exhibit hypoxic (< 2 mg/L) and anoxic (< 0.5 mg/L) conditions. Oxygen gradients are apparent in the transition zone, even when the zone does not show thermal stratification. During high-flow years, the transition zone remains oxygenated, while in medium- to low-flow years, extensive and severe hypoxia develops within the transition zone. The lowest DO concentrations typically occur in July. The hypoxic zone generally originates near the bottom of the reservoir, probably caused by sediment oxygen demand, but it can expand to encompass nearly the entire transition zone and at times reach the surface. Fish mortality associated with depressed DO concentrations has been documented for the transition zone of Brownlee Reservoir. However, similar mortalities have not been documented throughout the rest of the HCC.

The most extensive areas of low DO concentrations in Brownlee Reservoir are found in the lacustrine zone, especially during low-flow years. In the thermally stratified lacustrine zone, the hypolimnion and metalimnion become anoxic, while the epilimnion exhibits a wide range of oxygen levels. This structure, described as a clinograde oxygen profile, is typical of eutrophic (nutrient rich) and moderately oligotrophic (nutrient poor) lakes that thermally stratify (Goldman and Horne 1983). Water in the epilimnion generally remains relatively well oxygenated throughout the upper 10 m of the water column, with occasional intrusions of depressed oxygen levels extending to the water surface. These intrusions may be caused by algae die-off, low wind, or upwelling from deeper within the epilimnion. Hypoxia typically originates near the substrate of the transition zone and then progresses downstream along the thermocline to Brownlee Dam. The penstock intakes “pull” metalimnion water from the transition zone to the penstock intakes. This water from the transition zone has high concentrations of organic material and low concentrations of DO. Low DO levels in the hypolimnion occur every year in Brownlee Reservoir. Thermal stratification, which discourages vertical mixing and related reaeration, and sediment oxygen demand contribute to anoxic conditions.

E.2.2.2.3.2. Oxbow Reservoir

Oxygen conditions in Brownlee Reservoir are the controlling factor for DO concentrations in Oxbow Reservoir because nearly 98% of the water flowing into Oxbow Reservoir comes from Brownlee Reservoir (Table 2 in Technical Report E.2.2-1). Oxbow Reservoir consistently shows a relatively small change in horizontal and vertical DO concentrations throughout most of the reservoir, largely because of the relatively low retention time and the lack of regular thermal stratification. These two factors minimize the effects of in-reservoir processes.

As mentioned earlier, the section of Oxbow Reservoir between the penstock intakes and Oxbow Dam has a longer retention time and very different hydrodynamics than the rest of the reservoir. As a result, a clinograde oxygen profile develops: water in the epilimnion is well oxygenated, while conditions are hypoxic or anoxic in the hypolimnion. While more prominent in low-flow years, an oxygen gradient consistently forms in all years.

E.2.2.2.3.3. Oxbow Bypass

DO concentrations were slightly higher near the downstream end of the reach than immediately below Oxbow Dam (Technical Report E.2.3-1). These higher concentrations may be the result of inflows from Indian Creek. This tributary, a stream of moderate gradient, contributes about 5 cfs during base flows. This flow may be enough to elevate DO concentrations during the 100-cfs minimum flows. Photosynthesis within the Oxbow Bypass may also contribute to high surface DO concentrations.

Profiling of the water column showed DO gradients present at a deeper site immediately below Oxbow Dam (Technical Report E.2.3-1). As flows of 1,350 cfs eliminated temperature stratification at this deep-water site, flows of 1,350 cfs increased DO concentrations, which quickly decreased when flows were reduced to 100 cfs.

E.2.2.2.3.4. Hells Canyon Reservoir

Like Oxbow Reservoir, DO concentrations in Hells Canyon Reservoir are strongly influenced by the DO concentration in water released from the Oxbow Powerhouse or Oxbow Dam. DO concentrations remain relatively similar throughout the water column, except in the lower 10 mi of the reservoir. The presence of a weak thermocline immediately upstream of the dam causes a clinograde oxygen profile to develop. Low DO concentrations can occur at depths greater than 50 m. The extent of these conditions increases, in both area and time, during low-flow years.

E.2.2.2.3.5. Snake River below Hells Canyon Dam

DO levels in the Snake River below Hells Canyon Dam are generally saturated. However, the one exception is during late summer and fall when releases from Hells Canyon Dam can exhibit DO levels that are less than saturated. Overall, because of the high turbulence throughout the reach, DO concentrations remain relatively high, even when Hells Canyon Dam is releasing water with low DO levels.

E.2.2.2.4. Total Dissolved Gas

Spilling water at most hydroelectric facilities causes total dissolved gas levels to become supersaturated. These elevated levels often exceed the state standards and may affect aquatic biota. Spilling water at any of the three projects within the HCC can increase total dissolved gas concentrations to supersaturation levels (Technical Report E.2.2-4). Adult steelhead trout (*Oncorhynchus mykiss*) and chinook salmon (*O. tshawytscha*) captured at Hells Canyon Dam have exhibited symptoms of gas bubble disease (Burton 1988a,b; Bertellatti and Young 1990; Snider 1993). Determining the source of gas bubble disease is problematic. However, surveys conducted during times of supersaturation failed to identify any symptoms in juvenile fall chinook (W. Connor, U.S. Fish and Wildlife Service, personal communication). Effects of supersaturation to aquatic biota would be less likely below the Brownlee and Oxbow dams because these locations have deeper areas that may provide more refuge.

E.2.2.2.4.1. Below Hydroelectric Facilities in the Hells Canyon Complex

Total dissolved gas concentrations in the tailraces of both Brownlee and Oxbow dams generally range from 120 to 125% saturation during spill episodes. Little of the dissolved gas is dissipated downstream through Oxbow and Hells Canyon reservoirs. In the tailwater of Hells Canyon Dam, total dissolved gas peaks at about 135% saturation.

E.2.2.2.4.2. Snake River below Hells Canyon Dam

Total dissolved gas supersaturation declines in the Snake River as water flows downstream of Hells Canyon Dam. It dissipates at a rate of about 0.3% saturation per river mile when levels of total dissolved gas exceed 120% saturation in the releases from Hells Canyon Dam. Levels exceeding the 110% criterion (see Table E.2-7) can persist downstream to the confluence with the Snake and Salmon rivers.

E.2.2.2.5. Nutrients

Nutrients are essential to the growth of aquatic plants. Phosphorus is probably the nutrient that limits growth in the HCC. Phosphorus concentrations generally decrease through Brownlee Reservoir, except in the hypolimnion where concentrations of soluble reactive phosphorus increase. Phosphorus concentrations in Oxbow and Hells Canyon reservoirs are remarkably consistent and similar to concentrations in the epilimnion of Brownlee Reservoir's lacustrine zone. Measurements of nitrogen constituents are somewhat more variable, particularly in Oxbow and Hells Canyon reservoirs. All of these nitrogen constituents show decreasing patterns through Brownlee Reservoir, except for ammonia. This constituent increases in the hypolimnion.

E.2.2.2.5.1. Brownlee Reservoir

Longitudinal and vertical distributions of total phosphorus occur throughout the HCC. Although the Snake River inflow to Brownlee Reservoir also has elevated concentrations of total phosphorus, the highest concentrations are generally found in the hypolimnion of Brownlee Reservoir. Of these, the highest concentrations are near the interface between the transition and lacustrine zones, while the lowest are near Brownlee Dam. These distributions indicate that, toward the end of the transition zone, total phosphorus is beginning to settle. These data are corroborated with total phosphorus loadings. Total phosphorus loads decrease through the HCC, with substantially larger loads entering the complex from the Snake River than leaving (Technical Report E.2.2-1). The entire HCC retained total phosphorus ranging from 7 to 42% of inflowing loads, and the majority of the retention occurred in Brownlee Reservoir.

Soluble reactive phosphorus concentrations exhibited smaller longitudinal changes but larger vertical gradients. The lowest concentrations of soluble reactive phosphorus occur in the inflow from the Snake River. These low concentrations are attributed to considerable biological processing (Technical Report E.2.2-1). Concentrations increased slightly from the riverine zone of Brownlee Reservoir through the epilimnion of the lacustrine zone, but they increased substantially with depth in the hypolimnion. Soluble reactive phosphorus loads were greater in water leaving the HCC than in water entering, suggesting that the elevated concentrations in Brownlee Reservoir's hypolimnion may be the source (Technical Report E.2.2-1).

Nitrate concentrations decreased through Brownlee Reservoir, where the concentrations were lowest in the hypolimnion. Conversely, ammonia concentrations were highest in the hypolimnion. The largest export of ammonia appears to be associated with high-flow events, a finding that supports the conclusion that ammonia export is related to the disturbance and resuspension of reservoir sediments.

As mentioned earlier, phosphorus is the nutrient most likely to limit the growth of aquatic plants. This conclusion is indicated by nitrogen-to-phosphorus ratios throughout the HCC.

E.2.2.2.5.2. Oxbow Reservoir

Phosphorus concentrations in Oxbow Reservoir are the same as concentrations in the lacustrine zone of Brownlee Reservoir above the hypolimnion. There are no apparent patterns relative to distance or depth.

Ammonia concentrations are a function of levels being released from Brownlee Dam. Like phosphorus concentrations, ammonia concentrations are relatively uniform throughout Oxbow Reservoir.

E.2.2.2.5.3. Hells Canyon Reservoir

Again, the influence of Brownlee Reservoir on water quality throughout the HCC is evident. Phosphorus concentrations in Hells Canyon Reservoir were nearly identical to those in both Oxbow Reservoir and the metalimnion and epilimnion of Brownlee Reservoir's lacustrine zone.

Like Oxbow Reservoir, Hells Canyon Reservoir does not exhibit longitudinal or vertical gradients for any of the nutrient constituents.

E.2.2.2.6. Organic Matter

Bacterial respiration consumes DO through aerobic and anaerobic degradation of organic matter in both the water column and sediments (Maier et al. 2000). This decay of organic matter is the primary factor in low DO concentrations in Brownlee Reservoir's transition zone (Harrison et al. 1999).

As mentioned earlier, DO concentrations decrease through the HCC. The strong correlation between DO concentrations in releases from Hells Canyon and Brownlee dams indicates that concentrations in Hells Canyon Dam's releases largely result from Brownlee Dam's releases. Therefore, sources of organic matter (identified as total organic carbon and chlorophyll *a* concentration indices) to Brownlee Reservoir are important. The following three mechanisms contribute to organic matter in Brownlee Reservoir's water column:

- Externally produced organic matter delivered to Brownlee Reservoir by the Snake River
- Externally delivered nutrients that stimulate the growth of algae within Brownlee Reservoir
- Internally cycled nutrients from the sediments, which in turn stimulate the growth of algae within Brownlee Reservoir

Most (about 90%) of the organic matter delivered to Brownlee Reservoir either originates externally to the reservoir or is produced in the reservoir from externally delivered nutrients (Harrison et al. 1999).

E.2.2.2.6.1. Externally Produced Organic Matter

Chlorophyll *a* is often used as a surrogate for algal biomass (Carlson 1977) and, therefore, organic matter. Chlorophyll *a* concentrations were elevated in the riverine zone of Brownlee Reservoir. Externally produced loads of organic matter (that is, loads from the Snake River upstream of

Brownlee Reservoir) were estimated to contribute between 58 and 87% of the total organic matter loads to Brownlee Reservoir (Harrison et al. 1999).

E.2.2.2.6.2. Internally Produced Organic Matter

Soluble reactive phosphorus is the form of phosphorus most available for the production of algae. Given the assumption that all available inorganic phosphorus is converted to algal biomass, internally produced organic matter is less than 30% of the annual load.

E.2.2.2.6.2.1. Externally Delivered Nutrients

Nutrients delivered to Brownlee Reservoir from the Snake River and other tributaries contribute to depressed DO conditions. These nutrients prompt the excessive growth of algae and, subsequently, the decay of that organic matter. Soluble reactive phosphorus loads to Brownlee Reservoir are mostly externally derived (Technical Report E.2.2-1). Given the assumption that all available inorganic phosphorus is converted to algal biomass, potential organic matter produced from these loads can be estimated using a ratio of available inorganic phosphorus to organic matter of 1:100. Based on this stoichiometric ratio, the potential organic matter load from externally delivered nutrients is less than 20% of the total load.

E.2.2.2.6.2.2. Internal Nutrient Cycling

Internal nutrient cycling from bottom sediment is a process that occurs in most lakes and reservoirs, and it occurs in Brownlee Reservoir. Although concentrations of soluble reactive phosphorus are highest in the anoxic hypolimnion of the reservoir, anoxic sediments in the riverine and transition zones can also release nutrients into the water column. Therefore, organic matter can be produced and deplete oxygen in the transition zone as a result of internal nutrient cycling. The phosphorus released from sediments in the transition zone was calculated using a typical sediment release rate (Nurnberg 1984). This rate was multiplied by an estimated area of anaerobic sediments above the hypolimnion and then converted to organic matter. The estimated internal load is less than 10% of the total organic matter loads.

E.2.2.2.6.3. Chlorophyll **a** *Concentrations/Phytoplankton Speciation*

Chlorophyll *a* concentrations from surface samples (those from within 0.3 m of the surface) exhibited a distinct longitudinal pattern throughout the HCC. Chlorophyll *a* concentrations decreased from the riverine zone of Brownlee Reservoir downstream to Brownlee Dam. However, throughout Oxbow and Hells Canyon reservoirs, concentrations remained similar to those at Brownlee Dam.

Differences in the magnitude of chlorophyll *a* concentrations and longitudinal patterns were seen among representative high-, medium-, and low-flow years. Lower measurements were seen during years with high flows, and the decreasing longitudinal pattern moving downstream was not as apparent. Chlorophyll *a* concentrations were higher in the riverine and transition zones of Brownlee Reservoir during normal-flow conditions. Measurements taken in the surface waters of Brownlee Reservoir's lacustrine zone were similar to those taken in both Oxbow and Hells Canyon reservoirs, and longitudinal patterns were most pronounced during low-flow conditions. Relatively high concentrations (over 100 micrograms (µg)/L) in the riverine zone of Brownlee Reservoir decreased sharply throughout the transition zone and remained low in the lacustrine zone and throughout the remainder of the HCC.

Surface chlorophyll *a* concentrations are useful for describing longitudinal distributions and comparing concentrations among years. Examining concentrations related to depth also provides a more comprehensive understanding of how algal biomass is distributed. In early March, concentrations were similar at all depths at select sampling locations throughout Brownlee Reservoir, and longitudinal patterns of decreasing concentrations were evident. By early May, concentrations were similar throughout the water column in the riverine zone and decreased with depth in the transition zone. In Brownlee Reservoir's lacustrine zone, chlorophyll *a* concentrations were relatively low at the surface, higher near the bottom of the epilimnion, and decreasing at greater depths. Unlike the surface measurements, longitudinal distributions at depth showed only slight decreases in algal biomass from the transition zone downstream toward Brownlee Dam.

Comparisons of chlorophyll *a* inflow and outflow loads support observations about chlorophyll *a* concentrations. Inflow loads of chlorophyll *a* to Brownlee Reservoir always exceeded outflow loads, coinciding with high concentrations in the riverine zone and relatively low concentrations near the dam. Similarly, differences between inflow and outflow loads for both Oxbow and Hells Canyon reservoirs were negligible, a finding that reflected the relatively uniform chlorophyll *a* concentrations throughout the remainder of HCC. These relatively low loadings in Oxbow and Hells Canyon reservoirs indicate the effect of Brownlee Reservoir outflow on water quality throughout the HCC.

High densities of species in the Chrysophyta division, all of which were diatoms, characterized surface assemblages during spring in all three reservoirs. The most common species was an unidentified *Cyclotella* species. Species composition shifted from spring to summer, resulting in a heavy dominance by Cyanophyta species, which are commonly known as the blue-green species. However, relatively low densities of Chrysophyta and Chlorophyta species characterized Brownlee Reservoir's riverine zone. *Aphanizomenon flos-aquae* was the most abundant blue-green species, making up the majority (> 80%) in all three reservoirs. Most other sample locations remained dominated by Cyanophyta species at 10 m deep, although the densities were lower than at the other sites. Members of the Cyanophyta division are often considered indicators of organic nutrient enrichment.

E.2.2.2.7. Trophic Status

Trophic state classifications were developed to quantitatively and qualitatively compare water bodies. Although these trophic state classes have no absolute meaning, they are generally used to denote the nutrient "status" of a body of water or describe the effects of nutrients on water quality. Carlson (1977) proposed a trophic state classification based on Secchi depth (or water transparency), total phosphorus concentration, and chlorophyll *a* concentration along a continuum from ultra-oligotrophic (nutrient poor) to ultra-hypertrophic (nutrient enriched). Each major division represents a doubling in algal biomass, which is defined by the chlorophyll *a* concentration.

A downward trend in trophic state, meaning an increase in water quality, was evident downstream through the HCC. This trend was most pronounced in Brownlee Reservoir. Inflow to Brownlee Reservoir was characterized as eu-hypertrophic (nutrient rich), while the outflow could more accurately be characterized as meso-eutrophic (middle of the continuum from nutrient rich to nutrient poor) but tending toward eutrophic. However, there was much variability. Trophic state through the remainder of the HCC was relatively consistent with that for outflow from Brownlee Reservoir.

These findings were consistent with criteria established by Vollenweider (1973, cited in USEPA 1986) for areal total phosphorus loads that led to undesirable water quality. Because all three reservoirs exceeded the permissible areal load, they should exhibit water quality traits found in eutrophic bodies of water.

E.2.2.2.8. Metals and Pesticides

Trace elements and organochlorine compounds are not highly soluble in water; instead, they sorb to sediments and accumulate along the bottom. Particle size (the smaller grain sizes have higher surface areas for absorption), therefore, is important in understanding contaminants and is inversely related to their concentrations. Fish species that are bottom oriented probably ingest more sediments or benthic organisms that have been in contact with contaminants than other species do and therefore are likely to have higher levels in their tissues. The Applicant funded two studies related to the presence and bioaccumulation of contaminants in fish and sediments in the HCC (Clark and Maret 1998, CH2M HILL 2000).

E.2.2.2.8.1. Trace Elements in Sediments

Except for chromium and mercury, the concentration of trace elements measured in Brownlee Reservoir generally increased downstream. This pattern coincides with higher percentages of fine material farther downstream. Chromium and mercury concentrations were highest in the riverine zone of Brownlee Reservoir. These elevated concentrations occurred at RM 335, a sampling location where essentially no grain sizes were smaller than fine sand; rather, this location was dominated by coarser-grained material. The heavy, dense, and generally refractory (inert) minerals are typically deposited with the coarser-grained sediments, a situation suggesting that mercury is present either in its native form or as a sulfide (that is, cinnabar [HgS]). Chromium oxide is typically present in refractory minerals with titanium oxide in a mixture commonly called black sands, which are deposited in pockets of coarser-grained sediments, while lighter and less dense particles, particularly silts and clays, are deposited farther downstream.

Because deep-core samples were taken in sections and analyzed, the deepest sample included sediments existing before the HCC was constructed and therefore provided data about preimpoundment conditions. Trace element concentrations in deep-core samples—particularly of arsenic, nickel, and chromium—indicated that there had been little change in the elemental composition of the sediments and that these elements prevail because of the dominant mineralogy in the Snake River basin.

E.2.2.2.8.2. Trace Elements in Aquatic Life

The Canadian Council of Ministers of the Environment (1995) established concentrations for what are known as threshold effect levels and probable effect levels for the protection of benthic life. The threshold effect level concentrations for chromium, arsenic, and mercury were exceeded in the riverine zone of Brownlee Reservoir.[4] In the lacustrine zone, all measured trace elements, except cadmium and lead, exceeded the threshold effect level concentrations. The most numerous exceedances were for arsenic, copper, and nickel. In the deep core samples, arsenic, nickel, and chromium most frequently exceeded the threshold effect level concentrations, while no exceedances were found for cadmium, lead, mercury, and zinc. The U.S. Geological Survey identified not only these trace elements, but also cadmium and zinc near the end of the transition zone.

In general, concentrations of most trace elements were greater in largescale sucker and common carp than in fillets of sportfish (Clark and Maret 1998). However, concentrations of mercury and strontium were generally greater in sportfish fillets. Regardless, none of the mercury concentrations in fillet samples exceeded either the mean international standard of 0.5 µg/gram (g) (Nauen 1983, cited in Clark and Maret 1998) or the U.S. Food and Drug Administration action level of 1.0 µg/g for mercury in edible fish tissue (Nowell and Resek 1994, cited in Clark and Maret 1998). Mercury concentrations in common carp and channel catfish, collected in Brownlee Reservoir at the Burnt River, did, however, slightly exceed the U.S. Environmental Protection

4. Although one sample was intended to capture fine sediment, the elevated chromium and mercury concentrations probably indicated the coarser-grained materials.

Agency (USEPA)-recommended criterion of 0.3 µg/g for the protection of human health (USEPA 2001b). Mercury concentrations in largescale suckers had decreased two-thirds in fish collected in the Snake River at Pittsburg Landing.

E.2.2.2.8.3. Organochlorine Compounds in Sediments

None of the samples of bed sediment from Brownlee Reservoir had detectable concentrations of any organochlorine compounds. However, Clark and Maret (1998) detected p,p′ DDE (a metabolite of DDT, which is a toxic compound formerly used as an insecticide but now banned in the United States). Like trace elements, organochlorine compounds are probably related to the concentration of fine-grained sediment since both trace elements and organochlorine compounds had higher concentrations in the same area.

E.2.2.2.8.4. Organochlorine Compounds in Aquatic Life

The only organochlorine compound with a concentration that exceeded the probable effect level concentrations established by the Canadian Council of Ministers of the Environment (1995) in Brownlee Reservoir was also p,p′ DDE. However, fish tissue contained detectable concentrations of 12 organochlorine compounds or metabolites of the organochlorine compounds (Clark and Maret 1998). All fish tissue samples contained DDT and/or a DDT metabolite. For Brownlee Reservoir, total DDT concentrations in largescale sucker and common carp and in fillets from channel catfish exceeded the criterion of 200 µg/kilogram (kg) established by the New York Department of Environmental Conservation for the protection of fish-eating wildlife (Newell et al. 1987, cited in Clark and Maret 1998). Total PCBs (a family of highly toxic compounds that have been banned in the United States) also exceeded the fish-eating wildlife criterion of 110 µg/kg in common carp from Brownlee Reservoir. Concentrations of total DDT in all fish and dieldrin (also an insecticide) in largescale sucker, common carp, and channel catfish in Brownlee Reservoir, and probably largescale sucker in the Snake River at Pittsburg Landing, exceeded a cancer-risk screening value of 10^{-6} established by the USEPA (Nowell and Resek 1994, cited in Clark and Maret 1998). However, none of the concentrations of organochlorine compounds in sportfish fillets exceeded U.S. Food and Drug Administration action levels set for the human consumption of fish.

E.2.2.2.9. Conditions Relative to Standards

Because the Snake River running through the HCC is boundary water for Idaho and Oregon, water quality standards and criteria of both states apply. As part of efforts to develop the draft TMDL, the respective state regulatory agencies assessed standards and criteria from both states and formulated one set of targets that satisfied the requirements of both (Table E.2-7). These targets are designed to protect the designated uses. Coldwater biota and salmonid rearing are among the current designated uses within the HCC (Table E.2-5 and Table E.2-6); however, the states determined that, generally, criteria for coolwater biota would apply (IDEQ and ODEQ 2001). Downstream of the HCC, criteria for coldwater biota and salmonid spawning and rearing apply.

E.2.2.2.9.1. Temperature

The temperature criterion of 17.8 °C applies to the waters of the HCC (IDEQ and ODEQ 2001). This criterion applies to the seven-day moving average of the daily maximum temperatures. In addition, human activities are not permitted to increase temperatures measurably. An instantaneous measurement greater than 13 °C or an average daily measurement greater than 9 °C applies downstream of the HCC when and where salmonids are spawning. Narrative criteria also apply, criteria that are based on effects of temperature on biological communities.

E.2.2.2.9.1.1. Temperatures in the Reservoirs

Instantaneous measurements were taken throughout the HCC, and temperatures were found to exceed the 17.8 °C criterion in each of the reservoirs. The frequency with which in-reservoir temperature measurements exceeded the criterion varied in Oxbow and Hells Canyon reservoirs and by zone in Brownlee Reservoir. During summer, temperatures of inflowing water (based on data in the riverine zone) generally exceeded the criterion at the highest annual percentage, while temperatures in the hypolimnion zone were always below the criterion. The most notable trend in temperature exceedances occurs during high-flow years when exceedances are much more widespread and longer in duration. During high-flow years, water temperatures in the lacustrine zone exceed the criterion at about twice the rate as in either low- or medium-flow years.

E.2.2.2.9.1.2. Tailwater Temperatures

Temperature data were measured in the tailwaters of Brownlee and Oxbow dams and in the penstock for Hells Canyon Dam. The 17.8 °C criterion was exceeded below each of the facilities. However, exceedances below Hells Canyon Dam were less frequent during the period for fall chinook salmon spawning and egg incubation (October 24 to May 10) than exceedances of Brownlee Reservoir inflow temperatures (Table E.2-8).

E.2.2.2.9.2. Dissolved Oxygen

DO criteria apply differently in the HCC depending both on the aquatic organisms present and location. Coolwater biota criterion of 6.5 mg/L applies in the reservoirs unless continuous data are available to allow assessment of multiple criteria, such as a 7-day or 30-day mean (IDEQ and ODEQ 2001). Because the in-reservoir DO data were not sufficient for estimating a moving average, the 6.5-mg/L minimum was used for analyses. Additionally, in reservoirs that stratify, hypolimnetic waters are excluded. For the Hells Canyon Dam releases and the Snake River below Hells Canyon Dam, where criteria for coldwater biota apply, the DO standard is 8.0 mg/L between May 11 and October 23 and 11.0 mg/L during the rest of the year, that is, the spawning period for fall chinook salmon. DO data collected at 10-minute intervals in the penstock for Hells Canyon Dam were compared to identify the most conservative of the three criteria. Narrative criteria also apply to DO.

E.2.2.2.9.2.1. Dissolved Oxygen in the Reservoirs

Instantaneous DO measurements taken throughout the HCC were compared with the coolwater instantaneous minimum criterion of 6.5 mg/L. About 55% of the measurements in Brownlee Reservoir were below the standard. Similar cumulative frequency curves showed that, except for the hypolimnion, Brownlee Reservoir’s metalimnion had the highest number of measurements below the standard. DO concentrations less than 6.5 mg/L were more frequent during low- and medium-flow years in Brownlee Reservoir than in high-flow years, but these low concentrations were less frequent in Brownlee Reservoir than in either Oxbow or Hells Canyon reservoirs during high-flow years. The riverine and transition zones in Brownlee Reservoir exhibit notably higher percentages of low DO concentrations during low-flow years.

E.2.2.2.9.2.2. Tailwater Dissolved Oxygen

Tailwater DO measurements were also compared with the 6.5-mg/L minimum criterion. As for in-reservoir measures for Brownlee Reservoir, DO concentrations were higher during high-flow years than during low- or medium-flow years in the waters below Brownlee Dam. This trend, however, was not apparent in either Oxbow or Hells Canyon reservoirs. In general, DO levels were below the criterion from about mid-June through mid-November.

Waters passing through Hells Canyon Dam are below draft TMDL targets for 58% of the days in the high-flow year of 1997, and 98% of the lower flow years of 1991 and 1993. However, measurements of DO concentrations show that the water is reaerated relatively rapidly as it moves downstream. In September, DO concentrations in Hells Canyon Dam releases are typically 4.0 mg/L, but they rise to over 6.0 mg/L within about 10 mi downstream.

E.2.2.2.9.3. Total Dissolved Gas

Total dissolved gas is not to exceed 110% saturation (IDEQ and ODEQ 2001). Measurements indicated that Brownlee Reservoir complied with this standard (Technical Report E.2.2-4). However, elevated levels of total dissolved gas in the Brownlee Dam releases dissipate very little through the remainder of the HCC, resulting in total dissolved gas saturation levels that exceed 110% in Oxbow and Hells Canyon reservoirs whenever water is spilled at Brownlee Dam.

Noncompliance with the 110% saturation level for total dissolved gas is also evident below Hells Canyon Dam during spill rates over 2,500 cfs and occasionally at spill rates less than 2,500 cfs (Technical Report E.2.2-4). Generally, levels again comply with the standard by the confluence with the Salmon and Snake rivers about 60 mi downstream.

E.2.2.2.9.4. pH

Acidity or alkalinity is measured by the hydrogen ion concentration (pH) in water. A pH value of 7.0 is neutral, with values from 0 to 7.0 being acidic and from 7.0 to 14.0 being alkaline. Extremely acidic or alkaline waters can be toxic to aquatic life. Even at less extreme levels, acidic or alkaline conditions can cause chemical shifts in a system. In acidic conditions, these shifts can lead to the release of metallic compounds from sediments. In alkaline conditions, they can lead to the increased release of ammonia and possible toxicity and the increased release of sorbed phosphorus. A pH range of 7.0 to 9.0 has been established to limit potential toxicity to designated uses associated with aquatic life (IDEQ and ODEQ 2001).

More than 90% of the measured pH concentrations were within the range established to protect aquatic life. When exceedances existed, alkaline conditions were more common than acidic conditions and occurred most frequently from March through October. These exceedances were most frequent (about 10% of the time) in the riverine zone of Brownlee Reservoir. The other waters of the HCC did not exceed the standard in more than 10% of the measurements (85% of the values below 7 were at depths of 5 m or greater, and values above 9 can occur at any depth).

E.2.2.2.9.5. Ammonia

Ammonia standards are a function of temperature and pH. Acceptable limits are higher under cooler temperatures and lower pH levels. All of the ammonia concentrations for Oxbow and Hells Canyon reservoirs were within the limits of criteria for coldwater biota. Only in Brownlee Reservoir were ammonia concentrations found that exceeded 1.0 mg/L. Ammonia concentrations above 1.0 mg/L generally occur in deeper water that is cooler. The total ammonia data, when adjusted to un-ionized levels, indicated that chronic ammonia could be exceeded when pH and temperatures are higher.

E.2.3. Measures Recommended by the Agencies

To consolidate measures, the Applicant has included measures recommended by the agencies in section E.2.4.3. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.2.4. Applicant's Existing and Proposed Measures

E.2.4.1. Existing Measures to Be Continued

The Applicant proposes to continue three existing measures: passing 100 cfs of minimum flow through the Oxbow Bypass, disposing of wastes associated with recreational use of the HCC, and preferentially using the upper spillgates at Brownlee Dam during periods of spill. These measures are described in the following paragraphs.

The Applicant is currently required to pass 100 cfs through the Oxbow Dam spillway, in part to maintain water quality in the Oxbow Bypass. While the Applicant's study of water quality conditions within the Oxbow Bypass shows that standards are not always met, the study also found that most of the water quality degradation is caused by degraded conditions upstream (Technical Report E.2.3-1). Specifically, water temperatures and DO levels fall outside the standards for coldwater biota before the water enters the Oxbow Bypass. The Applicant's proposed operation of the Oxbow Project includes continuing to pass minimum flows of 100 cfs through Oxbow Dam and the Oxbow Bypass.

The Applicant provides and maintains on-site wastewater treatment systems at all of the Applicant's developed parks associated with the HCC. These systems prevent waste from contaminating the river. Also, during camping season, the Applicant pays for portable toilets and trash pickup at undeveloped sites on all three reservoirs. The sanitary waste from the portable toilets is collected and disposed of at municipal treatment plants to ensure that the river is not contaminated. In addition, the Applicant has contributed to the construction of centralized fish-cleaning stations at boat ramps on Brownlee Reservoir and built a fish-cleaning station at Woodhead Park. These stations help prevent fish wastes from being delivered to the reservoirs.

The Applicant has found that spilling water from the upper spillgates at Brownlee Dam may help minimize elevated total dissolved gas levels during periods of spill (Technical Report E.2.2-4). The Applicant proposes to continue to preferentially spill water through the upper spillgates whenever practical. Continuing this practice should help minimize total dissolved gas levels in both Oxbow and Hells Canyon reservoirs, and, therefore, minimize the potential for negative effects associated with elevated total dissolved gas supersaturation during periods of spill.

E.2.4.2. New Measures Proposed by the Applicant

The Applicant proposes four measures. Three of these measures—aerating Brownlee Reservoir, venting turbines for units 1 through 4 at the Brownlee Project, and venting for unit 5 at the

Brownlee Project—are proposed to increase DO levels. The fourth measure—installing flow deflectors in the Hells Canyon Dam spillway—is proposed to decrease total dissolved gas levels. These measures are described in the following sections.

E.2.4.2.1. Brownlee Reservoir Aeration

Justification

Currently, DO levels in Brownlee Reservoir do not always meet the Idaho and Oregon water quality standards. Nor are they adequate to support all designated beneficial uses (Technical Report E.2.2-2). DO in Brownlee Reservoir can become severely degraded, especially during summer, a condition that has occasionally caused fish mortality. The low DO levels are attributable to in-reservoir processing of inflows with severely degraded water quality. In the draft TMDL process, the ODEQ and IDEQ have determined through their analyses that, even if water flowing into Brownlee Reservoir met the draft TMDL targets, oxygen levels in Brownlee Reservoir may not meet the oxygen target for some areas of the reservoir. The substandard oxygen levels in Brownlee Reservoir that are expected to remain after the water quality of inflows meets the draft TMDL targets have been allocated to the Applicant.

Pollutant load targets identified in the draft TMDL would substantially reduce watershed-source pollutants and result in improved conditions to water quality flowing into Brownlee Reservoir and throughout the HCC. Conditions likely to occur after substantial modifications have been made to the system are highly uncertain. Despite this uncertainty, improvements to the existing severely degraded condition of inflowing water would undoubtedly improve DO conditions throughout the complex. In fact, water quality modeling simulations undertaken by the Applicant during the relicensing process indicate that improvement of inflowing water alone would probably not result in oxygen targets being met in Brownlee Reservoir.

Goal

The goal of this measure is to implement actions that, along with the implementation of other draft TMDL load allocations, would improve oxygen conditions within the HCC so that they meet the appropriate Oregon and Idaho standards. Both the ODEQ and IDEQ have determined through their analyses in the draft TMDL process that reductions in inflowing nutrient and organic matter, along with the Applicant's proposed level of aeration, should lead to compliance with DO targets for Brownlee Reservoir.

Description

The Applicant proposes to supplement DO by 1,450 tons annually into Brownlee Reservoir. The Applicant's proposed method of introducing the oxygen into Brownlee Reservoir is by injecting it into the transition zone or the upstream end of the lacustrine zone. Additional details regarding reservoir oxygen injection systems are presented in section 5.15.1.7. of Technical Report E.2.2-2. The Applicant recognizes that there is significant uncertainty associated with identifying specific design features of, and understanding the reservoir response to, this measure at this time. Because of this uncertainty, the Applicant proposes that the specific details regarding design, location, and operation, as well as a plan for monitoring effectiveness, be developed through consultation with ODEQ and IDEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of the relicensing process.

Associated Benefits

Increasing DO levels in Brownlee Reservoir would benefit habitat in the reservoir for all aquatic species. In particular, poor DO conditions in the transition zone of Brownlee Reservoir have been identified as potentially limiting for survival of the white sturgeon population in the river from Brownlee Dam upstream to Swan Falls Dam (Chapter 3 of Technical Report E.3.1-6). Reservoir oxygen injection may also increase oxygen levels in deeper parts of the reservoir where aerated cool water could provide summer refuge habitat for coldwater fish, such as trout, and may reduce internal loading of phosphorus, ammonia, and metals. In addition, since current low DO levels in Brownlee Reservoir pass downstream, resulting in low DO levels in Oxbow and Hells Canyon reservoirs, aeration in Brownlee Reservoir could also improve DO levels downstream. The extent of associated benefits would depend on the timing and magnitude of water quality improvements to inflowing water.

E.2.4.2.2. Brownlee Powerhouse Units 1 through 4 Turbine Venting

Justification

DO conditions in Brownlee, Oxbow, and Hells Canyon reservoirs, at times, result in water with low DO levels being released from the dams associated with those reservoirs. These low DO conditions may result in habitat conditions that are less than optimal for fish species in Oxbow and Hells Canyon reservoirs, as well as in a short reach of the Snake River downstream of Hells Canyon Dam (Technical Report E.3.1-1). While implementing the draft TMDL should significantly improve DO levels in releases from all three reservoirs, it is difficult to predict the precise oxygen levels that may result from those measures. Because of this uncertainty, the Applicant also proposes turbine venting as a measure to improve DO levels.

Goal

The goal of this measure, when implemented along with all other proposed measures for improving oxygen levels, is to enhance oxygen levels in the waters below Hells Canyon Dam.

Description

The Applicant proposes to install and operate turbine-venting systems in units 1 through 4 at the Brownlee Project. Preliminary feasibility analyses conducted by the Applicant (Technical Report E.2.2-2) indicate that a passive aeration system using the existing turbine vacuum breaker system could aerate releases from units 1 through 4 of the Brownlee Powerhouse. Turbines at this project are Francis-type units with a vacuum breaker system that prevents damaging vacuum pressures from occurring during sudden closures of the wicket gates. Under certain operating conditions, the vacuum breaker system is designed to admit atmospheric air to each unit. This measure may include modifications to the units such as hub baffles or piping alterations to increase the amount of air admitted by the vacuum breaker system during operation and thereby increase DO levels downstream of Brownlee Dam.

The Applicant proposes that specific details regarding design and operation, as well as an effectiveness monitoring plan, be developed through consultation with the ODEQ and IDEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of the relicensing process for the HCC.

Associated Benefits

Increasing DO levels in releases from Brownlee Dam would benefit DO in Oxbow and Hells Canyon reservoirs and also in the Snake River immediately downstream of Hells Canyon Dam. The extent and magnitude of associated benefits would partly depend on the effectiveness of draft TMDL efforts implemented upstream and other Applicant-proposed measures for supplementing oxygen.

E.2.4.2.3. Brownlee Powerhouse Unit 5 Turbine Venting

Justification

DO conditions in Brownlee, Oxbow, and Hells Canyon reservoirs, at times, result in water with low DO levels being released from the dams associated with those reservoirs. These low DO conditions may result in habitat conditions that are less than optimal for fish species in Oxbow and Hells Canyon reservoirs, as well as in a short reach of the Snake River downstream of Hells Canyon Dam (Technical Report E.3.1-1). While implementing the draft TMDL should significantly improve DO levels in releases from all three reservoirs, predicting the precise oxygen levels that may result from those measures is difficult. Because of this uncertainty, the Applicant also proposes turbine venting in an effort to provide reasonable assurances that waters below the project achieve current water quality standards.

Goal

The goal of this measure, when implemented along with all other proposed measures for improving oxygen levels, is to enhance oxygen levels in the waters below Hells Canyon Dam.

Description

The Applicant proposes to investigate, and install and operate if practical, a system to inject oxygen or atmospheric air into water passing through unit 5 at the Brownlee Project. Because of the physical layout of unit 5 with respect to tailwater elevations, a passive oxygen introduction system similar to that proposed for units 1 through 4 for aeration is probably not possible for unit 5. The unit 5 venting system would probably require blowers or compressors to deliver atmospheric air or oxygen to water passing through the unit. Oxygen uptake would vary depending on flow, wicket gate settings, tailwater elevation, and initial DO conditions in the water. The Applicant proposes pilot tests to perform a feasibility analysis prior to developing specific details regarding design and operation. If the oxygen injection system for unit 5 is found to be feasible, the Applicant proposes that an effectiveness monitoring plan be developed through consultation with the ODEQ and IDEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of the relicensing process for the HCC.

Associated Benefits

Increasing DO levels in releases from Brownlee Dam would benefit DO in Oxbow and Hells Canyon reservoirs and also in the Snake River immediately downstream of Hells Canyon Dam. The extent and magnitude of associated benefits would partly depend on the effectiveness of draft TMDL efforts implemented upstream and other Applicant-proposed measures for supplementing oxygen.

E.2.4.2.4. Hells Canyon Dam Spillway Flow Deflectors

Justification

Total dissolved gas conditions in the releases from Hells Canyon Dam meet neither the Idaho nor the Oregon standard for total dissolved gas during spills in excess of approximately 2,500 cfs (Technical Report E.2.2-4). Spill typically occurs between late winter and early summer in years of average to above-average runoff. Spill at Hells Canyon may also occur during a unit outage. When Hells Canyon Dam is spilling water and thereby elevating total dissolved gas levels, potentially harmful levels can persist in the river for up to 60 mi downstream. Hells Canyon Dam is not unique in its tendency to elevate total dissolved gas levels during spill. At other dams throughout the Northwest, flow deflectors have been used in spillways to manage total dissolved gas levels.

Goal

The goal of this measure is to reduce total dissolved gas levels in the tailrace of Hells Canyon Dam and the Snake River downstream of the dam.

Description

The Applicant proposes to install flow deflectors on the Hells Canyon Dam spillway; these flow deflectors would be consistent with the conceptual design presented in Technical Report E.2.2-4. The flow deflector's function would be to alter the flow characteristics from the spillway to reduce air entrainment deep in the Hells Canyon Dam tailrace during spill episodes up to approximately 30,000 cfs. The altered flow characteristics should result in total dissolved gas levels in the tailrace that are lower than they are during current spill episodes without the flow deflectors. The Applicant proposes that a schedule for constructing and installing the flow deflectors, as well as an effectiveness monitoring plan, be developed through consultation with the ODEQ and IDEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of the relicensing process for the HCC.

Associated Benefits

Decreasing total dissolved gas levels in the spill at Hells Canyon Dam would reduce potential effects to all aquatic species in the Snake River downstream to its confluence with the Salmon River. The habitat benefit would be greatest for those species that occupy habitats less than 2 m deep.

E.2.4.3. Measures Recommended by the Agencies

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.2.4.3.1. Accepted or Conditionally Accepted Measures or Facilities

Bureau of Land Management comment letter, dated January 9, 2003

BLM3-46

> The BLM should recommend that the applicant modify the Hells Canyon, Oxbow, and . Brownlee dams to meet the 110% state standard.

Response

The Applicant accepts the recommendation that it should modify Hells Canyon Dam to meet the state standard. Structural modification of Hells Canyon Dam was accepted and is proposed (section E.2.4.2.4.).

E.2.4.3.2. Rejected Measures or Facilities and Explanations for Rejection

Bureau of Land Management comment letter, dated January 9, 2003

BLM3-46

> The BLM should recommend that the applicant modify the Hells Canyon, Oxbow, and . Brownlee dams to meet the 110% state standard.

Response

The Applicant rejects the recommendation that it should modify Oxbow and Brownlee dams to meet the 110% of standard. Structural modification of Oxbow and Brownlee dams was rejected for several reasons. First, TDG conditions during spill with the current structure of Oxbow and Brownlee dams are not known to result in negative impacts. There is no site-specific evidence that current TDG conditions resulting from spill at Brownlee or Oxbow dams are having a negative effect on biota downstream of Brownlee Dam. The prevalence of large areas of habitat in both Oxbow and Hells Canyon reservoirs where elevated TDG levels would be depth-compensated are important site-specific considerations in evaluating the effects of elevated TDG. Additionally, dam modifications could increase the potential for downstream erosion. Increased downstream erosion potential creates increased potential for damage to the highway bridge below Brownlee Dam, as well as to downstream boat-launching facilities.

National Marine Fisheries Service comment letter, dated January 9, 2003
NMFS1-14

> We recommend that IPC expand this program by locating two permanent water quality/flow monitoring stations downstream of Hells Canyon Dam and upstream of Brownlee Reservoir.

Response

The Applicant rejects the NOAA Fisheries (previously known as the National Marine Fisheries Service) recommendation to expand its monitoring program by locating two permanent water quality/flow-monitoring stations downstream of Hells Canyon Dam and upstream of Brownlee Reservoir. Flow-monitoring stations already exist immediately below Hells Canyon Dam and upstream of Brownlee Reservoir near Weiser, Idaho. The Applicant has proposed developing water quality monitoring plans relative to its proposed PM&E measures. The NOAA Fisheries recommendation proposes to expand the Applicant's monitoring beyond the scope of its responsibilities.

NOAA Fisheries comments at the joint agency meeting, held March 5 and 6, 2003

Recommended selective temperature withdrawal for Brownlee Reservoir

Response

The Applicant rejects the NOAA Fisheries (previously referred to as NMFS) recommendation to install a selective withdrawal system for Brownlee Reservoir. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way to address the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

U.S. Forest Service comments at the joint agency meeting, held March 5 and 6, 2003

Recommended six additional operational scenarios

Response

The Applicant rejected this recommendation because it was an additional study request, not a PM&E recommendation.

Idaho Department of Fish and Game comments at the joint agency meeting, held March 5 and 6, 2003

Recommended multilevel temperature-control structure for Brownlee Reservoir

Response

The Applicant rejects the IDFG recommendation to install a selective withdrawal system for Brownlee Reservoir. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way to address the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

Confederated Tribes of the Umatilla Indian Reservation comment letter, dated January 10, 2003

CTU1-27

> To better meet water quality standards and protect designated beneficial uses, the CTUIR recommends that IPC (1) install a selective withdrawal system on Brownlee Reservoir to provide suitable temperatures at appropriate times to aid migrating adult and juvenile anadromous fish; (2) install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone and other reservoirs as necessary; (3) install a flow deflector on Brownlee Dam spillway to reduce total dissolved gas in the tailrace; (4), implement higher minimum flows in Oxbow Reservoir to achieve temperature and dissolved oxygen targets; (5) install flow deflectors on the Hells Canyon Dam spillway; and (6) shape and provide flows in coordination with federal project managers from upriver storage facilities.

Response

The Applicant rejects the CTUIR recommendation to install a selective withdrawal system for Brownlee Reservoir. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way of addressing the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

The Applicant rejects the CTUIR recommendation to install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone, and other reservoirs as necessary. The Applicant contends that its proposal to aerate the transition zone of Brownlee Reservoir is adequate and appropriate. The CTUIR recommendation includes measures to deal with oxygen issues that are already being addressed in the draft Snake River–Hells Canyon TMDL. The draft Snake River-Hells Canyon TMDL is a comprehensive plan developed by Oregon and Idaho to address water quality issues throughout the HCC on a watershed basis. In the draft Snake River-Hells Canyon TMDL, Oregon and Idaho determined that if inflowing water to Brownlee Reservoir met standards, dissolved oxygen levels in the epilimnion and hypolimnion of Brownlee Reservoir would be compliant.

The Applicant rejects the CTUIR recommendation to install a flow deflector on the Brownlee Dam spillway and implement higher minimum flows in Oxbow Reservoir. Installation of flow deflectors on Brownlee Dam is not justified for several reasons. First, elevated TDG levels occur relatively infrequently. Second, most of the habitat in Oxbow and Hells Canyon reservoirs has adequate depth to compensate for elevated TDG levels. Third, because of downstream structures such as the highway bridge, there is a relatively high level of concern and risk associated with increased downstream erosion potential. Finally, no site-specific data or anecdotal information exists to support the claim that elevated TDG levels are having a negative effect on biota.

The Applicant rejects the CTUIR recommendation to shape and provide flows from upriver storage projects. Shaping and providing flows in an effort to mitigate impacts from federal projects is not the responsibility of the Applicant.

Nez Perce Tribe comment letter, dated January 10, 2003

NPT1-13

> "*Water Quality Measures*—Additional measures should be implemented by the Applicant to meet water quality standards and protect designated beneficial uses: (1) address water quality impacts of the Project, including installation of a selective withdrawal system on Brownlee Reservoir to provide suitable temperatures at the appropriate times to aid adult and juvenile anadromous fish; (2) install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone and other reservoirs as necessary; (3) install a flow deflector on Brownlee Dam spillway to reduce total dissolved gas in the tailrace of Brownlee Dam; and implement higher minimum flows in Oxbow Reservoir to achieve temperature and dissolved oxygen targets; and (4) shape and provide flows (in coordination with federal Adaptive Management Process) from upriver storage projects.

Response

The Applicant rejects the Nez Perce Tribe's recommendation to install a selective withdrawal system on Brownlee Reservoir to provide suitable temperatures at the appropriate times to aid adult and juvenile anadromous fish. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir did. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way of addressing the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

The Applicant rejects the Nez Perce Tribe's recommendation to install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone, and other reservoirs as necessary. The Applicant contends that its proposal to aerate the transition zone of Brownlee Reservoir is adequate and appropriate. The Nez Perce Tribe's recommendation includes measures to deal with oxygen issues that are already being addressed in the draft

Snake River–Hells Canyon TMDL. The draft Snake River–Hells Canyon TMDL is a comprehensive plan developed by Oregon and Idaho to address water quality issues throughout the HCC on a watershed basis. In the draft Snake River–Hells Canyon TMDL, Oregon and Idaho determined that if inflowing water to Brownlee Reservoir met standards, dissolved oxygen levels in the epilimnion and hypolimnion of Brownlee Reservoir would be compliant.

The Applicant rejects the Nez Perce Tribe's recommendation to install a flow deflector on the Brownlee Dam spillway and implement higher minimum flows in Oxbow Reservoir. Installation of flow deflectors on Brownlee Dam is not justified for several reasons. First, elevated TDG levels occur relatively infrequently. Second, most of the habitat in Oxbow and Hells Canyon reservoirs has adequate depth to compensate for elevated TDG levels. Third, because of downstream structures such as the highway bridge, there is a relatively high level of concern and risk associated with increased downstream erosion potential. Finally, no site-specific data or anecdotal information exists to support the claim that elevated TDG levels are having a negative effect on biota.

The Applicant rejects the Nez Perce Tribe's recommendation to shape and provide flows from upriver storage projects. Shaping and providing flows in an effort to mitigate impacts from federal projects is not the responsibility of the Applicant.

NPT1-65

> The Tribe recommends the following to meet water quality standards and protect designated beneficial uses: (1) install a selective withdrawal system on Brownlee Reservoir to provide suitable water temperatures at the appropriate times to aid adult and juvenile anadromous fish; (2) install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone and other reservoirs as necessary; (3) install a flow deflector on Brownlee Dam spillway to reduce total dissolved gas in the tailrace of Brownlee Dam; and implement higher minimum flows in Oxbow Reservoir to achieve temperature and dissolved oxygen targets; and (4) shape and provide flows (in coordination with the federal Adaptive Management Process) from upriver storage projects.

Response

The Applicant rejects the Nez Perce Tribe's recommendation to install a selective withdrawal system on Brownlee Reservoir to provide suitable temperatures at the appropriate times to aid adult and juvenile anadromous fish. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way of addressing the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

The Applicant rejects the Nez Perce Tribe's recommendation to install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone, and other reservoirs as necessary. The Applicant contends that its proposal to aerate the transition zone of Brownlee Reservoir is adequate and appropriate. The Nez Perce Tribe's recommendation includes measures to deal with oxygen issues that are already being addressed in the draft Snake River–Hells Canyon TMDL. The draft Snake River–Hells Canyon TMDL is a comprehensive plan developed by Oregon and Idaho to address water quality issues throughout the HCC on a watershed basis. In the draft Snake River–Hells Canyon TMDL, Oregon and Idaho determined that if inflowing water to Brownlee Reservoir met standards, dissolved oxygen levels in the epilimnion and hypolimnion of Brownlee Reservoir would be compliant.

The Applicant rejects the Nez Perce Tribe's recommendation to install a flow deflector on the Brownlee Dam spillway and implement higher minimum flows in Oxbow Reservoir. Installation of flow deflectors on Brownlee Dam is not justified for several reasons. First, elevated TDG levels occur relatively infrequently. Second, most of the habitat in Oxbow and Hells Canyon reservoirs has adequate depth to compensate for elevated TDG levels. Third, because of downstream structures such as the highway bridge, there is a relatively high level of concern and risk associated with increased downstream erosion potential. Finally, no site-specific data or anecdotal information exists to support the claim that elevated TDG levels are having a negative effect on biota.

The Applicant rejects the Nez Perce Tribe's recommendation to shape and provide flows from upriver storage projects. Shaping and providing flows in an effort to mitigate impacts from federal projects is not the responsibility of the Applicant.

NPT1-68

> The Tribe supports Brownlee Reservoir aeration in general but we believe that the hypolimnion requires direct oxygenation to meet the DO standard and protect white sturgeon. Further, the Applicant does not provide sufficient detail regarding how, when and where they will implement the Brownlee Reservoir Aeration PM&E. This is unfortunate given the final license is due July 2003, less than seven months away. The Tribe urges the Applicant to work quickly and collaboratively with the Tribe and other agencies to finalize and implement this proposal.

Response

The Applicant rejects the Nez Perce Tribe's recommendation to install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone, and other reservoirs as necessary. The Applicant contends that its proposal to aerate the transition zone of Brownlee Reservoir is adequate and appropriate. The Nez Perce Tribe's recommendation includes measures to deal with oxygen issues that are already being addressed in the draft Snake River–Hells Canyon TMDL. The draft Snake River–Hells Canyon TMDL is a comprehensive plan developed by Oregon and Idaho to address water quality issues throughout the HCC on a watershed basis. In the draft Snake River–Hells Canyon TMDL, Oregon and Idaho determined that if inflowing water to Brownlee Reservoir met standards, dissolved oxygen levels in the epilimnion and hypolimnion of Brownlee Reservoir would be compliant.

NPT1-144

3. Evaluation and implementation of selective withdrawal studies at Brownlee Dam.

Response

The Applicant rejects the Nez Perce Tribe’s recommendation to install a selective withdrawal system on Brownlee Reservoir to provide suitable temperatures at the appropriate times to aid adult and juvenile anadromous fish. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way of addressing the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

Nez Perce Tribe comments at the joint agency meeting, held March 5 and 6, 2003

Recommended multilevel temperature-control structure for Brownlee Reservoir

Response

The Applicant rejects the Nez Perce Tribe’s recommendation to install a selective withdrawal system on Brownlee Reservoir to provide suitable temperatures at the appropriate times to aid adult and juvenile anadromous fish. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. Furthermore, there is no evidence to suggest that the existing temperature regime in the reach below Hells Canyon Dam is having a noticeable adverse effect on anadromous fish.See prior comment. If temperature becomes an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way of addressing the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

> Recommended dissolved oxygen additions and flow deflectors for Brownlee and Oxbow reservoirs

Response

The Applicant rejects the Nez Perce Tribe's recommendation to install an oxygenation system for aerating the hypolimnion of Brownlee Reservoir, the epilimnion of the transition zone, and other reservoirs as necessary. The Applicant contends that its proposal to aerate the transition zone of Brownlee Reservoir is adequate and appropriate. The Nez Perce Tribe's recommendation includes measures to deal with oxygen issues that are already being addressed in the draft Snake River–Hells Canyon TMDL. The draft Snake River–Hells Canyon TMDL is a comprehensive plan developed by Oregon and Idaho to address water quality issues throughout the HCC on a watershed basis. In the draft Snake River–Hells Canyon TMDL, Oregon and Idaho determined that if inflowing water to Brownlee Reservoir met standards, dissolved oxygen levels in the epilimnion and hypolimnion of Brownlee Reservoir would be compliant.

The Applicant also rejects the Nez Perce Tribe's recommendation to install flow deflectors on Brownlee and Oxbow dams. Installation of flow deflectors on Brownlee and Oxbow dams is not justified for several reasons. First, elevated TDG levels occur relatively infrequently. Second, most of the habitat in Oxbow and Hells Canyon reservoirs has adequate depth to compensate for elevated TDG levels. Third, because of downstream structures such as the highway bridge, there is a relatively high level of concern and risk associated with increased downstream erosion potential. Finally, no site-specific data or anecdotal information exists to support the claim that elevated TDG levels are having a negative effect on biota.

Recommended sediment augmentation

Response

The Applicant does not believe it is appropriate for the Applicant to implement sediment augmentation to Hells Canyon for several reasons. In the case of spawning-size gravels (25–152 mm), evidence shows that these materials are and have always been of local origin. Also, no sediments in this size range were found in Brownlee Reservoir during the physical sampling. And finally, there is no evidence that spawning areas in Hells Canyon are being eroded, and calculations indicate that they are generally stable. For more information about sediments, see Appendix 4, section 5, in the Consultation Appendix, section VII.

In the case of sand-size materials, while some sand-size sediments were found in Brownlee Reservoir, the majority of them were smaller than the majority of sediments that constitute the sandbars found in Hells Canyon. The majority of sand-size sediments trapped in Brownlee Reservoir are also smaller than the majority of sizes found in sandbars formed before the HCC was constructed. The sediments composing sandbars in the Hells Canyon reach are 50 to 85% of Idaho Batholith origin. The Idaho Batholith was cut off as a source of sediment supply prior to construction of the HCC. For additional discussion on these points, see Appendix 4, sections 1 and 13, in the Consultation Appendix, section VII. Also, it is not known, nor is information available to determine, what the stable frequency and size (or dynamic range of sizes) of sandbars were in Hells Canyon prior to construction of the HCC. There is information indicating that sandbars were smaller pre-HCC than in 1964 (the year used by Grams and Schmidt in Grams' 1991 senior thesis and subsequent report [Grams and Schmidt 1991, 1999] commissioned by the USFS), but this information is inadequate to determine what the sizes were. Therefore, there would be no definitive target to shoot for in reestablishing sandbars to pre-HCC levels. Simply transporting sediments trapped in Brownlee Reservoir to the river downstream of Hells Canyon Dam would be unlikely to have a significant impact on sandbar features in Hells Canyon because of the sizes of the materials involved, as previously discussed.

Introduction of smaller sediments, such as sands or sediments trapped in Brownlee Reservoir, would probably have detrimental effects on spawning beds, water quality, and other resources in the Hells Canyon reach. For example, the primary conclusions in the comparative freeze-coring work at known spawning locations in the upper Hells Canyon reach, lower Hells Canyon reach, and Hanford reach of the Columbia River are that, collectively, the spawning sites evaluated in the upper Hells Canyon reach have the highest potential of survival to emergence of incubating salmonids because of the generally lower percentage of fines in the bed matrix relative to the other locations. It is well established in the scientific literature that survival to emergence declines with increasing fine sediments in the bed matrix.

Recommended National Pollution Discharge Elimination System (NPDES) permit

Response

The Applicant rejected this recommendation because an NPDES permit is not required for general powerhouse releases of river water. The Applicant currently holds NPDES permits for cooling water releases that are associated with operation of the three facilities in the HCC.

Recommended additional flow studies

Response

The Applicant rejected this recommendation because it was an additional study request, not a PM&E recommendation.

Recommended a temperature analysis of Hells Canyon and Oxbow reservoirs

Response

The Applicant rejected this recommendation because it was an additional study request, not a PM&E recommendation.

Shoshone-Bannock Tribes comment letter, dated January 10, 2003

SBT1-29

> 100 cfs through spillway(should be increased to at least a minimum of 1,350 cfs to increase flow through Oxbow bypass to reduce retention and increase DO levels in reach area). Most of the year water is routed through the powerhouse. The minimum of 100 cfs through spillway year round should be increased to 1350 cfs of he inflow to the dam to increase flow through Oxbow bypass to reduce retention and increase DO (Dissolved Oxygen) levels in reach area. In the 0.4.19Mile reach because 1) 20 day retention time, 2) deep pool, 3) 100 cfs flow. Increasing flow over spillway to 1350 cfs should help reduce thermal stratification in the 0.4 mile reach.

Response

The Applicant rejects the recommendation to increase the minimum flow in the Oxbow Bypass to at least 1,350 cfs. Increasing the flow would not result in substantive improvements to either water quality or habitat. Oxygen conditions throughout much of the bypassed reach are determined by oxygen levels in water being discharged from Brownlee Reservoir. Likewise, while Brownlee Reservoir is generally improving downstream water temperatures for coldwater biota, temperature conditions in the bypassed reach do not always meet standards. However, the main factor controlling temperatures in the Oxbow Bypass is temperatures of water being released upstream. Increasing the minimum flow would provide little or no improvement to water quality conditions in the bypassed reach but would simply result in an additional amount of degraded water passing through the Oxbow Bypass.

SBT1-33

> 0.4 mile Oxbow reach exhibits hypoxic and anoxic conditions. Increase flow through by pass to greater than 1350 cfs.

Response

The Applicant rejects the recommendation to increase the minimum flow in the Oxbow Bypass to at least 1,350 cfs. Increasing the flow would not result in substantive improvements to either water quality or habitat. Oxygen conditions throughout much of the bypassed reach are determined by oxygen levels in water being discharged from Brownlee Reservoir. Likewise, while Brownlee Reservoir is generally improving downstream water temperatures for coldwater biota, temperature conditions in the bypassed reach do not always meet standards. However, the main factor controlling temperatures in the Oxbow Bypass is the temperature of water being released upstream. Increasing the minimum flow would provide little or no improvement to water quality conditions in the bypassed reach but would simply result in an additional amount of degraded water passing through the Oxbow Bypass.

E.2.5. Continuing Impact on Water Quality

Because the impact of the complex on water quality is related to the quality of water flowing into the complex, describing the continuing impact on water quality requires assumptions about the quality of inflows. Specific actions taken by the Applicant would have varying responses, depending on future conditions of the inflows. For the purposes of this assessment, the Applicant assumes that implementation of the draft TMDL will lead to inflows to Brownlee Reservoir that meet targets identified in the draft TMDL.

The draft TMDL has identified water temperature targets of 17.8 and 13 °C for the Snake River (IDEQ and ODEQ 2001) to protect coldwater biota and salmonid spawning. However, the draft TMDL also includes a determination that temperature conditions were not a result of controllable human activities, so no temperature-specific improvements are expected under the draft TMDL. Therefore, despite these findings and measurable improvements to downstream temperature conditions for coldwater biota and salmonid spawning caused by the presence of the HCC (Table E.2-8), no temperature measures have been proposed by the Applicant.

The presence and existing operational configuration of the HCC will continue to support an aquatic community downstream of Brownlee Dam that is more coldwater oriented than the community within Brownlee Reservoir or in the 100-mi reach of the river upstream of Brownlee Reservoir. Maximum summer temperatures of inflowing water will continue to exceed 26 ºC, while outflows will remain near 23 ºC. Retention of the warm summer inflows in the reservoirs, especially Brownlee Reservoir, will continue to delay fall cooling of outflows relative to inflows. The Applicant's modeling showed that temperature conditions within and downstream of the HCC are affected both in magnitude and timing by temperature conditions of inflowing water. Despite the generally improved conditions for coldwater biota and salmonid spawning downstream of Hells Canyon Dam, Idaho and Oregon criteria will continue to be exceeded annually because of the warm Snake River inflows to Brownlee Reservoir (Table E.2-8).

Regarding nutrients and organic matter, improvements to the existing severely degraded condition of the inflowing water would substantially improve DO levels throughout the complex. In fact, modeling undertaken by the Applicant during the relicensing process indicates that improvement of inflowing water alone would probably not result in oxygen targets being met in Brownlee Reservoir. However, given the uncertainty associated with predicting the response to dramatic improvements in inflowing water, the Applicant has proposed to aerate Brownlee Reservoir at the level identified in the draft TMDL (see section E.2.4.2.1.). Both the ODEQ and IDEQ have predicted that, through the draft TMDL process, reductions in inflowing nutrients and organic matter, along with the Applicant's proposed level of aeration, would lead to levels of DO that meet state standards. However, because of the uncertainty in predicting the effect that aerating Brownlee Reservoir would have in the waters below Hells Canyon Dam, the Applicant has also proposed turbine venting at the Brownlee Project to further improve downstream oxygen levels. Given that demonstrable downstream impairments are absent with current low DO levels, continuing impacts related to future DO levels within and downstream of the HCC should be minimal. The Applicant's proposed DO monitoring plan (proposed in sections E.2.4.2.1., E.2.4.2.2., and E.2.4.2.3.) would provide reasonable assurance that measures to supplement oxygen are implemented in the most efficient, effective, and practical way.

Installing flow deflectors on Hells Canyon Dam to alter the spillway flow characteristics during spill events of less than 30,000 cfs should substantially reduce the potential for continuing downstream effects from elevated total dissolved gas levels. The deflectors are expected to control gas levels during all but the highest 5% of flows. While the Applicant cannot quantify what the total dissolved gas levels would be after the flow deflectors were installed, similar measures at other projects (both federal and public utility districts) on the Snake and Columbia rivers have improved total dissolved gas conditions. Levels of total dissolved gas in both Oxbow and Hells Canyon reservoirs would continue to be elevated during periods of spill at Brownlee Dam, despite the Applicant's continued efforts to reduce these increases by spilling from the crest gates at Brownlee Dam. Despite the elevated levels of total dissolved gas, effects to biota in Oxbow and Hells Canyon reservoirs should continue to be minor because of the large amount of habitat available at depths greater than 2 m.

E.2.6. Consultation

For a summary of consultation efforts to date for the HCC, see the Consultation Appendix.

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Table E.2-1 Applicant's Oregon consumptive water uses within project boundaries

WR	Priority	Stage	Source	Amount	Use
50644	12/09/1988	Permit	Snake River	0.22 cfs	Irrigation
50570	02/24/1986	Certificate	Groundwater	0.20 cfs	Domestic
30551	03/10/1960	Certificate	Spring	0.20 cfs	Domestic/Irrigation
Bake 242	05/29/1987	Certificate	Groundwater	0.77 cfs	Domestic
Bake 243	06/01/1987	Certificate	Groundwater	0.35 cfs	Domestic
72198	1878	Certificate	Eagle Creek	0.69 cfs	Irrigation
72611	05/31/1947	Certificate	Powder River	1.29 cfs	Irrigation
63298	08/13/1981	Certificate	Snake River	130.0 cfs	Fish Ladder and Attraction for Trapping
12778	04/22/1992	Permit	Groundwater	0.29 cfs	Fish Propagation
15318	11/06/2000	Application	Groundwater	1.80 cfs	Fish Propagation

Table E.2-2 Oregon existing/proposed consumptive water rights[a]

Name	Water Right	Priority	SOURCE	USE	AMOUNT	STATUS
Existing						
Carothers, R.E.	54005	06/24/1912	Powder River	Irrigation	0.13 cfs	Certificate
Greene, John	56226	01/23/1918	Powder River	Irrigation	0.31 cfs	Certificate
Bogart, Clarence	56380	12/31/1900	Powder River	Irrigation	0.25 cfs	Certificate
Greene, John	56557	12/31/1909	Powder River	Irrigation	0.20 cfs	Certificate
Harvill, Charles	56577	12/31/1896	Powder River	Irrigation	0.35 cfs	Certificate
Schultz, Elmer	56821	12/31/1893	Powder River	Irrigation	1.20 cfs	Certificate
Howell, W.W.	66517	10/29/1936	Powder River	Irrigation, Supplemental	4.83 cfs	Certificate
Dennis, David	93263	09/07/1965	Powder River	Irrigation	0.57 cfs	Certificate
Knoblauch, Paul	96643	12/31/1900	Powder River	Irrigation	0.675 cfs	Certificate
Howell, Charles	124865	1863, 1890	Powder River	Irrigation	2.975 cfs	Certificate
Dry Gulch Ditch Co.	128211	02/14/1978	Powder River	Irrigation, Supplemental	0.38 cfs	Certificate
Dry Gulch Ditch Co.	128217	12/31/1893	Powder River	Irrigation	0.68 cfs	Certificate
Dry Gulch Ditch Co.	128218	12/31/1893	Powder River	Irrigation, Supplemental	0.32 cfs	Certificate
Ensenada Pastoral	47048	05/25/1978	Powder River	Irrigation, Primary & Supplemental	13.9 cfs	Permit
Oregon Shortline Railroad Co.	54459	12/08/1916	Snake River	Industrial/ Manufacturing	0.10 cfs	Certificate
ODOT-Parks Division	84901	04/01/1959	Snake River	Irrigation	0.30 cfs	Certificate

Table E.2-2 Oregon existing/proposed consumptive water rights[a]

Name	Water Right	Priority	SOURCE	USE	AMOUNT	STATUS
Existing						
Roumagoux, Arthur	54267	10/09/1916	Snake River	Irrigation	0.51 cfs	Certificate
Darrow, Wm. S.	58503	09/12/1922	Snake River	Irrigation	0.15 cfs	Certificate
Washburn, Edward	57178	04/08/1918	Snake River	Irrigation	0.13 cfs	Certificate
Holtz, Charlie	15150	12/27/1990	Snake River	Irrigation, Primary & Supplemental	2.23 cfs	Application
Lawton, Esther	63157	07/26/1933	Snake River	Irrigation, Livestock	3.20 cfs	Certificate
Ramsey, Clyde	94425	06/27/1957	Snake River	Irrigation	1.55 cfs	Certificate
Gay, Ebba	94759	10/15/1964	Snake River	Irrigation	3.55 cfs	Certificate
Grooms, Carl	93540	09/26/1968	Snake River	Irrigation	0.16 cfs	Certificate
Walker, Virgul	79588	07/31/1957	Snake River	Irrigation	2.30 cfs	Certificate
Friedrichsen, Paul	103749	09/16/1968	Snake River	Irrigation	0.92 cfs	Certificate
Friedrichsen, Wayne	103874	06/13/1977	Snake River	Irrigation	0.34 cfs	Certificate
Grooms, Carl	93540	09/26/1968	Snake River	Irrigation	0.16 cfs	Certificate
Kohler, Ralph	46470	01/25/1977	Snake River	Irrigation, Primary & Supplemental	5.90 cfs	Certificate
Crichton, A.R.	53362	08/11/1909	Snake River	Irrigation, Domestic	0.20 cfs	Certificate

a. No proposed consumptive water rights at this time

Table E.2-3 Applicant's Idaho consumptive uses within project boundaries

WR	PRIORITY	STAGE	SOURCE	AMOUNT	USE
03-10162	05/20/1960	Beneficial Use	Snake River	0.086 cfs	Irrigation
03-10168	12/31/1959	Beneficial Use	Snake River	0.12 cfs	Irrigation
69-07098	06/12/1989	License	Groundwater	0.50 cfs	Domestic
69-11490	12/10/1974	Beneficial Use	Groundwater	0.04 cfs	Domestic
03-7063	09/23/1996	Permit	Snake River	0.06 cfs	Irrigation
03-10167	12/01/1967	Beneficial Use	Snake River	0.20 cfs	Irrigation
79-13952	12/01/1967	Beneficial Use	Spring	0.02 cfs	Irrigation
79-13953	12/01/1967	Beneficial Use	Groundwater	0.04 cfs	Domestic

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Existing[a]						
USA-BLM	03-10110	12/31/1968	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10111	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10112	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10113	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10114	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10115	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10116	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10117	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10119	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10120	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10127	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10129	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10130	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10131	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10132	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10133	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10135	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10138	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10139	12/31/1968	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10140	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10141	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10142	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10163	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10169	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Existing[a]						
USA-BLM	03-10170	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10171	12/31/1959	Snake River	Stockwater	0.02 cfs	Decreed
USA-BLM	03-10172	12/31/1963	Snake River	Stockwater	0.02 cfs	Decreed
Bell, Alvie	03-2026	08/19/1961	Snake River	Domestic-Irrigation	1.64 cfs	License
Armacost, Bret	03-7057	09/08/1994	Snake River	Irrigation	0.04 cfs	License
Stevenson, Bill	67-10441	01/01/1874	Spring	Stockwater	0.24 cfs	Decreed
USA-BLM	67-7549	10/15/1981	Yellow Jacket Sspring	Stock-Wildlife	0.02 cfs	License
USA-BLM	67-7652	08/15/1983	Spring	Stock-Wildlife	0.02 cfs	Decreed
Herup, William	67-7778	12/02/1989	Warm Springs Creek	Irrigation	0.03 cfs	License
Hixon Properties	69-10030	05/01/1910	Warm Springs Creek	Stockwater	0.02 cfs	Decreed
Hixon Properties	69-10031	05/01/1910	Indian Creek	Stockwater	0.02 cfs	Decreed
Hixon Properties	69-10032	05/01/1910	Blue Creek	Stockwater	0.02 cfs	Decreed
Stevenson, Bill	69-10043	01/01/1874	Spring	Stockwater	0.24 cfs	Decreed
State of Idaho	69-10080	01/01/1912	Unnamed Stream	Stockwater	0.23 cfs	Decreed
State of Idaho	69-10085	06/01/1969	Spring	Stockwater	0.23 cfs	Decreed
State of Idaho	69-10097	03/15/1963	Spring	Domestic	0.04 cfs	Decreed
State of Idaho	69-17A	01/01/1885	Brownlee Creek	Stockwater	0.23 cfs	Decreed
Rix, Jennie	69-2002	09/24/1904	Rock Creek	Domestic-Irrigation	2.4 cfs	License

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Existing[a]						
Tarter, James	69-2012	12/18/1909	Dennett Creek	Domestic-Irrigation	1.0 cfs	License
Putnam, Myers	69-2014	06/27/1910	Grouse Creek	Domestic-Irrigation	0.56 cfs	License
Pedri, P. Zam	69-2026	07/29/1916	Sumac Creek	Domestic-Irrigation	0.80 cfs	License
Randall, Cyrenius	69-2050	08/20/1904	Wolf Creek	Domestic-Irrigation	0.74 cfs	License
USA-BLM	69-2057	09/11/1963	Spring	Domestic-Irrigation	0.04 cfs	License
Coston, Mary	69-2058	04/18/1912	Warm Springs Creek	Domestic-Irrigation	0.10 cfs	License
Bell, Alvie	69-2059	08/19/1961	Snake River	Domestic-Irrigation	1.64 cfs	License
Nelson, Robert G.	69-7100	10/12/1989	Spring	Domestic	0.02 cfs	License
USA-BLM	69-7113	03/20/1990	Spring	Stock-Wildlife	0.02 cfs	License
USA-BLM	79-10440	05/01/1895	Kinney Creek	Stockwater	0.02 cfs	Decreed
USA-BLM	79-10441	06/01/1888	Hibble Gulch Creek	Stockwater	0.02 cfs	Decreed
USA-BLM	79-10443	05/01/1895	Limepoint Creek	Stockwater	0.02 cfs	Decreed
USA-BLM	79-10452	06/01/1890	Deep Creek	Stockwater	0.02 cfs	Decreed
Huntley, Arthur	79-2044	03/14/1913	Eckels Creek	Domestic-Irrigation	1.10 cfs	License
Huntley, Arthur	79-2045	01/17/1913	Allison Creek	Irrigation	0.80 cfs	License
Burns, J.J.	79-2099	07/24/1918	Springs	Domestic-Irrigation	0.80 cfs	License

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10739	01/01/1887	Unnamed Stream	Stockwater	0.19 cfs	Beneficial Use
USA-BLM	69-11464	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10474	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10468	01/01/1887	Lone Pine Gulch Creek	Stockwater	0.17 cfs	Beneficial Use
USA-BLM	69-10681	01/01/1887	Unnamed Stream	Stockwater	0.09 cfs	Beneficial Use
State of Idaho	69-10069	01/01/1920	Springs	Stockwater	0.23 cfs	Beneficial Use
USA-BLM	69-10675	01/01/1887	Spring	Stockwater	0.10 cfs	Beneficial Use
USA-BLM	69-10676	01/01/1887	Spring	Stockwater	0.10 cfs	Beneficial Use
USA-BLM	69-10678	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
State of Idaho	69-10053	09/01/1980	Board Gulch Creek	Stockwater	0.23 cfs	Beneficial Use
USA-BLM	69-10422	01/01/1887	Board Gulch Creek	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10421	01/01/1887	Board Gulch Creek	Stockwater	0.05 cfs	Beneficial Use
State of Idaho	69-10063	01/01/1958	Spring	Stockwater	0.23 cfs	Beneficial Use
State of Idaho	69-10083	01/01/1912	Spring	Stockwater	0.23 cfs	Beneficial Use
Hillman, Michael	69-4114	01/01/1912	Springs	Stockwater	0.14 cfs	Statutory
Hillman, Michael	69-4118	01/01/1912	Springs	Stockwater	0.12 cfs	Statutory
State of Idaho	69-4111	01/01/1912	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
State of Idaho	69-10052	09/01/1980	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
Hillman, Michael	69-10093	01/01/1894	Grade Creek	Stockwater	0.23 cfs	Beneficial Use
Hillman, Michael	69-4117	01/01/1912	Grade Creek	Stockwater	0.12 cfs	Statutory
State of Idaho	69-10068	01/01/1983	Springs	Stockwater	0.23 cfs	Beneficial Use
State of Idaho	69-10070	01/01/1962	Springs	Stockwater	0.23 cfs	Beneficial Use
USA-BLM	69-10415	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10418	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10414	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
State of Idaho	69-10051	09/01/1958	Cave Creek	Stockwater	0.23 cfs	Beneficial Use
State of Idaho	69-10075	01/01/1912	Springs	Stockwater	0.23 cfs	Beneficial Use
USA-BLM	69-10412	01/01/1887	Cave Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10455	01/01/1887	Scorpion Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10456	01/01/1887	Scorpion Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10449	01/01/1887	Summer Creek	Stockwater	0.12 cfs	Beneficial Use
USA-BLM	69-10713	01/01/1887	Limestone Gulch Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10726	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10727	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10446	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10447	01/01/1887	Williamson Creek	Stockwater	0.02 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10448	01/01/1887	Summer Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10444	01/01/1887	Jacob's Ladder Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10445	01/01/1887	Cougar Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10443	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10441	01/01/1887	Myra Tree Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10694	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10695	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-12101	06/01/1883	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-12102	06/01/1883	Tamarack Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-14176	06/01/1883	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-4382	06/01/1962	North Keithly Spring	Stockwater	0.02 cfs	Statutory
USA-BLM	69-10462	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
Nagy, Stacy	79-13610	12/18/1899	Unnamed Stream	Domestic-Irrigation, Mining	1.06 cfs	Beneficial Use
USA-BIA	69-10872	Time Immemorial	Spring	Stock-Wildlife	Natural Flow	Reserved
Nez Perce Tribe	69-11163	Time Immemorial	Spring	Stock-Wildlife	Natural Flow	Reserved
Hixon Properties	69-10023	05/01/1910	Salt Creek	Stockwater	0.02 cfs	Beneficial Use
Jepsen, Robert	03-10157B	04/01/1956	Snake River	Irrigation	1.24 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
Lawrence Ranch	69-11494	06/27/1934	Cottonwood Creek	Stockwater	0.02 cfs	Beneficial Use
Lawrence Ranch, Inc.	03-10007	06/07/1969	Snake River	Irrigation	0.80 cfs	Beneficial Use
State of Idaho	03-10011	09/01/1958	Snake River	Stockwater	0.23 cfs	Beneficial Use
State of Idaho	69-4107	01/01/1912	Dukes Creek	Stockwater	0.02 cfs	Beneficial Use
State of Idaho	69-10067	01/01/1969	Snake River	Stockwater	0.23 cfs	Beneficial Use
USA-BLM	03-10118	01/01/1887	Snake River	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	03-10121	01/01/1887	Snake River	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10518	01/01/1887	Rock Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10485	01/01/1887	Trail Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	03-10108	01/01/1887	Snake River	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10548	01/01/1887	Grouse Creek	Stock-Wildlife	0.02 cfs	Beneficial Use
USA-BLM	03-10137	01/01/1887	Snake River	Stock-Wildlife	0.07 cfs	Beneficial Use
USA-BLM	69-10710	01/01/1887	Snake River	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	03-10134	01/01/1887	Snake River	Stock-Wildlife	0.17 cfs	Beneficial Use
USA-BLM	03-10143	01/01/1887	Snake River	Stock-Wildlife	0.04 cfs	Beneficial Use
USA-BLM	03-10107	01/01/1887	Snake River	Stock-Wildlife	0.05 cfs	Beneficial Use
USA-BLM	67-12675	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-12697	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-13103	01/01/1887	Unnamed Stream	Stockwater	0.03 cfs	Beneficial Use
USA-BLM	67-13104	01/01/1887	Unnamed Stream	Stockwater	0.03 cfs	Beneficial Use
Witte, Genevieve	67-4173	06/01/1910	Warm Springs Creek	Irrigation	2.11 cfs	Statutory

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10575	04/17/1926	Spring	Domestic-Stock, Wildlife	0.11 cfs	Reserved
USA-BLM	69-10577	04/17/1926	Spring	Domestic-Stock, Wildlife	0.11 cfs	Reserved
USA-BLM	69-10546	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10574	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10576	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10629	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10627	01/01/1887	Unnamed Stream	Stockwater	0.08 cfs	Beneficial Use
USA-BLM	69-10628	01/01/1887	Unnamed Stream	Stockwater	0.08 cfs	Beneficial Use
USA-BLM	03-10122	01/01/1887	Snake River	Stock-Wildlife	0.11 cfs	Beneficial Use
USA-BLM	03-10123	01/01/1887	Snake River	Stock-Wildlife	0.04 cfs	Beneficial Use
USA-BLM	03-10124	01/01/1887	Snake River	Stock-Wildlife	0.04 cfs	Beneficial Use
USA-BLM	03-10125	01/01/1887	Snake River	Stock-Wildlife	0.07 cfs	Beneficial Use
USA-BLM	03-10126	01/01/1887	Snake River	Stock-Wildlife	0.07 cfs	Beneficial Use
USA-BLM	03-10128	01/01/1887	Snake River	Stock-Wildlife	0.10 cfs	Beneficial Use
USA-BLM	03-10136	01/01/1887	Snake River	Stock-Wildlife	0.07 cfs	Beneficial Use
USA-BLM	03-10109	01/01/1887	Snake River	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10586	12/31/1963	Snake River	Stock-Wildlife	14.0 AFA	Beneficial Use
USA-BLM	69-10453	01/01/1887	Salt Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10423	01/01/1887	Dukes Creek	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	69-10477	01/01/1887	Sheep Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10486	01/01/1887	Wolf Creek	Stockwater	0.02 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10424	01/01/1887	Wildhorse River	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10487	01/01/1887	Sumac Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10545	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10625	01/01/1887	Unnamed Stream	Stockwater	0.08 cfs	Beneficial Use
USA-BLM	69-10626	01/01/1887	Unnamed Stream	Stockwater	0.08 cfs	Beneficial Use
USA-BLM	69-10543	01/01/1887	Unnamed Stream	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	69-10623	01/01/1887	Unnamed Stream	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	69-10624	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10665	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-12359	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-12360	06/28/1934	Unnamed Stream	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	67-12370	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-13105	06/28/1934	Unnamed Stream	Stockwater	0.03 cfs	Beneficial Use
Jepsen, Robert	67-10667A	01/01/1919	Springs	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	67-12372	01/01/1877	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10503	01/01/1887	Raft Creek	Stock-Wildlife	0.05 cfs	Beneficial Use
USA-BLM	69-10473	06/28/1934	Cottonwood Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10466	01/01/1887	Sturgill Creek	Stockwater	0.02 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
Van Tassel, Gail	03-10157A	04/01/1956	Snake River	Irrigation	0.16 cfs	Beneficial Use
Hillman, Michael	69-4115	01/01/1912	Brownlee Creek	Stockwater	0.12 cfs	Statutory
Laird, Eugene	03-4001	04/15/1938	Snake River	Irrigation	1.50 cfs	Statutory
U Bar M Ranch	03-4007	06/01/1955	Snake River	Irrigation	1.70 cfs	Statutory
USA-BLM	67-12358	06/28/1934	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10541	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10542	01/01/1887	Unnamed Stream	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	69-10622	01/01/1887	Coal Mine Gulch Spring	Stockwater	0.05 cfs	Beneficial Use
Eckhardt, James	67-14386	12/31/1908	Ponds, Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10656	01/01/1887	Unnamed Stream	Stockwater	0.03 cfs	Beneficial Use
USFS	69-10567	04/17/1926	Spring	Domestic-Stock	0.04 cfs	Reserved
USA-BLM	69-10566	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10618	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10632	01/01/1887	Unnamed Stream	Stockwater	0.08 cfs	Beneficial Use
USA-BLM	69-10651	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
Van Tassel, Gail	69-10047	04/01/1956	Snake River	Irrigation	1.40 cfs	Beneficial Use
USA-BLM	69-4121	01/01/1965	Spring	Domestic-Irrigation	0.05 cfs	Statutory

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10569	04/17/1926	Spring	Domestic-Stock, Wildlife	0.11 cfs	Reserved
USA-BLM	69-10568	01/01/1887	Spring	Domestic-Stock	0.11 cfs	Beneficial Use
USA-BLM	69-10620	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
Nez Perce Tribe	03-10075	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
Nez Perce Tribe	03-10076	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
Nez Perce Tribe	03-10072	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
Nez Perce Tribe	03-10073	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
Nez Perce Tribe	69-10779	Time Immemorial	Indian Creek	Instream Flow	220 cfs	Reserved
Nez Perce Tribe	03-10071	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
Nez Perce Tribe	69-10787	Time Immemorial	Brownlee Creek	Instream Flow	50 cfs	Reserved
Nez Perce Tribe	03-10074	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
Nez Perce Tribe	69-10790	Time Immemorial	Sturgill Creek	Instream Flow	130 cfs	Reserved
Nez Perce Tribe	79-12079	Time Immemorial	Deep Creek	Instream Flow	250 cfs	Reserved
Nez Perce Tribe	03-10077	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	79-11961	Time Immemorial	Deep Creek	Instream Flow	250 cfs	Reserved
USA-BIA	69-10761	Time Immemorial	Indian Creek	Instream Flow	220 cfs	Reserved

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BIA	69-10773	Time Immemorial	Brownlee Creek	Instream Flow	50 cfs	Reserved
USA-BIA	03-10042	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	03-10048	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	03-10047	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	03-10043	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	69-10777	Time Immemorial	Sturgill Creek	Instream Flow	130 cfs	Reserved
USA-BLM	69-10631	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10547	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10630	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10640	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10641	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10645	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BIA	03-10045	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	03-10046	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BIA	03-10044	Time Immemorial	Snake River	Instream Flow	65,000 cfs	Reserved
USA-BLM	69-10642	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10643	01/01/1887	Unnamed Stream	Stockwater	0.09 cfs	Beneficial Use
USA-BLM	69-10644	01/01/1887	Unnamed Stream	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10517	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10530	04/17/1926	Spring	Domestic-Stock	0.09 cfs	Reserved
USA-BLM	69-10516	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10529	01/01/1887	Spring	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10657	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10669	01/01/1887	Spring	Stockwater	0.07 cfs	Beneficial Use
USA-BLM	69-10708	01/01/1887	Unnamed Stream	Stockwater	0.05 cfs	Beneficial Use
USA-BLM	69-10488	01/01/1887	Golden Goose Canyon Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10490	01/01/1887	Golden Goose Canyon Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10686	01/01/1887	Unnamed Stream	Stock-Wildlife	0.07 cfs	Beneficial Use
USA-BLM	69-10684	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10464	01/01/1887	Lick Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10476	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10606	01/01/1887	Unnamed Stream	Stockwater	0.17 cfs	Beneficial Use

Table E.2-4 Idaho existing/proposed water rights

Name	Water Right	Priority	Source	Use	Amount	Status
Proposed[b]						
USA-BLM	69-10505	01/01/1887	Unnamed Stream	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10607	01/01/1887	Unnamed Stream	Stockwater	0.17 cfs	Beneficial Use
USA-BLM	69-10504	01/01/1887	Wayle Creek	Stockwater	0.02 cfs	Beneficial Use
USA-BLM	69-10683	01/01/1887	Unnamed Stream	Stockwater	0.03 cfs	Beneficial Use

a. Existing surface water rights (58 water rights): Water rights based upon a state-licensed right, a decree from an earlier adjudication, or a partial decree issued in the Snake River Basin Adjudication (SRBA).

The SRBA is a statutorily-created lawsuit to inventory all of the surface and groundwater rights in the stream system. Parties to the SRBA, known as claimants, objectors, or respondents, include individuals, corporations, the state of Idaho, cities and counties, the federal government, Native American tribes, and other entities. Parties filed over 150,000 claims for all uses of water (surface water, groundwater, agricultural, industrial, hydropower, aquaculture, municipal, and federal reserved rights). Because the SRBA is a general adjudication of an entire stream system, the United States has appeared in state court and filed its claims under a congressional waiver of sovereign immunity (the McCarran Amendment, 43 U.S.C. § 666). The United States has filed approximately 50,000 claims for ten federal departments or agencies and four Native American tribes. The U.S. claims are for consumptive and nonconsumptive and federal reserved and state law-based water rights. A special court system was created to manage this large and complex case. Partial and final decrees will be entered by the presiding judge. The case is governed by the Idaho Rules of Civil Procedure and the Idaho Rules of Evidence.

b. Proposed surface water rights (182 water rights): Water rights based upon beneficial use or a statutory claim that have not yet been adjudicated in the Snake River Basin Adjudication; permitted but not yet licensed rights; and federal reserved rights. The federal reserved rights consist of the overlapping U.S. and Nez Perce Tribe instream flow claims, which were denied upon summary judgment in the SRBA Court and are now on appeal before the Idaho Supreme Court.

Table E.2-5 Information about Idaho's designated uses and § 303(d) listings for segments of the Snake River

Snake River Segment	Designated Uses	§ 303(d) Listed Pollutants
Snake River: Salmon River inflow to Hells Canyon Dam	coldwater biota salmonid spawning primary contact recreation domestic water supply agricultural water supply industrial water supply wildlife habitats aesthetics special resource water	temperature[a]
Snake River: Hells Canyon Dam to Oxbow Dam	coldwater biota primary contact recreation domestic water supply agricultural water supply industrial water supply wildlife habitats aesthetics special resource water	none listed
Snake River: Oxbow Dam to Brownlee Dam	coldwater biota primary contact recreation domestic water supply agricultural water supply industrial water supply wildlife habitats aesthetics special resource water	nutrients pesticides sediment
Snake River: Brownlee Dam to Scott Creek inflow	coldwater biota primary contact recreation domestic water supply agricultural water supply industrial water supply wildlife habitats aesthetics special resource water	dissolved oxygen (DO) nutrients hydrogen ion concentration (pH) sediment mercury

a. Temperature is listed as a pollutant on the U.S. Environmental Protection Agency's additions to Idaho's 1998 § 303(d) list (USEPA 2001a).

Table E.2-6 Information about Oregon's designated uses and § 303(d) listings for segments of the Snake River

Snake River Segment	Designated Uses	§ 303(d) Listed Pollutants
Snake River: Salmon River inflow to lower half of Hells Canyon Reservoir	salmonid fish spawning and rearing	temperature
	anadromous fish passage	toxics (mercury)
	resident fish and aquatic life	
	water contact recreation	
	public/private domestic water supply	
	irrigation	
	livestock watering	
	industrial water supply	
	wildlife and hunting	
	fishing, boating	
	aesthetics	
	commercial navigation and transportation	
Snake River: upper half of Hells Canyon Reservoir to Farewell Bend State Park	salmonid fish spawning and rearing	temperature
	resident fish and aquatic life	toxics (mercury)
	water contact recreation	
	public/private domestic water supply	
	irrigation	
	livestock watering	
	industrial water supply	
	wildlife and hunting	
	fishing, boating	
	aesthetics	
	hydropower	

Table E.2-7 Levels indicating water quality limitation for the Snake River from near Weiser, Idaho, to the confluence with the Salmon River (IDEQ and ODEQ 2001)

Measures	Levels Indicating Water Quality Limitation
Water Temperature	A 7-day average of daily maximums greater than 17.8 °C for designated uses: cool and coldwater biota (resident fish and aquatic life), anadromous fish passage, and salmonid rearing. A single sample greater than 13 °C or an average daily mean greater than 9 °C when and where salmonid spawning occurs. In the absence of site-specific data, fish kills, lack or loss of habitat, unsuccessful spawning, and reduced growth rates may indicate water quality limitation.
Dissolved Oxygen	A single water-column sample less than 8.0 mg/L for designated uses: coldwater biota (resident fish and aquatic life), anadromous fish passage, and salmonid rearing. A single water-column sample less than 8.0 mg/L applies below Hells Canyon Dam. A single water-column sample less than 11.0 mg/L or a single intergravel sample less than 8.0 mg/L when and where salmonid spawning occurs. A single water-column sample less than 6.5 mg/L for designated uses: coolwater biota (resident fish and aquatic life). In the absence of site-specific data, the following may indicate water quality limitation: fish kills, anaerobic sediments, and lack of support for aquatic life.
Total Dissolved Gas	A single water-column sample greater than 110% saturation for designated uses: cool and coldwater biota (resident fish and aquatic life), anadromous fish passage, salmonid rearing, and salmonid spawning (when and where it occurs). In the absence of site-specific data, gas bubble disease in fish may indicate water quality limitation.
Nutrients	A single sample greater than 70 mg/L total phosphorus.
Nuisance Algae	A single sample greater than 15 µg/L chlorophyll *a* (a surrogate for algae mass). In the absence of site-specific data, visible nuisance aquatic growths associated with excessive nutrient loading may indicate water quality limitation.
Bacteria	A single sample greater than 406 *E. coli* organisms per 100 milliliters (ml) or a 30-day geometric mean greater than 126 *E. coli* organisms per 100 ml based on a minimum of 5 samples taken every 3 to 5 days for the primary contact recreation designated use. In the absence of site-specific data, illness in primary contact recreation users may indicate water quality limitation.

Table E.2-7 Levels indicating water quality limitation for the Snake River from near Weiser, Idaho, to the confluence with the Salmon River (IDEQ and ODEQ 2001)

Measures	Levels Indicating Water Quality Limitation
Hydrogen Ion Concentration (pH)	A single water-column sample less than 7 and/or greater than 9 pH units for designated uses: cool and coldwater biota (resident fish and aquatic life), anadromous fish passage, salmonid rearing, and salmonid spawning (when and where it occurs). In the absence of site-specific data, fish kills and lack of support for aquatic life uses may indicate water quality limitation.
Sediment	A 14-day average total suspended sediment greater than 80 mg/L and/or a monthly average greater than 50 mg/L for designated uses: cool and coldwater biota (resident fish and aquatic life), salmonid rearing, and salmonid spawning (when and where it occurs). In the absence of site-specific data, the following may indicate water quality limitations: lack or degradation of spawning habitat, population decline, reduced feeding and growth, and gill and scale problems.
Mercury	A single total mercury water-column sample greater than 0.012 µg/L and/or methylmercury in fish tissue greater than 0.35 mg/kg for designated uses: cool and coldwater biota (resident fish and aquatic life), salmonid rearing, and salmonid spawning (when and where it occurs). In the absence of site-specific data, advisories about consuming fish may indicate water quality limitation.
Pesticides	Single water-column samples greater than 0.024 nanograms (ng)/L DDT, 0.83 ng/L DDD, 0.59 ng/L DDE, and/or 0.07 ng/L dieldrin for designated uses: cool and coldwater biota (resident fish and aquatic life), salmonid rearing, and salmonid spawning (when and where it occurs).

Table E.2-8 Percentage of days sampled (% D) and the number of days exceeding (# D ≥) the draft TMDL salmonid spawning and coldwater biota water temperature targets (13 and 17.8 °C, respectively) by fall chinook cohort year[a] upstream (RM 345.6) and downstream (RM 247.6) of the HCC

	Salmonid Spawning[b]									
	Fall				Spring					
	Upstream		Downstream		Upstream		Downstream		HCC Benefit[c]	
Cohort Year[a]	% D	# D ≥	% D	# D ≥	% D	# D ≥	% D	# D ≥	Fall	Spring
1991			100	15			100	4		
1992										
1993			36	12			45	0		
1994			100	16			78	0		
1995			100	10			91	0		
1996	99	0	100	11	100	12	78	1	-11	11
1997	100	0	100	4	82	19	81	0	-4	19
1998	88	0	96	9	14	0	95	0	-9	0
1999	99	0	99	11	100	29	97	16	-11	13
Median		0		11		16		0		
Difference									**-11**	**16**

	Coldwater Biota				
	Upstream		Downstream		
Cohort Year[a]	% D	# D ≥	% D	# D ≥	HCC Benefit[c]
1991			65	82	
1992			60	63	
1993			70	73	
1994			89	86	
1995	75	91	89	99	-8
1996	100	138	88	96	42
1997	100	114	87	110	4
1998	86	97	94	99	-2
1999	92	127	80	71	56
Median		114		86	
Difference					**28**

a. Cohort year represents calendar dates from October 24 through October 23 of the following year, so that cohort year 1997 is the fall of 1997 to the fall of 1998.

b. Salmonid spawning season is divided into fall, October 23–December 31, and spring, January 1–May 10, dates

c. Number of days calculated as a difference between upstream and downstream results

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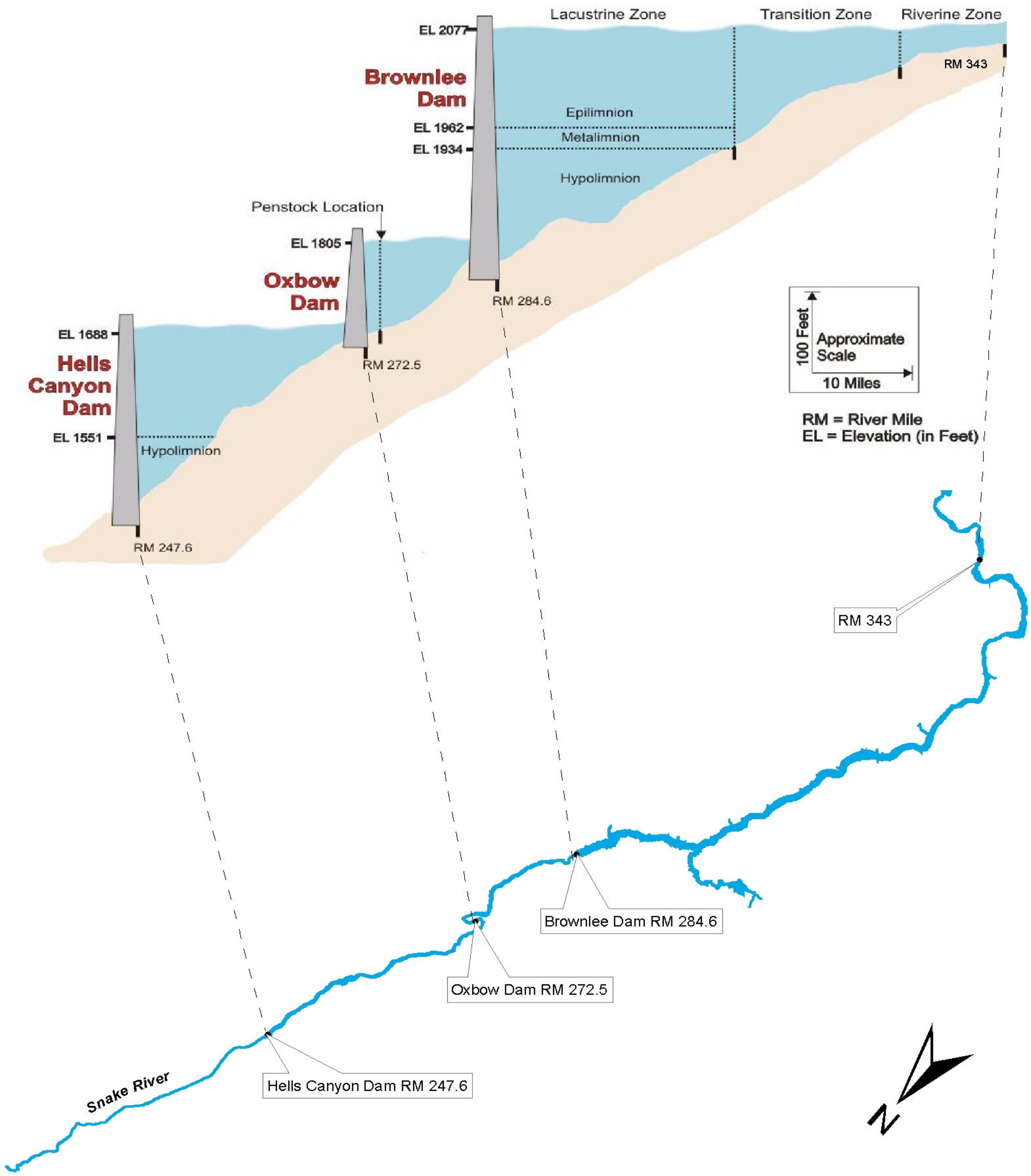

Figure E.2-1 Reaches, zones, and strata for Brownlee, Oxbow, and Hells Canyon reservoirs

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The *Code of Federal Regulations* below—18 CFR § 4.51(f)(3)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

§ 4.51(f)(3) *Report on fish, wildlife, and botanical resources.* The report must discuss fish, wildlife, and botanical resources in the vicinity of the project and the impact of the project on those resources. The report must be prepared in consultation with any state agency with responsibility for fish, wildlife, and botanical resources, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service (if the project may affect anadromous fish resources subject to that agency's jurisdiction), and any other state or Federal agency with managerial authority over any part of the project lands. Consultation must be documented by appending to the report a letter from each agency consulted that indicates the nature, extent, and results of the consultation. The report must include:

(i) A description of the fish, wildlife, and botanical resources of the project and its vicinity, and of downstream areas affected by the project, including identification of any species listed as threatened or endangered by the U.S. Fish and Wildlife Service (*See* 50 CFR 17.11 and 17.12);

(ii) A description of any measures or facilities recommended by the agencies consulted for the mitigation of impacts on fish, wildlife, and botanical resources, or for the protection or improvement of those resources;

(iii) A statement of any existing measures or facilities to be continued or maintained and any measures or facilities proposed by the applicant for the mitigation of impacts on fish, wildlife, and botanical resources, or for the protection or improvement of such resources, including an explanation of why the applicant has rejected any measures or facilities recommended by an agency and described under paragraph (f)(3)(ii) of this section.

(iv) A description of any anticipated continuing impact on fish, wildlife, and botanical resources of continued operation of the project, and the incremental impact of proposed new development of project works or changes in project operation; and

(v) The following materials and information regarding the measures and facilities identified under paragraph (f)(3)(iii) of this section;

(A) Functional design drawings of any fish passage and collection facilities, indicating whether the facilities depicted are existing or proposed (these drawings must conform to the specifications of § 4.39 regarding dimensions of full-sized prints, scale, and legibility);

(B) A description of operation and maintenance procedures for any existing or proposed measures or facilities;

(C) An implementation or construction schedule for any proposed measures or facilities, showing the intervals following issuance of a license when implementation of the measures or construction of the facilities would be commenced and completed;

(D) An estimate of the costs of construction, operation, and maintenance, of any proposed facilities, and of implementation of any proposed measures, including a statement of the sources and extent of financing; and

(E) A map or drawing that conforms to the size, scale, and legibility requirements of § 4.39 showing by the use of shading, cross-hatching, or other symbols the identity and location of any measures or facilities, and indicating whether each measure or facility is existing or proposed (the map or drawings in this exhibit may be consolidated.)

E.3. REPORT ON FISH, WILDLIFE, AND BOTANICAL RESOURCES

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The *Code of Federal Regulations* below—18 CFR § 4.51(f)—specifies the content of Exhibit E, the environmental report. However, codes include no clear placement of geomorphology and hydrology aspects of the environment. For that reason, the Applicant has included this section to provide background information necessary for the development of other environmental sections.

> (f) *Exhibit E* is an environmental report. Information provided in the report must be organized and referenced according to the itemized subparagraphs below. *See* § 4.38 for consultation requirements.

E.3.0. Geomorphology and Sediment

While geomorphology and sediment are not necessarily resources, they are important factors in the discussion of many of the resources in the Hells Canyon area (see section E.0.). To understand how geomorphology and sediment affect resources in the area, it is also important to understand the current, historical, and prehistorical (or before written records) conditions and processes taking place in the area. Because an appropriate interpretation of the current condition depends so heavily on historical and prehistorical conditions and processes, geomorphology and sediment must be presented and understood as a whole and not only as parts that might apply to a particular resource. In addition, geomorphic processes tend to occur on geologic time scales (thousands to tens of thousands of years or more), rather than on historic time scales (decades to hundreds of years). Therefore, the Applicant has created and inserted this section of the license application with sections on other resources associated with the Hells Canyon Complex (HCC)[1] to explain the geomorphology and sediment processes in the study area. The Applicant also presents specific interactions of these processes with individual resources in sections specific to those resources.

E.3.0.1. Introduction

In the northwestern United States, the Pleistocene and early Holocene periods had much wetter climates than the current climate. The resulting prehistoric hydrology and floods (such as the Bonneville Flood) formed the bed and channel shape of the Snake River upstream and downstream of the HCC that we see today. Over the last 1,000 years, the climate has been drier, and there have been no floods of the magnitude experienced previously. As a result, the channel has changed little since it was formed and is very stable under recent flows. In the last 150 years, human-caused, or anthropogenic, disturbances throughout the watershed, including the Hells Canyon area, first caused significant additional sediment supply to the system and then

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

subsequent decreases in sediment supply, in part because of multiple water resource projects such as the diversion and storage of water. The combination of these factors produced a “slug” of sediment that worked its way through the system but may now have mostly disappeared. Visitors to Hells Canyon in the early to middle twentieth century probably observed the effects of this slug of sediment working its way through the system. The previously established stable channel probably continues to serve as a conveyance for smaller sediments that reach the mainstem and are capable of being transported by current hydrology.

Geomorphology and sediment are closely related. Sediment supply, transportation, and deposition are affected by the geomorphology of an area, and, in turn, can influence the geomorphology. For example, in a classical alluvial river, sediments are regularly eroded from one area and transported to and deposited in other areas, floodplains are inundated and dewatered, and the channel can migrate within the floodplain. All river-forming flows (typically flows with a return period of about 1.5 to 2.0 years or greater) alter river features, such as bars, islands, and occasionally even the planform (or outline as viewed from above) of the river, by the working and reworking of sediments in the river channel. Hardened points (whether natural, such as bedrock outcroppings, or artificial, such as rip-rapped banks) generally cause the river to erode different areas than it would without these constraints. While the Snake River is a gravel-bed river, in Hells Canyon it does not act as a classical alluvial river because the present river form was developed under complex geological structural controls and significantly higher flow regimes than the current hydrologic conditions produce.

The river in the study reach is highly stable, with occasional reworking of features within the channel and some areas of erosion and deposition, but with no evidence of major changes in river planform or slope in recorded history. Evidence indicates that anthropogenic factors in the last 150 years have changed sediment loads in the river by initially increasing and then decreasing them (Technical Report E.1-2). But these sediments have apparently moved through the previously existing river channel, with some areas of erosion and deposition, without substantially changing the river channel. Therefore, evaluating only those changes that have occurred since construction of the HCC provides an incomplete picture for determining whether the continued operation of the HCC affects the study area and, if so, how much and in what manner HCC operation affects the study area.

The geomorphology and sediments in a system—unlike many other resources considered in the study area of immediate interest—can be affected and controlled by factors that are removed or distant in both time and space from the study area. Therefore, to provide appropriate context for geomorphology and sediment, both the study area and the time scale considered in this section are expanded somewhat from other parts of the application. For example, the geomorphology of the Snake River in the study area was largely fixed by events occurring from thousands to millions of years ago. Sediment that has moved, or could move, through the system has been affected by actions high up in the watershed.

E.3.0.2. General Description of the Snake River Basin

The Snake River begins high in the mountains of western Wyoming, flows through the Snake River Plain of southern Idaho, and turns northwest toward the HCC, which is located on the border between Oregon and Idaho. For a long reach through southern Idaho, there are no major tributaries to the Snake River. Just upstream of the HCC, five major tributaries—the Owyhee, Boise, Malheur, Payette, and Weiser rivers—join the Snake River. Elevations in the Snake River basin range from 735 feet (ft) mean sea level (msl) (at Lewiston) to 13,766 ft msl (at Grand Teton), in part because the large study area encompasses much of southern and central Idaho. Downstream of the HCC, Hells Canyon is a deep, narrow gorge that was created by geologic structural development and rapid downcutting with no true floodplain (Vallier 1998). Numerous local tributaries within the canyon drain various subbasins, in addition to which the mainstem Snake River is joined by the Imnaha and Salmon rivers approximately 60 miles downstream of Hells Canyon Dam. Inflows from the Salmon and Imnaha rivers are largely unregulated, meaning that there are no major dams. These inflows increase flows in the Snake River by approximately 40%.

Although stream flows and sediment dynamics influence geomorphology, the channel in Hells Canyon is largely controlled by its complex geologic history. The mainstem Snake River within the Snake River Plain cuts into mafic volcanic flows (such as basalt), felsic pyroclastics (such as rhyolite), and sedimentary alluvium lithologies. On the Idaho side, the major tributaries of the western Snake River Plain drain the granitic Idaho Batholith, while on the Oregon side, the major tributaries cut through volcanic highland areas. Within Hells Canyon, local tributaries primarily drain either basaltic volcanics or a complex assemblage of metavolcanic and metasedimentary rocks that comprise the Seven Devils and Wallowa mountains. Further downstream, basalts are the dominant source rock in the mainstem and lower reaches of the Imnaha, Salmon, and Grande Ronde rivers.

The Snake River began cutting Hells Canyon around 2.0 to 2.5 million years ago by draining large volumes of water during glacial periods and by tectonic uplifting along the many faults in the canyon. During the Quaternary glacial period, the canyon continued to be shaped by sustained seasonal flows estimated to have been at least 10 times larger than the discharges of present streams (Pierce and Scott 1982). In addition, about 14,500 years ago, a catastrophic flood from Lake Bonneville escaped into the Snake River Plain and Hells Canyon (O'Connor 1993). During the last 10,000 years, hydraulic discharges and sediment transport capacity have markedly decreased toward current conditions (Pierce and Scott 1982), and stream flows have remained essentially unchanged for the past 1,000 years (Skinner and Porter 1987, Hydrocomp 1990).

Most hillslope, valley, and channel morphology features appear to be relict features associated with preregulation hydrologic and geologic events. That is, these events occurred prior to the construction of the HCC, as well as before the numerous other water-regulation projects in the upper Snake River basin. The catastrophic Bonneville Flood left a sediment imprint on the system that has yet to be significantly altered. Although conditions before Euro-Asian settlement and water regulation are not well known, evidence strongly suggests that the Snake River has been a largely static river system for at least 1,000 years, if not longer (Hydrocomp 1990). Therefore, the HCC has had few effects on annual and monthly stream flows, sediment dynamics, and channel morphology in Hells Canyon.

Current peak discharges are not markedly different from flows before construction of the HCC (referred to in some exhibits as pre-HCC) because the HCC can store only about 11% of the river's average annual flow. However, usable storage is an even smaller percentage of the river's average annual flow. Because the reservoirs will either be full or fill rapidly, the HCC cannot substantially affect annual or peak flows in Hells Canyon, and peak flows tend to control the channel form. In terms of sediment dynamics, many of the potential channel responses to differing sediment inputs simply cannot compete with the larger geologic controls at work in the canyon. For example, decreased sediment loads generally cause riverbeds to armor,[2] a response that decreases the zone of active sediment transport. In this case, the bed was already well armored long before the HCC was built, so only a minimal response would be expected.

Finally, downstream of the HCC, the river morphology is characterized by a deep, narrow valley that is confined by bedrock walls, talus slopes, debris flows, landslides, and alluvial terraces from Bonneville Flood deposits, landslide backwater deposits, relict alluvial fans, or relict bars. This confinement has precluded the development of an alluvial floodplain that is typical of other rivers of comparable discharge area and gradient (ranging from 0.002 to 0.0007 ft [10.5 to 3.7 ft per mile] in the downstream direction) (Technical Report E.1-2). Rapids caused either by boulders in the bed material or by debris-flow fans are common in the canyon. Bedrock and debris fans also control the formation of 91% of the pools. This characteristic contrasts with other typical alluvial rivers where most pools are self-formed by alluvial processes.

E.3.0.3. Upstream of the Hells Canyon Complex

E.3.0.3.1. Potential Sediment Transport

For the Snake River upstream of the HCC to be a contributor of riverbed-sized materials in the river downstream, these sizes of material would have to be available and transported through the upstream reach. In Technical Report E.1-2, Miller and the other investigators discuss the findings of a study about bedload movement near the Deer Flat National Wildlife Refuge, which is located upstream of the HCC. Results of this study indicate that bedload during the last 70 years or more has been restricted to sand and gravel sizes with a d_{50} of 30 millimeters (mm) or smaller[3] (Osterkamp 1997), provided that supplies of sediments of this size are available. The average d_{50} of the surface layer in the reach from Hells Canyon Dam to the Salmon River is 144 mm. To move material of this size through the reach of the Snake River between the Weiser River and Brownlee Reservoir, the Snake River would have to flow at a depth of over 200 ft. A rough estimation, based on cross-section and slope data from another study (Technical Report E.3.3-3), indicates that the flows required to produce depths in this range are at least an order of magnitude greater than (increased by a factor of about 10) recorded peak flows. Alternatively, for a flow of

2. Armoring is the layer of larger material on the surface of a gravel-bed river. See Technical Report E.1-1 for a more complete description of armor and its formation.
3. This value means that 50% of the particles by weight are smaller than the given value.

about 100,000 cubic feet per second (in the range of current 100-year peak flow), the slope would have to be on the order of 36 ft per mile to mobilize the d_{50} material, a slope that is about six times the preregulation and current slope of the Snake River in this reach (USGS 1925). Taken together, these data indicate that under current hydrological conditions, the Snake River upstream of the HCC is incapable of transporting the sizes of material that dominate the river downstream of the HCC.

Further evidence of the lack of bed-material mobility in the reach upstream of the HCC is the historical stability found at one of the U.S. Geological Survey (USGS) gauging stations. The stability of the river at the Snake River at Weiser (13269000) gauging station was evaluated, using both the cross sections surveyed by the USGS over the time since the gauge was installed in 1910 and the rating curves developed by the USGS to estimate flow at this site. Both methods confirm that, in this location, the river has experienced some small changes but no substantial degradation, aggradation, or lateral movement. The stability of the cross section does not imply that there is no sediment transported through the reach. In fact, the USGS suspended sediment sampling and the Brownlee Reservoir sediment survey confirm there is sediment transport in the Snake River at the Weiser gauge. The stability of the Weiser gauge shows that bed-sized materials, not found in the USGS sampling or in appreciable quantities in Brownlee Reservoir sediments, are not being stored in the river channel upstream of the reservoir due to backwater.

In general, this reach of the Snake River is located in a relatively flat alluvial plain where coarse sediment that reached the mainstem would generally be deposited before it reached the HCC. Because of a combination of upstream regulation projects and a flat gradient, channel islands upstream of the HCC have increased in area by an average of 8% since 1938 (Johnson and Dixon 1997). This increase was confirmed qualitatively through a series of aerial photographs from 1977 and 1996. These photographs covered the reach from Swan Falls Dam to Weiser, Idaho. Overall, the mainstem and tributary storage projects have reduced peak flows and decreased the volume of fine and coarse sediment transported downstream past Weiser compared with flows and sediment volumes experienced before water regulation.

E.3.0.3.2. Anthropogenic Influences

Since the geologic framework for the Snake River system was formed, more recent anthropogenic disturbances have affected physical processes in the study area and Hells Canyon specifically. By the 1880s, land uses varied by river reach, but overall the following activities substantially increased sediment supplies over conditions before Euro-Asian settlement (Technical Report E.1-2).

Trapping—As a result of widespread trapping in the 1800s, beaver populations dwindled. Failing beaver dams, which released trapped sediment, probably caused significant downstream sediment pulses.

Mining—By the 1860s, large dredge and hydraulic mining resulted in sedimentation rates up to 1,500 times higher than rates under natural erosion. For example, in Hells Canyon, placer mining activities were common and caused the creation of new gravel bars. A local newspaper article from the 1940s profiled Oakey Grogg, one of the "hundreds of placer miners and prospectors" who worked the sediments in Hells Canyon (source unknown). The same article said that the same area contributed much of the gold that financed the Civil War. During cultural surveys, archaeologists working for the Applicant noted a distinct lack of soil horizons at Salt Creek. The lack of these horizons strongly indicates that the entire area has been reworked in historical times, possibly through hydraulic mining activities.

Forest Management—Sediment yields in timber production areas along tributaries are estimated to have increased by an order of magnitude by the 1860s. Roads, which were built to access timber through river valleys and riparian areas, typically produce between 26 and 346 times the sediment volume that undisturbed areas produce. Several entities, including the U.S. Forest Service, Bonneville Power Administration, Northwest Power Planning Council, and University of Idaho have spent millions of dollars investigating anthropogenic influences in the adjacent Salmon River basin.

Wildfire—Fire generally increases erosion into adjacent creeks and rivers. Prior to Euro-Asian settlement, Native Americans supplemented wildfires by starting their own fires. Although fire was routinely prevented by the early 1990s, high-intensity fires and associated erosion in the region increased dramatically between 1970 and 1995.

Agricultural Development—From 1890 to 1992, Idaho's irrigated acreage increased from 0.2 to more than 3.0 million acres. Early irrigation practices severely eroded agricultural lands within the Snake River Plain. Current sediment yields, which are improved (decreased), range from 0.67 to 51 cubic yards per acre per year.

Grazing—Livestock grazing during the late 1800s and early 1900s was unrestricted. This grazing caused surface erosion and mass wasting in riparian zones throughout the watershed. A 1963 U.S. Forest Service study addressed a "combination of severe overgrazing for the past half century and periodic storm[s] of cloudburst in intensity [that] has caused severe sheet and gully erosion" in Kurry Creek (at Pittsburg Landing in Hells Canyon) (U.S. Forest Service, Grangeville, ID, internal personal communication, 1963).

Urbanization—Within the last 40 years, the net change in sediment loading that has resulted from replacing agricultural land with urban land uses in the Snake River basin has not been well quantified.

Current land uses that continue to affect the river are rangeland, forest, cropland and pasture, and recreational uses. Recreational uses within the canyon specifically include rafting, boating, fishing, hunting, camping, and hiking.

Therefore, sediment supplies to the Hells Canyon reach of the Snake River have been substantially modified by activities upstream of and within Hells Canyon before construction and operation of the HCC. Any accurate assignment of impact on sediment and geomorphology below the HCC must take these other factors into account.

E.3.0.3.3. Basin Water Development

Following most of these earlier anthropogenic effects, water storage and regulation became the most significant anthropogenic disturbance in the basin with the greatest influence on the hydrology and sediment supply. Streamflows upstream of the HCC have been altered because so much of the water is either stored or diverted. During dry years, almost half of the estimated naturally occurring volume of the Snake River is diverted for agricultural purposes, while during wet years, about one-third is diverted. Most importantly from a geomorphic context, water storage and regulation projects have also reduced peak flows that transport the majority of sediment load. Therefore, the transport capacity of available sediment has continued to decline, not only compared with prehistoric conditions (that were driven by climatic and hydrologic changes), but also compared with recent historical conditions (driven by anthropogenic disturbance).

Storage on the mainstem and in the upstream tributaries, as well as channel morphology and changes in hydrology, limits the amount of large sediments that can be transported to Hells Canyon independently of the influence of the HCC. Between 1901 and 1969 (before the HCC was completed), over 10 mainstem and 35 tributary facilities were constructed in the Snake River system (Technical Report E.1-2). These upstream projects prevent the productive (in terms of sediment supply) upper watershed areas, including the Boise and Payette drainages that originate in the Idaho Batholith, from providing sediments to the Hells Canyon reach.

E.3.0.4. Within the Hells Canyon Complex

Brownlee Dam was the first of three dams constructed as part of the HCC. At the time Brownlee Dam was completed (1958), 87% of the drainage basin upstream of the HCC was already cut off from supplying sediment to the study area. In addition, the areas cut off from supplying sediment were in the higher yield areas in the upper parts of watersheds, particularly in the Idaho Batholith area (the Boise and Payette river watersheds). In Technical Report E.1-2, Miller and the other investigators estimated that, from 1901 through 1999, other reservoirs (upstream of Brownlee Reservoir) effectively trapped 92% of the available sediment. The Weiser River is the only major tributary to the Snake River downstream of Swan Falls Dam and upstream of the HCC that is not blocked by a major dam.

E.3.0.4.1. Sediments Trapped in Brownlee Reservoir

Evaluation of available sediment data indicates that sediment that is not trapped in upstream reservoirs is predominantly finer-grained material. Analysis of the USGS data on the Snake River at Weiser (13269000) indicates that, on average, about 81% of the suspended sediment in the Snake River near Weiser is smaller than 0.062 mm, meaning that this sediment is predominantly silts and clays (smaller than very fine sand) (USGS 1997). This gauge is located downstream of all major tributaries to the Snake River before it enters Brownlee Reservoir.

Evidence that the size of sediment transported in the reach of the Snake River upstream of the HCC is very small is confirmed by samples taken in Brownlee Reservoir. The Applicant collected approximately 14 sediment samples throughout Brownlee Reservoir, plus 3 deep-core samples. The 14 sediment samples were taken underwater, but on the surface of the sediment layer. Approximately 96% of the sediment trapped in Brownlee Reservoir consists of fine sand, very fine sand, and silt-clay (Appendix B to Technical Report E.1-1). At a bulk density of 82.4 pounds per cubic feet, these fine sands and smaller particles are about 2.7 million tons per year out of a total of 2.8 million tons of sediment per year. This reservoir contains only about 8% of all sediment that was trapped upstream of Hells Canyon between 1901 and 1999. Approximately 1,550 acre-feet (2.78 million tons) of fine sediments from upstream of Brownlee Dam would have been transported downstream into Hells Canyon annually if the HCC had not been constructed. Because nearly all of the sediments in Brownlee Reservoir are of silt and clay sizes, they would largely flush through the Hells Canyon reach: with steeper slopes, the transport capacity of the Snake River in Hells Canyon is much greater than the transport capacity upstream of the HCC. Sediments trapped in Brownlee Reservoir could probably not significantly affect bed material or sandbars downstream of the HCC.

E.3.0.4.2. Sediment Sources Within the Hells Canyon Complex

Existing studies by others have focused on the HCC as the cause of downstream sediment issues. Therefore, the Applicant's studies have focused on sediment sources downstream of the HCC and have primarily utilized existing data for analysis upstream of the HCC. The watersheds contributing directly to the HCC generally have different topographies, geology, lithology, and hydrology than the watersheds downstream of HCC. These differences result in lower sediment yields than those found for the watersheds downstream of the HCC. For example, slope is directly related to sediment discharge. Because watersheds feeding into the HCC tend to have lower slopes, they would contribute less sediment than those below the HCC.

Sediment loads directly to the HCC were calculated based on the same methodology as for below Hells Canyon Dam. Oxbow Reservoir includes a fairly small watershed compared with those of the other two reservoirs, and only a couple of tributaries fit within the bounds of the methodology (regarding attributes such as basin size and slope). Both of these basins (Wildhorse River and Salt Creek, ID) show zero sediment load. Clearly, based on observations of the conditions of these two basins, they do contribute sediment. Therefore, an area weighted average from tributaries to Brownlee and Hells Canyon reservoirs was used to estimate sediment load into Oxbow Reservoir.

The upper end of the range of total sediment load to the HCC is estimated to be about 207,000 tons per year, with sand estimated at 50,500 tons per year and spawning gravels at 48,900 tons per year. If a reasonable estimate of the lower end of the range is taken to be one order of magnitude lower, estimates of the lower end are 20,700; 5,050; and 4,890 tons per year for total sediment, sand, and spawning-size gravel, respectively.

E.3.0.5. Downstream of the Hells Canyon Complex

E.3.0.5.1. Sediment Sources

There is clear visual evidence that many of the tributaries downstream of Hells Canyon Dam have supplied sediment to the mainstem Snake River in recent years. Sediment loads, including sizes from sand through gravel, were calculated from 17 tributaries to the mainstem. Note that two of the tributaries (Cherry and Cook creeks) are just downstream of the Salmon River. The tributaries selected ranged throughout the study area downstream of Hells Canyon Dam on both sides of the river. The two largest suppliers of sediment (by a factor of 10) are located in the upper part of Hells Canyon, upstream of most of the sand beaches and spawning areas identified as areas of particular concern. This finding means that the majority of sediments supplied by the tributaries are supplied upstream of the areas in the canyon that benefit from sediment supply (such as sandbars and spawning sites).

The tributaries for which the sediment supply was calculated (between the HCC and the Salmon River [not including the Imnaha River drainage]) account for approximately 348 square miles out of 540 square miles in the total watershed area. The average sediment yield from these tributaries was applied to the remaining area not included in the calculated tributaries, for an estimated total sediment supply of 8.60 million tons per year (Technical Report E.1-1). The same calculations for sand- and spawning-size gravels, respectively, are 1.44 million tons per year (17% of the total) and 4.14 million tons per year (48% of the total). It should be noted that the numbers presented above likely represent an upper bound of sediment supplies below Hells Canyon Dam. While there are no definitive ways to estimate how much these numbers should be reduced for a reasonable supply estimate, some preliminary information based on reservoir trapping indicates that a lower bound may be approximately one order of magnitude lower. This indication for a lower bound would produce estimates for total sediment, sand, and spawning-size gravel of 0.86, 0.144, and 0.414 million tons per year, respectively. To put these quantities in perspective, the annual quantity of sand that the tributaries supply would range between about one-quarter of the average annual load of sand-size material trapped in Brownlee Reservoir to almost four times the quantity of trapped sand. Visual observations of the tributaries following high-flow events support the findings that the tributaries supply substantial quantities of sediments of all sizes to the mainstem Snake River.

Sediment is supplied directly from the tributaries on relatively short time scales (tens to hundreds of years) during peak-flow events. Additional sediment accumulates upstream of sharp bends in the tributaries above the confluence with the Snake River; these materials are probably mobilized only during extreme events on longer time scales (hundreds to thousands of years) (Technical Report E.1-2). Steep hillslopes (62% have slopes greater than 40 degrees) have provided a significant supply of sediment over the last 1,000 years, as well as over longer geologic time periods. Rock varnish confirms that episodic small to catastrophically massive landslides have occurred along both sides of Hells Canyon. Therefore, a substantial supply of sediment reaches the mainstem over short and long time periods from adjacent hill slopes.

Riverbed material itself does not appear to produce substantial volumes of sediment. Because the channel is a stable, armored system, the riverbed is not extensively reworked during peak events. Based on weathering patterns on the armored gravel bars, these features appear to have been armored for a significant period of time (on the order of hundreds to thousands of years) (Technical Report E.1-2). The lithology and mineralogy of armored surface and subsurface sediments indicate that the majority of bed materials downstream of Hells Canyon Dam have been locally derived over the same geologic time frame.

Professional geologists examined 4 bed-material samples upstream of the HCC and 26 bed-material samples throughout the reach downstream of the HCC. The geologists compared the mineralogy of the bed-material samples collected in Hells Canyon to samples collected upstream of the HCC and determined that the samples originated separately (Technical Report E.1-2). The analysis indicates that surface and subsurface sediments from bed materials upstream of the HCC had a distinctly different mineralogy. Downstream of the HCC, the lack of acidic intrusive bed material (such as granite or granodiorite) in the coarse fraction, as well as the lack of a prevalence of potash feldspar in the finer-grained fraction, are the most important distinguishing features (Technical Report E.1-2). This analysis suggests that, over a long geologic period, most of the bed downstream of the HCC has been derived from local canyon sources and not from sources upstream of the HCC.

Sediment chemistry (x-ray diffraction) analyses have been conducted on bed material samples downstream of the HCC. Bed material samples, including spawning gravels, from the mainstem Snake River have been collected over the last several years for various purposes. Samples from a terrace relic of the Bonneville Flood (Big Bar) were taken. Coarser-grained material (between 0.125 and 4.76 mm) and larger, based on visual analysis, from Big Bar appear to be all locally derived from bedrock below the HCC. In sharp contrast, the finer-grained fraction (less than 0.125 mm) has a signature close to that of the sediments above the HCC. These lithological and mineralogical data for the Big Bar are limited, but the coarser-grained sediment data indicate that most of the coarser-grained material is from the bedrock exposed in Hells Canyon, with limited contributions from upstream sources. The data imply that the fine sand and larger grain-size particles that were contributed by erosion of the Bonneville terrace sediments have a signature of bedrock exposed below the HCC. Therefore, in addition to sediments derived from the current tributaries below the HCC, the sediments derived from the Bonneville terraces probably contribute sediments with a local signature to features such as the spawning gravels. These data and analyses suggest that the HCC has had only minimal influence on the composition of spawning gravels in the reach downstream of the HCC. They also support the conclusions that upstream material (now trapped by Brownlee Reservoir) historically did not contribute to the spawning gravel resources and that the influence on spawning gravels from the trapping of coarser local tributary sediments with the HCC reservoirs is probably minimal.

E.3.0.5.2. Sandbars

There are no data to determine whether the size and numbers of sandbars found in historical accounts (oral, written, or photographic) existed within a regime of dynamic equilibrium in the overall system. Nor are there data to indicate whether anthropogenic factors (from the mid-1800s through mid-1900s) and available geomorphic and channel characteristics allowed their development (Technical Report E.1-2).

The analysis of sandbars in Hells Canyon yields or confirms several important points. The majority of the sediments found in the sandbars fall within the sand-size range (0.062 to 2 mm), with an average of less than 3% of the material falling into the silt and clay-size range (Technical Report E.1-1). Further, cores taken in Fish Trap and Pine Bar show that the particle size distribution and minerology are relatively constant with depth. That is, there is no sign that the deeper parts of the bars have a different character than the surface has. Therefore, supplies over this full range of sizes are necessary to maintain the sandbars. Most of the sediments stored in Brownlee Reservoir are smaller than those found in sandbars throughout the Hells Canyon reach. Of the sand trapped in Brownlee Reservoir, over 86% is smaller than sand (< 0.62 mm) (Technical Report E.1-1). Therefore, under current watershed development, sources upstream of Brownlee Reservoir do not provide the full range of sediment sizes required to maintain these sandbars.

The Applicant has monitored sandbars at four locations between Hells Canyon Dam and the Salmon River for several years. The monitoring consists of physically surveying the size and shape of the sandbars on a regular basis. The monitoring began shortly after the highest recorded flow downstream of Hells Canyon Dam in early 1997. After this high flow and the following high-flow periods in 1997 and 1998, several of the tributaries had deposited large amounts of materials at their confluence with the mainstem river. The data also show that the elevation at the top of the bars generally coincides with a regularly occurring high flow (approximately 30,000 cubic feet per second). Analysis of survey data collected to date, together with aerial photography from various years before and during construction of the HCC, indicates that sandbars have been, and continue to be, dynamic features of the river system, features that grow, shrink, and change shape in response to varying flows and sediment loads in the river.

Little historic information specific to sandbars exists for the Hells Canyon reach of the Snake River. After the HCC was constructed, Grams and Schmidt were hired by the U.S. Forest Service to conduct two studies to evaluate the trends of sandbars and terraces in this reach (1999a,b). They concluded that sandbars in the Hells Canyon reach decreased in area by 75% between 1964 and 1973 because of recurring large floods and the lack of sediment resupply downstream of the HCC (that is, clear water floods) (Grams and Schmidt 1999a). They acknowledged that the HCC does not significantly affect the magnitude of the floods but claimed that “the dams of the Hells Canyon Complex also block all sediment from all upstream sources.” The Applicant conducted its own analysis of aerial photographs that included the time period analyzed by Grams and Schmidt. The Applicant’s work shows a less dramatic decline and more evidence of current stability than the work of Grams and Schmidt did (see Technical Report E.1-1 for details).

Grams and Schmidt did not consider that 87% of the watershed upstream of the HCC was already behind dams (or sediment traps) by the time that Brownlee Dam was completed. Therefore, the majority of their assumed sediment supply was already unavailable. They also lacked information on sediments actually trapped in Brownlee Reservoir. Such information would have shown that only minor amounts of sand have been trapped. These sands are of the fine and very fine sizes and include almost no coarser sand sizes. In contrast, sandbars downstream have the full range of sand sizes, from very fine to very coarse sizes, throughout their depth. In addition, the provenance of the sands throughout the profiles of sandbars is in large part from the Idaho Batholith, which is the Boise and Payette river watersheds. These watersheds were cut off at the time the HCC was constructed. Therefore, the Applicant’s analysis and findings invalidate several of the key assumptions on which Grams and Schmidt relied when they concluded that the HCC was the sole cause of sandbar degradation in Hells Canyon.

Another key assumption on which Grams and Schmidt's conclusions depend is that the Snake River and specifically the sandbars in the Hells Canyon reach were in a state of dynamic equilibrium from 1955 to 1964. They did not consider anthropogenic disturbances in the watershed above the HCC and within the Hells Canyon area. However, these disturbances initially increased the sediment supply to the Snake River, and then in subsequent years, over 500 dams with over 10 million acre-feet of storage were built. Therefore, assuming that the Hells Canyon reach was at a state of dynamic equilibrium following approximately 100 years of upstream and in-canyon activity and development is not appropriate, and making this assumption leads to the erroneous conclusion that the HCC is responsible for all changes to sandbars in the Hells Canyon reach.

E.3.0.5.3. Bed and Bank Stability

To evaluate bed stability in the Snake River downstream of the HCC, we used two methods—incorporating measurements of cross sections and calculations of incipient motion. According to the results of both of these methods, the downstream riverbed is predominantly stable. The USGS gauging station immediately downstream of the dam (13290450) has been in operation since 1965. The gauging station on the Snake River near Joseph (13209500) was established downstream of China Bar in 1955, although it was discontinued in 1971. Neither actual measurements of the cross section at each station nor the rating curves used for gauge operation show any trend in river bottom changes. Note that the stability of these sections does not imply that there is no sediment transport, but only that the bed is not scouring or aggrading over time.

Calculations of incipient motion were based on particle-size information for bed materials and the one-dimensional hydraulic model developed for the Snake River downstream of Hells Canyon Dam (Technical Report E.1-1). Results for the mainstem indicate isolated pockets of bed-material movement for flows that are currently experienced in the Snake River reach of Hells Canyon. However, most of the bed appears to be stable. This channel stability can be attributed to the armored surface that was probably established by prehistorical high-flow events. During these high-flow events, an armor layer consisting of large material was developed along the river channel, but current flow conditions have insufficient energy to move this established layer of surface armor. The incipient motion results do, however, indicate some areas of mobile bed materials. These areas are typically located downstream of the mouths of tributaries. This finding indicates that the pockets of mobile material probably originate from the local tributaries that supply sediments to the mainstem during high-flow events. This material probably moves along the river until it is deposited in some of the deeper pools downstream or retained by some of the large downstream bars. However, the long reaches between tributaries, which usually have larger bed material (200 mm or greater), are stable. Technical Report E.1-2 includes more detailed information on the classification of bed materials.

The presence of bedrock and debris flows in Hells Canyon also contributes to the stability of the river channel. When debris flows occur, both large and small materials are washed into the river channel. The river transports the small material downstream, but material too large to be transported remains. This large material creates a stable, armored channel. This armoring is evident at Wild Sheep, Granite Creek, and Rush Creek rapids, as well as at numerous small rapids along the river. As a result of the large material armoring the channel, the rapids are also considered to be stable. In addition, bedrock constrictions force flows to converge, an action that consistently scours the channel. Therefore, since the bedrock is immobile, it also creates consistent flow conditions that maintain stable channels.

The incipient motion methodology was also used to evaluate spawning sites where the Applicant's biologists had done some habitat modeling (Technical Report E.1-1). Gravel sizes on the small end of the scale of spawning gravel sizes (1 and 2 inches [25 and 51 mm]) were used in the analysis. For the 1-inch (25 mm) size class, results indicate that most of the spawning sites are stable for flows experienced in the study area. For the 2-inch (51 mm) size class, all sites were stable. Technical Report E.1-1 includes a detailed discussion of spawning site stability. Since the larger gravel sizes do not move, they tend to shield the smaller 1-inch (25 mm) materials and prevent them from moving. This tendency, in turn, enhances the stability of the spawning sites. The stability analysis for spawning sites shows that these sites can be stable even when the bed shows some signs of mobility (using values averaged across the cross section).

This stability analysis is reinforced by the results of x-ray diffraction analysis of gravels in spawning sizes. The results of this provenance study show that gravels in spawning-size range are almost exclusively from local sources. This finding means that the historical sources of spawning gravels are still largely available to Hells Canyon.

Except at a few locations, riverbanks in Hells Canyon are also stable. A study of shoreline erosion (Technical Report E.3.2-42) indicates that the Hells Canyon reach is one of the most stable reaches studied (from the Salmon River upstream to Weiser). In the reach downstream of Hells Canyon Dam, erosion occurred at 60 sites, or in 2.44 of 125 miles (on both sides of the river), an area that accounts for only about 2% of the reach. Because most sites were above the range of typical flow fluctuations (Technical Report E.3.2-42), operations of the HCC do not appear to cause most of the erosion. Instead, anthropogenic disturbances (such as recreational foot traffic) or other hillslope processes (such as groundwater seepage) probably cause the localized erosion.

Grams and Schmidt (1999b) analyzed two locations—Tin Shed and Camp Creek—because they were specific riverbank terraces with cultural significance. Their analysis, based on historical aerial photographs from 1964 through 1996, assumed that any changes shown were driven by construction and operation of the HCC. They concluded that, in an unregulated system, the erosion of the bars and banks would be balanced by regular sediment deposition. However, their conclusion incorrectly assumed that the HCC severely limits the amount of material that would be available to replenish sandbars; it neglects all of the local sediment sources that continue to contribute loads to the mainstem and its geomorphic features; and possibly most importantly, it ignores all anthropogenic influence upstream of the HCC and within the Hells Canyon area. As discussed in section E.3.0.5.2., drawing any conclusions about the effects of HCC operations without also considering the contributions from local tributaries and the anthropogenic influences upstream of the HCC is inappropriate. For example, the two aerial photo series used in evaluating sandbars clearly show significant ranching operations at Tin Shed in both 1964 and 1973, including fences and roads down to the water's edge.

Grams and Schmidt (1999b) did acknowledge that the operations of the HCC could not be unequivocally linked to terrace erosion: they stated that the largest peak flows since 1964 could not have overtopped terrace surfaces. One example of something other than river processes influencing a terrace area is found at Salt Creek. Archaeologists noted that the soil column had been recently disturbed. Apparently, soil that had been removed during historical placer-mining operations had been redeposited. Given that placer mining was conducted before the HCC existed, these changes, as well as others, to beach and terrace areas did not result exclusively because of river processes, including river processes influenced by the HCC.

E.3.0.6. Interactions of Geomorphology and Sediments with Other Resources

Geomorphology and sediment, along with river flows, define the physical landscape or framework on which river-based resources depend. A consistent understanding and application of the processes that form this landscape is fundamental to an integrated approach for evaluating multiple resources. Geomorphology and sediment define this landscape and a thorough understanding of them is essential to a complete understanding of the resources in Hells Canyon. The following sections emphasize how geomorphology and sediment interact with various resources.

E.3.0.6.1. Aquatic Resources

Sediments (as substrate) are a major component in defining habitat requirements for many aquatic resources. Different aquatic species or life stages often require different sizes or compositions of sediment. For example, sediment size is a key factor in how fall chinook salmon select spawning areas (Chapter 2 of Technical Report E.3.1-3). The Applicant's sediment study (Technical Report E.1-1) looked at both the supply to the mainstem and the stability of spawning gravel sizes (1 to 6 inches [25 to 152 mm]) in locations where the Applicant's biologists identified and described spawning areas for fall chinook salmon (Chapter 3 of Technical Report E.3.1-3). Results of the Applicant's studies indicate that these spawning beds are generally stable, significant supplies of new material are available in a broad range of sizes (including sands and spawning gravels), and spawning-size substrate is and has been of local origin.

Rearing habitats for fall chinook are also defined in part by sediment size, although sediment size is generally less important than other habitat features, such as shoreline gradient and water velocity. Rearing juvenile fall chinook generally use substrates smaller than 240 mm that are associated with shallow, low-gradient, and low-velocity shoreline areas (Garland et al. 2001, Tiffan et al. 2002). These local habitat features are influenced largely by channel morphology and gradient in the reach. The amount of rearing habitat for fall chinook salmon increases in availability with distance from Hells Canyon Dam (Technical Report E.2.3-2). This increase corresponds to changes in confinement and gradient features of the river channel (Technical Reports E.1-2 and E.2.3-2).

E.3.0.6.2. Recreational Resources

Recreation in Hells Canyon includes several activities directly and closely tied to the river and its geomorphology, such as boating, fishing, sightseeing, and others. However, the recreational activities that seem to be most closely tied to geomorphology and sediment downstream of the HCC are camping and stopping (or day use) on sandbars. The Applicant and U.S. Forest Service identified more than 150 dispersed recreational-use sites along the river corridor from Hells Canyon Dam downstream to Cache Creek, the northern entry portal to the Hells Canyon National Recreation Area (Technical Report E.5-9). With few exceptions, these sites are relatively flat areas that adjoin the river. They usually consist of sandbars or low-lying terraces that—depending on topography, bank material composition, and channel morphology—are susceptible to erosion. While the terraces above sand beaches are generally more desirable for camping than the beaches themselves (because of ground cover and shade), the beaches are used for other activities associated with camping.

E.3.0.6.3. Cultural Resources

Cultural resources are connected to geomorphology and sediment because people often selected locations for living and working based on the geomorphology and sediment and because those activities often left cultural artifacts. Particularly in Hells Canyon, areas where human habitation is practical are limited. These areas tend to be close to the river on benches left by prehistorical floods or alluvial/colluvial fans. They also tend to be where people can dig for housing (pit houses) and, during historical times, where areas were suitable for farming, ranching, or mining. Therefore, artifacts, structures, and other cultural features are generally located in areas with finer-grained materials (not purely large rocks), meaning that they are subject to erosion.

Approximately 1,000 mapped archaeological sites are located along the Snake River between Farewell Bend (RM 334) and the confluence with the Salmon River (RM 188) (Technical Reports E.4-1, E.4-2, and E.4-3). Many of these sites are historically significant. In certain places, shoreline erosion has undermined bank stability and disturbed soils containing archaeological deposits, such as artifacts, organic materials, and, in one case, Native American remains. These materials are nonrenewable cultural resources that are protected by various state and federal laws.

Federal agency staff have suggested, based wholly or in part on studies by Grams and Schmidt (1999a,b) that “sediment starved floods” have caused the shoreline erosion that damaged several archaeological sites downstream of Hells Canyon Dam. Their suppositions were supported by the Grams and Schmidt studies (1991; 1999a,b). These beliefs imply that the Applicant is responsible for most or all of the bank stability problems at archaeological sites downstream of Hells Canyon Dam. However, the Applicant’s study allows for a better determination of what, if any, effect the construction and operation of the HCC has had on erosion at these archaeological sites. Specifically, the Applicant’s studies show that the HCC neither causes sediment-starved floods nor has been the sole, or even the primary, cause of the loss of sand-sized materials in the Hells Canyon reach (Technical Report E.1-1). In addition, the river is largely stable, and much of the erosion identified at archaeological sites (Technical Report E.4-1) appears to occur at flows greater than the plant capacity of the HCC (approximately 30,000 cfs). These flows are therefore outside the range of flows that can be controlled by the operation of the HCC.

E.3.0.6.4. Terrestrial Resources

Terrestrial resources are also connected to geomorphology and sediment. Riparian areas by the river erode, while finer-grained materials, from sands down to silts and clays, are deposited where willows and other riparian vegetation can become established.

Erosion of riparian areas is important primarily because of the direct loss of established vegetation and the loss of finer-grained materials where vegetation can become established. The Applicant’s studies show that the riverbanks downstream of the HCC are stable; in fact, bank erosion occurs in only about 2% of the Hells Canyon reach (Technical Report E.3.2-42). The geomorphology study (Technical Report E.1-2) also indicates that the river is highly stable, with banks largely formed and “locked in” by the high flows of prehistorical floods. In recent history, the river has migrated from side to side in very few places. The Applicant’s studies further show that the HCC has not measurably increased the erosive potential of the Snake River in Hells Canyon.

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E.3.1. Fish and Snail Resources

E.3.1.1. Description of Fish and Snail Resources

The study area for fish resources associated with the Hells Canyon Complex (HCC)[1] is large and broadly includes much of the Snake River basin between Shoshone Falls at river mile (RM) 615 and Lower Granite Reservoir at RM 147. Most of the studies related to fish focused on the mainstem Snake River and tributaries between Swan Falls Dam (RM 458) and Asotin, Washington (RM 145) (Figure E.3.1-1). Studies associated with the historical distribution of anadromous fish focused on the Snake River basin between Hells Canyon Dam (RM 247.6) and Shoshone Falls and all of the major tributary basins associated with that reach of the Snake River (Figure E.3.1-2). In addition, studies related to the Applicant's mitigation hatchery facilities for anadromous fish included two hatcheries located on the Snake River (Niagara Springs Fish Hatchery and Oxbow Fish Hatchery) and two hatcheries located along the Salmon River (Rapid River Fish Hatchery and Pahsimeroi Fish Hatchery, which includes an upper and lower facility) (Figure E.3.1-3).

Fish communities associated with the HCC, the vicinity, and areas downstream of the HCC comprise 10 families with wide representations of different phylogeny (Table E.3.1-1). Native family representation is limited to 6 families of fish, including lamprey (Petromyzontidae), white sturgeon (Acipenseridae), salmon and trout (Salmonidae), minnows (Cyprinidae), suckers (Catostomidae), and sculpins (Cottidae). As is typical for fish fauna of the Pacific Northwest, native species in the HCC and vicinity are few, limited in fact to only 18 species. Members of the Cyprinidae and Salmonidae families show the greatest representation of native species. In 1986, 1 species, the Snake River coho salmon (*Oncorhynchus kisutch)*, was declared extinct in the vicinity downstream of the HCC. Species representation in the Cottidae family is not completely described for the immediate vicinity and may be underrepresented in our account. Although the diversity of native species is low, representation of diverse life histories within species is rich. Diversity of potamodromous (migrating, spawning, and feeding entirely in fresh water) and anadromous (migrating between saltwater and freshwater to mature in saltwater and spawn in freshwater) life histories is evident, but these life histories may not be fully understood, especially

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

for less-studied species such as cyprinids and catostomids. The richness of native species and diversity of life histories were reduced above and within the HCC when the three dams (Brownlee, Oxbow, and Hells Canyon) were constructed. The period before construction is referred to in this exhibit as the pre-HCC period. These dams became migration barriers, primarily for anadromous species such as the Pacific salmon species (*Oncorhynchus* species) and Pacific lamprey (*Lampetra tridentata*).

The dams may also represent migration barriers to potamodromous species such as bull trout (*Salvelinus confluentus*), the only native char in the vicinity, redband trout (*O. mykiss gairdneri*), bridgelip suckers (*Catostomus columbianus*), largescale suckers (*C. macrocheilus*), northern pikeminnow (*Ptycocheilus oregonensis*), mountain whitefish (*Prosopium williamsoni*), and white sturgeon (*Acipenser transmontanus*). Historically, populations of bull trout and possibly other species may have been part of larger metapopulations, with exchange of individuals among various local populations and tributaries to the Snake River. The maintenance of migratory life histories has been identified as critical to the persistence and viability of bull trout populations (Technical Report E.3.1-7).

Following Euro-Asian settlement of the region, many fish species were introduced into the Northwest and specifically within the HCC and its vicinity (Special Appendices to Technical Report E.3.1-2). Introduced species are represented in 7 families of fish and include 23 species. The sunfish and black basses family (Centrarchidae) and the catfish family (Ictaluridae) represent the greatest number of introduced species.

Clearly, construction of the reservoirs has created favorable environments for many of the introduced species. However, even in free-flowing habitats of river sections, introduced species are common. Interactions of introduced species and native species are not fully understood, but they could include predation, competition, and hybridization. These interactions may be reduced by temporal and spatial habitat differences and preferences among species. Some of the greatest concerns about introduced species focus on interactions among closely related species, such as salmonids. For example, introduction of eastern brook trout (*Salvelinus fontinalis*) may especially impair bull trout through hybridization.

E.3.1.1.1. Threatened and Endangered Species

E.3.1.1.1.1. Bull Trout

The U.S. Fish and Wildlife Service (USFWS) issued a final rule listing the Columbia and Klamath river populations of bull trout as threatened under the Endangered Species Act (ESA) on June 10, 1998 (*Federal Register* [Docket No. 98-15319] 63[111]:31647–31674). The listing for the distinct population for the Columbia River segment included habitat degradation and fragmentation, migratory corridor blockage, poor water quality, and past fisheries management practices—such as the introduction of nonnative species—as factors contributing to the listed status. In the final rule, the USFWS identified four bull trout subpopulations in the Pine Creek watershed (Meadow Creek–Clear Creek, upper Pine Creek, East Pine Creek, and Elk Creek) and three bull trout subpopulations in the upper Powder River basin.

For purposes of recovery planning, these subpopulations considered in the rule and subpopulations in Indian Creek and the Wildhorse River were combined in the Hells Canyon Complex Recovery Unit. The Hells Canyon Complex Recovery Unit also includes all tributaries in Idaho and Oregon from just downstream of the confluence of the Snake and Weiser rivers down to Hells Canyon Dam. The following definitions used in the planning process for bull trout recovery are directly from the draft recovery plan (USFWS 2002):

> Each bull trout recovery unit consists of one or more core areas. A core area represents the closest approximation of a biologically functioning unit for bull trout. The combination of core habitat (that is, habitat that could supply all elements for the long-term security of bull trout, including both spawning and rearing habitat as well as foraging, migrating, and overwintering habitat) and a core population (that is, bull trout inhabiting core habitat) constitutes the basic unit on which to gauge recovery within a recovery unit. Within core areas, one to several local populations may exist. A local population is a group of bull trout that spawn within a particular stream or portion of a stream system, which may typically be represented by a headwater tributary or complex of tributaries. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the likelihood of a core area to persist.

The Hells Canyon Complex Recovery Unit Team has identified two core areas within the recovery unit. The Pine–Indian–Wildhorse core area encompasses Hells Canyon Reservoir, Oxbow Reservoir, and their tributaries, specifically Pine Creek, Indian Creek, and Wildhorse River. Seven local populations and two potential local populations (that is, currently unoccupied areas that may be able to support a local population) were identified in the Pine–Indian–Wildhorse core area. The Powder River core area encompasses the Powder River basin upstream of its confluence with Brownlee Reservoir. The USFWS considered habitat fragmentation and degradation as the most likely limiting factors for bull trout throughout the Hells Canyon Complex Recovery Unit. Dams, irrigation diversions, and road crossings have formed impassable barriers to fish movement within the basins, further fragmenting habitats and isolating bull trout. Land management activities that degrade aquatic and riparian habitats by altering streamflow and riparian vegetation—activities such as water diversions, past and current mining operations, timber harvest and road construction, and improper grazing practices—have negatively affected bull trout in several areas of the recovery unit. Bull trout are also subject to negative interactions with nonnative brook trout in some streams.

E.3.1.1.1.2. Snake River Pacific Salmon

E.3.1.1.1.2.1. Snake River Spring/Summer Chinook Salmon

Snake River stocks of spring and summer chinook salmon (*Oncorhynchus tshawytscha*) were listed as threatened on April 22, 1992 (*Federal Register* [Docket No. 910647-2043, 22 April 1992] 57[78]:14653–1466). The Evolutionarily Significant Unit (ESU)[2] includes all natural populations of spring/summer chinook salmon in the mainstem Snake River and in the Tucannon, Grande Ronde, Imnaha, and Salmon river subbasins. Critical habitat includes river reaches currently or historically accessible (except reaches above impassable natural falls or above Dworshak and Hells Canyon dams) to Snake River spring/summer chinook salmon in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake rivers, as well as all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam (*Federal Register* [Docket No. 920783-3235, 28 December 1993]

2. An ESU is a population or group of populations that is considered distinct for purposes of conservation under the Endangered Species Act.

58[247]:68543–68553). Major river basins containing spawning and rearing habitat for this ESU make up approximately 22,390 square miles in Idaho, Oregon, and Washington.

E.3.1.1.1.2.2. Snake River Fall Chinook Salmon

Snake River stocks of fall chinook salmon (*Oncorhynchus tshawytscha*) were listed as threatened on April 22, 1992 (*Federal Register* [Docket No. 910647-2043, 22 April 1992] 57[78]:14653–1466). The ESU includes all natural populations of fall chinook salmon in the mainstem Snake River and in the Tucannon, Grande Ronde, Imnaha, Salmon, and Clearwater rivers. Like critical habitat for spring/summer chinook salmon, that for the listed ESU for fall chinook includes river reaches currently or historically accessible (except reaches above impassable natural falls or above Dworshak and Hells Canyon dams) to Snake River fall chinook salmon in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake rivers, as well as all river reaches from the confluence upstream to Hells Canyon Dam. The listed ESU also includes the Palouse River from its confluence with the Snake River upstream to Palouse Falls, the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek, and the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam (*Federal Register* [Docket No. 920783-3235, 28 December 1993] 58[247]:68543–68553). Major river basins containing spawning and rearing habitat for this ESU make up approximately 13,679 square miles in Idaho, Oregon, and Washington.

E.3.1.1.1.2.3. Snake River Sockeye Salmon

Snake River sockeye salmon (*Oncorhynchus nerka*) were listed as endangered on November 20,1991 (*Federal Register* [Docket No. 910379-1256, 20 November 1991] 56(224):58619–58624). The ESU includes populations of sockeye salmon from the Snake River basin, Idaho (although extant populations occur in the Stanley River subbasin). Critical habitat for the Snake River sockeye includes river reaches currently or historically accessible (except reaches above impassable natural falls or above Dworshak and Hells Canyon dams) to Snake River sockeye salmon in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake rivers. It also includes all Snake River reaches from the confluence of the Columbia River upstream to the confluence of the Salmon River; all Salmon River reaches from the confluence of the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellow Belly, Pettit, and Alturas lakes (including their inlet and outlet creeks); Alturas Lake Creek and the portion of Valley Creek between Stanley Lake Creek and the Salmon River. Watersheds containing spawning and rearing habitat for this ESU make up approximately 510 square miles in Idaho (*Federal Register* [Docket No. 920783-3235, 28 December 1993] 58[247]:68543–68553).

E.3.1.1.1.2.4. Snake River Steelhead

Snake River steelhead (*Oncorhynchus mykiss*) were listed as threatened on August 18, 1997 (*Federal Register* [Docket No. 960730210-7193-02, 18 August 1997] 62[159]:43937–43954). The ESU includes all naturally spawned populations of steelhead (and their progeny) in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. Critical habitat includes all river reaches accessible to listed steelhead in the Snake River and its tributaries in Idaho, Oregon, and Washington (*Federal Register* [Docket No. 990128036-0025-02, 16 February 2000] 65[32]:7764–7787). Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the confluence with the Snake River. However, tribal lands and areas above specifically identified dams or above long-standing, naturally impassable barriers (such as Napias Creek Falls and other natural waterfalls in existence for at least several hundred years) are excluded. Major river basins containing spawning and rearing habitat for this ESU make up approximately 29,282 square miles in Idaho, Oregon, and Washington.

E.3.1.1.1.2.5. Status Review

In the case of *Alsea Valley Alliance v. Evans* (161 F. Supp. 2d 1154 [D. OR 2001]), the U.S. District Court in Eugene, Oregon, set aside the National Marine Fisheries Service (NMFS, also known as the National Atmospheric and Oceanic [NOAA] Fisheries) 1998 listing of Oregon Coast coho salmon (*Oncorhynchus kisutch*), ruling that NMFS's treatment of hatchery populations within an ESU was arbitrary and capricious. Shortly after that ruling, in September and October of 2001, NMFS received 6 petitions to delist 15 ESUs of Pacific salmon and steelhead. In a notice published in the *Federal Register* on February 11, 2002, NMFS concluded that 5 of the petitions presented "substantial and scientific commercial information" indicating that delisting "may be warranted for 14 of the 15 petitioned ESUs" (67 FR 6215, February 11, 2002). As a result, NMFS has initiated status reviews of the 14 ESUs, including those for Snake River spring/summer chinook, Snake River fall chinook, and Snake River steelhead. As part of this reevaluation, NMFS also indicated that it intended to reevaluate how hatchery populations are considered in ESA listing determinations, a restriction that resulted in NMFS including an additional 11 ESUs in the status review process. To ensure that the status review updates are complete and based on the best available and most recent scientific and commercial data, NMFS asked interested parties to submit relevant information and comments by August 12, 2002 (67 FR 40679, June 13, 2002). It is not yet known what effect the NMFS status review will have on ESA listings relevant to the HCC.

E.3.1.1.1.2.6. Critical Habitat Review

Under a consent order approved by the U.S. District Court on April 30, 2002, in the case of the *National Association of Home Builders v. Evans* (D.D.C. No. 00-CV-02799), NMFS agreed to vacate the critical habitat designations for 19 salmon and steelhead ESUs, including the Snake River steelhead. NMFS agreed to vacate the designations to undertake a new, more thorough analysis of the critical habitat designations consistent with a 2001 decision in the 10th Circuit Court of Appeals (*New Mexico Cattle Growers Association v. USFWS*, 248 F3d 1277). NMFS did not vacate the critical habitat designations associated with the Snake River spring/summer chinook or the Snake River fall chinook. However, these designations may be affected by the pending status reviews of these species.

E.3.1.1.1.3. Bliss Rapids Snail and Idaho Springsnail

In 1990, the Bliss Rapids snail (*Taylorconcha serpenticola*) and Idaho springsnail (*Pyrgulopsis idahoensis*) were proposed by the USFWS as endangered under the ESA. In the final rule, published in December 14, 1992 (*Federal Register*, Docket No. 92-30173, December 14, 1992, 57[240]:59244–59257), the status of the Bliss Rapids snail was changed to threatened, but designation for the Idaho springsnail remained endangered.

The Bliss Rapids snail was first collected live and recognized as a new taxon by Dwight Taylor in 1959 (Taylor 1982); however, it went undescribed until Hershler et al. (1994) placed the snail in the new genus *Taylorconcha* and in the new species *serpenticola* (Hydrobiidae). The Bliss Rapids snail is a nondescript member of one of the most diverse groups of prosobranch snails among freshwater molluscs of the United States. The origins of the Bliss Rapids snail are distinct in molluscan fauna. This species can be traced back to the late Pliocene Epoch from the Blancan Glenns Ferry formation in Gooding County and the early Pleistocene Epoch from the Bruneau formation in Owyhee County (Frest and Johannes 1992). In 1992, the year the snail was listed, its range in the middle Snake River, Idaho, was from the Kanaka Rapids (RM 589) downstream to Clover Creek (RM 545). The snail was found in this stretch of the river near Hagerman, Idaho, and in many of the springs and alcoves common to the area.

In 1998, the Applicant's biologists collected 1 snail below Hells Canyon Dam in the Pine Bar vicinity (RM 215) that were identified as a Bliss Rapids snail (Technical Report E.3.1-8). In October 2002, the Applicant's biologists returned to the vicinity and collected 3 individuals that were identified in the field as the same species as the original 1 individual collected in 1998. The specimens were sent to Dr. Robert Hershler (Department of Systematic Biology, Smithsonian Institution, Washington, DC.) for taxonomic review. He was unable to conclusively determine the taxonomy of the snails but concluded that they were either Bliss Rapids snails or *Aminicola* sp. Therefore, at this time there is no definitive determination regarding the taxonomy of the 5 snails that were preliminarily identified as Bliss Rapids snails.

In 1930, College of Idaho professor H. M. Tucker collected samples containing the first known specimens of the Idaho springsnail near Homedale, Idaho, on the Snake River (Taylor 1982). H. A. Pilsbury examined these specimens in 1933. He then named and illustrated the new species, initially designated as *Amnicola idahoensis*. Gregg and Taylor (1965) revisited this designation and placed the species in the genus *Fonticella* (Prosobranchia: Hydrobiidae) and the subgenus *Natricola.* Hershler and Thompson (1987) revised the genus and placed *Fonticella* in the genus *Pyrgulopsis*, hence the species name *Pyrgulopsis idahoensis.* This springsnail is considered to be a surviving species from Lake Idaho, a lake of the Pliocene Epoch that once covered southwestern Idaho and Oregon. Its historical range was between Homedale, at RM 415, and Bancroft Springs, at RM 553 (USFWS 1992). In 1992, a discontinuously distributed Idaho springsnail population was documented from RM 518 upstream to approximately RM 553. Updated surveys show this species ranging from the middle Snake River, in a variety of habitats in the Hagerman Valley area (RM 570), downstream to Cobb Rapids (RM 340), which is located at the upstream end of Brownlee Reservoir. The taxonomic status of the Idaho springsnail was reviewed by Dr. Robert Hershler in 2003. He determined that the morphological and genetic evidence both suggest that *Pyrgulopsis idahoensis* does not merit recognition as a distinct species (Hershler and Liu 2003).

E.3.1.1.2. Anadromous Fish

E.3.1.1.2.1. Life History

E.3.1.1.2.1.1. Chinook Salmon

Several reviews of chinook salmon life history are available, including Waples et al. (1991a) for Snake River fall chinook and Matthews and Waples (1991) for Snake River spring/summer chinook. In addition, reviews such as those by Healey (1991) and Myers et al. (1998) offer perspective beyond the Snake River basin. Therefore, only a general overview of the life histories of Snake River chinook salmon is included in this exhibit. Chinook salmon stocks native to the Snake River basin exhibit anadromous life histories, which include spawning, incubation, and some rearing in freshwater environments. Juvenile fish migrate to ocean environments where estuarine and ocean rearing continues. Residence in the marine environments continues through sexual maturity, and adults return to fresh water to spawn and complete the life cycle. Female salmon excavate redds in gravel habitats and deposit and bury eggs in the gravel to incubate. Salmon emerge from the gravel and rear in fresh water for varying periods of time. Chinook salmon are semelparous, meaning that they die after spawning once. This simplistic overview of the life history ignores the considerable variation among Pacific salmon and among and within races and stocks of chinook salmon. Variation occurs in freshwater residency, timing of juvenile and adult migration, ocean distribution, and age of sexual maturity. One of the clearest dichotomies to separate races of chinook salmon is the distinction between ocean-type and stream-type life histories (Healey 1991). For Snake River chinook salmon, this life history trait is one of the primary characteristics for separating spring/summer chinook from fall chinook. Another clear distinction between the two races in the Snake River basin is that fall chinook are primarily associated with large mainstem Snake River environments and the lower portions of some of the larger tributaries; however, spring/summer chinook are associated with tributary habitats and higher elevations than those observed for fall chinook. The habitat distinctions between these environments are probably fundamental to the segregation of the races (Healey 1991).

Snake River Fall Chinook Salmon

Snake River fall chinook salmon generally spawn in October, November, and early December (Chapter 1 of Technical Report E.3.1-3). There is little information on when spawning occurred in reaches of the Snake River that are now blocked. However, some anecdotal accounts and redd and carcass surveys suggest that spawn timing has not changed significantly (Connor 2001, Chapter 5 of Technical Report E.3.1-2). Some anecdotal accounts in Evermann (1896) could indicate a slight temporal cline from earlier spawning in the upper Snake River reaches to slightly later in lower Snake River reaches.

Incubation and emergence are largely determined by the thermal conditions experienced within the redd environment. These conditions can be influenced by the water column (vertical portion of a water body from the surface to the bottom), as well as by hyporheic (underground habitats through the sediment deposit area of the channel) thermal characteristics. Emergence timing varies and can extend from early March to early June, depending on the location and spawn timing (Chapter 5 of Technical Report E.3.1-2, Technical Report E.3.1-3). Fall chinook salmon rear in mainstem environments that are generally associated with low-gradient, low-velocity shorelines. They somewhat avoid large boulder-type substrates (Tiffan et al. 2002, Technical Report E.2.3-2). While rearing, fall chinook salmon forage primarily on aquatic insects (K. Tiffan, U.S. Geological Survey, Cook, WA, personal communication). Fall chinook salmon rear for only a few months in freshwater environments before they migrate to the ocean as subyearlings, a situation characteristic of the ocean-type life history. The timing of fall chinook outmigration ranges from May through August, with migration past Lower Granite Dam peaking in early to mid-July. Adults return to the Snake River at ages 2 to 5, although age 4 is the most common age for spawning (Waples et al. 1991a). Adults generally arrive at the spawning areas from mid-August to November, with peak periods ranging from mid-September to the first week in October. It has also been observed that a very few juvenile fall chinook salmon outmigrate through the lower Snake River as yearlings, but that most of these fish originate from the Clearwater River (Connor 2001).

Snake River Spring/Summer Chinook Salmon

Spawn timing of spring/summer chinook varies, generally from mid-August to mid-September. There is commonly an elevational cline in spawn timing, with earlier spawning occurring at higher elevations, that is closely linked to thermal conditions (Matthews and Waples 1991). The distinctions between spring and summer chinook are not always clear. In some examples in the upper Columbia River, summer chinook outmigrate as subyearlings, a behavior that is more closely aligned with that of fall chinook salmon. However, in the Snake River, summer chinook more commonly outmigrate as yearling or stream-type chinook, a behavior that is more aligned with that of spring chinook. Therefore, summer chinook spend a complete summer period in fresh water. Outmigration timing of juveniles is typically in the early spring, during April, May, and June. Adults spend two to three years in the ocean and then return to fresh water. Adult spring chinook salmon generally return to the Snake River from May to June, with summer stocks of chinook salmon arriving through July.

E.3.1.1.2.1.2. Steelhead

The life history of steelhead (*Oncorhynchus mykiss*) is much more diverse and complex than the Pacific salmons. A description of life histories for *O. mykiss* is presented in Busby et al. (1996). Multiple life histories are evident in the species, ranging from entirely freshwater to anadromous life histories. Within the entirely freshwater life histories, there is considerable variation related to migrations. Within anadromous life histories, the age of outmigration and ages of adult returns to fresh water varies considerably. In general, *O. mykiss gairdneri* in the interior Columbia River basin that exhibit entirely freshwater life histories are redband trout, while those that exhibit anadromous life histories are steelhead. To complicate the description further, all of these life histories can be expressed within a single drainage, although segregation among the life histories is hardly apparent. It is further believed that, in many instances, progeny from a single mating can produce any of the life histories expressed.

In the Snake River, steelhead are “summer” steelhead. These summer steelhead complete sexual maturation in the freshwater environment. Snake River steelhead can be further divided into two groups of returns: A-runs and B-runs. As defined in Busby et al. (1996), these designations are based on the observation of a bimodal migration of adult steelhead at Bonneville Dam in the Columbia River and on differences in age and adult size observed among Snake River steelhead.

Adult A-run steelhead enter fresh water from June to August. As defined, the A-run passes Bonneville Dam before August 25. Adult B-run steelhead enter fresh water from late August to October, passing Bonneville Dam after August 25. At Lower Granite Dam on the Snake River, the groups are separated based on ocean age and body size. A-run steelhead are defined as predominantly one-ocean, while B-run steelhead are defined as two-ocean.[3] In the Snake River below Hells Canyon Dam, both now and when the complex was constructed, A-runs dominated the returns. The composition of ocean-age returns to basins that historically produced steelhead upstream of Hells Canyon Dam is unknown.

Although there is considerable variation, the modal age of outmigrating steelhead in the Snake River is two years old. Also with considerable variation is the length of residency in the ocean environment, ranging from one to three years. Snake River A-run fish are more commonly one-ocean fish. Adults typically begin returning to the Snake River in September through November and commonly hold over in winter and then begin moving again the following March and April. Spawn time is primarily during early spring months. Unlike chinook salmon, steelhead are iteroparous, or capable of repeat spawning. However, in most inland stocks, the frequency of repeat spawning is probably low, with post-spawn mortality higher than that for more coastal strains of steelhead. Before dams in the Snake and Columbia rivers were built, repeat spawning by steelhead may have been more frequent.

E.3.1.1.2.1.3. Sockeye Salmon

Complete reviews of sockeye salmon life history are provided by Burgner (1991) and Gustafson et al. (1997). Production areas of sockeye salmon in the Snake River basin and throughout their range are commonly associated with natural lake environments. Although spawning occurs both in stream and lake habitats, juvenile rearing is primarily associated with lake habitats. Sockeye salmon exhibit a greater variety of life history patterns than any of the other Pacific salmons. As with steelhead, there are commonly resident life histories exhibited within populations of sockeye salmon that spend their entire life cycle within fresh water (kokanee salmon). Sockeye salmon, the anadromous life history form, generally spawn from late summer into the fall months. Prior to construction of Black Canyon Dam in 1924, sockeye salmon in Payette Lake appeared in the river

3. The ocean designation refers to the time spent in salt water: one-ocean fish return to their natal streams after one year in the ocean; two-ocean fish return to their natal streams after spending two years in the ocean.

between August 10 and 15 of each year and were present until the end of October (Evermann 1896). Juvenile sockeye use lake environments for rearing for one, two, or three years and then migrate to sea, returning to the natal lake system to spawn after spending one to four years in the ocean. Migrating juvenile sockeye salmon are generally observed at Lower Granite Dam during the months of April through June. Adult sockeye salmon are observed passing Lower Granite Dam generally between the end of June and the first part of August. Dependence on lake environments resulted in the evolution of complex timing for incubation, fry emergence, spawning, and adult lake entry that often involves intricate patterns of adult and juvenile migration and orientation not seen in other *Oncorhynchus* species (Burgner 1991). Adult sockeye salmon home precisely to the natal stream or lake habitat. This fidelity to spawning areas ensures that juveniles will encounter suitable rearing habitats.

E.3.1.1.2.1.4. Pacific Lamprey

Primary spawning and rearing habitats for Pacific lamprey, referred to simply as lamprey unless otherwise noted, are found in tributary streams (Kan 1975). Pacific Lamprey make "limited use of mainstem corridors except during adult and juvenile migration periods" (Moursund et al. 2000). Close et al. (1995) found that lamprey begin their spawning migration into fresh water as early as March and have completed their migration into streams by September. Pacific lamprey are widely described as poor swimmers, averaging between 4.5 and 8.0 kilometers (km) per day during upstream migrations (Kan 1975, Beamish and Levings 1991). During migration, adult lamprey discontinue feeding after entering fresh water and may shrink by as much as 20% before they spawn (Beamish 1980).

Stone et al. (2001) found that adult lamprey entered Cedar Creek during June and September 2000. NMFS biologists found that lamprey move upstream to spawn from May to September in the Columbia River basin (Bayer et al. 2001). Bayer et al. (2001) reported from telemetry studies that most lamprey initiated overwinter holding by mid-September 2000 and continued to mid-March 2001. All but one of their tagged lamprey (n = 42) remained in the lower John Day River at depths of 0.5 to 10.4 meters (n = 35, median = 0.9 meter), with velocities from 0.02 to 1.22 meters per second (n = 29, median = 0.37 meter per second), before moving into spawning areas. In the Columbia River system, most lamprey hide under stones and overwinter until the following spring, after which they resume their spawning migrations (Scott and Crossman 1973).

Bayer et al. (2001) found that overwintering lamprey in the John Day River displayed similar cryptic behavior, hiding under boulders in riffle or glide habitats.

Spawning commences the following spring when temperatures reach between 10 and 15 °C. Depending on temperatures, lamprey can spawn as early as May along the Oregon coast or as late as July in upper reaches (Close et al. 1995, and citations within). Adult lamprey spawning behavior includes building nests in sandy gravel (Scott and Crossman 1973; Close et al. 1995, and citations within), gravel in riffles (Page and Burr 1991), or the tails of pools (Scott and Crossman 1973, Close et al. 1995). Water depth at nest sites is typically less than 1 meter (Wang 1986, Close et al. 1995), but nests have been observed in depths up to 4 meters (Close et al. 1995, and citations within). Nests are typically constructed in lotic environments where water velocities have been measured at between 0.5 and 1.0 meter per second (Pletcher 1963, Kan 1975). Pacific lamprey nests identified on Cedar Creek ($n = 132$) by Stone et al. (2001) in April through July 2000 indicate that these fish use 50% pool tailouts, 33% riffles, and 12% glides at a mean depth of 0.4 meter in fine and gravel substrate. After a pair constructs a shallow nest, the male attaches to the female and fertilizes the eggs as they are emitted during an estimated 12-hour spawning session (Scott and Crossman 1973). Nest building continues throughout and between spawning acts. During this nest construction, the adhesive embryos are covered with sand and pebbles (Scott and Crossman 1973, Close et al. 1995). Males may mate with several females in different nests (Wang 1986, and citations within).

Lamprey larvae hatch within two to three weeks (Scott and Crossman 1973, Close et al. 1995) and leave their natal substrate approximately two or three weeks after hatching, drifting downstream into slower pools and eddies (Close et al. 1995). The eyeless larvae (ammocoetes) spend four to six years burrowing into fine stream sediments and pumping water through their branchial chamber to filter-feed on algae, diatoms, and detritus (Stone et al. 2001, and citations within).

During this life stage, ammocoetes seem to prefer fine sediment (mud or silt) located near the river margins rather than coarser sediment located in deeper habitats (CPUD 2000). Ammocoetes seem to prefer cooler water, but they have been collected when water temperatures were as high as 25 °C in Idaho (Mallat 1983). Similarly, Holmes and Lin (1994) reported that larval sea lamprey (*Petromyzon marinus*) preferred summer water temperatures ranging from 17.8 to

21.8 °C. Data from Close and Bronson (2001) also corroborate these temperature ranges. During an extensive survey within the Columbia River basin, they observed highest densities of larval Pacific lamprey (12 to 32 individuals per square meter) in streams where mean water temperatures were recorded at between 16.0 and 21.8 °C. Data concerning this species' oxygen tolerance are relatively scarce. Mallat (1983) reported that a low partial pressure of oxygen (7 to 10 millimeters [mm] of mercury) at 15.5 °C caused larval lamprey to die, but that they tolerated concentrations from 18 to 20 mm of mercury at the same temperature.

Transformation from an ammocoete to a juvenile (macropthalmia) is a multiphase process that involves internal as well as external changes in the fish. These changes prepare it to successfully osmoregulate (maintain a proper salt-to-water concentration in the cells) in salt water (Close et al. 1995). The process generally occurs from July through October, prior to a late fall to spring outmigration (CPUD 2000, and citations within). Major external changes during this alteration include the development of eyes and the transformation of the hood into a disc-shaped mouth. Internal changes involve development of the foregut and a unidirectional respiratory system, changes in blood proteins, and aging of the gallbladder and the bile duct (Close et al. 1995). During and after transforming to macropthalmia, the species' habitat preference shifts: juveniles prefer higher velocities and larger substrate material (CPUD 2000, and citations within).

Juvenile lamprey migrate downstream after completing their metamorphosis (Close et al. 1995), or during its final stages (Moursund et al. 2000), in late fall through spring. Moursund et al. (2000) found that during sampling at John Day and McNary dams in 1998, lamprey outmigration peaked on May 29, with all lamprey collected showing signs of late metamorphosis. Nonetheless, these lamprey may have been on course to complete metamorphosis before they entered the saline estuary downstream of Bonneville Dam. This late May peak migration seems to concur with results from fyke net sampling at the Wells and Rocky Reach dams in the middle Columbia River (CPUD 2000). Likewise, incidental catch during 1999 monitoring efforts for downstream migrating salmon and steelhead smolts at John Day Dam yielded three distinct juvenile lamprey outmigration peaks: April 23, June 3 through 6, and a smaller one July 3 (Martinson et al. 2000). Timing of downstream migrations tends to correlate with spring freshets (Stone et al. 2001).

Juvenile migrants are relatively weak swimmers (Moursund et al. 2000) and tend to drift downstream tail first rather than swim in the conventional sense (Close et al. 1995, and citations within; CPUD 2000). Developing juvenile and young adult lamprey initially leave the substrate and migrate during the night hours (Close et al. 1995, Moursund et al. 2000) in the lower portions of the water column, as seen in fyke net data from the Wells Dam investigations where nets at greater than 90-foot depth collected most lamprey (CPUD 2000). Night migration may help decrease lamprey susceptibility to predators (Moursund et al. 2000). As juveniles approach the estuary, they actively migrate in the daytime as well. Little information exists on time spent in the estuary before the lamprey enter the ocean; however, lamprey become parasitic feeders at this time (Wang 1986). Variations in the spatial scale of rearing to estuary locations for lamprey populations may account for the various estimates on time spent in the ocean, estimates that range from 1 to 3.5 years. Kan (1975) estimated that lamprey off the Oregon coast may spend 20 to 40 months in the ocean.

E.3.1.1.2.2. Anadromous Fish of the HCC and Vicinity

Four species of anadromous fish were historically associated with the HCC and the vicinity upstream of Hells Canyon Dam. Anadromous salmonids included spring/summer and fall stocks of chinook salmon, sockeye salmon, and steelhead. Also, a single species of lamprey (Pacific lamprey) was associated with the HCC and the upstream vicinity. White sturgeon also may have exhibited some degree of anadromy in the HCC and vicinity. However, construction of mainstem dams in the Columbia River prior to the HCC likely limited the ability of this species to migrate. There is no evidence that coho salmon were distributed upstream of the present-day Hells Canyon Dam site; however, coho salmon were in the lower Snake River basin, including the Grande Ronde River (ODFW 1990). Snake River coho salmon were declared extinct in 1986.

E.3.1.1.2.2.1. Historical Distribution and Status

Fall Chinook Salmon in the Mainstem Snake River

The mainstem Snake River has been, and continues to be, differentially used by anadromous fish. All of the anadromous fish species used the mainstem Snake River as a migratory corridor, but only the fall chinook salmon stock used it for spawning and rearing, as well as for migration.

Fall chinook salmon were historically distributed throughout the mainstem Snake River, from its mouth upstream to Shoshone Falls (Gilbert and Evermann 1894, Fulton 1968, Armour 1990). This salmon stock probably used the entire mainstem Snake River for spawning and rearing, as well as for adult and juvenile migration. Potential mainstem Snake River spawning and rearing habitat totaled about 615 miles, from the river mouth to Shoshone Falls. Some of the earliest records of anadromous fish in the mainstem Snake River came from anecdotal accounts that explorers and settlers wrote in their journals (Special Appendix M to Technical Report E.3.1-2). Many early writers related their observations of tribal fisheries distributed all along the Snake River. Other major fishing areas included the King Hill and Glenns Ferry areas (Evermann 1896, Myers 1998); the Bruneau River (Steward 1970); and an area near the confluence of the Boise, Owyhee, Payette, and Weiser rivers (Swinney and Wells 1962).

In the late 1800s to early 1900s, nonnative fisheries began operating on the Snake River. For example, the Henoty fishery was near the Washoe Ferry located between the Malheur and Payette rivers (Gregg 1950). These fisheries typically employed large seines set by boat and pulled by horsemen, and they were generally at spawning bed locations. Evermann (1896) described other fisheries between Weiser and Ontario, near Glenns Ferry, and above Lower Salmon Falls at Millet Island. Evermann considered the spawning areas between Huntington and Auger Falls the most important in Idaho. His focus was on the upper Snake River, however, and he did not explore areas downstream of approximately Huntington, Oregon. In years approaching the end of the nineteenth century, declines in salmon fisheries became noticeable. Some years later, the declines were linked to intensive commercial fishing. The declining trend prompted Evermann and others to investigate the natural history of salmon (Evermann 1896).

In 1901, the Trade Dollar Mining Company of Silver City constructed the Swan Falls Dam. The dam became the upstream terminus for salmon in the Snake River. Swan Falls Dam blocked approximately 157 miles (253 km) of mainstem Snake River, or approximately 25% of the entire anadromous section of the Snake River. Although a fish ladder was installed during the initial construction, it was not functional for salmon (Van Dusen 1903, Irving and Cuplin 1956, Lavier 1976).

Fall chinook salmon continued to persist in the mainstem below Swan Falls Dam. The next downstream terminus was Brownlee Dam, constructed in 1958. In 1956, the diversion tunnel for use during Brownlee Dam construction was completed, along with temporary fish passage facilities to move adults around the construction area. When Brownlee Reservoir filled in May 1958, collection of adult fish was moved downstream to the Oxbow Dam construction site and then, in 1966, to below Hells Canyon Dam. However, shortly after Brownlee Dam construction, it became apparent that downstream collection efforts had failed. In December 1963, the Federal Power Commission (FPC) ordered the Applicant to abandon the downstream collection efforts prior to the outmigration of 1964. This order soon led to the development of the hatchery mitigation efforts (Chapter 2 of Technical Report E.3.1-2, Technical Report E.3.1-4). Because of these events, Hells Canyon Dam became the terminus for wild production of anadromous fish.

The HCC inundated approximately 93 miles (150 km) of Snake River habitat and blocked access to approximately 118 miles (190 km) of free-flowing Snake River up to Swan Falls Dam. A total of 211 miles (340 km), or 34%, of mainstem Snake River habitat was lost.

Chapter 6 of Technical Report E.3.1-2 presents estimates of pre-Brownlee Dam run sizes. Using Chapman's (1986) estimate of historical chinook salmon returns to the Columbia River basin and apportioning his totals based on potential subbasin and run compositions, it is possible to estimate that as many as 450,000 fall chinook salmon returned annually to the Snake River prior to the 1900s. Of those fall chinook returning to the Snake River, it is further estimated that about 270,000 actually spawned upstream of the current HCC.

Waples et al. (1991a) estimated that, during the early twentieth century, only as many as 72,000 fall chinook salmon returned annually to the upper Snake River. These same authors concluded that, by the 1950s up until the construction of the Brownlee Dam, the annual upper Snake River escapement had dropped to about 30,000 fish. Escapement numbers prior to construction of the HCC are not available because the Brownlee fish trap offered the first counts in the Snake River. McNary Dam counts began in 1954 and provided counts for Snake River and upper Columbia River fall chinook. Spawning ground counts above Brownlee Dam showed a relatively high redd count in 1947 that corresponded to high counts at the Columbia River dams.

Richards (1973) estimated run sizes of fall chinook before Celilo Falls was inundated (1954–1956) as 2,695. Van Hyning (1968) suggested that abundance of fall chinook was declining in the Marsing reach (Swan Falls Dam to Marsing) and had reached a low in the early 1950s before the inundation of Celilo Falls. After Celilo Falls was inundated and before Brownlee Reservoir was filled (1957–1959), escapement to the reach above Brownlee Dam averaged 14,944. Whether these higher returns could have been sustained is unknown. The extent to which land uses at that time were impacting the quality of spawning habitat below Swan Falls Dam is also unknown. Accounting for potential production in the reaches now inundated by Oxbow and Hells Canyon reservoirs, the Applicant estimates an escapement of 16,387 fall chinook past the present-day Hells Canyon Dam site. Accounting for in-river harvest, escapement to the mouth of the Columbia River from reaches above Hells Canyon Dam is estimated at 29,936 (Chapter 6 of Technical Report E.3.1-2).

The decline in fall chinook abundance after Swan Falls Dam construction has been primarily attributed to commercial fishing (Van Hyning 1968). However, the sharp decline in returns to the HCC after Brownlee Dam was constructed, through 1971, when returns to the HCC dropped to fewer than 10 individuals, is attributable to the lost production area above Brownlee Dam coupled with the federal hydroelectric projects on the Columbia River (Chapter 2 of Technical Report E.3.1-2).

Fall chinook salmon habitat was also being eliminated in the lower Snake River, below Hells Canyon Dam, around the same time that Oxbow and Hells Canyon dams were completed. Ice Harbor Dam was constructed in 1962, inundating approximately 32 miles (51.5 km) of the lower mainstem habitat. Construction of Lower Monumental and Little Goose dams followed in 1969 and 1970, respectively. Finally, Lower Granite Dam was constructed in 1975. Combined, these four dams inundated a total of 135 miles (217.3 km, or 24%) of mainstem habitat for fall chinook production. By 1975, the total loss in Snake River mainstem habitat was approximately 83%. Through the 1980s and into the early 1990s, fall chinook returns into the Snake River continued to decline, eventually reaching alarmingly low numbers. The lowest return on record for these fish was in 1990: fewer than 400 adults returned upstream of Lower Granite Dam, and only 78 of those were estimated to be naturally produced, wild fall chinook salmon.

Anadromous Fish in Snake River Tributaries

The historical production area of anadromous fish in the Snake River basin between the present site of Hells Canyon Dam (RM 247.6) and the natural barrier to anadromous fish at Shoshone Falls (RM 615) includes nine major tributary river basins to the Snake River and many smaller basins. The major river basins include the Powder, Burnt, and Malheur rivers in Oregon; the Owyhee River, which includes areas in Oregon, Nevada, and Idaho; the Bruneau and Salmon Falls rivers, which include areas in both Nevada and Idaho; and the Boise, Payette, and Weiser rivers in Idaho. Only the lower 5 km of the Wood River (Malad River) basin were accessible to anadromous fish because of a natural barrier. Smaller river basins include Pine Creek, Indian Creek, and the Wildhorse River, which are tributaries within the HCC. Tributaries to the Snake River within the historical production area produced primarily stream-type stocks of spring and summer chinook and steelhead. The lower areas of some basins may have produced late summer stocks of chinook salmon that exhibited ocean-type life histories more similar to fall chinook salmon. Sockeye salmon were produced only in the Payette River basin and also exhibited an ocean-type life history.

As discussed in Chapter 4 of Technical Report E.3.1-2, tributary habitat and access began to be degraded and eliminated relatively early in the Snake River basin. Mining throughout the basins brought early Euro-Asian settlement, which brought with it livestock, timber harvest, and multiple land uses. The productivity of the land was quickly realized through irrigated agriculture, which led to wide-scale development and the construction of tributary dams (see Special Appendices to Technical Report E.3.1-2).

For the predevelopment era (pre-1860), the Applicant estimates that the area above Hells Canyon Dam produced between 1 and 1.7 million adult Pacific salmon and steelhead (Chapter 6 of Technical Report E.3.1-2). The distribution and abundance of Pacific lamprey is unknown.

The first tributary basin to be removed from anadromous production was the Bruneau River. In 1890, a mining company from Boston, Massachusetts, constructed a dam 1.5 miles upstream of the river’s mouth (Tolman 1933, Plain 1940, Adams 1986). The original purpose of the dam was to supply water for placer mining, although the value of the dam for irrigation was quickly recognized. In 1894, Gilbert and Evermann wrote, “Recently a dam has been placed in the lower course of the stream for irrigation purposes. The dam is without a fishway, and salmon are now absolutely prevented from ascending." There are a few accounts of the dam being washed out and rebuilt (1892, 1910, 1936 [partially], and 1948), with each rebuild improving the design. The 1949 rebuild was the last one before C.J. Strike Dam, which impounded the lower section of the Bruneau River and the old dam site, was constructed on the Snake River.

Soon after Bruneau Dam was originally built, Swan Falls Dam on the mainstem Snake River, constructed in 1901 by the Trade Dollar Mining Company of Silver City, became the upstream terminus for chinook salmon. To a large extent, the dam was also a barrier to steelhead. Swan Falls Dam blocked approximately 157 miles (253 km) of mainstem Snake River, or approximately 25% of the entire anadromous section of the Snake River. Although a fish ladder was installed during the initial construction, it was not functional, at least for salmon and probably for steelhead (Van Dusen 1903, Irving and Cuplin 1956, Lavier 1976).

In 1922, after the Applicant had taken ownership of the dam, the ladder was reconstructed. At the time, it was considered one of the best-constructed fish ladders (IDFG 1922). Unfortunately, the ladder was still ineffective at passing salmon around the dam. But apparently some steelhead were able to pass it. Irving and Cuplin (1956) reported that a small run of steelhead ascended the river to C.J. Strike Dam (constructed in 1952), which was a complete barrier. Still, very little production potential for steelhead existed between C.J. Strike and Swan Falls dams.

Pacific lamprey could apparently use the fish ladder to pass Swan Falls Dam. Stanford (1942) reported that "Pacific lamprey…[was] taken in the spring as it made its way with apparent ease over the fishway or attempted to climb the lower face of the dam." Irving and Cuplin (1956), though, made no mention of Pacific lamprey below C.J. Strike Dam. Considering the dates of Stanford and of Irving and Cuplin's writings, the fishway they referred to would have been the reconstructed fish ladder. It is unclear whether either steelhead or Pacific lamprey could use the original fishway to pass the dam. If they could not, these fish would have been excluded above Swan Falls for approximately 20 years until the new ladder was constructed.

If some steelhead and Pacific lamprey could pass the original fishway, the first upstream terminus for these fish was the Lower Salmon Falls Dam on the Snake River, constructed in 1910 for the Great Shoshone and Twin Falls Water-Power Company (Stacy 1991). This dam blocked access to tributaries, including the Salmon Falls Creek basin and Rock Creek basin near Twin Falls, Idaho. However, much of the Salmon Falls Creek basin was blocked by the construction of Salmon Falls Creek Dam in the same year. In 1947, a new dam and fish ladder were constructed at the Lower Salmon Falls site. However, the upstream terminus soon moved to Bliss Dam (1948), before the Lower Salmon Falls ladder was completed. Bliss Dam had no provision for fish passage. Then, in 1952, C.J. Strike Dam was constructed without fishways and became the upstream terminus, at least for steelhead and Pacific lamprey.

Following construction of Swan Falls Dam in 1901, basin habitat continued to be lost through habitat degradation and dam construction. Dams in the Boise, Payette, and Malheur rivers were soon constructed. Dams being constructed in the lower Boise River and just upstream of the city of Boise began to impede fish passage. The Barber Mill Dam, constructed in 1906, included a fish ladder. Later, in 1908, the Boise Diversion Dam, which diverts water into the New York Canal, was constructed 3 miles downstream of the Barber Mill Dam by the U.S. Bureau of Reclamation. The Boise Diversion Dam also provided fish passage. This dam was remodeled in 1911, but there is some indication that anadromous fish were occasionally observed upstream in Mores Creek, even after 1911 (Murray 1964). Arrowrock Dam was also under construction in 1911, and the diversion tunnel at this site was considered a complete barrier to anadromous fish. By 1915, Arrowrock Dam was completed and anadromous fish were blocked from the majority of the Boise River basin. Major dam construction in the Malheur River basin began in 1919 with the construction of Warm Springs Dam, and Black Canyon Dam was constructed in the lower Payette River in 1924. The construction of Black Canyon Dam not only blocked access to spring/summer chinook and steelhead production areas, but it eliminated the only sockeye salmon run in the historical Snake River production area.

The Owyhee Dam in the lower Owyhee River, constructed in 1935, eliminated access to the entire Owyhee River basin. This basin accounted for approximately 25% of the anadromous basin area above Hells Canyon Dam. Dam construction continued through the 1940s, with additional dams constructed in the Malheur, Burnt, and Powder rivers. At the time of construction of Brownlee

Dam in the 1950s, only 22.4% of the historical production area remained (Figure E.3.1-2). This percentage equates to approximately 12% of the anadromous production area, historical and present, of the entire Snake River basin.

Immediately before construction of Brownlee Reservoir, only a few basins were still producing anadromous fish. These basins included Pine Creek, Eagle Creek (a tributary to the Powder River), Weiser River, Wildhorse River, and Indian Creek. In addition, some minor production of steelhead probably occurred in many of the smaller basins that are currently within the HCC, such as Brownlee and Rock creeks. Large areas in the Malheur and Burnt rivers were accessible to anadromous fish, as was the lower portion of the Boise River. However, despite being accessible, these rivers no longer supported anadromous salmonids, with the exception of a few runs of steelhead remaining in the Burnt River. This lack of anadromous fish emphasizes the severe degradation of habitat that had already occurred in many of these basins. Of the 41,388 square miles of basin, excluding the Wood River basin located between Hells Canyon Dam and Shoshone Falls, approximately 22.4% (9,268 square miles) was accessible to anadromous fish immediately before closure of Brownlee Dam (Chapter 4 of Technical Report E.3.1-2).

Estimates of adult escapement to tributaries immediately before the influence of the HCC are 1,857 spring/summer chinook salmon and 7,534 steelhead. Accounting for losses of adults to ocean and river harvest and to passage through projects in place in the lower Columbia River, estimates of ocean recruits at two-ocean age are 5,540 spring/summer chinook salmon and 16,388 steelhead (Chapter 6 of Technical Report E.3.1-5). Sockeye salmon had been eliminated from the area above the HCC by construction of Black Canyon Dam on the Payette River in 1924. Anecdotal accounts of Pacific lamprey captured in upstream migration traps during the time of construction of the HCC document lamprey presence in tributaries upstream of Hells Canyon Dam; however, there is no way to estimate what their abundance may have been.

Pacific Lamprey—Little is known about the historical distribution of Pacific lamprey in the area above and within the HCC, and essentially nothing is known about historical abundance. Historically, Pacific lamprey have occurred throughout the Columbia and Snake river basins, mirroring ranges of migrating salmon (Close et al. 1995). Primary spawning and rearing habitats for Pacific lamprey are found in tributary streams (Kan 1975), and the fish made "limited use of mainstem corridors except during adult and juvenile migration periods" (Moursund et al. 2000).

It is assumed that the decline in abundance closely followed that of chinook salmon and steelhead since tributary habitats were blocked. It is unknown, however, whether lamprey were subject to the same land-use effects that Pacific salmon were and whether they were present in the accessible areas of basins, such as the Malheur or Boise rivers, even though Pacific salmon were not. Lamprey juveniles, which spend several years as ammocoetes in the stream substrate and therefore are less mobile, may have suffered greater mortality from tributary dewatering and altered thermal regimes than salmonids did.

While two other lamprey species inhabit the Columbia River basin, no river or western brook lamprey have been documented in the Snake River. Most historical accounts that mentioned the presence of lamprey failed to identify species or give supporting evidence that additional species existed. However, at most upstream sites, including those on the Snake River, the term "lamprey" is widely accepted as referring to Pacific lamprey.

There are few anecdotal accounts regarding the presence of Pacific lamprey in the historical production area, despite the probability that they were highly abundant. Gilbert and Evermann (1894) found 40 dead lamprey on a sandbar below Lower Salmon Falls, noting that lamprey arrived at that point in the river sometime in July. Pacific lamprey were also reported in the Boise River. Eigenmann (1895) mentioned Pacific lamprey collections in the lower Boise River near Caldwell. He stated,

> I secured a large number of the young of this species [lamprey]…. [T]hey burrow in the sand at the margin of the stream. If they are disturbed they will come out of the sand a few centimeters from the place of disturbance. The small ones were procured by throwing sand on the banks whereupon they would squirm out and could be secured….

Hallberg (1976) mentioned in an oral interview that his father "always had a barrel of salt eel…" at Caldwell, Idaho. It seems likely that the "eels" were Pacific lamprey. In oral histories of individuals living in northeastern Oregon that were transcribed by Gildemeister (1992), one person stated that "Eels [came up the Powder River] by the thousands in the early days; locals caught them in Squaw Creek and used them for sturgeon bait." Pacific lamprey also inhabited the Payette River and were noted by Evermann (1896). Pacific lamprey apparently could use the fish ladder to pass Swan Falls Dam (Stanford 1942).

Lamprey were still fairly abundant in the mid-1950s in the Snake River, making up 47% of the nongame fish captured in downstream migrant barge traps in the river downstream of Brownlee Dam in 1959 (Bell 1960). Murray (1959) reported September catches in the adult trap at Oxbow in 1959, noting, "Lamprey eel moved into the Oxbow trap in large numbers in September. The largest run I have observed in the canyon." In August 1960, Murray noted that "a fair run of eel" had arrived at the Oxbow trap (1960). Platts (1964) mentioned the capture of 33 lamprey in a Wildhorse River trapping in 1958.

Steelhead—Steelhead, in early accounts, were commonly referred to as salmon-trout (Special Appendices to Technical Report E.3.1-2). There is archaeological and anecdotal evidence of steelhead widely distributed in every accessible basin upstream of Hells Canyon Dam. No evidence indicates that steelhead spawned in the mainstem Snake River. The distribution of steelhead was larger than spring/summer chinook primarily because of their earlier arrival into tributary streams. Steelhead could take advantage of higher tributary flows and access areas that would later be inaccessible to chinook because of lower instream flows and, in some cases, higher water temperatures. Therefore, steelhead were less subject to some of the effects of land uses than spring/summer chinook were. Evidence of this advantage is the documentation of some steelhead runs remaining in some of the smaller tributaries to the Burnt River prior to construction of Brownlee Dam; however, spring chinook were no longer present (Chapter 4 of Technical Report E.3.1-2). Steelhead were still subject to losses in unscreened diversions, and even in accessible areas, the distribution was decreased by the reduction of suitable rearing habitat, even though those areas may have allowed successful spawning.

Abundance of steelhead during the predevelopment era of the Snake River basin is unknown. The Applicant, using Chapman's (1986) estimate of peak runs to the Columbia River basin, developed crude approximations of steelhead abundance in the area above the HCC using several approaches (Chapter 6 of Technical Report E.3.1-2). The estimates range from 117,000 to 225,700 adult steelhead.

Abundance of steelhead prior to construction of the HCC has been estimated by the Applicant based on agency accounts and on captures of adult returns from outmigrants whose ability to move downstream would not have been impaired by the presence of the HCC reservoirs (Chapter 6 of Technical Report E.3.1-2).

The Oregon Fish Commission (OFC) (1958), on the basis of allocations of McNary Dam-extrapolated escapements, estimated that 117,000 steelhead used the Snake River basin. Of these, 15,000 were assigned to the area upstream of Brownlee Dam; 1,000 to the Wildhorse River; 2,750 to Pine Creek; and 1,000 to Indian Creek. Another 50 fish were estimated to use “small tributaries” between the present-day sites of Hells Canyon and Oxbow dams.

Later, at a 1961 hearing of the Pacific Northwest Power Company–Washington Public Power Supply System held before the FPC, the consolidated testimony of the fish and game agencies of Idaho, Oregon, and Washington led to lower estimates of escapement: 6,000 steelhead upstream of Oxbow Dam (including the Wildhorse River) and 3,750 steelhead between the Hells Canyon and Oxbow Dam sites.

Using returns to the HCC fish traps, the Applicant estimated that an average of 4,834 adult steelhead returned above the Oxbow Dam site and an additional 2,700 steelhead returned to Pine and Indian creeks. Combined, these estimates indicate a total steelhead adult escapement of 7,534 (Chapter 6 of Technical Report E.3.1-2). Expanding these escapements to account for ocean harvest (which was minimal), in-river harvest, and losses at Columbia River projects, the estimate of adult escapement to the mouth of the Columbia River was 16,388.

Sockeye Salmon—The available information indicates that sockeye salmon, often referred to as “bluebacks,” spawned upstream of, and reared as juveniles in, Big Payette Lake. They did not use Little Payette or Upper Payette lakes. Evermann (1896) reported information received from W. C. Jennings indicating that commercial fisheries operated near Payette Lake for seven or eight years sometime between 1870 and 1880. According to this source, up to 75,000 fish were taken in one year. The migrating fish appeared in the river between August 10 and 15 of each year and were present until the end of October. Principal spawning beds were located in the inlets 2 to 3 miles upstream of the lake but reached as far upstream as 5 to 6 miles. Sockeye salmon spawned in high abundance around the edges of the lake, in sandy places near springs of cold water. This lake-edge spawning occurred at the same time as the spawning in the inlets. “Millions” were said to have come up the North Fork Payette River, but few or none went up Lake Fork Creek into Little Payette Lake and none entered the Gold Fork River. The large “redfish,” probably sockeye and not kokanee, which were often called “little redfish,” were about 4 to 5 pounds whole. Fisheries counted 40 fish to produce100 pounds of dressed fish. According to W. C. Jennings, sockeye were “so thick that often in riding a horse across at the ford, I have been compelled to get off and drive them away before my horse would go across” (Evermann 1896). Thousands of carcasses were seen along shores and in deep holes.

Robertson looked for redfish in 1894 and observed them in the inlet (Evermann 1896). He had last seen redfish in 1888. He stated that one commercial fishery operating 15 to 20 years earlier (about 1870 to 1875) salted down 30,000 to 40,000 pounds of redfish each year and shipped them to mining camps. In 1894, Smith stated that he saw no redfish in 1890, 1891, or 1892 and heard of none in 1893 (Evermann 1896). He had also heard claims that sockeye spawned 2 miles above Emmett during a year when water was so low that fish could not reach the lake. Evermann (1896) stated that the sockeye run was large in even years and small in odd ones.

It is unlikely that sockeye salmon passed Horseshoe Bend in 1906 (Lyle 1975). At that time, a diversion dam located downstream of Horseshoe Bend created a barrier to sockeye (Welsh et al. 1965). The Horseshoe Bend Dam was first built as a diversion dam and constructed of timbers and rock fill. According to Tappan (1980), the dam did not prevent fish from migrating upstream. By 1924, fish could not pass Black Canyon Dam, which was built by the U.S. Bureau of Reclamation (Welsh et al. 1965). All subsequent observations of sockeye were made downstream of that dam, where they were occasionally seen (OFC 1947).

It is unknown whether the resident Payette Lake stock retains anadromous genetic traits or whether the hatchery plantings of kokanee in the lake have influenced the genetic potential.

Waples et al. (1997) suggested that a remnant of the native *O. nerka* population from Payette Lake may still exist, despite plantings of hatchery kokanee that occurred at least between 1968 and 1993.

Between 1962 and 1965, Krcma and Raleigh (1970) reported kokanee salmon from the Payette River arriving at the upper end of Brownlee Reservoir during June. In 1965, they estimated approximately 500,000 kokanee arriving in Brownlee Reservoir. These fish could have been kokanee produced in Payette Lake or kokanee associated with spawning in Poison Creek or other tributaries to Cascade Reservoir. During his 1964 study of Cascade Reservoir, Webb (1966) reported an observation of a spawning run of kokanee "in recent years." After dam construction in 1948, kokanee were established into Cascade Reservoir by drift from Payette Lake (Webb 1966). Webb further reported that Cascade Reservoir was not conducive to supporting kokanee and that numbers had been declining. Sampling in Brownlee Reservoir since 1991 has captured only one kokanee in the HCC (IPC unpublished data); however, the timing of the Applicant's sampling is generally earlier than June, whether kokanee still arrive in Brownlee Reservoir as they did in the early 1960s is unknown. Downstream drift of kokanee is not unusual. For example, similar observations have been made from resident kokanee populations out of Dworshak Reservoir and other locations (see examples cited in Waples et al. 1991b).

Using estimates from Chapman (1986) and the proportion of surface area that Payette Lake contributed to the surface area of all lakes that were producing sockeye salmon in the Columbia River basin, the Applicant estimated a maximum of 57,400 adult sockeye salmon returns to the Payette River basin (Chapter 6 of Technical Report E.3.1-2).

Spring/Summer Chinook Salmon—As for steelhead, there are archaeological and anecdotal accounts of spring/summer chinook in all of the major river basins above the HCC. There is little evidence that chinook used smaller tributaries to the Snake River, such as Brownlee Creek. The smallest basins for which anecdotal accounts of spring/summer chinook presence can be found are the Wildhorse River, Pine Creek, and Rock Creek (near Twin Falls). Some spring/summer chinook production could have occurred at the lower end of some of the smaller tributaries; however, the production potential of these smaller tributaries was probably low.

As discussed above, loss of access to tributary habitats was responsible for the large decline in abundance of spring/summer chinook prior to the HCC. But besides losing access, spring/summer chinook were probably the most vulnerable of the anadromous fish to development and impacts of various land uses, especially irrigation practices. Spring/summer chinook adults returned to spawning areas as flows decreased and during the period that irrigation withdrawals would be occurring in many of the basins. They were subjected to low instream flows and to partial or complete barriers from irrigation diversion structures, and they were vulnerable to unscreened diversions. In addition, primary production areas were generally in lower-gradient streams that were fourth order[4] and greater, which would have increased the vulnerability of spawning and rearing areas not only to low instream flows but also to the effects of reduced riparian vegetation (either through clearing for agricultural access or livestock grazing) and warm instream temperatures. The combination of these two land uses probably reduced the suitability and availability of spawning and rearing areas and, in many cases, eliminated access to more favorable areas.

Examples of reduction in spring/summer chinook abundance and habitat are available for many of the basins that were accessible prior to construction of the HCC (Chapter 4 of Technical Report E.3.1-2). The Burnt and Malheur rivers no longer supported spring/summer chinook prior to construction of the HCC. Habitat degradation from irrigation practices and chronic effects from mining are thought to be causes for the extirpation of chinook salmon from the accessible portions of these basins. Several drainages within the Weiser River basin were cited as no longer capable of supporting spring chinook salmon prior to the construction of the HCC, including the main Weiser River downstream of Cambridge, Idaho. The Weiser River was still producing spring chinook prior to the HCC; however, there are reports that the Galloway Diversion Dam, located on the lower Weiser River, was often a partial or complete barrier to spring chinook. Similarly, partial barriers were reported for spring chinook in the Powder River basin. Water diversions and withdrawals, as well as the warmer water temperatures associated with these diversions and withdrawals, undoubtedly also had a profound effect on the habitats of spring chinook in Pine Creek prior to HCC construction.

4. Stream order refers to the hierarchical ordering of streams based on the degree of branching. A first-order stream is unforked or unbranched. Two first-order streams flow together to form a second-order stream, two second-order streams combine to make a third-order stream, and so on (Armantrout 1998).

The Applicant estimates that returns of spring/summer chinook salmon adults ranged from 0.76 to 1.2 million and that spring/summer chinook were the largest component of anadromous adult returns during the predevelopment period, accounting for 70 to 75% of adult anadromous fish (Chapter 6 of Technical Report E.3.1-2). Pacific lamprey may be the exception to that estimate; although, as discussed above, no estimate is available for Pacific lamprey.

However, by the time immediately prior to the construction of the HCC, spring/summer chinook were estimated to be the lowest component of the run, with adult returns estimated at just under 2,000 fish (Chapter 6 of Technical Report E.3.1-2). In 1961, the consolidated testimony of the state fish and game agencies of Idaho, Oregon, and Washington, at a hearing of the Pacific Northwest Power Company–Washington Public Power Supply System before the FPC, produced escapement estimates of 6,500 spring chinook above Oxbow Dam, including the Wildhorse River, and 300 spring chinook in Pine Creek.

The Applicant tabulated the HCC count of spring chinook in 1958–1960 and adjusted the mean count of 1,557 upward to account for interdam losses and fishing. Arrivals of spring chinook at the mouth of the Columbia River were estimated at 4,098, and recruits to the exploitable phase at sea were estimated at 4,553. These estimates include fish destined to enter Wildhorse River. Adding 300 fish, estimated to enter Pine Creek, would increase the HCC numbers by 888 fish at the mouth of the Columbia River and 987 fish reaching the exploitable phase at sea. Therefore, the total spring chinook count for the HCC would increase to 1,857; arrivals at the mouth of the Columbia River, to 4,986; and recruits to the exploitable phase at sea, to 5,540.

Fall Chinook Salmon—Production of fall chinook salmon in tributary habitats was limited to the lower portions of some of the major tributaries. Anecdotal accounts of fall chinook in tributaries upstream of the HCC need to be interpreted with caution. Fall chinook salmon in these accounts were commonly referred to as “dog salmon,” yet spring chinook salmon on spawning beds were also often referred to by the same name. In another example, a dog salmon was referred to as the male chinook (Evermann 1896). In some instances, references were made to fall chinook salmon, but the dates of the observations indicate that they were probably spring chinook. For example, an OFC publication (1947) mentioned that “Mr. Grubb, an old-time resident and ardent fisherman in Halfway, was sure there had been no fall chinook in Pine Creek for years because the water was too low during the summer due to irrigation ditches, as on Eagle Creek." This comment suggests that "fall chinook" were, in part or wholly, spring chinook. There are anecdotal accounts of fall chinook salmon in Salmon Falls Creek, the lower Boise and Payette rivers, and the Powder River (Chapter 4 of Technical Report E.3.1-2). Certainly the presence of fall chinook salmon in the lower end of these and other tributaries is plausible, based on where fall chinook salmon are observed today below the HCC. However, the proportion of tributary spawning for fall chinook was probably low, and the majority of production of fall chinook salmon came from mainstem habitats.

E.3.1.1.2.2.2. Conservation Efforts

During the late 1940s, both private and federal interests were contemplating several proposals for construction of hydroelectric dams in Hells Canyon. By 1950, the Applicant was also exploring options for constructing a dam or series of dams in this area. Despite an emphasis on economic growth and the expansion of the West, state and federal agencies responsible for managing and conserving anadromous fish in the middle Snake River opposed constructing dams in Hells Canyon. Citing the inability of anadromous fish to pass over dams with high heads, such as those being proposed, the agencies expressed concern for the welfare of existing fisheries.

The FPC carefully considered testimony amounting to 19,215 transcript pages and 400 exhibits before issuing a license to the Applicant on August 4, 1955, that allowed the HCC to be constructed. Following issuance of the license, the Applicant initiated discussions about appropriate means of conserving the anadromous fish of the middle Snake River. On August 12, 1954, the Applicant submitted a letter to the USFWS requesting information on the type of fish-handling program the hydroelectric projects would require (Gale 1954). Under the terms of article 34 of the license, and with funding provided by the Applicant, state and federal agencies were charged with investigating or considering all known methods for mitigating losses to the anadromous fish runs. These possible methods included passage, translocation, artificial and semiartificial propagation, and natural redistribution of fish in streams below the projects (Haas 1965).

Since the late nineteenth century, hatcheries appeared to some as a solution to the problem of declining salmon populations (Mighetto and Ebel 1995). So appealing were hatcheries that, by

1929, 72 hatcheries for salmon and steelhead were annually stocking 500 million fry and fingerlings in the Pacific Northwest (Lichatowich and McIntyre 1987). In addition, the Mitchell Act of 1938 had already set the precedent of using hatcheries to mitigate for the loss of anadromous fish associated with Bonneville and Grand Coulee dams. But hatcheries were not the option of choice for mitigating impacts of the HCC.

Of the methods considered for protecting the fisheries resource, upstream and downstream fish passage was most appealing to the agencies because it focused on natural production and continuing use of remaining historical spawning and rearing habitats. The use of hatcheries to replace natural production lost to the HCC might have received greater consideration were it not for the unfavorable results of hatchery-siting studies conducted by the USFWS. These studies indicated a general scarcity of available sites with adequate water supplies and suitable water temperatures for hatchery development. While these concerns did not entirely rule out the use of hatcheries at some future date (Haas 1965), they did make hatcheries a secondary option to be investigated further before being fully considered.

Although fish passage was the preferred option, it was not without its own set of problems. Knowledge and experience with fish passage at high-head hydroelectric projects were minimal. Because of questions over the ability of anadromous fish to ascend fish ladders of the height needed at these projects, a trap-and-transport approach to adult passage was selected over the use of fish ladders. Agency biologists were also acutely aware that no feasible method had been developed for protecting downstream migrants at the lower Columbia River projects that could be applied to this location. They were also aware that additional hydroelectric projects—such as Nez Perce, Mountain Sheep, and Pleasant Valley farther downstream on the Snake River—would probably be constructed. The logistics of transporting fish around a series of dams separated by such a great distance drew concerns about elevated transport temperatures and excessive handling stress for both adults and juveniles. Biologists had no way of predicting whether their plan would succeed. The decision to proceed with fish passage as the major means of mitigating effects of the HCC was made with full understanding that devices and procedures for protecting fish would be experimental.

Construction of temporary passage facilities for upstream migrants at the site of Brownlee Dam began on June 11, 1956. The facility became operational in October 1956. Equipment consisted of an electrical barrier positioned at the diversion tunnel discharge and a trapping and truck-loading facility for trapping adult fish. The electrical barrier was used to discourage fish from entering the tunnel and to deflect them into the adult trap.

While development of adult passage facilities proceeded quickly, similar efforts to develop downstream passage were more complex. Early in their deliberations, agency biologists had entertained the idea of using net barriers to block the access of juvenile fish to all exits from Brownlee Dam itself, such as penstocks and spillways. Eventually the biologists agreed to use this same principle to capture migrating smolts in the forebay about 1 mile upstream of the dam. Structural design of the net barrier became the responsibility of the Applicant, while the agencies made recommendations concerning the biological and fish-safety aspects of both the net barrier and associated fish-handling facilities. Final design of the juvenile collection facility consisted of a gigantic net of small-mesh nylon that extended 0.5 mile from one shore of the forebay to the other and reached from the reservoir surface to a depth of 120 feet. Artificial outlet structures were provided at the center and both ends of the net to capture downstream migrants. A transportation pipe and pumping system were used to convey captive fish to a shore loading facility for trucking downstream of the dams. By order dated February 12, 1958, the FPC directed the Applicant to proceed with construction of the forebay net barrier and associated transport equipment. Brownlee Reservoir began filling in April 1958, and the net barrier was operational in October 1958.

Fish passage facilities were evaluated by various agencies, and funding was provided by the Applicant. Study results indicated that reservoir water temperatures, dissolved oxygen dynamics, and failure of smolts to find their way through the reservoir contributed to poor smolt collection and passage. Some fish swam under the net or passed through holes, while others never reached the forebay at all. Of 15,881 fall chinook trapped and marked in the spring of 1962, only 0.85% were recovered at the net barrier. Of 2,898 spring chinook and 1,188 steelhead smolts marked at the trap in the lower Weiser River in the same year, 10.4 and 0.17%, respectively, were recovered in the juvenile collection facility. Because of these data and concurrence from the fishery agencies, the FPC issued an order, dated December 11, 1963, that required the Applicant to remove the net barrier in Brownlee Reservoir from operation before the 1964 migration season started.

E.3.1.1.2.3. Anadromous Fish of Downstream Areas Affected by the HCC

Currently, four species of anadromous fish—three salmonids and one lamprey—are distributed downstream of the HCC. These species include spring, summer, and fall stocks of chinook salmon; steelhead; sockeye salmon; and Pacific lamprey. Only the fall stock of chinook salmon is known to spawn and rear within the mainstem Snake River downstream of the HCC, but all of these anadromous species use that portion of the river as a migration corridor for adults and juveniles.

E.3.1.1.2.3.1. Distribution and Status of Fall Chinook Salmon in the Mainstem Snake River

Fall chinook salmon begin to enter the Columbia River by early August (observed at Bonneville Dam) and the Snake River by mid-August (observed at Ice Harbor Dam). For counting purposes, the U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife designate all salmon counted between August 18 and December 15 at Lower Granite Dam (the farthest upstream hydroelectric project on the Snake River that has fish passage) as fall chinook. The run of this stock peaks at Lower Granite Dam by about September 20 each year. The adult passage at Lower Granite Dam between 1975 and 1990 ranged between 334 and 1,054, averaging 646 annually over that 15-year period. Chronically low returns of adults prompted the NMFS to list this stock of chinook salmon as threatened in 1992 under the ESA. From 1991 through 2001, the adult returns of Snake River fall chinook salmon have increased from 596 to 5,997, averaging 1,490 annually over an 11-year period. A large proportion of the more recent returns (perhaps as much as 85%) consists of hatchery fish produced at the Lyons Ferry Hatchery (considered part of the Snake River fall chinook salmon ESU); these fish are being used in the Nez Perce Tribe's supplementation program.

Fall chinook salmon spawn within the mainstem Snake River, as well as the lower portions of the larger tributary rivers (Clearwater, Grande Ronde, Imnaha, and Salmon). Before 1991, spawning surveys were not conducted yearly, and rarely was more than one survey conducted during any single year (Chapter 1 of Technical Report E.3.1-3). These data did not indicate whether the entire river was searched during historical surveys or whether observations were limited to specific river segments or known spawning locations. Therefore, the historical data are only useful for determining presence or absence. Since 1991, fall spawning surveys have been conducted weekly from mid-October through early December and have provided more accurate information about timing and distribution of spawning within the Snake River and its major tributaries (Chapter 1 of Technical Report E.3.1-3). Spawning can begin as early as the first week of October (observations from 2000) and as late as the first week of November (observations from 1991), but it is generally initiated during mid-October. Spawning activity generally peaks between the last week of October and the first week of November. The bulk of spawning (95%) is generally completed by mid-November, but can extend into the first week of December. Since 1992, approximately 60% of all spawning observed upstream of Lower Granite Dam has occurred consistently within the mainstem Snake River.

Spawning (both shallow and deep) has been observed throughout the free-flowing reach of the Snake River from above Lower Granite Reservoir to Hells Canyon Dam, about river kilometer (RKM) 239 to 397.[5] In the mainstem Snake River, redds constructed within deep water (unsurveyed before 1991) have been documented to account for as much as 50% of the total spawning activity, but they more commonly make up about 30%. The number of redds observed within the mainstem Snake River (shallow and deep water inclusive) has increased over recent years from 46 in 1991 to 710 in 2001. As of 2001, 98 shallow and 35 deep-water spawning locations have been documented within the mainstem Snake River. However, this compilation of spawning sites should not be viewed as definitive: as the spawning population continues to increase, new spawning sites may be observed. The absolute number of specific locations used for spawning has increased as escapement numbers have increased. However, even at the highest level of use (710 redds in 2001), only 50% of shallow and 40% of deep-water sites were used to the maximum ever documented. This result suggests that full seeding, or carrying capacity in terms of spawning, has not been attained at even the highest escapement levels (Chapter 1 of Technical Report E.3.1-3). A physical habitat model was developed by Applicant biologists for use in estimating the spawning capacity of the Snake River downstream of the HCC. Within a discharge range of 8,000 to 13,000 cubic feet per second (cfs), the model predicts the redd

5. Because river kilometers were used to identify reaches in some studies, those same units of measure are given in this exhibit.

capacity of the Snake River downstream of the HCC to be between approximately 3,450 and 3,750 redds (± 1,217) (Chapter 3 of Technical Report E.3.1-3). Recovery goals for Snake River fall chinook salmon require that sufficient suitable habitat be available upstream of Lower Granite Reservoir to support a minimum of 1,250 redds (NMFS 1995). A separate analysis of redd capacity within the Snake River was completed by Connor et al. (2001). Their estimate used a larger surface area per redd, but it ultimately agreed with the Applicant's assessment that enough habitat exists within the Snake River to at least attain ESA recovery goals sanctioned by NMFS.

Spawning occurs during the descending limb of the thermal regime of the river, beginning generally as water temperatures reach 16 °C, but Applicant biologists have observed that spawning can be initiated when temperatures are as high as 17 °C or as low as 12 °C. Within the Snake River, the majority of spawning occurs at temperatures between 15 and 8 °C (Chapter 1 of Technical Report E.3.1-3). The spawn timing and water temperatures associated with redd construction activity of fall chinook salmon within the Snake River are consistent with timing and thermal conditions reported for similar stocks of fall chinook.

Recent studies within the Snake River (Chapter 1 of Technical Report E.3.1-3), as well as previous studies conducted in the Columbia River (Chapman et al. 1986, Swan 1989), indicate that fall chinook spawning can occur over a wide distribution of physical habitat criteria. Redds observed within the Snake River downstream of the HCC have been measured at depths between 0.2 and 6.5 meters. Velocity measured at fall chinook salmon redds within the Snake River ranged between 0.6 and 1.7 meters per second. The substrate within which fall chinook salmon construct their redds is generally homogenous in character and has been measured to be between 2.6 and 15.0 centimeters (cm, according to the long axis) (Chapter 1 of Technical Report E.3.1-3).

The quality of the substrate within which redds are constructed and fertilized embryos are deposited directly affects survival through emergence. Substrate quality can also affect size at emergence. The overall particle size distribution of the substrate matrix (and how the particles are sorted or mixed) directly influences the permeability, subsurface water velocity, and dissolved oxygen content within the incubation environment.

The quality of the incubation environment within the Snake River varies between sites located upstream and downstream of the Salmon River confluence (referred to in this section as the upper Hells Canyon reach [upstream to Hells Canyon Dam] and the lower Hells Canyon reach [downstream to the upper end of Lower Granite Reservoir, near Asotin, Washington]). Dissolved oxygen levels in the hyporheic zone, measured in late September in the upper reach, generally exceeded levels necessary to incubate salmon embryos (approximately 5 milligrams per liter [mg/L]). However, in the lower reach, dissolved oxygen averaged only 1.5 mg/L (Chapter 3 of Technical Report E.3.1-3). It is important to remember that these measurements were not obtained from actual redds, which would probably have significantly higher dissolved oxygen levels, but from undisturbed, ambient gravel.

The velocity of subsurface water has been shown to correlate positively with the embryonic survival to emergence (STE) and the growth of salmonids. Values of subsurface water velocity calculated from data collected within the Snake River indicate that, within the upper reach, the STE would be at least 22% and that, within the lower reach, the STE would be very low (approximately 1%) (Chapter 3 of Technical Report E.3.1-3). For comparison, within a fall chinook salmon spawning area on the Columbia River in the Hanford reach (Priest Rapids Dam to above the confluence of the Snake River), STE calculated from subsurface water velocity measurements was just over 4%, and within a nonspawning area in the same reach, it was just over 2%. Again, the Applicant emphasizes that the Snake River survival estimates are from undisturbed, ambient gravel, and not from functional redds. The estimates should serve only as an index. The process of creating a redd probably increases the permeability of the sediment, and actual survival is expected to be significantly higher than the estimates indicate.

No general agreement on a numerical target for defining a habitat criterion for fine sediment has been reached in the scientific literature, although several values have been suggested and are in common use as default criteria. The percentage of fines (< 1 mm) at the lower Hells Canyon reach site was approximately 11%, compared with approximately 3 to 8% at the three sites in the upper Hells Canyon reach. For comparison, the percentage of fines within spawning and nonspawning areas of fall chinook salmon in the Hanford reach were higher, averaging 15 and 19%, respectively. Our data indicate that the upper Hells Canyon reach would have an STE of 46.5% and that the lower Hells Canyon reach would have an STE of 26%. Data for the Hanford reach predict an STE of at least 8.6% in spawning areas and less than 8% in nonspawning areas (Chapter 3 of Technical Report E.3.1-3). These results should be viewed with caution because using fine-sediment content as a criterion for determining STE is complicated, given the difficulties in quantifying its effect on salmonids.

To avoid the difficulties of using percentage of fines to calculate incubation and emergence success, various unifying statistics—such as the geometric mean particle size (d_g), degree of sorting (s_g), and Fredle index (F_i)—have been proposed to calculate STE. Data from the Hells Canyon reach sites translate into an STE of 61 to 90% at sites in the upper canyon and 58 to 87% in the lower canyon. Samples collected from the Hanford reach of the Columbia River predict an STE of at least 56% in spawning areas and 31% in nonspawning areas. Using the calculated Fredle indices, the STE would be at least 46.5% in the Snake River, 54% in the Hanford reach spawning areas, and 20% in the Hanford reach nonspawning areas (Chapter 3 of Technical Report E.3.1-3).

The average of all sediment evaluation methods (percentage of fines < 1 mm, d_g, F_i) suggests that the most suitable areas (in terms of quality of available habitat) for spawning and incubation are the upper Hells Canyon reach sites, then the Hanford reach spawning and lower Hells Canyon reach sites, and finally the Hanford reach nonspawning sites (Chapter 3 of Technical Report E.3.1-3).

Fall chinook salmon fry emerge from the gravel during the spring (March through May). Embryonic development, and ultimately emergence, are significantly affected by prevailing water temperature during the incubation period. Emergence timing is estimated based on the accumulation of 1,000 centigrade thermal units (plus an additional five days) after spawning is completed (methods based on information from Alderdice and Velsen [1978]). Thermal unit accumulation means that daily mean water temperature values are summed until 1,000 units are accumulated. For example, the centigrade thermal unit accumulation for three days having mean water temperature values of 10.0, 10.5, and 11.5 °C would be 32. Because of the thermal buffering of the HCC and the relatively cooler fall and winter temperatures of the Salmon and Grande Ronde rivers, emergence generally occurs earliest upstream of the Salmon River confluence and generally corresponds to an earlier outmigration. Also, because the local climate essentially controls water temperature, the thermal regime of the Snake River can vary considerably by year, ultimately controlling emergence timing. Finally, it has been speculated that fry actually remain within the hyporheic zone (or within the gravel) until water temperatures are greater than 8.0 °C. However, based on size at capture, estimated emergence sizes, initial growth rates, and water temperatures in the upper and lower Hells Canyon reaches, data collected by the USFWS appear to contradict this theory.

Juvenile fall chinook salmon rear for a brief time within their natal rivers before they migrate toward the ocean during their first year of life. Research on the Columbia and Snake rivers has shown that fall chinook salmon juveniles tend to rear in shallow, near-shore areas (about 1.5 meters deep). Rearing areas are also characterized as having substrates of less than 22.5 cm (long-axis length), mean water-column velocities less than 0.4 meters per second, and lateral shoreline slopes less than 40% (Garland and Tiffan 1999, Garland et al. 2001, Tiffan et al. 2001).

Modeled rearing habitat decreases in availability across a range of increasing steady state discharges simulated from Hells Canyon Dam (Technical Report E.2.3-2). The habitat–discharge relationship for the entire Hells Canyon reach is relatively similar upstream and downstream of the Salmon River, although maximum habitat availability below the Salmon River is about seven times higher than maximum habitat above the Salmon River. The maximum amount of modeled habitat in the Snake River above the Salmon River totals 2.5% of the Hells Canyon reach area, while habitat below the Salmon River totals 12.6% of the reach area. Overall, the maximum rearing habitat estimate (at 7.5-kcfs [or 7,500-cfs] discharge from Hells Canyon Dam) in the Snake River below Hells Canyon Dam totals 8.3% of the reach area, while the minimum habitat estimate (at 100-kcfs discharge from Hells Canyon Dam) totals 0.8% of the reach area.

The spatial distribution of rearing habitat patches at a discharge of 30-kcfs indicates that the fragmentation of juvenile rearing habitat in the Snake River decreases with distance downstream of Hells Canyon Dam. The percentage of habitat patches within 450 meters of each other (measured either side of the channel) increases from 81% in the upper portion of the upper Hells Canyon reach (RM 230–RM 247.6) to 99% in the lower Hells Canyon reach (RM 145–RM 188.2). Comparatively, Tiffan et al. (2001) reported that rearing habitat in the Hanford reach of the Columbia River was contiguous at all modeled flows. In addition, the distance from known spawning sites to the first downstream rearing habitat patch decreases with distance downstream of Hells Canyon Dam. In this case, the percentage of habitat patches within 450 meters of each other (measured either side of the channel) increases from 33% in the upper reach to 100% in the lower reach. It is unknown what effect fragmentation of rearing areas has on the survival of subyearling fall chinook. Undoubtedly, subyearling fall chinook run some risk when they are required to move across unsuitable habitats to access the next suitable rearing patch. Very few habitat patches were modeled in the first 20 river miles below Hells Canyon Dam. In fact, there were only 10 habitat patches modeled between RM 236 and RM 227.5, yet USFWS beach seine surveys collected more than 1,300 subyearling fall chinook at Pine Bar (RM 227.5) during spring 2001 (USFWS unpublished data). The nearest upstream spawning sites to Pine Bar that were identified in fall 2000 were at RM 235 and RM 235.7 where 19 redds were counted (Chapter 1 of Technical Report E.3.1-3). This information suggests that subyearling fall chinook emerging from spawning sites at or above RM 235 traveled through very little habitat to rear at Pine Bar.

The Hanford reach is the primary natural production area for fall chinook salmon in the Columbia River system (Dauble and Watson 1997). It annually produces an estimated 25 to 30 million natural fry that rear along the shallow mainstem shorelines (Tiffan et al. 2002). Rearing habitat modeled in the Hanford reach ranged from a maximum of 8.42 hectare per kilometer at 50 kcfs to 3.86 hectares per kilometer at 400 kcfs (Tiffan et al. 2001). These estimates are 6.3 and 19.3 times higher than habitat modeled in the Snake River below Hells Canyon Dam. The density of juvenile chinook rearing (the number of juveniles per hectare) in each system was estimated to evaluate the capacity level of rearing habitat in the Hells Canyon reach relative to rearing habitat in the Hanford reach. Densities were determined using aerial redd count data and applying fecundity and STE estimates to estimate the number of juvenile fall chinook in each reach. Estimated densities for each reach were made for the maximum and minimum habitat estimates to provide a range of capacity conditions. The densities of juveniles in the Hells Canyon reach were estimated to be lower (with no overlap in ranges) than those in the Hanford reach for the eight years from 1993 through 2000. Estimated rearing densities in the Hells Canyon reach overlapped with Hanford reach densities for the 2001 estimate and with the recovery goal (1,250 redds). These results indicated that our habitat estimate in the Hells Canyon reach would result in densities similar to those in the Hanford reach under escapement levels similar to those for 2001 and under recovery goal levels.

Besides rearing densities, food habits and growth rates must also be considered. Low densities, coupled with relatively high growth rates, would indicate that productivity could be high and that carrying capacity has not been attained. Research conducted by the U.S. Geological Survey found that juvenile fall chinook rearing within the Snake River eat mainly dipterans and trichopterans, but that ephemeropterans and homopterans (insects) can at times make up a significant portion of their diet (K. Tiffan, U.S. Geological Survey, Cook, WA, personal communication). According to these same researchers, the diet of juvenile fall chinook rearing within the Hanford reach of the Columbia River was found to be similar. Studies conducted by the USFWS within the Snake River have provided data that can be used to determine growth rates. Those studies indicate that subyearling fall chinook salmon rearing within the Hells Canyon reach of the Snake River have growth rates averaging greater than 1.0 mm per day (Connor et al. 1994; Connor 1999, 2001). This growth rate is quite high when compared with other stocks of fall chinook salmon found along the west coast of North America (Healey 1991). These factors, when taken into consideration with the physical habitat models, indicate that the carrying capacity of the Hells Canyon reach of the Snake River has not been attained.

The timing of fall chinook outmigration ranges from May through August, with the migration period past Lower Granite Dam peaking in early to mid-July. Studies conducted by the USFWS indicate that naturally produced juvenile fall chinook salmon have migrated from the Hells Canyon reach of the Snake River before water temperatures increase above 17 °C (William Connor, USFWS, Ahsahka, ID, personal communication). These same data suggest that juvenile fall chinook have completely emigrated from the Hells Canyon reach (upper and lower reaches) by the third week in June. The daily mean water temperature within the mainstem Snake River generally exceeds 17 °C by late June or early July each year (IPC unpublished data). The exact date of this occurrence largely depends on annual climatic conditions. Historically, before Hells Canyon Dam and the lower Snake River dams were built, all races of chinook salmon had migrated past the Lower Granite Dam site by the end of June (Mains and Smith 1964). Currently, downstream migrating juvenile fall chinook salmon must pass through eight federal hydroelectric projects and associated reservoirs before they reach the Columbia River estuary. These projects and reservoirs cumulatively increase the time involved in migration and subject juvenile migrants to extended exposure to higher water temperatures. This increased time and exposure also increase the chances that juvenile migrants will encounter predators or develop disease. For example, the average travel time to Lower Granite Dam (RM 107.5), determined for pit-tagged juvenile fall chinook salmon released within the Snake River by NMFS at Pittsburg Landing (RM 216), is approximately 40 days (NMFS unpublished data). A separate study conducted by Connor (1999) showed similar results. Because spawn timing, and ultimately emergence timing, vary and because these fish rear for an undetermined amount of time before actively migrating toward the ocean, it is difficult to apportion travel time estimates in the free-flowing reach of the Snake River and in the more lentic environment of the Lower Granite Reservoir.

E.3.1.1.2.3.2. Distribution and Status in the Snake River Tributaries

Pacific Lamprey

Historically, Pacific lamprey have not been the focus of attention in the Pacific Northwest region, and information about these primitive fish is scarce and difficult to obtain. Pacific lamprey (*Lampetra tridentata*) are primitive anadromous fish indigenous to the Columbia and Snake river basins. Historically, Pacific lamprey have been found along the North American coast, as far south as Baja California and as far north as the Bering Sea in Alaska (Wang 1986). *Lampetra tridentata* is divided into two subspecies within Oregon—the anadromous Pacific lamprey and the landlocked Goose Lake lamprey, which is listed as a species of special concern (ODFW 1995). Two additional lamprey species, river lamprey (*L. ayresi*) and western brook lamprey (*L. richardsoni*), also occur within the Columbia River basin (Close et al. 1995). Of these, only Pacific lamprey have a native range that includes the Snake River (Scott and Crossman 1973).

Many factors that have affected populations of salmon species throughout the Pacific Northwest have similarly affected Pacific lamprey. Hydroelectric projects have blocked access to or altered habitat and probably disrupted passage, both upstream and downstream. Changes in land-use practices have probably also affected habitat quality within spawning and rearing areas.

Currently, the distribution of lamprey on the Snake River extends upstream to Hells Canyon Dam (Close et al. 1995), the upstream barrier to anadromous fishes. Recent investigations into lamprey populations in Snake River tributaries show that low numbers of lamprey larvae remain in the Grande Ronde (Close and Bronson 2001) and Clearwater river basins (Cochnauer and Claire

2000). Conversely, recent investigations into the status of lamprey in the John Day River basin indicate “general reproductive and rearing success” (Close and Bronson 2001), although current population numbers are largely unknown. The overall trend in declining numbers of lamprey has been attributed to several causes, including habitat loss, water pollution, ocean conditions, and dam passage (Close et al. 1995, Cochnauer and Claire 2000, CPUD 2000, Close 2001). Recent research on upstream passage efficiency at Bonneville Dam suggests that hydroelectric projects can significantly threaten migrating adult lamprey, which have a passage success rate of less than 50% (Close and Bronson 2001). Barriers that are placed into fish ladders at some Columbia River dams may cause additional stress for adult migrating lamprey (Close et al. 1995).

Collecting accurate lamprey numbers at lower Columbia and Snake River hydroelectric projects has proven to be problematic for a number of reasons. In the past, fish-counting techniques relied on personnel counting for 8 hours near the beginning and end of the salmon runs and for 16 hours during peak periods (Close et al. 1995). Given that adult lamprey appear to be most active at night (Close et al. 1995, Moursund et al. 2000), counters probably underestimated actual numbers. Under current fish-counting techniques, fish are counted for 24 hours or recorded by video during migration for later analysis (CPUD 2000). Still, counting stations are designed for salmon enumeration (Close 2000), and lamprey can pass fish-counting windows at hydroelectric projects undetected (Jackson et al. 1996). At Bonneville Dam, for example, lamprey can move along the bottom of the counter undetected, skirt the counter by passing behind the picketed leads at the crowder, or avoid detection by other means (Jackson et al. 1996, and citations within). Inconsistent data on adult lamprey passage have been collected at all eight dams on the lower mainstem Columbia and Snake rivers, preventing direct comparisons among run years (Jackson et al. 1996). Finally, Close (2000) determined that lampreys display a high degree of fallback at the dams, particularly at Bonneville Dam. Based on data collected at the Washington shore-count station, for every Pacific lamprey observation, only 3% result in a net upstream count (Close 2000).

Data collection on downstream juvenile migrations have also been subject to similar problems. Most information found on juvenile numbers comes either from collection operations for salmon smolts or from directed study (for example, electroshocking for ammocoetes or using fyke nets) to assess current numbers.

Juvenile lamprey are commonly captured in downstream salmon smolt-collection facilities, indicating that the intake bypass screens probably intercept them. Because of their demersal (dwelling at or near the bottom of a body of water) nature, a more significant number are routed through the turbines (Moursund et al. 2000). Recent studies indicate that juveniles contacting fixed bar screens have a high probability of impingement when velocities exceed 1.5 feet per second at the screen (Moursund et al. 2000). Moursund et al. (2000) also investigated the role that turbine shear forces may have on downstream juvenile lamprey survival and determined that these forces have little consequence to the juveniles.

Comparisons between adult passage estimates collected in the early 1960s and 1997 counts by the U.S. Army Corps of Engineers are presented in Close (2000). While data should be treated as conservative, trends clearly show significant reductions in 1997 counts. A closer look at the 1997 counts reveals that over 1,000 adults “disappeared” at Lower Monumental and Little Goose dams and then reappeared at Lower Granite Dam, a phenomenon that indicates the difficulty in counting and reporting at various projects. This last factor is also true for Pacific salmon, but it is probably more common for lamprey.

Adult and juvenile passage data for Columbia River dams and the Ice Harbor Dam from the Chelan Public Utility District (CPUD 2000)—which in turn used data from Close et al. (1995), Jackson et al. (1996, 1997), Chelan Public Utility District, Douglas Public Utility District, and the U.S. Army Corps of Engineers—have also been compared. For undetermined reasons, adult counts for all the projects appear to fall most sharply in the late 1960s. At face value, juvenile counts appear to display infrequent but highly successful recruitment. However, counting uncertainties make this assumption questionable. Data inconsistencies prevent the formulation of any stock recruitment relationships over time.

Information that Martinson et al. (2000) presented includes collection data for downstream migrating lamprey juveniles at John Day and Bonneville dams between 1985 and 1999. However, trend data for their overall abundance among years at the project can only be extrapolated because juvenile sampling is a byproduct of salmon smolt-collection efforts at mainstem dams and lamprey behave differently than salmon do. Regarding collections at John Day Dam, a transition in sampling methodology occurred between 1997 and 1998 when the facility switched from "single gatewell" to "full bypass" sampling for downstream juvenile salmon. While these changes in collection design are certainly more efficient, they make comparing results from prior years difficult. Collections of macropthalmia at Bonneville Dam between 1988 and 1999 show the continuing, widespread problem of highly variable counts. It is unknown whether entrainment rates through turbines or spill vary among projects (indicating that lamprey bypass the counters) or whether current counting techniques reflect what is occurring biologically with lamprey.

Because the Pacific lamprey is a parasitic fish and held little value as a sport or commercial species to early Euro-Asian settlers in the Northwest, this fish has either been ecologically ignored or deliberately eradicated. This lack of concern has resulted in a limited body of knowledge concerning the Pacific lamprey's ecology, life history, and historical and present distribution or status. Only recently has this fish received some attention by fish management agencies.

Steelhead

Anadromous steelhead are currently found within the Snake River basin downstream of the HCC. The mainstem Snake River is primarily used as a migration corridor for juveniles, as well as for migration and overwinter holding by adults. Spawning occurs in the larger tributary basins (such as the Grande Ronde, Salmon, and Imnaha rivers), as well as in a few of the smaller tributaries upstream of the Salmon River confluence (such as Granite, Sheep, and Kirkwood creeks). Juveniles tend to rear within their natal streams for approximately two years before migrating to the ocean. These fish remain in the ocean for up to three years before maturing and returning to fresh water to spawn.

Steelhead adults arrive in the Columbia River (as observed at Bonneville Dam) from July through October of each year, with numbers peaking in August. Fish destined for the Snake River basin pass Ice Harbor Dam from late August through late November, with peak passage in late September. They pass Lower Granite Dam from early September through early December, with the peak occurring during October. Many adults of the A-run group overwinter within the Hells Canyon reach of the Snake River downstream of Hells Canyon Dam. A small proportion of later-arriving adults destined for the Snake River basin overwinter downstream of the lower Snake River dams and continue passage the following spring. These fish generally pass Lower

Granite Dam and move into the upper Snake River basin and tributaries during March and April. As mentioned previously, spawning occurs during early spring months within the tributaries.

Juveniles rear within their natal streams for approximately two years and then migrate to the ocean. Downstream migrations occur each spring, generally during peak runoff periods. Collections of juveniles at Lower Granite Dam indicate that steelhead juveniles are moving out of the Hells Canyon reach of the Snake River from about early April through early June, with outmigration peaking during the last week of April and first two weeks of May.

Sockeye Salmon

Both adult and juvenile sockeye salmon use the lower Hells Canyon reach (downstream of the confluence of the Salmon River) of the Snake River solely for a migration corridor. Sockeye salmon that pass through the Hells Canyon reach are either destined for, or leaving, the upper Salmon River basin. As described previously, these fish typically require a lake before they can complete their normal life history.

Adult returns of sockeye to the Snake River basin have been low since the early 1900s because of early development that eliminated production areas within the Grande Ronde River (Wallowa Lake), Payette River (Black Canyon Dam), and the upper Salmon River (Sunbeam Dam). Sunbeam Dam in the Salmon River basin has since been removed. Adult counts at Ice Harbor Dam by the early 1960s were generally about a thousand fish per year. Because counts at Lower Granite Dam between 1978 and 1990 ranged from 458 to 0, NMFS listed the Snake River stock as endangered in 1991. Soon after, the Idaho Department of Fish and Game (IDFG) began a captive brood program designed to turn around the precipitous decline of this stock. Adult counts at Lower Granite Dam since 1991 have averaged approximately 37 adults, ranging from a low of 3 to a high of 282.

Data from counts at U.S. Army Corps of Engineers dams indicate that adult sockeye generally migrate upstream through the Snake River from mid-June through early August, peaking during early to mid-July. Juvenile downstream migration through the lower Snake River is generally from early April through mid-July, with the peak occurring during May. These fish are not believed to spend any time within the mainstem Snake River for rearing purposes.

Spring/Summer Chinook Salmon

Both adult and juvenile spring/summer chinook salmon also use the Hells Canyon reach of the Snake River downstream of Hells Canyon Dam solely for a migration corridor. These fish tend to use higher-elevation tributaries for the spawning and rearing phases of their life history. In general, adults return to the Snake River basin during April through August and spawn during September and October. After emerging from the gravel the following spring, juveniles then rear for approximately one year in their natal streams before they migrate toward the ocean early during the second year of their life. Spring chinook salmon make up the majority of this stock. Low returns of this stock to the Snake River basin prompted NMFS to list it as threatened under the ESA in 1992. While recent numbers of returning adults have increased over the last few years (record high of over 185,000 in 2001), it should be noted that most of these fish are of hatchery origin.

Adults are counted at Lower Granite Dam from about early April through mid-August, with a spring chinook peak around early May and a later, smaller summer chinook peak during the latter half of June. These fish continue to migrate into the Clearwater, Salmon, Grande Ronde, and Imnaha river basins, and a small percentage of them may actually move into some of the minor Snake River tributaries upstream of the Salmon River confluence (such as Granite, Sheep, and Kirkwood creeks). Most fish that move into the upper Hells Canyon reach are probably hatchery fish destined for the trap at Hells Canyon Dam.

Juveniles tend to spend very little time moving through the Hells Canyon reach during their spring outmigration. These fish are not believed to remain for any length of time within the mainstem Snake River for rearing purposes. Outmigation timing for juvenile spring/summer chinook is similar to what has been observed for steelhead. Index counts from Lower Granite Dam indicate that these fish are moving out of the Snake River basin from mid-April through mid-June, with a strong peak occurring either in late April or early May.

Fall Chinook Salmon

Fall chinook salmon also use the lower reaches of the larger tributaries to the Snake River for spawning and rearing. Redd surveys since 1992 have documented spawning within the Clearwater, Grande Ronde, Imnaha, and Salmon rivers. Spawning within each of these tributaries occurs over a similar time period in the fall as what has been observed in the mainstem Snake River (mid-October through early December, peaking in early November). Annual spawning surveys since 1992 have incorporated observations within all of the larger tributaries. The percentage of annual spawning observed within each of the tributaries since 1992 has remained fairly consistent, with approximately 30% occurring within the Clearwater, 10% within the Grande Ronde, and less than 5% within both the Imnaha and Salmon rivers (IPC and Nez Perce Tribe unpublished data).

The larger tributaries are generally cooler during the fall and winter than what is observed within the mainstem Snake River (IPC unpublished data). Because of this thermal difference and because embryonic development is positively correlated with water temperature, fry probably emerge from the gravel later in the spring within the tributaries than what is estimated for the mainstem Snake River. Tagging of juveniles that are rearing within the Clearwater River has shown that those fish tend to migrate toward the ocean later than juveniles tagged within the mainstem Snake River (Connor 2001). Because of thermal similarities among the tributaries, fish rearing within the Grande Ronde, Imnaha, and Salmon rivers may also migrate seaward later in the season. Also, tagging of juvenile fall chinook salmon rearing within the Clearwater River and subsequent recaptures indicate that a portion of those fish tend to exhibit a stream-type life history, migrating toward the ocean as yearlings in the early spring of their second year of life (William Connor, USFWS, Ahsahka, ID, personal communication). Because the thermal characters of the other tributaries are similar to the thermal character of the Clearwater River, a portion of the fry produced in those rivers probably also exhibits a stream-type life history.

Whether juveniles from any of these larger downstream tributaries actually use the mainstem Snake River for rearing is unknown. However, downstream migrants from the Imnaha, Salmon, and Grande Ronde rivers certainly use the free-flowing reach of the Snake River downstream of the HCC as a migration corridor. Seaward migrants dispersing from the Clearwater River move directly into the upper end of the Lower Granite Reservoir.

E.3.1.1.2.3.3. Artificially Produced Fish

Transition to Mitigation Hatchery Program

It appears that the first significant discussion of converting from a passage program to hatchery mitigation occurred at a meeting of the Applicant personnel and agency officials in August 1960. At the meeting, participants discussed a pilot program in which 200 adult fall chinook would be spawned and temporary hatching facilities organized for the resulting eggs. They envisioned constructing a supplemental production facility at the Oxbow Dam site. Looking ahead, they anticipated moving the facility downstream as successive dams were built on the Snake River (Moore 1960). Within months, the FPC (1960) ordered the Applicant to construct artificial propagation facilities below Oxbow Dam that were capable of holding 2,000 adult fall chinook and their resulting eggs. In July 1961, construction of Oxbow Fish Hatchery began (shown in Figure E.3.1-3). The facility became operational in September of that year.

Preliminary results from passage evaluation studies prompted the Applicant to explore alternatives to fish passage at the HCC. In August 1962, the Applicant outlined a plan for transferring spring chinook and steelhead into the undammed Salmon River drainage (Smith 1962). This shift in thinking is reflected in an order issued by the FPC that would be the most significant event in the development of the mitigation hatchery program. On December 11, 1963, after reviewing the results of passage efficiency studies conducted by state and federal resource agencies, the FPC ordered the Applicant to abandon the barrier net and fish passage program and shift its efforts to other means of conserving anadromous fish. The order required Oxbow Fish Hatchery to expand its operation to include trapping and spawning *all* returning fall chinook. The order also mandated that the Applicant acquire property on Rapid River near Riggins, Idaho, on which an experimental hatchery could be constructed. The hatchery would be able to rear 600,000 chinook salmon or steelhead and provide for expansion of both. Construction of Rapid River Fish Hatchery, shown in Figure E.3.1-3, began in March 1964. While still under construction, the hatchery became operational in May 1964.

After receiving additional agency input on the use of artificial propagation, the FPC issued an order dated January 18, 1966, requiring the Applicant to construct a steelhead rearing facility near Buhl, Idaho, that was capable of rearing 200,000 pounds of fish, as well as steelhead smolt acclimation and trapping/spawning facilities in Lemhi County, Idaho, with a capacity of

3.3 million steelhead eggs. After this order, the Applicant's Niagara Springs and Pahsimeroi fish hatcheries became operational in July 1966 and March 1967, respectively (shown in Figure E.3.1-3). In each of these orders, the Applicant's mitigation responsibilities were described in terms of providing facilities with the capacity to produce a desired number of smolts. These hatchery capacities were based on the maximum counts of record at Oxbow and Brownlee dams from 1957 to 1959. The maximum trap counts for adult fall chinook, spring chinook, and steelhead were 17,848; 2,631; and 5,185 respectively.

In April 1974, the agencies sought additional compensation from the Applicant, alleging that previous measures implemented by the Applicant had not provided appropriate mitigation for losses of anadromous fish associated with the construction and operation of the HCC and that certain fall chinook and steelhead runs had been eliminated by construction of the HCC. Details of the agencies' demands are provided in Technical Report E.3.1-4. Unable to resolve the matter directly with the Applicant, the agencies petitioned the FPC. For nearly three years, the parties engaged in a formal proceeding before the FPC to explore issues raised by the petition. After extensive litigation—including discovery, briefing, and presentation of written testimony—the parties entered into negotiations that ultimately resolved all anadromous fish issues relating to the HCC under the license. The Applicant and the petitioners resolved the issues raised by the petition that had been filed with the FPC by jointly filing an uncontested offer of settlement with the Federal Energy Regulatory Commission (FERC, and formerly the FPC). The settlement, which became known as the *Hells Canyon Settlement Agreement*, was embodied in a written agreement dated February 14, 1980, and signed by the Applicant; the State of Idaho, through the IDFG; the State of Oregon, through the Oregon Department of Fish and Wildlife (ODFW); the State of Washington, through the Washington Department of Game and Department of Fisheries; and the U.S. Department of Commerce, through the NMFS. FERC accepted the offer of settlement by order dated February 27, 1980, and concluded the following:

> The offer of settlement provides that its requirements would constitute full and complete mitigation for all numerical losses of salmon and steelhead caused by the construction and operation of Project No. 1971 under the existing license. According to the offer of settlement, Idaho Power Company will provide, operate, and maintain fish traps, fish hatchery facilities, and fish handling and transportation facilities that will provide annual production levels of fall

> chinook, spring chinook, and steelhead smolts. Facilities development includes providing a permanent adult trapping facility on the Oregon side of the Snake River below Hells Canyon Dam, refurbishing the Oxbow hatchery facilities, enlarging the Pahsimeroi Hatchery, and modifying the Niagara Springs Hatchery…. The offer of settlement resolves all of the issues set for hearing in our order of April 20, 1977. We conclude that the offer of settlement is reasonable and in the public interest in carrying out the provisions of the Federal Power Act and should be approved. (FERC 1980)

This 1980 order approving the settlement is the last and most recent order issued by FERC on the subject of fish mitigation at the HCC. This order and the *Hells Canyon Settlement Agreement* form the basis of the Applicant's mitigation hatchery program today. In short, the agreement states that the Applicant will provide hatchery facilities capable of producing 1 million fall chinook (Oxbow Fish Hatchery), 4 million spring/summer chinook (3 million at Rapid River Fish Hatchery and 1 million at Pahsimeroi Fish Hatchery), and 400,000 pounds of steelhead smolts (Niagara Springs Fish Hatchery). With no other means of obtaining Snake River fall chinook broodstock for hatchery purposes, the Applicant entered into an agreement with the U.S. Army Corps of Engineers dated May 31, 1984. According to the agreement, the Applicant would provide a portion of the construction cost of the U.S. Army Corps of Engineers Lyons Ferry Hatchery in exchange for sufficient capacity within the new Lyons Ferry facility to ensure the availability of approximately 1.3 million eyed fall chinook eggs annually. Because of the critically depleted size of fall chinook populations in the Snake River at that time, the agreement further stated that the Applicant would not be entitled to any eggs in any year until the Lyons Ferry had obtained 80% of its annual quota of 12 million eggs. Recently, this qualifier has been modified by annual fall agreements pursuant to *U.S. v. Oregon* litigation. Distribution of Lyons Ferry eggs among programs sponsored by the Washington Department of Fish and Wildlife, Nez Perce Tribe, and Applicant is now negotiated among state, federal, and tribal salmon managers. Consequently, the Applicant did not receive any fall chinook eggs until December 7, 2000.

Fall Chinook Salmon

Oxbow Fish Hatchery began operating in fall 1961 to produce subyearling fall chinook smolts to supplement wild fish production in the Snake River. From 1961 to 1973, adult fall chinook were trapped at Oxbow and Hells Canyon dams and transported to Oxbow Fish Hatchery for spawning.

During the first two years of operation, fewer than half of the fish trapped at the Oxbow Dam site were delivered to Oxbow Fish Hatchery. The majority were transported above Brownlee Dam and released to spawn naturally. However, as trap catches declined in subsequent years, an increasing proportion of fish were transferred to Oxbow Fish Hatchery for artificial propagation. Excessive water temperatures and fish health issues hampered spawning efforts throughout the brief history of the program (Technical Report E.3.1-4).

Efforts to culture fall chinook continued through 1973; however, extremely low adult collections and complete broodstock mortality resulted in no smolt production beyond 1970. No further fall chinook production occurred at Oxbow Fish Hatchery until December 2000, when 122,514 eyed eggs were received from Lyons Ferry Hatchery pursuant to the *Hells Canyon Settlement Agreement*. Subyearling smolts produced from these eggs were released below Hells Canyon Dam in May 2001. A second group of approximately 200,000 eggs was received in December 2001 and released in May 2002. These fish are included in the ESU for listed Snake River fall chinook. A complete summary of adult fall chinook collection and spawning operations and smolt production from Oxbow Fish Hatchery appears in Table 5 in Technical Report E.3.1-4.

Spring/Summer Chinook Salmon

Rapid River Fish Hatchery began operating in 1964 with an annual production goal of 600,000 spring chinook smolts. Fish for broodstock for initial program development were trapped at Oxbow and Hells Canyon dams and transported to Rapid River Fish Hatchery for spawning (Table 9 in Technical Report E.3.1-4). The program quickly became self-sufficient, and efforts to trap spring chinook from the Snake River were discontinued in 1969. The first group of smolts was released to Rapid River in 1966, and the first return of jacks occurred in 1967. Based on favorable adult returns, the production goal was expanded to 1.6 million smolts in 1967 and 3.0 million smolts in 1969. From brood years 1964 through 1998, Rapid River Fish Hatchery collected over 213 million green (unfertilized) eggs and released over 85 million smolts for mitigation purposes (Table 10 in Technical Report E.3.1-4). Mean annual releases are 2,257,664 smolts to Rapid River (from 1966 through 2000) and 313,303 smolts to the Snake River (from 1981 through 2000). Rapid River stock spring chinook are not listed under the ESA, nor are they considered part of the ESU for Snake River spring/summer chinook. The relative success of Rapid River Fish Hatchery's spring chinook program has given the IDFG and ODFW the opportunity to use this stock extensively to supplement other fish management programs within Idaho and Oregon. Since 1964, approximately 75,454,000 surplus eggs and 16,831,000 surplus parr and smolts have been produced at Rapid River Fish Hatchery for use in programs in the Clearwater, Lochsa, upper Salmon, Lemhi, and Grande Ronde river basins. These efforts are unrelated to the Applicant's mitigation. Transfers of this nature have occurred in 27 of 35 years. The number and disposition of these surplus fish are summarized in Table 11 in Technical Report E.3.1-4.

Following the development of the *Hells Canyon Settlement Agreement*, the production of spring and summer chinook smolts was expanded to include Pahsimeroi Fish Hatchery. The Applicant's chinook mitigation program at Pahsimeroi Fish Hatchery began in 1981 with the collection of eggs from 4 female summer chinook and receipt of 616,823 spring chinook eggs from Rapid River Fish Hatchery. The first volitional release of hatchery smolts associated with the Applicant's mitigation occurred in 1983. From brood years 1981 through 1999, Pahsimeroi Fish Hatchery has produced approximately 7,203,601 spring and summer chinook smolts (Table 17 in Technical Report E.3.1-4), averaging slightly over 379,000 smolts annually. Spring chinook were phased out at Pahsimeroi Fish Hatchery after brood year 1984 in favor of summer chinook. During this phasing-out period, adult spring chinook salmon were outplanted for ceremonial fisheries by the Shoshone-Bannock Tribe, while eggs and fry were distributed to Lookingglass, Irrigon, and Sawtooth hatcheries (Table 18 in Technical Report E.3.1-4). Since 1992, Pahsimeroi Hatchery summer chinook have been listed under the ESA, and the hatchery stock is included in the ESU. The IDFG now operates the hatchery in a conservation mode directed at recovery of this depressed population.

Steelhead

Initial efforts to relocate steelhead from the Snake River to the Salmon River basin began in September 1965 with the collection of broodstock at Hells Canyon Dam. The first eggs were spawned in March 1966, at Oxbow Fish Hatchery. Since that time, egg collections at Oxbow Fish Hatchery have ranged from 54,169 to over 8 million, with an average of approximately 2.03 million green steelhead eggs produced annually (Table 6 in Technical Report E.3.1-4). Eyed eggs were first transferred to Niagara Springs Fish Hatchery in 1966, and the first group of smolts was released in 1967. The production goal at that time was 200,000 pounds of steelhead smolts annually. From 1967 through 1980, 29,577,694 steelhead weighing 3,018,153 pounds were produced at this facility. Mean annual production during this time was 215,575 pounds or 2,112,692 fish. Most of these fish (99.6% by weight) were released directly into anadromous waters for mitigation purposes. Since the emphasis was on transplanting Snake River stock steelhead into the Salmon River basin, most of these fish were released into the Pahsimeroi River, while fewer than 5% by weight were allotted to the Snake River (Table 8 in Technical Report E.3.1-4). The first hatchery-origin one-ocean adults returned to the Pahsimeroi River in 1969. Efforts to collect summer steelhead broodstock at Pahsimeroi Fish Hatchery for artificial propagation began in March of that same year. Since then, nearly 152 million steelhead eggs have been collected at Pahsimeroi Fish Hatchery, ranging from a low of 1,620,000 to over 11 million annually (Table 14 in Technical Report E.3.1-4). Average egg collection over the 32-year history of the facility is 4,742,649 eggs annually. Approximately 53% of the eggs and fry produced at Pahsimeroi Fish Hatchery have been shipped to Niagara Springs Fish Hatchery. The remaining 47%, or 57,423,006 eggs, identified as surplus to the Applicant's mitigation needs by the IDFG have been used in the form of eggs or fry in various locations to enhance sport fishing opportunities, supplement natural steelhead production, and fill other mitigation hatchery programs.

With the signing of the *Hells Canyon Settlement Agreement* in February 1980, the Applicant agreed to continue operating the Niagara Springs Fish Hatchery and modify it as necessary to permit the production of 400,000 pounds of steelhead smolts annually. From 1981 through 1999, a total of 36,392,419 steelhead weighing 7,392,833 pounds was produced. Mean annual production during this time was 369,642 pounds, or 1,819,621 fish. As during the previous period, virtually all of the fish produced at Niagara Springs Fish Hatchery from 1980 to 1999 (98.6% by weight) were released into anadromous waters for mitigation purposes. During this more recent period, however, fish were more equally split between the Snake and Pahsimeroi rivers. This split reflected *Hells Canyon Settlement Agreement* requirements and resource agencies' associated desire to promote the recreational potential of the Snake River below Hells Canyon Dam (Table 12 in Technical Report E.3.1-4). Neither Oxbow Hatchery stock nor Pahsimeroi Hatchery stock steelhead are listed under the ESA. Therefore, the IDFG continues to use these fish for harvest augmentation. Although NMFS has included the Oxbow Hatchery stock in the Snake River steelhead ESU, no efforts have been made to convert any portion of the Applicant's steelhead program to a conservation mode.

E.3.1.1.3. White Sturgeon

E.3.1.1.3.1. History of Fish Resources

The white sturgeon (*Acipenser transmontanus*) is a large, long-lived, late-maturing fish that historically migrated between estuaries along the Pacific coast and large river systems. These rivers included the Fraser, Columbia, San Joaquin, and Sacramento rivers. Although white sturgeon may use the marine environment, they do not require access to the salt water (PSMFC 1992). The largest tributary to the Columbia River is the Snake River, which originates in Wyoming, runs through Idaho, and joins the Columbia River in the state of Washington. White sturgeon inhabit 615 miles of the Snake River downstream of Shoshone Falls, Idaho (a natural barrier), and at least two of its major tributaries, the Salmon and Clearwater rivers (Cochnauer et al. 1985). The concern about white sturgeon stems, in part, from the declines observed in other species of sturgeon and paddlefishes (Rochard et al. 1990, Birstein et al. 1997). When rivers are impounded, migratory species such as sturgeon are the first to disappear (Poddubny and Galat 1995, Welcomme 1995). More than half of the land-locked white sturgeon populations in North America have declined (Cochnauer et al. 1985, Beamesderfer and Farr 1997).

The Snake River within Idaho offers a contrast in population status among river segments, with some segments having healthy, reproducing populations and others having very few individuals and no detectable recruitment (Jager et al. 2000). Many factors—including altered habitat, pollution, historical exploitation, and populations fragmented by dams—have contributed to the sturgeon's current status. Snake River sturgeon populations apparently began declining in Idaho as early as the late 1930s (Edson 1956). At that time, three dams had been built on the Snake River below Shoshone Falls (Swan Falls, Lower Salmon Falls, and Upper Salmon Falls) and impounded only about 4% of the river. Overharvest was believed to be the primary factor responsible for Snake River sturgeon decline, so fishing regulations were implemented beginning in 1943. Nine additional dams were constructed on the Snake River between the late 1940s and mid-1970s, and these dams further divided the river habitat into smaller segments, several of which lacked free-flowing river habitat.

In addition, water quality has been degraded in several reaches of the Snake River from agricultural, industrial, and municipal development of the surrounding watersheds. While white sturgeon are still found throughout their historical range in the Snake River, several reaches no longer support wild, viable populations, and sturgeon have declined to levels where long-term persistence is questionable or unlikely.

E.3.1.1.3.2. Life History

E.3.1.1.3.2.1. Sexual Maturity

The size and age at first maturity for white sturgeon is extremely variable. Male sturgeon in the wild begin to mature as 12 year olds at around 125 cm in length, while females normally require longer periods, generally 15 to 32 years (PSMFC 1992). Reproductive periodicities (time period between spawning events) also vary between sexes; males may reproduce every two to four years, while females may reproduce at no less than five-year intervals (Conte et al. 1988, Chapman et al. 1996, Anders et al. 2002). Spawn periodicities for white sturgeon may also range up to 11 years (Semakula and Larkin 1968, Simpson and Wallace 1982, Cochnauer 1983). In domestic broodstock, initial egg development requires two to five years (Binkowski and Doroshov 1985, Conte et al. 1988). Females may carry 0.1 to 7 million mature eggs, depending on fish size and age (Bajkov 1949, Scott and Crossman 1973, Stockley 1981). In general, only a small portion (about 10%) of white sturgeon populations are reproductive in any given year (S. Doroshov, University of California, Davis, personal communication to Apperson and Anders, 1990).

E.3.1.1.3.2.2. Spawning

White sturgeon are iteroparous, broadcast spawners (fish that spew the eggs without first creating a nest) that depend on free-flowing rivers for suitable spawning conditions. Spawners broadcast gametes (eggs and sperm) into the water column where fertilization occurs before the demersal, adhesive embryos settle to the substrate (Paragamian et al. 2001, and citations within).
White sturgeon spawn in extremely fast-flowing water, with velocities exceeding 1.8 meters per second thought to be the most suitable (Parsley et al. 1993a, Parsley and Beckman 1994). Researchers have proposed a number of benefits from fish spawning in fast, turbulent waters. For example, high-velocity flows remove fine sediments from spawning areas, sediments that might otherwise suffocate eggs (Parsley et al. 1993a). Also, broadcasting eggs in fast, turbulent water may enhance egg viability by dispersing adhesive eggs, thereby preventing clumping and disease.

Dispersal probably also reduces egg and larval predation and minimizes competition among postlarval fish (McCabe and Tracy 1994). In the Snake River, spawners fitted with radio transmitters (telemetered fish) were commonly associated with turbulent pools, high-velocity runs, and nearby rapids where eggs were collected (Chapter 2 of Technical Report E.3.1-6). These telemetered fish used a wide range of depths (2–21 meters). Upper velocities approached 2.72 meters per second in some locations (Chapter 2 of Technical Report E.3.1-6).

White sturgeon spawning in the Columbia River basin occurs during spring (April–July) when water temperatures are between 10 and 18 °C (Parsley et al. 1993a, R L & L Environmental Services 1994), with the peak in spawning occurring when temperatures are typically between 13 and 15 °C. Generally, the Snake River reaches have suitable spawning temperatures (10–18 °C) from March through late June, depending on annual spring conditions and the location of the reach. Lepla and Chandler (Chapter 2 of Technical Report E.3.1-6) reported that, as for Columbia River observations, most spawning in the Snake River (based on development of collected eggs) occurred when the water temperatures ranged from 12 to 16 °C, with a mean temperature of 14 °C, which is considered optimal for egg incubation (Wang et al. 1985). The temperature regimes in the Snake River and the temperatures of the water in which the majority of eggs were collected (12–16 °C) suggest that peak spawning activity occurs from mid-March to the end of May in the reaches above the HCC and from late April to mid-June in the reaches below the HCC (Chapter 2 of Technical Report E.3.1-6).

E.3.1.1.3.2.3. Incubation

Wang et al. (1985) indicated that a water temperature of 14 °C is optimal for egg incubation, mortality increases in temperatures of 18 to 20 °C, and water temperatures beyond 20 °C clearly become lethal for developing embryos. The lower limit at which temperatures become lethal to incubating white sturgeon eggs may be similar to the lower limit for other sturgeon species, a temperature near 6 to 8 °C (Wang et al. 1985), although research has not yet established this conclusion. Egg incubation usually lasts 7 to 14 days, depending on water temperature (Bajkov 1949, Wang et al. 1985, Conte et al. 1988). Eggs of white sturgeon are vulnerable to predation because adults broadcast the eggs and provide no parental protection. Research indicates that several species of fish prey on sturgeon eggs, including northern pikeminnow, common carp (*Cyprinus carpio*), largescale sucker, and prickly sculpin (*Cottus asper*) (Carl 1936, Patton and Rodman 1969, Scott and Crossman 1973, Wydoski and Whitney 1979, Kempinger 1988, Miller and Beckman 1993). Incubating eggs in the Snake River were commonly associated with turbulent pools and runs with mean column velocities ranging from 0.1 to 2.0 meters per second and depths of 4 to 19 m. Egg incubation primarily occurs from mid-March through early June upstream of the HCC and from late April to the end of June downstream of the complex (Chapter 2 of Technical Report E.3.1-6).

E.3.1.1.3.2.4. Larvae

Upon hatching, yolk-sac larvae are planktonic and drift downstream on river currents. Larvae can disperse across long distances. Kohlhorst (1976) and McCabe and Tracy (1993) reported observing sturgeon larvae about 115 to 121 miles downstream of known incubation and probable spawning sites. Brannon et al. (1986) described three phases of larval development and behavior (dispersal, hiding, and feeding) that occur between hatching and metamorphosis, with each phase lasting up to 6 days, depending on environmental conditions. At 17 °C, exogenous feeding begins about 12 days after hatching, and larvae disperse into the water column as they begin to feed (Buddington and Christofferson 1985, Conte et al. 1988). Post yolk-sac larvae collected in the Columbia River feed primarily on amphipods of the genus *Corophium* (Muir et al. 2000). Other food items probably include copepods, Ceratopogonidae larvae, and Diptera pupae and larvae. Within 20 to 30 days after hatching, metamorphosis is complete (Buddington and Christofferson 1985).

Lepla and Chandler (Chapter 2 of Technical Report E.3.1-6) reported that few larval white sturgeon were captured during the Applicant's sturgeon surveys, primarily because of gear limitations. However, sturgeon larvae were sampled in both riverine and reservoir environments. Larvae in the riverine environment were sampled at the substrate in a deep, turbulent pool where spawners and eggs were found. One larval sturgeon was also captured in Brownlee Reservoir (4 meters below the surface). Although the origin of this larva was uncertain, its location illustrated the mobility of sturgeon during this life stage and the potential to drift far from upstream spawning sites during its dispersal phase. The habitats where larvae were collected had water temperatures of 17 to 18.6 °C, flow velocities of 0.0 to 0.9 meters per second, and depths of 4 to 14 meters. Using developmental criteria by Wang et al. (1985) and the Applicant's data from collections of sturgeon eggs in the Snake River, Lepla and Chandler (Chapter 2 of Technical

Report E.3.1-6) suggested that most yolk-sac larvae are probably free swimming and have begun exogenous feeding by late June in reaches between Bliss Dam and the confluence with the Salmon River and by mid-July in reaches downstream of the Salmon River.

E.3.1.1.3.2.5. Young-of-Year

Young-of-year sturgeon grow rapidly in a laboratory environment. Their body weight doubles with each two- to three-week period at 16 °C during the first four months of life (Brannon et al. 1984). Food habitats of young-of-year include various species of aquatic insect larvae, including *Corophium,* chironomids, mysids, and amphipods (benthic invertebrates) (Scott and Crossman 1973, PSMFC 1992). Using habitat information from McConnell (1989) and Parsley and Beckman (1994), Lepla and Chandler (Chapter 2 of Technical Report E.3.1-6) reported that conditions for young-of-year white sturgeon in the Snake River were suitable at water temperatures of 0.1 to 28 °C, flow velocities of 0.0 to 1.9 meters per second, and depths greater than 6.1 meters. Lepla and Chandler (Chapter 2 of Technical Report E.3.1-6) also estimated that young-of-year sturgeon begin appearing in various reaches of the Snake River from mid-April through early June.

E.3.1.1.3.2.6. Juveniles and Adults

Losses of juvenile sturgeon to predation are probably slight because of their protective scutes (bony scales), benthic habitats, and fast growth. White sturgeon are also opportunistic feeders. Their diets become increasingly more diverse as they mature and commonly include various species of fish, crayfish, and benthic invertebrates. Initially, juvenile sturgeon feed primarily on benthic invertebrates (Muir et al. 2000), while fish and crayfish become the principal food for larger individuals (> 48.3 cm) (Scott and Crossman 1973). In some populations, sturgeon may migrate seasonally in response to food resources. (PSMFC 1992).

Sturgeon are perhaps best known for their large size. The largest white sturgeon captured in the Fraser River in 1912 was 20 feet long and weighed 1,800 pounds. Similarly, the largest recorded sturgeon captured in the Snake River weighed 1,500 pounds in 1928 (Anderson 1988). Growth rates vary considerably among individuals, with the highest rates typically occurring during the earlier years. Based on age–length relationships, the average annual growth rates of Snake River sturgeon range from 11 cm for sturgeon shorter than 92 cm (less than 7 years old) long, 7 cm for sturgeon between 92 and 183 cm (8 to 19 years old), and 3 cm for sturgeon longer than 183 cm (20 years or older).

Habitat measurements of juvenile and adult white sturgeon indicate that these fish use a wide range of habitats within both riverine and reservoir environments (Chapter 2 of Technical Report E.3.1-6). In riverine sections, sturgeon were often captured along current breaks in or near the thalweg (stream path that follows the deepest part of the channel) of runs and pools. Fish tend to use areas where potential food resources tend to collect and settle out from the river currents. Sturgeon sampled in reservoirs by the Applicant's investigators tended to use the middle section and upper transition areas, while use of the lower pool was typically low. This use pattern may also be related to food opportunities and, in some cases, poor water quality in the lower sections of some reservoirs. Overall, sturgeon were captured most often at depths greater than 6 meters and in water velocities less than 1.50 meters per second. However, some sturgeon were found at sites with relatively high velocities (up to 2.91 meters per second) or very shallow depths (less than 2 meters). Because these instances were few, Lepla and Chandler (Chapter 2 of Technical Report E.3.1-6) indicated that sturgeon use of these conditions would be infrequent.

E.3.1.1.3.2.7. Movement

Species in the order Acipenseriformes migrate for two basic reasons: feeding (rearing) and reproducing. Upstream migrations are usually associated with spawning activities, while downstream migrations are associated with feeding (Bemis and Kynard 1997). However, there are considerable variations in the migration patterns of sturgeon species, including white sturgeon. In the lower Columbia River, seasonal distribution patterns of white sturgeon suggest a general upstream migration in the fall, a quiescent winter period, downstream migration in the spring, and large congregations of sturgeon in the estuary during summer. DeVore and Grimes (1993) suggested that these migration patterns were a result of ephemeral food availability. However, Bajkov (1949) found that some white sturgeon appeared to not migrate at all during a particular year. North et al. (1993) also reported variations in movement patterns of white sturgeon in three Columbia River reservoirs above Bonneville Dam. Of the sturgeon sampled, half the fish moved downstream after release, while the other 50% moved upstream. Most sturgeon moved at least 0.6 river miles, with some individuals traveling up to 94 miles.

Similar variations among movement patterns were observed for telemetered white sturgeon in the Snake River between Swan Falls Dam and the Salmon River. Several sturgeon at large between 193 and 648 days traveled distances totaling 73 to 96 miles, while others at large for similar durations (185–679 days) traveled less than 10 miles. While sturgeon are capable of traveling great distances, much of the distance observed during telemetry studies in the Snake River was “accumulated” by individuals traveling between areas of close proximity. Overall, the range of movement activity between Swan Falls and the Salmon River was fairly localized, with the majority (73%) of fish traveling less than 10 miles from their initial capture locations. The average distance traveled by all sturgeon during the Applicant’s monitoring efforts was less than 4 miles. Coon (1978) observed similar localized movement patterns by sturgeon greater than 183 cm long below Hells Canyon; these fish often moved only between pools in close proximity. He noted that smaller sturgeon tended to move downstream but averaged only around 4.3 miles per year. Similar ranges in movement activity have also been observed in other Snake River reaches between Swan Falls and Bliss dams (Chapter 4 of Technical Report E.3.1-6).

The most notable movement patterns in the Snake River are generally associated with spawning, and the distance traveled depends on the proximity of suitable spawning habitat (Chapters 2 and 4 of Technical Report E.3.1-6). These patterns are particularly evident among sexually mature sturgeon traveling from reservoir to riverine environments to spawn. In C.J. Strike Reservoir, located 37 miles upstream of Swan Falls Dam, reproductive adults often left the pool as spawning temperatures approached and, depending on their capture location in the pool, traveled about 16 river miles upstream of the pool to stage and spawn near RM 521.8. Similar upstream spawning movements, although typically less than a few miles, were observed among sturgeon below C.J. Strike and Oxbow dams as the fish sought suitable spawning conditions that generally occurred only near the tailraces.

Spawning-related movements in the river canyon corridors below Swan Falls, Hells Canyon, and Bliss (located 102 miles upstream of Swan Falls) dams were generally less defined. These river sections contain numerous pools for staging, as well as nearby high-velocity runs and rapids for spawning. The distances that spawners traveled varied between 0.3 and 9.0 river miles between King Hill and Bliss Dam, 1.5 to 6.0 river miles below Swan Falls Dam, and 0.0 to 2.0 river miles below Hells Canyon Dam. None of the spawners in these river segments traveled upstream to the dam tailraces. Post-spawning movement activity was also variable: some individuals traveled between 13 and 61 miles, while others showed no discernible movement at all (Chapters 2 and 4 of Technical Report E.3.1-6). Overall, the predominantly localized movement behavior by reproductive and nonreproductive sturgeon suggested that several sections of the Snake River, particularly in reaches below Bliss, Swan Falls, and Hells Canyon dams, provide suitable habitat for several life history functions that include feeding, rearing, overwintering, and spawning.

E.3.1.1.3.3. Fish Communities of HCC and Vicinity

E.3.1.1.3.3.1. Brownlee Reservoir Upstream to Swan Falls Dam

A total of 16,752 setline hours, 268 gill-net hours, and 18 angling hours of effort was expended to capture 45 white sturgeon (including 3 recaptures) between Swan Falls and Brownlee dams (also known as the Swan Falls to Brownlee reach). Most sturgeon (*n* = 34) were sampled within 8 miles of Swan Falls Dam, while 11 sturgeon were captured near the upper end of Brownlee Reservoir between RM 326.6 and RM 331.6. Overall, catch rates for sturgeon were poor regardless of the fishing gear used. The highest catch rates for sturgeon in this reach using setline gear were near Swan Falls Dam (Chapter 1 of Technical Report E.3.1-6).

Based on the sampling conducted by Lepla et al. (Chapter 1 of Technical Report E.3.1-6), the status of the white sturgeon population in the Swan Falls to Brownlee reach is poor. Catch rates and overall numbers of sturgeon sampled in this reach were very low, with most fish captured being near the upper end of the reach between Swan Falls Dam and Walters Ferry. The quality of habitat downstream of Walters Ferry to Brownlee Reservoir might explain the skewed distribution of sturgeon toward the upper end of this reach. Although there are intermittent deep pools between Walters Ferry and the top of Brownlee Reservoir, much of this section of river consists of relatively shallow runs and braided channels associated with island complexes. For instance, no sturgeon were sampled in similar types of river habitats in the Bliss Dam to C.J. Strike Dam reach, where a sizeable population of sturgeon exists (Lepla and Chandler 1995). Poor water quality in the reservoir and lower river section probably contributes to the skewed distribution of sturgeon toward the top of this reach.

Recruitment levels appear to have remained poor since earlier IDFG surveys during which the population consisted primarily of subadult and adult sturgeon, with few fish being smaller than 92 cm in total length (TL). Sturgeon captured with gill-net gear showed a similar size distribution, with larger fish dominating. The continuing presence of some small sturgeon indicates that some recruitment is occurring, but at low levels. Comparing the current status of sturgeon with earlier IDFG studies has shown that sturgeon abundance between Hells Canyon and Swan Falls dams has changed little over the past 30 years. Cochnauer (1983) concluded that this population was depressed in abundance and had been reduced since the early 1970s. The average relative weights for all sturgeon captured in this reach (86%) were similar to those for the Hells Canyon population; however, sturgeon in Brownlee Reservoir had a significantly lower condition factor than other sturgeon in Snake River reservoirs. Severe water quality degradation, particularly in the lower river and Brownlee Reservoir, appears to be limiting white sturgeon in this reach. A small population currently composed of predominately mature adults, few new recruits, and few annual spawners suggests that future recruitment will remain low, perhaps below the levels necessary to sustain the population (Chapter 1 of Technical Report E.3.1-6).

E.3.1.1.3.3.2. Oxbow Reservoir

A total of 2,913 setline hours and 32 gill-net hours of effort was expended in Oxbow Reservoir during 1998. No sturgeon were captured during the survey of Oxbow Reservoir (Chapter 1 of Technical Report E.3.1-6). The status of the white sturgeon population in Oxbow Reservoir is poor and appears unchanged since earlier IDFG surveys. Welsh and Reid (1971) concluded that, although anglers had captured sturgeon in the tailrace of Brownlee Dam, the species was probably not abundant in Oxbow Reservoir and probably not present in Hells Canyon Reservoir.

A common observation in reaches associated with both the Hells Canyon three-dam complex and the mid-Snake three-dam complex was that presence of sturgeon was slight or not detectable. The Brownlee Dam to Oxbow Dam reach is one of the shortest river segments in the Snake River. The relatively close spacing of adjacent dams not only limits the amount of available habitat, but the short distance between dams probably contributes more to downstream losses of sturgeon than longer reaches do, particularly for sturgeon in early life stages. White sturgeon larvae are planktonic and capable of dispersing long distances by using the river currents. Simulated recruitment for white sturgeon in Oxbow Reservoir indicated that recruitment was limited by larval export, spawner limitations, and poor water quality (Chapters 1 and 3 of Technical Report E.3.1-6).

E.3.1.1.3.3.3. Hells Canyon Reservoir

In Hells Canyon Reservoir, a total of 2,690 setline hours and 39 gill-net hours of effort was expended to capture four sturgeon during 1998. Three wild adult sturgeon and one juvenile hatchery sturgeon were caught with setline gear near the upper end of Hells Canyon Reservoir between RM 263.4 and RM 269.9 (Chapter 1 of Technical Report E.3.1-6).

As in Oxbow Reservoir, the status of the white sturgeon population in Hells Canyon Reservoir is poor, with few wild white sturgeon remaining. Of the four sturgeon captured, three were adult wild sturgeon ranging from 139 to 250 cm TL and one was a juvenile hatchery fish measuring 63 cm TL. Mean length-at-age indicated relatively good growth rates, and the mean relative weight was 93% of the standard for white sturgeon. However, the capture of only three adult sturgeon in Hells Canyon Reservoir suggested that opportunities for reproduction are infrequent. The absence of small sturgeon indicated that no recent recruitment has occurred. The youngest wild sturgeon was 13 years old. Simulated recruitment for white sturgeon in Hells Canyon Reservoirs indicated that recruitment was limited by larval export, spawner limitations, and poor water quality (Chapters 1 and 3 of Technical Report E.3.1-6).

E.3.1.1.3.4. White Sturgeon in Downstream Areas Affected by the HCC

E.3.1.1.3.4.1. Modeled Habitat

Modeled habitat versus discharge relationships were developed for the upper and lower Hells Canyon reaches as part of the Hells Canyon instream flow assessment (Technical Report E.2.3-2). Modeled habitat for the lower Hells Canyon reach is presented in the revised version of Technical Report E.2.3-2, which accompanies this final license application.

Spawning habitat for white sturgeon between Hells Canyon Dam and the Salmon River (upper Hells Canyon reach) increases with flow throughout the range of modeled discharge and is the most available habitat of any sturgeon life stage (Technical Report E.2.3-2). Modeled spawning habitat, as a percentage of total reach area, increases steadily from 16 to 58% between 5 and

30 kcfs and continues to increase to 79% at the maximum modeled discharge of 100 kcfs. Habitat suitability criteria (HSC) for the spawning life stage apply maximum suitability to mean column velocities greater than 1.7 meters per second and depths greater than 2.4 meters. HSC for the spawning life stage do not have an upper limit for mean column velocity and probably overestimates habitat availability during very high discharges or in areas modeled with very high velocities. Areas with fast, turbulent flows have been documented as important sturgeon spawning areas (Parsley et al. 1993b, Lepla and Chandler 1995, Chapter 2 of Technical Report E.3.1-6), but staging and holding areas adjacent to these high-velocity areas may also be important (Lepla and Chandler 1995, Chapter 2 of Technical Report E.3.1-6). The estimates of spawning habitat below Hells Canyon Dam do not account for the presence of adjacent holding or staging areas and probably overestimate modeled habitat at very high discharges. However, even with these considerations, modeled spawning habitat probably does not limit the population at any modeled discharge. Several authors have reported the importance of high-flow years coinciding with suitable water temperature in determining sturgeon spawning and incubation success (Khoroshko 1972, Votinov and Kas'yanov 1978, Lepla and Chandler 1995, Auer 1996, Chandler and Lepla 1997, Chapter 2 of Technical Report E.3.1-6). Modeled spawning habitat available in the upper Hells Canyon reach is proportionate to the magnitude of the hydrologic year, with extremely high-, high-, and medium-flow years providing considerably more habitat than low- and extremely low-flow years.

White sturgeon incubation habitat modeled in the upper Hells Canyon reach increases sharply with discharge up to 30 kcfs and then decreases steadily with increasing discharge. Modeled incubation habitat comprises only 2% of the total reach area at the lowest modeled discharge of 5 kcfs, increases to 28% between discharges of 28 to about 35 kcfs, and then decreases to about 11% of the reach area at the highest modeled discharge of 100 kcfs. HSC applied in the modeling assign maximum suitability to areas with mean column velocities between 0.8 and 2.9 meters per second, depths between 3 and 24 meters, and substrate larger than sand. The spatial distribution of incubation habitat at some of the modeled locations in the Hells Canyon reach demonstrates that incubation areas can become fragmented at relatively low discharges (10 kcfs) and become largely continuous near the maximum habitat that occurs at approximately 30 kcfs. The estimated incubation habitat modeled in the Hells Canyon reach was low in availability at discharges of about 10 to 11 kcfs, comprising only about 10% of the reach area. Modeled habitat increases sharply with discharge and accounts for almost 30% of the reach area at higher discharges of about 30 kcfs. As with spawning habitat, magnitude of the hydrologic year is proportionate to incubation habitat in the upper Hells Canyon reach, with the medium-, high-, and extremely high-flow years providing significantly more modeled incubation habitat than the low- and extremely low-flow years. While modeled incubation habitat in the Hells Canyon reach was low in availability across relatively low discharges (that is, extremely low- and low-flow years), there is no evidence from population assessments that the Hells Canyon white sturgeon population is limited in habitat for early life stages. During the last 30 years, the sturgeon population below Hells Canyon Dam has shown positive changes, particularly in size composition: the abundance of fish larger than 92 cm TL has steadily increased. Juvenile fish smaller than 92 cm TL have dominated, and continue to dominate, the population (Chapter 1 of Technical Report E.3.1-6).

Modeled habitat for white sturgeon larvae in the upper Hells Canyon reach shows nearly the same relationship with discharge that the incubation life stage exhibited. Modeled habitat increases sharply from about 4% of the reach area at 5 kcfs to about 33% of the reach area at 23 to 30 kcfs and then decreases steadily to about 14% of the reach area at 100 kcfs. HSC used to model habitat for larvae assign a suitability score (SI > 0) to areas where the mean column velocity ranged between 0.5 and 2.7 meters per second and depth exceeded 4 meters. The spatial distribution of habitat patches, as represented in modeled sites, does not change appreciably between modeled discharges, indicating that fluctuations in modeled habitats are more attributable to changes in suitability than to changes in habitat patch location or size (Technical Report E.2.3-2). Modeled habitat for white sturgeon larvae in the upper Hells Canyon reach is low in availability at modeled discharges less than about 8 kcfs. Habitat increases sharply with discharge and resulted in about one-third of the reach being suitable as habitat for larvae at discharges between about 20 and 40 kcfs. As with the spawning and incubation life stage, modeled habitat for larvae is dependent on the magnitude of the hydrologic year. The medium-, high-, and extremely high-flow years resulted in significantly more habitat (as a percentage of maximum) than the low- and extremely low-flow years. High flows associated with high-flow years not only maximize habitat in the Hells Canyon reach, but also probably provide the mechanism for the dispersal phase of larval white sturgeon. McCabe and Tracy (1993) found high flows to be important in the dispersal of white sturgeon larvae from spawning and egg incubation areas in the Columbia River. Wide dispersal from high flows was thought to allow better use of feeding areas and rearing habitats by larval and postlarval white sturgeon, minimizing competition. Nilo et al. (1997) determined that hydrologic condition during the drift phase, when larvae drift to young-of-year rearing areas, was a critical determinant of year-class strength.

Modeled habitat in the upper Hells Canyon reach for the young-of-year life stage for white sturgeon increases and decreases gradually between discharges of 5 and 45 kcfs and then remains relatively unchanged with discharges up to 100 kcfs. Modeled habitat area as a percentage of total reach area peaks at only about 12.5% and changes only 2% between 5 and 45 kcfs. The HSC assign maximum suitability to mean column velocities less than 1.0 meters per second and depths greater than 12 meters, occurring primarily in deep pools. Modeled habitat for the young-of-year life stage was the least abundant of the habitats for all white sturgeon life stages in overall availability across the modeled discharges. There is little information for young-of-year white sturgeon in the Hells Canyon reach above the Salmon River, as this life stage was not sampled because of gear limitations (Chapter 2 of Technical Report E.3.1-6).

The availability of modeled juvenile white sturgeon habitat decreases gradually with discharge in the upper Hells Canyon reach, accounting for between 14 and 23% of the total reach area between modeled discharges of 5 and 100 kcfs. Peak modeled habitat availability occurs at 5 kcfs and decreases gradually across the remaining discharges. Modeled habitat for juvenile sturgeon occurs primarily in the pools. Maximum habitat suitability is in areas with bottom velocities less than 0.2 meters per second and depths greater than 15 meters.

Modeled habitat for adult white sturgeon comprises 24 to 52% of the surface area in the upper Hells Canyon reach at discharges of 5 to 100 kcfs. Modeled habitat presented as a percentage of total reach area declines much more sharply across modeled discharges than total modeled habitat in hectares does. HSC used to model habitat for adults is greatest at bottom velocities less than 0.5 meters per second and depths greater than 6 meters. Suitable habitat for adult sturgeon can be found throughout the reach and accounts for more than half of the reach area at low flows. The population assessment (presented in Chapter 1 of Technical Report E.3.1-6) supports this finding as collections of both juvenile and adult sturgeon were distributed throughout the reach.

E.3.1.1.3.4.2. Population Status

A total of 27,658 hours of setline and 681 hours of angling effort was expended to capture 923 white sturgeon, which included 270 recaptures, between Granite Rapids and the mouth of the Salmon River during 1997–2000. The distribution of sturgeon above the Salmon River was relatively consistent upstream to Granite Rapids, with the highest catch rates occurring upstream of RM 217 (Chapter 1 of Technical Report E.3.1-6). Downstream of the Salmon River confluence to Lower Granite Dam, a total of 876 sturgeon (including 106 recaptures) was sampled by the Nez Perce Tribe during the 1997–2000 period (Tuell and Everett 2001[6]). The highest number of sturgeon sampled in this section occurred between RM 188.2 and RM 159.

The sturgeon population between Hells Canyon and Lower Granite dams is currently the largest population in the Snake River upstream of Lower Granite Dam. Juvenile fish smaller than 92 cm TL continue to dominate the population, and size groups larger than 92 cm TL have steadily increased since the 1970s. The positive changes in size composition have been attributed primarily to the population's recovery from the effects of catch-and-keep fishing regulations for fish 92 to 183 cm long (Cochnauer et al. 1985, Cochnauer 2002). The population currently provides a catch-and-release sport fishery (including incidental angling mortality) and tribal harvest by the Nez Perce Tribe. Survival estimates were also similar to rates observed in several Snake River populations, and the trend of mean relative weights showed that fish condition has not declined since earlier surveys conducted by Coon et al. (1977) and Lukens (1985). Reproductive readiness of female sturgeon was also comparable to reproductive readiness typically expected in white sturgeon populations. The current sturgeon population below Hells Canyon Dam is genetically diverse and exhibits a healthy population structure, based on the current stock structure dominated by juveniles, wide range of size classes, and stages of maturity from immature juveniles to reproductive adults (Chapter 1 of Technical Report E.3.1-6).

6. At the time of IPC's analysis, Everett and Tuell (2001) included the most current information on white sturgeon from the Nez Perce Tribe study. The data were made available to IPC through a data sharing agreement with the tribe. This information has since been updated and is found in S. R. Everett and M. A. Tuell, 2003, "Evaluation of Potential Means of Rebuilding Sturgeon Populations in the Snake River Between Lower Granite and Hells Canyon Dams," 2000 Annual Report, Report to: Bonneville Power Administration, Portland, OR, Contract Number 00000333?00023, Project Number 9700900.

E.3.1.1.4. Native Resident Salmonids

Native resident salmonids associated with the HCC include bull trout, Columbia River redband trout, and mountain whitefish. Redband trout are a poorly defined subspecies of inland rainbow trout (*Oncorhynchus mykiss*) and includes anadromous, potamodromous, and resident populations in the Columbia, Fraser, and Sacramento river basins, as well as the ancient lake basins of the northern Great Basin (Behnke 1992, Currens 1996). Redband trout are classified as a species of special concern in Idaho (IDCDC 1994) and a vulnerable species in Oregon (ORNHP 1995). Bull trout are listed as threatened under the ESA, as a species of special concern by the State of Idaho (IDCDC 1994), and as a critical species by the State of Oregon (ORNHP 1995). Because redband and bull trout have been identified as native resident salmonids of special concern, the Applicant focused its efforts on describing populations of these species associated with the HCC.

E.3.1.1.4.1. History of Native Salmonids

E.3.1.1.4.1.1. Redband Trout

Historically, Columbia River redband trout were distributed within the Columbia River basin east of the Cascade Range to barrier falls on the Kootenai, Pend Oreille, Spokane, and Snake rivers (Behnke 1992). Anadromous, potamodromous, and resident forms were present across the species range. Within the vicinity of the HCC projects, redband are believed to have occupied the mainstem Snake River and most tributaries having adequate flows and spawning and rearing habitat (Thurow et al. 1997). Steelhead also used most of the large tributaries within the HCC. Despite widespread distribution of resident interior redband trout in the Columbia River basin, their populations have been virtually unstudied across most of their range. Therefore, historical data on resident populations associated with the HCC are absent.

E.3.1.1.4.1.2. Bull Trout

Bull trout are native only to North America. Their historical range extends from the McCloud River in northern California and the Jarbidge River in Nevada north to the headwaters of the Yukon River in Canada (Haas and McPhail 1991). Tributaries of the Puget Sound on the Pacific Coast define the western limit of the species, which has been found eastward to the headwaters of the Saskatchewan and Athabasca rivers in Alberta and the headwaters of the Columbia and

Flathead rivers in British Columbia and Montana. Bull trout have been documented throughout the Columbia River basin and in the Snake River basin to Shoshone Falls.

Much of the historical information concerning bull trout populations within the vicinity of the HCC is anecdotal. The Applicant found little to no data concerning the species distribution and use of the mainstem Snake River. Historical accounts indicate that bull trout within the HCC occurred in the following basins: Powder River, Pine Creek, Indian Creek, Wildhorse River, and the mainstem Snake River (Buchanan et al. 1997). It is suspected that bull trout were widely distributed in the headwaters of the Powder River basin, but documentation of their distribution prior to the 1960s has not been established (Buchanan et al. 1997). Bull trout were documented in 1965 creel reports from Eagle Creek and West Fork Eagle Creek, but they are now believed to be extremely rare or extirpated from this basin. The most recent account of the species downstream of the Eagle Creek basin came from ODFW personnel who reported catching a 12-inch bull trout in a gill net set at Brownlee Reservoir in 1959. Though bull trout are thought to have been distributed throughout the Pine Creek basin, Buchanan et al. (1997) did not find documentation of the species in the drainage prior to the 1960s. Bull trout were reported in creel surveys from Lake Fork Creek and Pine Creek during the 1960s and 1970s, and their presence was noted in East Pine, Clear, North Pine, Lake Fork, and Little Elk creeks during biological surveys performed between 1961 and 1965. The Applicant was unable to find historical accounts of bull trout in the Indian Creek and Wildhorse River basins. But the species is thought to have been present throughout both basins.

It is believed that bull trout below Hells Canyon Dam were historically distributed across the entire Imnaha and Grande Ronde river basins and that they used the mainstem Snake and Salmon rivers to some unknown extent. Bull trout were also suspected to use tributaries smaller than the Imnaha, Grande Ronde, and Salmon rives, but their presence was not documented in these tributaries. IDFG biologists did document the species in Sheep and Granite creeks as early as the mid-1980s.

E.3.1.1.4.1.3. Mountain Whitefish

The mountain whitefish is native to lakes and streams in western North America. It is present from the Lahontan Basin in Nevada north through the northwestern states, including Wyoming, Montana, and Idaho, to the Yukon–British Columbia border (Scott and Crossman 1973). The species is widely distributed throughout the Columbia and Snake river basins and is considered abundant in all of the river drainages in Idaho (Simpson and Wallace 1982). The Applicant captured mountain whitefish at all three HCC reservoirs and at all of the major reservoir tributaries. Mountain whitefish were particularly abundant between Swan Falls Dam and the upstream extent of Brownlee Reservoir (Chapter 3 of Technical Report E.3.1-5). The species was also captured in Sheep Creek and the mainstem Snake River downstream of Hells Canyon Dam. Little is known about the biology and habitat requirements of mountain whitefish, and information on distribution and density of individual populations in the Snake River basin is scant.

E.3.1.1.4.1.4. Introduced Salmonids

Over the past century, nonnative hatchery-reared salmonids have been widely introduced to streams, lakes, and rivers in Idaho and Oregon. In the early 1900s, the U.S. Bureau of Fisheries began stocking hatchery salmonids to nearly every water body in Idaho that was accessible by vehicle (Van Vooren 1995). State fish and wildlife agencies continued with these early stocking practices and began managing many waters with intensive hatchery supplementation programs.

Since construction of the HCC, the IDFG and ODFW have managed rainbow trout in the reservoirs primarily as put-grow-and-take fisheries for hatchery-reared fish. From 1969 to 2000, the IDFG and ODFW stocked over 8.5 million salmonids to HCC reservoirs (Table 1 in Chapter 3 of Technical Report E.3.1-5).

Hatchery fish have been mostly a combination of fingerling and catchable trout of various coastal rainbow trout strains. Since the 1980s, the IDFG has also routinely transplanted adult hatchery steelhead from the Snake River below Hells Canyon Dam to Hells Canyon Reservoir. Historically, the ODFW also planted hatchery rainbow trout to the Snake River below Hells Canyon Dam. Between 1977 and 1986, approximately 50,000 to 950,000 Oak Springs strain rainbow trout fingerlings were released annually at Hells Canyon Dam (Lukens 1986). Lukens (1986) also reported that the rainbow trout fishery in the Snake River below Hells Canyon Dam appeared to be supported mainly by residualized steelhead smolts released at the dam. As part of the Applicant's mitigation plan for the HCC, the IDFG annually plants an average of 705,007 (range: 92,750 to 1,281,400) steelhead smolts at the dam (Technical Report E.3.1-4).

Eastern brook trout were also introduced to tributaries associated with the HCC by the U.S. Bureau of Fisheries in the early 1900s and later by the IDFG and ODFW (Special Appendices to Technical Report E.3.1-2). Brook trout have been stocked to some tributaries in the area as recently as the 1970s (IDFG Fish Stocking Database 1967 to 2001). Currently, brook trout are present in the headwaters or in high-elevation lakes in nearly all of the major tributaries associated with the HCC.

Brown trout (*Salmo trutta*) have not been introduced directly to HCC tributaries, but the species has been regularly planted to a number of tributaries upstream of the HCC. The species has apparently moved into the HCC to some extent, though, as IPC biologists captured two brown trout adults outmigrating from Indian Creek, a tributary to Hells Canyon Reservoir, in the fall of 1998 and another adult was captured in the Oxbow Bypass reach (Oxbow Dam to Oxbow Powerhouse) during electrofishing operations in 1998.

Westslope cutthroat trout (*Salmo clarki*) have also been introduced to several high mountain lakes and headwater areas of tributaries associated with the HCC. In particular, downstream of the HCC, westslope cutthroat trout were found to be abundant in the upper Sheep Creek drainage (Chapter 4 of Technical Report E.3.1-7).

E.3.1.1.4.2. Redband Trout and Bull Trout Life Histories

E.3.1.1.4.2.1. Redband Trout

Interior redband trout evolved in habitats covering a wide range of environmental variables. In the desert basins of Idaho and Oregon, redband trout are known to tolerate water temperature, dissolved oxygen, and flow conditions that are considered severe for other salmonids (Behnke 1992). In particular, redband populations persist in tributaries to the Snake River in southwestern Idaho, where they experience maximum daily water temperatures ranging from 26.7 to 29.0 °C with 24-hour fluctuations of 9.5 to 11.0 °C (Zoellick 1999). The species has also been shown to survive in streams where dissolved oxygen concentrations are as low as 1.6 to 4.0 mg/L

(Vinson and Levesque 1994). Because of their ability to survive under a wide range of environmental conditions, redband trout populations do not appear to be as sensitive to habitat disturbance as many other salmonid species.

In addition to being able to survive in streams with severe temperature, dissolved oxygen, and flow conditions, redband trout populations display a range of life history strategies, including anadromous, potamodromous, and resident components. Trapping, radio-telemetry, and genetics data collected by the Applicant showed that fluvial and resident redband trout populations are present within the HCC and in the Snake River below Hells Canyon Dam (Chapter 4 of Technical Report E.3.1-7). The anadromous life history form (steelhead) is only present below Hells Canyon Dam and is intensively supplemented through hatchery propagation. Anadromous adults are also routinely transferred by the IDFG to Hells Canyon Reservoir from the trapping facility below Hells Canyon Dam. Juvenile and adult redband trout were captured migrating downstream of tributaries to the HCC reservoirs and the Snake River during fall when water temperatures began to drop below 8 to 10 °C. The high number of juvenile redband trout caught at tributary traps indicated that a significant amount of spawning occurred within the tributaries. Radio-tagged adult redband trout made numerous and extensive movements into tributaries, presumably to spawn, primarily during April and May. Adults appeared to remain in the tributaries through summer, since summer catch rates of redband trout in the reservoirs were consistently lower than fall and winter catch rates.

Results from genetic analyses of redband trout further indicate a fluvial life history form exists within and below the HCC (Chapter 3 of Technical Report E.3.1-7). The genetic composition of redband trout populations showed that gene flow among populations from different tributaries has occurred to a greater extent than genetic exchange between some populations within the same drainage. This genetic structure could be explained by the existence of two different life histories, migratory and resident.

Redband trout associated with the HCC appeared to use tributary habitats for spawning and rearing and reservoirs and the mainstem Snake River during fall and winter for overwintering. The specific features of suitable rearing habitat for emerging fry (including thermal regime and escape cover) may, in part, explain a natural selection for tributary spawning. Fry survival from tributaries would probably be higher than from spawning in the mainstem where predators are more abundant and physical habitat conditions less favorable. Substrate particle sizes suitable for small, nonanadromous salmonids could be subject to scour in larger river environments, a condition that may further explain natural selection of smaller fluvial environments. Fluvial–adfluvial life stages are generally associated with larger individuals that migrate out of smaller tributary environments to benefit from greater forage potential in large river habitats to ultimately achieve greater survival and fitness. And younger life stages are also known to migrate out of tributary habitats into mainstem environments, especially to overwinter. The extent to which these younger life stages use the HCC reservoirs through summer and winter until returning to tributaries to spawn is not well understood.

E.3.1.1.4.2.2. Bull Trout

In contrast to redband trout, bull trout are believed to be particularly sensitive to environmental change because of their specific habitat requirements. Rieman and McIntyre (1993) listed channel stability, substrate composition, temperature, cover, and migratory corridors as significant factors influencing bull trout distribution and abundance. Water temperature, in particular, may be the most critical limiting factor for the species. Bull trout require a narrow range of cold water temperatures to spawn and rear. Temperatures exceeding 15 °C are reported to limit the species distribution across its range.

Bull trout populations are known to possess multiple life history forms with complex age structures, behavior, and maturation schedules throughout their range (Rieman and McIntyre 1993). This diversity of life history strategies is thought to be critical to the stability and persistence of populations that occur in highly variable environments. Such diversity among bull trout associated with the HCC has been suspected but never evaluated. State and federal agency data collected over the past 10 years have documented the presence of several resident populations in the headwaters of Indian Creek, Pine Creek, and the Wildhorse River; however, the fluvial component within in these populations has not been investigated.

Radio-telemetry and trapping studies conducted by the Applicant’s biologists during 1998, 1999, and 2000 indicated that Indian Creek and Pine Creek probably contain at least a remnant fluvial bull trout population (Chapter 4 of Technical Report E.3.1-7). Early in the Applicant’s assessment, the Wildhorse River appeared to contain only resident populations, but the capture of a single bull trout and brook trout hybrid outmigrating in fall 2001 gave some sign that a remnant fluvial component may also be present in that drainage, though at an extremely low abundance. Because trap numbers for bull trout were extremely low, radio-tag monitoring provided the most convincing data suggesting a fluvial life history. Trapping information did indicate, however, that bull trout were migrating out of tributaries within the HCC at about 250 to 300 mm TL. Below Hells Canyon Dam, outmigrants were much larger, at 350 to 450 mm TL.

Bull trout tagged in the fall in the Oxbow Bypass reach, Indian Creek, and Hells Canyon Reservoir migrated to Pine Creek and North Pine Creek during spring. Electrofishing and radio-telemetry data indicated that bull trout used the Oxbow Bypass reach and Hells Canyon Reservoir primarily during late fall and winter and used tributaries in the spring and possibly through summer. Similar to redband trout, fluvial bull trout within the complex migrated to tributaries between April and early June, presumably to oversummer and then spawn in the fall. Chandler et al. (2001) documented the presence of a resident bull trout population in the Pine Creek basin where they monitored pre- and post-spawn movements of bull trout from August 1998 to April 1999. Most fish moved fewer than 100 meters from the point of capture, and none exhibited movements that suggested a fluvial or adfluvial life history. Mortality of radio-tagged fish was as high as 80% for two of the study streams during the spawning period. Chandler et al. (2001) attributed most of this mortality to terrestrial predation.

Radio-tagged bull trout below Hells Canyon Dam exhibited classic fluvial behavior during both years that the Applicant's biologists monitored movement. Fifty percent of the individuals that were remonitored made spring migratory movements downstream to the Imnaha River after wintering in the mainstem Snake River. Of the bull trout that were not tracked to the Imnaha River, most had radio tags that probably expired before fish would have begun migrating downstream to the Imnaha River. Therefore, these fish may have made similar movements to tributaries, but radio-tag life was inadequate to monitor their movements through spring. However, several bull trout that were tracked through summer did not migrate to the Imnaha River or any other tributary, possibly because they had spawned the previous year or had not reached sexual maturity.

Tributary migrations for radio-tagged fish in the Snake River generally occurred in late April through May. Movement up the Imnaha River was gradual through May, June, and July, suggesting that increasing water temperatures may have been influencing upstream movement through the summer. Additional observations of bull trout tagged in the Imnaha River in summer 2001 and monitored through the winter by U.S. Forest Service, ODFW, and Applicant biologists (USFS, Wallowa–Whitman National Forest, unpublished data, 2002) provided further evidence for the existence of a fluvial population that spawns in the upper Imnaha River basin. These fish spawned between September and October 2001. After spawning, one of the bull trout moved out of the Imnaha River sometime in November or December and remained in the Snake River from January to April 2002.

E.3.1.1.4.3. Redband Trout and Bull Trout in the HCC and Vicinity

E.3.1.1.4.3.1. Current Distribution

Redband Trout

The distribution of native Columbia River redband trout in the Snake River basin has gone largely uninvestigated by fisheries researchers. Recently, Thurow et al. (1997) summarized the distribution and status of seven native salmonids, including redband trout, in the Columbia River basin and parts of the Klamath River and Great basins. They reported that, despite the broad distribution of redband trout, less was known about the specific distribution of their populations than of any other salmonid and that relatively few strong populations have been identified.

Prior to the Applicant's studies, no comprehensive evaluation of the distribution of redband trout associated with the HCC had been completed. Sampling activities performed by the Applicant from 1991 to 2000 revealed that redband trout were distributed throughout the HCC, including nearly all tributaries (Chapter 4 of Technical Report E.3.1-7). Redband trout were also present in the Power River drainage. The only reach where redband trout were not found was the Snake River from Swan Falls Dam to Brownlee Reservoir. However, one of the Applicant's radio-tagged redband trout did migrate through this reach to the Weiser River. Redband trout were present in Brownlee Reservoir, Oxbow Reservoir, the Oxbow Bypass reach, Hells Canyon Reservoir, and most tributaries with adequate year-round discharge and no barrier (natural or manmade) preventing upstream movement. Tributaries to Brownlee Reservoir where the

Applicant's biologists found redband trout included Brownlee, Connor, North Fork Daly, Eagle, Dennett, Dukes, Fox, Rock, Sturgill, and Wolf creeks. Tributaries at Oxbow and Hells Canyon reservoirs included the Crooked and Wildhorse rivers and Bear, Lick, Pine, Indian, Ballard, Spring, 32-Point, Kinney, Eckels, and Steamboat creeks. An abundant and widely distributed hatchery rainbow trout population was also present throughout the HCC reservoirs and in some tributaries. Within the project reservoirs, hatchery rainbow trout were 3 to 10 times more abundant than redband trout, but redband trout dominated tributary streams throughout the study area.

Other recent studies within the HCC have documented redband trout in several major tributaries, including Indian Creek (Janssen et al. 1997, Nelson and Burns 1998), Bear Creek (Nelson and Burns 1998, Williams 2001), the Wildhorse River and Lick Creek (Nelson and Burns 1998), the Crooked River (Nelson and Burns 1998), and Brownlee Creek (Williams 2001). Anglers have also reported catching rainbow trout at all three reservoirs of the HCC (Technical Report E.5-10).

Bull Trout

Bull trout have been described as one of the least-studied fish species in Idaho (Schill 1992). Until recently, population data for most bull trout populations associated with the HCC were lacking, and most reports were observational or anecdotal in nature. Federal and state agencies have increased their efforts to assess the distribution of bull trout and their status by collecting population data from several drainages associated with the complex. Using these data and results of relicensing studies, the Applicant completed a distribution and status assessment for bull trout associated with the HCC (Chapter 4 of Technical Report E.3.1-7).

Between 1998 and 2001, the Applicant found that bull trout populations within the HCC were restricted to Indian Creek, Pine Creek, and the Wildhorse River drainages. Several bull trout were also found in the Oxbow Bypass reach and Hells Canyon Reservoir, but their abundance appeared to be extremely low. No bull trout or bull trout hybrids were found above Brownlee Dam (that is, in Brownlee Reservoir, tributaries to Brownlee Reservoir, or the mainstem Snake River) in any of the Applicant's sampling. However, bull trout are present in the headwaters of the Powder River watershed above Thief Valley Dam.

Other researchers from state and federal agencies have recently documented the presence of bull trout and their abundance in the headwaters of Indian Creek and the Wildhorse River (Buchanan et al. 1997, Janssen et al. 1997, Nelson and Burns 1998, Williams and Veach 1999). They reported that bull trout abundance was very low and that the species was absent from lower reaches in the drainage (below 5,600 feet elevation) and some smaller tributaries. Buchanan et al. (1997) described the distribution of resident bull trout in the Pine Creek basin. Bull trout have been found in the upper portions of each of the four primary subwatersheds composing Pine Creek: Pine Creek above Cornucopia, Clear Creek (including Meadow Creek), East Pine Creek, and Elk Creek (tributary to Lake Fork and North Pine creeks).

All HCC drainages that contained bull trout also had resident brook trout and hybridized individuals between bull trout and brook trout. Hybrids were particularly abundant in Indian Creek and the Wildhorse River, and a significant number were captured in Oxbow and Hells Canyon reservoirs.

E.3.1.1.4.3.2. Current Status

Redband Trout

Genetic analysis of rainbow trout samples collected from HCC tributaries revealed that nearly all of the tributaries contained native Columbia River redband trout populations (Chapter 3 of Technical Report E.3.1-7). Native redband trout were found in the Crooked River and in Rock, Sturgill, Brownlee, Dukes, North Daly, Eagle, Bear, Lick, Indian, and Pine creeks. Hybridized populations between redband and coastal rainbow trout were found in Dennett, Connor, and Spring creeks, and in the lower Wildhorse River. Of the reservoir samples, only the Hells Canyon sample was found to contain just native redband trout. Brownlee and Oxbow reservoirs had rainbow trout populations that were comprised of a mixture of native redband trout and coastal rainbow trout. However, the presence of hybrids between redband and coastal rainbow trout in Brownlee and Oxbow reservoirs could not be ruled out based on the allozyme analysis.

Hybridization between hatchery rainbow trout and native redband trout has occurred within the complex but to a lesser extent than might be expected based on historical stocking levels. The fact that nearly all of the reservoir tributaries were found to have pure redband trout populations while

Brownlee and Oxbow reservoirs contained a mixture of hatchery rainbows and native redbands suggested that hatchery fish have been either physically or reproductively isolated from interbreeding with native redband trout in the tributaries (Chapter 3 of Technical Report E.3.1-7). Williams et al. (1997) attributed the lack of hatchery rainbow trout hybridization in redband trout in the lower Metolius River, Oregon, to ecological isolation from hybridized fish in the upper reaches of the river. They suggested that hatchery rainbow trout were isolated from native redband trout by a section of habitat that may have been inhospitable to hatchery-reared fish. An interesting result of our genetic analysis was that redband trout in Hells Canyon Reservoir were not hybridized. This finding was surprising because Spring Creek, a tributary to Hells Canyon Reservoir, was found to be a hybridized population and because nearly 700,000 hatchery trout had been stocked in the reservoir between 1987 and 1997.

Currens (1996) also examined the genetic status of several redband trout populations, including those in tributaries of the Powder River (Summit and Sutton creeks), Pine Creek (North Pine and Lonesome creeks), Conner Creek (tributary to Brownlee Reservoir at RM 313.6), and McGraw Creek (a tributary to Hells Canyon Reservoir at RM 259). Fish in North Pine Creek and Summit Creek had genetic characteristics consistent with redband trout. Fish in Conner Creek and Sutton Creek had characteristics closer to nonnative coastal strains of rainbow trout. Most populations examined had intermediate characteristics of redband trout and coastal rainbow trout. Redband trout collected above a barrier in McGraw Creek were characteristic of a small population isolated over a long time, suggesting genetic drift from typical redband trout populations.

The Applicant completed snorkel surveys of a majority of the HCC tributaries in 1994. Redband trout were present in 17 of the 19 streams that were surveyed, and most fish observed during the surveys were smaller than 200 mm TL. Wild rainbow trout were also captured within all three HCC reservoirs during electrofishing sampling. Redband trout were on average more abundant in Oxbow Reservoir than in Brownlee or Hells Canyon reservoirs. Average relative abundance was similar at Brownlee and Hells Canyon reservoirs but was about half that estimated at Oxbow Reservoir. Redband trout catch rates ranged from 0.01 fish per 100 meters of shoreline in Brownlee Reservoir (stratum 2) to 0.16 fish per 100 meters of shoreline at Oxbow Reservoir. Hatchery rainbow trout were 10 times more abundant than wild rainbow trout, and they were most abundant in Brownlee Reservoir where catch rates ranged from 0.04 fish per 100 meters of shoreline within the Powder River arm (stratum 5) to 1.16 fish per 100 meters of shoreline within stratum 3. The majority of redband trout caught at Brownlee Reservoir were juveniles, but adults dominated the catch at Oxbow and Hells Canyon reservoirs. Fish smaller than 205 mm TL comprised 67.1% of redband trout sampled from Brownlee Reservoir but only made up 16.8 and 26.6% at Oxbow and Hells Canyon reservoirs, respectively.

Despite finding an abundant and widely distributed hatchery rainbow trout component of the fishery, the Applicant found that redband trout were present throughout the HCC reservoirs, and they dominated tributary streams throughout the study area. Juvenile trout were the predominant life-stage in all of the tributaries, while both juveniles and adults occupied reservoir habitats. Juveniles emigrating from tributaries served as the primary source of redband trout for the HCC reservoirs.

Bull Trout

The Applicant's genetic identification of char from the HCC suggested that first generation hybrids between bull trout and brook trout were relatively abundant in Indian Creek and the Oxbow Bypass reach (Chapter 4 of Technical Report E.3.1-7). Hybrids were also present in Hells Canyon Reservoir and Pine Creek.

Janssen et al. (1997) conducted electrofishing surveys at three locations in the Indian Creek drainage. Bull trout were observed at their uppermost location, at approximately 5,600 feet (1,700 meters) elevation, but none were collected downstream at approximately 4,800 feet (1,460 meters) and 4,000 feet (1,220 meters) elevation. At the uppermost location, researchers caught eight bull trout between 100 and 200 mm TL and six bull trout × brook trout hybrids between 140 and 200 mm TL. Brook trout were also present at all three locations but were more numerous at the lower elevation sites. Biological evaluations conducted by the Payette National Forest have previously mentioned bull trout observations in Indian Creek, but no quantitative surveys were performed (Faurot 1994). The Applicant's biologists captured 10 bull trout (100 to 230 mm TL) in upper Indian Creek in September 1999 while sampling for rainbow trout for genetic analyses. Genetic analysis of fin clips from these 10 fish determined that 4 were hybrids.

Buchanan et al. (1997) characterized the status of bull trout in the Pine Creek basin as fragmented, extremely low in abundance, and at "moderate risk." They reported that U.S. Forest Service surveys in 1994 found bull trout in the upper portions of each of the four primary subwatersheds composing Pine Creek: Pine Creek above Cornucopia, Clear Creek (including Meadow Creek), East Pine Creek, and Elk Creek (tributary to Lake Fork and North Pine creeks). Bull trout were not found in the Lake Fork of North Pine Creek, but brook trout were common. Length-frequency information from the 1994 surveys showed that 90 to 99% of bull trout from the four subwatersheds were smaller than 250 mm TL. Bull trout smaller than 100 mm TL accounted for between 2% (East Pine) and 17% (North Pine) of the fish sampled. Using the 1994 data, U.S. Forest Service biologists estimated the minimum and maximum number of bull trout on U.S. Forest Service land in each of the subwatersheds. Population estimates were 123 to 368 fish in North Pine Creek, 75 to 225 fish in East Pine Creek, 123 to 368 fish in Clear Creek, and 115 to 345 fish in upper Pine Creek (Buchanan et al. 1997). Chandler et al. (2001) confirmed the presence of bull trout in Pine, East Pine, Clear, and Elk creeks during 1998 while capturing fish for radio-telemetry monitoring. Twenty bull trout ranging in size from 205 to 328 mm TL (age 3 to age 5) were radio-tagged in the four Pine Creek subbasins.

The Wildhorse River was listed as a key watershed in the *Idaho Bull Trout Conservation Plan* (State of Idaho 1996); however, until recently, the status of bull trout in the basin was based primarily on anecdotal information (D. Anderson, IDFG, personal communication, 1998). The Wildhorse River comprises three main subwatersheds: Bear Creek, Lick Creek, and Crooked River. Faurot (1993) referred to "documented bull trout" in Crooked River and Dick Ross Creek (tributary to Crooked River) and suggested that the population was primarily resident, with adult fish measuring less than 300 mm. Recently, Williams and Veach (1999) found bull trout and bull trout hybrids in upper Bear Creek and in the Crooked River. In the electrofishing survey, bull trout were present above 5,000 feet (1,524 meters) and 4,500 feet (1,372 meters) elevation in Bear Creek and Crooked River, respectively. Williams and Veach (1999) reported capturing 11 bull trout, 1 bull trout hybrid, and 130 brook trout from seventy-nine 100-meter sites in the Bear Creek basin during 1999. Bull trout were restricted to the headwaters of Bear Creek, and they ranged in length from 76 to 220 mm fork length (FL, from snout to center of fork in tail). Four out of six sites sampled at the Crooked River were found to contain bull trout, and three out of six contained bull trout hybrids. Twenty-seven bull trout, 19 bull trout hybrids, and 8 brook trout were caught at the Crooked River sites. All but 1 bull trout (242 mm FL) from Crooked River were between 100 and 200 mm FL.

Between 1998 and 2000, the Applicant's biologists trapped 2 bull trout and 15 bull trout hybrids in a downstream migrant fish trap stationed near the mouth of Indian Creek. Bull trout measured 271 and 234 mm TL, and hybrids ranged from 175 to 305 mm TL. In fall 2001, a bull trout hybrid (387 mm TL) was captured in downstream migrant trap of the Wildhorse River. For the HCC reservoirs, the Applicant sampled bull trout in the Oxbow Bypass reach and in Hells Canyon Reservoir. Bull trout were captured at these locations primarily during annual spring and fall electrofishing runs between 1996 and 2000. Eight bull trout and 2 bull trout hybrids were captured in the Oxbow Bypass reach, and 1 bull trout was caught farther downstream in the reservoir. Bull trout from the Oxbow Bypass reach ranged between 270 and 350 mm TL. No bull trout were caught at Brownlee or Oxbow reservoirs.

E.3.1.1.4.4. Redband Trout and Bull Trout in Downstream Areas Affected by the HCC

E.3.1.1.4.4.1. Current Distribution

Redband Trout

The Applicant also found self-sustaining native redband trout populations in the Snake River and tributaries below Hells Canyon Dam. As with the project reservoirs, hatchery-produced trout (residual steelhead [do not go to the ocean]) were as much as three times more abundant than redband trout.

Redband trout were found in the lower reaches of Sheep Creek and throughout the mainstem Snake River from Granite Creek (RM 239.0) to the Imnaha River (RM 191.6) during the Applicant's sampling activities in 1999 and 2000. Fry and fingerlings were also observed in smaller tributaries during tributary access surveys in 1998, and anglers have reported catching rainbow trout in the mainstem Snake River in nearly every month of the year (Technical Report E.5-10).

From 1985 to 1998, IDFG personnel observed resident-sized rainbow trout in Granite Creek and Sheep Creek during their annual snorkel surveys of the lower ends of these drainages

(IDFG unpublished data). The IDFG reported relatively high densities of rainbow trout in the lower reaches of Sheep Creek, but because Snake River steelhead also had access to the stream, the surveyors were unable to positively identify fish as resident redband trout or steelhead progeny. The IDFG reported similar results for Granite Creek.

Bull Trout

Very limited information was found concerning the distribution of bull trout below Hells Canyon Dam, especially from the mainstem Snake River and smaller tributaries. From 1985 to 1998, IDFG personnel sporadically observed bull trout in Sheep Creek and Granite Creek during snorkeling surveys in the lower ends of the drainages (IDFG unpublished data). Buchanan et al. (1997) also reported that IDFG personnel had observed bull trout in Idaho streams that enter the Snake River between the Imnaha River and Hells Canyon Dam. Specifically, they reported that bull trout had been observed at the mouth of Sheep, Granite, Deep, and Wolf creeks. In 1993, the ODFW surveyed several Oregon tributaries (Temperance, Sluice, and Rattlesnake creeks) entering the same reach but did not find bull trout (Buchanan et al. 1997). In 1999 and 2000, the Applicant captured bull trout in the mainstem Snake River from Granite Creek to the Imnaha River. Several fish were captured near the mouths of Sheep and Granite creeks, and a handful of bull trout were caught in lower Sheep Creek during downstream migrant trap operations in 1999.

Bellerud et al. (1997) reported that bull trout inhabited the upper reaches of 18 headwater streams in the Grande Ronde River basin and that adults had been recorded in creel surveys on the mainstem Grande Ronde and Wallowa rivers. Trap data collected by Bellerud et al. (1997) during the 1990s indicated that bull trout were present in most major Grande Ronde subbasins and that some use of the mainstem river was still occurring. Buchanan et al. (1997) reported that small populations of bull trout were present in many headwater tributaries of the Grande Ronde River basin and that some populations appeared to be seasonally connected to the mainstem Grande Ronde and Snake rivers.

Buchanan et al. (1997) also described the distribution of bull trout within the Imnaha River basin based on data collected between 1990 and 1996. Bull trout were found in the Big Sheep Creek, Little Sheep Creek, and upper Imnaha River drainages. Populations were primarily located in the headwaters, but anadromous trapping data also showed use of the mainstem Imnaha River. Bull trout have also been studied in the Salmon River and tributaries near Riggins, Idaho (Schill et al. 1994). Schill et al. (1994) found that bull trout tagged in Rapid River used the mainstem Salmon River as far downstream as White Bird.

E.3.1.1.4.4.2. Current Status

Redband Trout

Prior to the Applicant's studies, the status of resident redband trout in the mainstem Snake River below the HCC was unknown. The presence of the anadromous life history form (steelhead) has made assessing the status of resident and fluvial life history forms difficult at best. Nonetheless, during 1999 and 2000, the Applicant found adult (larger than 290 mm TL) redband trout throughout the mainstem Snake River from Granite Creek (RM 239.0) to the Imnaha River (RM 191.6) and captured what appeared to be juvenile redband trout outmigrating from Sheep Creek in the fall (Chapter 4 of Technical Report E.3.1-7).

Redband trout in Sheep Creek had hybridized with introduced cutthroat trout, however, and redband trout were limited to the lowermost section of the drainage. Only cutthroat trout were present in the upper sections of Sheep Creek, and they were abundant.

The IDFG, during annual snorkel surveys of lower Granite Creek from 1985 to 1998, found an abundant redband trout population. The IDFG did not conduct any genetic analyses of redband trout from the Granite Creek drainage, but the presence of cutthroat trout in the basin provides obvious potential for hybridization. The IDFG estimated relatively high densities of redband trout in Granite Creek, and a small percentage of the fish was larger than 300 mm TL, but the overwhelming majority was smaller than 229 mm TL.

Bull Trout

The Applicant captured adult bull trout ranging from 290 to 479 mm TL throughout the mainstem Snake River from Granite Creek to the Imnaha River. Bull trout below the HCC were larger overall than bull trout from HCC reservoirs and tributaries. Bull trout below the HCC had not hybridized with brook trout; all bull trout were genetically pure. However, brook trout have been stocked in lakes in the upper Granite Creek drainage, and since the Applicant did not evaluate the genetics of Granite Creek bull trout, whether some hybridization may have occurred is unknown.

The Applicant did not observe bull trout during Sheep Creek snorkel surveys in either 1999 or 2000, and only one bull trout (286 mm TL) was caught when biologists used electrofishing gear in 2000. From snorkel surveys performed between 1985 and 1997, the IDFG estimated an average density of 0.12 (range: 0–0.24) bull trout per 100 square meters at their two sites in the lower 3 km of Sheep Creek. Seven of the nine bull trout that the IDFG recorded were larger than 300 mm TL.

The IDFG, during annual snorkel surveys of lower Granite Creek from 1985 to 1998, found low densities of bull trout. The agency did not conduct any genetic analyses of bull trout from the Granite Creek drainage, but the presence of eastern brook trout in the basin makes hybridization highly possible. Average annual densities for bull trout were 0.05 (0–0.2) fish per 100 square meters. Bull trout in the IDFG samples were between 152 and 304 mm TL.

Sampling by the Applicant showed that bull trout were distributed from Hells Canyon Dam to the Imnaha River and that abundance in the Snake River appeared to be higher than in the Sheep Creek and Granite Creek drainages. Sheep Creek and Granite Creek densities were extremely low during our survey and during the IDFG's long-term surveys. Considering that our rod-and-reel sampling in the Snake River was inherently biased toward adult-sized individuals, densities in the mainstem were probably substantially higher than densities in smaller tributaries like Sheep and Granite creeks.

E.3.1.1.4.4.3. Mainstem Habitat

Redband Trout

Physical habitat was modeled for redband trout in the upper Hells Canyon reach to represent habitat during an overwintering period between October 15 and May 31. Modeled habitat for redband trout below Hells Canyon Dam is highest in availability at the lowest discharges (Technical Report E.2.3-2). At discharges less than 20 kcfs, habitat suitability (composite score of depth and velocity) averages less than 0.2 across all two-dimensional (2-D) model sites. This number is largely driven by the HSC developed for redband trout that assign maximum suitability to relatively low mean column velocities (0.1–0.3 meters per second) and shallow depths (1.5–2.5 meters) (Chapter 1 of Technical Report E.3.1-7). Modeled habitat accounts for about 24% of the upper Hells Canyon reach area at a very low discharge of 5 kcfs and declines sharply to about 10% of the total surface area at a discharge of 30 kcfs. There is some likelihood that the Applicant may have underestimated total habitat for redband trout in the Hells Canyon reach because the HSC used assigned a relatively low suitability (< 0.2) to depths between 7 and 10 meters and rated depths greater than 10 meters as unsuitable. The use of radio-telemetry equipment becomes restricted in deeper habitats and may result in trout not being detected when they use deeper habitats, thereby not indicating that these deeper areas are suitable. Information presented in Chapter 1 of Technical Report E.3.1-7 supports the Applicant's belief that this potential bias is limited because, during the three-year habitat-use study, radio-tagged redband trout were detected 88.9% of the time. Based on this high detection rate, the Applicant believes that the range of depths included in the HSC is an appropriate characterization of habitats used by redband trout in the Hells Canyon reach during the October to May period modeled.

Bull Trout

Bull trout habitat modeled in the upper Hells Canyon reach decreases steadily with increasing discharge and declines from 26% of the reach area at 5 kcfs to about 6% of the reach area at 100 kcfs. At discharges less than 20 kcfs, habitat suitability (composite score of depth and bottom velocity) averages between 0.33 and 0.12 across all seven of the 2-D model sites. The habitat–discharge relationship was similar to that for redband trout but did not decrease as rapidly across the lower discharges. This difference was probably because bottom velocity was used as HSC for bull trout while mean column velocity was used for redband trout. HSC developed for bull trout rated low bottom velocities (0.0–0.3 meters per second) and shallow depths (1.5–2.5 meters) as having maximum suitability for bull trout in the upper Hells Canyon reach (Chapter 1 of Technical Report E.3.1-7). As with redband trout, physical habitat modeled for bull trout in the Hells Canyon reach represented an overwintering period between October 15 and May 31. Modeled weighted usable area, or WUA, accounted for 26% of the upper Hells Canyon reach area at very low discharges of 5 kcfs, declined steadily to 13% of the upper Hells Canyon reach area at 30 kcfs, and then continued to decrease to about 6% area at 100 kcfs. As indicated for redband trout modeled habitat, there is some likelihood that the Applicant may have underestimated total habitat for bull trout in the Hells Canyon reach because the HSC used rated depths greater than 8.5 meters as unsuitable. The use of radio-telemetry equipment becomes restricted in deeper habitats and may result in trout not being detected when they use deeper habitats, thereby not indicating that these deeper areas are suitable. Chapter 1 of Technical Report E.3.1-7 reported that radio-tagged bull trout were detected 97.1% of the time during the three-year habitat-use study, a finding indicating that the depth bias was probably very low. Based on this high detection rate, the Applicant believes that the range of depths included in the HSC is an appropriate characterization of habitats used by bull trout in the Hells Canyon reach during the October to May period modeled. Bull trout modeled habitat was primarily distributed along the river margin in all of the seven 2-D sites and nearly continuous at a discharge of 10 kcfs. This distribution corresponds with results from Chandler et al. (Chapter 4 of Technical Report E.3.1-7) who found that 49% of the observations of radio-tagged bull trout were within 8 meters of shore and approximately 87% were within 20 meters of shore. The average distance from shore during their three-year study ranged between 11.2 and 14.2 meters.

E.3.1.1.5. Resident Nonsalmonids

E.3.1.1.5.1. History of Resident Nonsalmonids

Relatively few fisheries studies have been done in the HCC reservoirs, and little baseline information on the fish community is available. Most available literature on the HCC deals with salmonids. Bell (1961) made some observations on temperature when smallmouth bass (*Micropterus dolomieui*) were spawning. However, most research has emphasized limnological surveys of anadromous fish passing downstream through the reservoir (Bell 1961, Ebel and Koski 1968).

A report on an early survey of the Snake River described the fish community for the valley section (between Swan Falls Dam and the upper end of present-day Brownlee Reservoir) as devoid of most native game fish and a catch-all for a host of imported species (Stanford 1942). The report mentioned several species, including largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* species), bluegill (*Lepomis macrochirus*), common carp, channel catfish (*Ictalurus punctatus*), and brown bullhead (*Ictalurus nebulosus*), but it did not include any quantitative information.

Then in 1973 and 1974, the same section was surveyed with electrofishing gear. That survey described fish species distribution and relative abundance. Of the 16 or more fish species sampled, 9 were classified as game fish. The principal species were channel catfish, black crappie (*Pomoxis nigromacularus*), smallmouth bass, and largemouth bass; they made up 35.3% of the total catch (Gibson 1974).

Goodnight (1971) cited Durkin's 1962–1965 work for the Bureau of Commercial Fisheries that listed 27 fish species in Brownlee reservoir. Channel catfish, black crappie, and common carp dominated that catch; there were much lower percentages of smallmouth bass. This sampling employed gill nets, Lake Merwin traps, and purse seines.

Pre-1969 information about the fish community and fishing harvest in HCC reservoirs is very limited. The IDFG began collecting information on fishing pressure and harvest from Brownlee Dam to Stud Creek (located 2 miles below Hells Canyon Dam) in 1969 (Welsh and Reid 1970, 1971). Crappie dominated the angler's creel, with smallmouth bass, channel catfish, and rainbow trout (*Oncorhynchus mykiss*) not far behind.

The IDFG *Fisheries Management Plan* in 1981 emphasized smallmouth bass management in Brownlee Reservoir to provide trophy bass. The plan's goal for warmwater species included a catch rate of at least one fish per hour. Under the plan, the coldwater fishery would be managed as a put-and-grow fishery for coho salmon, fall chinook salmon, and rainbow trout during the cold months. Considering this newly found emphasis, biologists initiated the next big sampling in the HCC. The IDFG researched Brownlee Reservoir's fish population dynamics, community structure, and fishery. In these studies, the fish community was sampled using electrofishing gear, with an emphasis on sampling smallmouth bass (Rohrer 1984). Length frequency, catch rate, proportional stock density, relative weight, food habits, age, and growth data were reported for smallmouth bass, as well as some information on other fish that were collected (Rohrer 1984, Rohrer and Chandler 1985, Bennett and Dunsmoor 1986).

In 1986, the IDFG initiated a statewide minimum size limit of 12 inches for smallmouth and largemouth bass. When IDFG personnel sampled Hells Canyon and Oxbow reservoirs in 1986 and 1987, they found that the most frequently sampled fish were smallmouth bass, largescale sucker, and bridgelip sucker in Hells Canyon and bridgelip sucker and rainbow trout in Oxbow Reservoir (Anderson et al. 1987). While electrofishing sampled primarily game fish, gill netting sampled primarily nongame fish. Creel surveys during the same time period revealed a good mix of warmwater and coldwater species (Anderson et al. 1987).

Brownlee Reservoir electrofishing surveys in 1988 and 1991 revealed few bass over the 12-inch minimum size limit (Mabbott and Holubetz 1990, Holubetz et al. 1994). In 1988, relative weight for smallmouth bass ranged between 80 and 100, while values above 100 were reported in 1991. This change in relative weight could be attributable to the sampling time. In 1991, fish were sampled in the beginning of May, whereas the 1988 sampling occurred in the second week of April, which is the usual spring sampling time.

In 1992, the IDFG and ODFW initiated a new regulation on Oxbow Reservoir for smallmouth bass (Janssen and Anderson 1994). The new regulations protected smallmouth bass measuring from 12 to 16 inches and allowed a daily limit of two fish outside those measurements. The agencies also closed the smallmouth bass season during the spawning period. The IDFG collected baseline data on smallmouth bass from Oxbow and Hells Canyon reservoirs.

In 1993, the IDFG and ODFW conducted a joint sampling on Brownlee Reservoir. They recorded species composition, relative weight, and length frequencies for smallmouth bass, crappie species, channel catfish, bluegill, yellow perch (*Perca flavescens*), largemouth bass, and rainbow trout (Allen et al. 1996). Then in 1996 and 1997, they conducted a study of channel catfish in Brownlee Reservoir and in the reach above Brownlee Reservoir. For this study, biologists gathered data on population, growth rate, mortality, length frequency, age structure, and exploitation from both areas and then compared them (Allen et al. 1998, Shrader et al. forthcoming). The study's results indicated that the populations in these two areas could be managed as a single population.

Fish-stocking into the HCC reservoirs began in 1958 when the IDFG stocked 200,000 bass fry into Brownlee Reservoir (Simpson 1958). According to IDFG and ODFW records from 1969 to

2000, over 8.5 million salmonids, 1,150 centrarchids, and 240 acipenserids have been stocked in HCC reservoirs (Table 1 in Chapter 3 of Technical Report E.3.1-5).

E.3.1.1.5.2. Life Histories of Resident Nonsalmonids

Seven families were represented in HCC sampling conducted by the Applicant (Chapter 3 of Technical Report E.3.1-5). Of these seven families, six include resident nonsalmonids. The life histories of resident nonsalmonids vary significantly by family.

Centrarchid males that reside in the HCC build and guard nests: they excavate a nest, lure in females to deposit eggs, and then guard the nest until the eggs hatch and the fry leave the nest. The general progression of species spawning is, from first to last, the smallmouth bass, white crappie (*Pomoxis annularis*), black crappie, largemouth bass, bluegill, pumpkinseed (*Lepomis gibbosus*), and warmouth (*Lepomis gulosus*), with quite a bit of overlap in the spawning season. Smallmouth bass beginning spawning in late April when the water temperature approaches 13 °C (Chapter 1 of Technical Report E.3.1-5), and warmouth cease spawning activity when water temperatures are 27 °C (Sublette et al. 1990). The dominant centrarchids in the HCC are smallmouth bass, white crappie, and black crappie (Chapter 3 of Technical Report E.3.1-5). During the Applicant's studies, annual mean nesting depths for smallmouth bass ranged from 1.4 to 2.8 meters, while the annual mean nest depths for crappie were 2.3 to 4.4 meters (Chapter 1 of Technical Report E.3.1-5). Larval smallmouth bass left the nest in 15.2 days, forming large aggregations that were associated with the shoreline and often protected by a large male. Crappie tended to leave the nest in eight days and become pelagic (living near the water surface, away from shore). Smallmouth bass tended to be more closely associated with the shoreline and moved to deeper areas after spawning. Conversely, crappie moved to shallower shoreline areas to spawn and to open water to congregate over the winter.

The major cyprinid species in the HCC are the common carp, northern pikeminnow, chiselmouth (*Acrocheilus alutaceus*), and peamouth (*Mylocheilus caurinus*) (Chapter 3 of Technical Report E.3.1-5). With some exceptions, cyprinids in the HCC are broadcast spawners in shallow water. Common carp, for example, gather in large groups near the water surface until the water temperatures reach 17 °C. Once spawning temperatures are met, the group moves into shallow areas near shore. At that time, a frenzy of activity begins, resulting in the release and fertilization of eggs that attach to submerged weed, grasses, and roots (Swee and McCrimmon 1966, McCrimmon 1968). Although the spawning temperatures vary from 12.2 °C for peamouth to 17 °C for chiselmouth and common carp, the mass spawning seems to be consistent. The northern pikeminnow may present one variation in spawning substrate in that it prefers gravel (Scott and Crossman 1973). The young of this family tend to remain in schools along the shore and move to deeper water in late summer. Adults of this family prefer still waters to swift streams (Scott and Crossman 1973). While adult chiselmouth are associated with inshore areas year-round, adult northern pikeminnow tend to remain offshore.

Channel catfish were the most abundant ictalurid sampled in the HCC reservoirs (Chapter 3 of Technical Report E.3.1-5). Other species include the blue catfish (*Ictalurus furcatus*), brown bullhead, flathead catfish (*Pylodictis olivaris*), and tadpole madtom (*Noturus gyrinus*). Channel catfish spawning was observed July through August at temperatures of 18.8 to 24.0 °C. Channel catfish males build their nests in semidark rock crevices. Spawning boxes placed in Oxbow Reservoir allowed biologists to observe nests, which appeared in the boxes when temperatures were between 19.2 and 25.2 °C (Chapter 1 of Technical Report E.3.1-5). Often a female was observed nearby, but unlike a brown bullhead, she probably did not participate in the construction or upkeep of the nest. Males protect the gelatinous egg mass until the larvae swim and begin to actively feed (Scott and Crossman 1973). It is thought that the channel catfish, like the brown bullhead, herd the young around in a loose sphere until the young disperse. Adult channel catfish usually inhabit lakes and moderate to large rivers with cool, clear, deep water, and with sandy gravel or rubble bottoms, while the brown bullhead inhabits shallower, more turbid water that has vegetated areas. Ictalurids are mostly sedentary animals; local movement and substantial downstream movements have been observed in the fall (Scott and Crossman 1973, Shrader et al. forthcoming).

The only percid in the HCC is the yellow perch. It spawns in early spring when water temperatures are 6.7 to 12.2 °C (Scott and Crossman 1973). Adults migrate shoreward into the shallows of lakes, and often into tributary rivers, to spawn. Spawning usually occurs near rooted vegetation, submerged brush, or fallen trees but at times occurs over sand or gravel. No nest is built, but eggs are extruded in a unique, transparent, gelatinous accordion-folded string or tube, which adheres to submerged vegetation or the bottom (Scott and Crossman 1973). During the first summer, young are in compact schools. Yellow perch are very adaptable and are able to use a wide variety of warm to cooler habitats. They are most abundant in the open waters of lakes that have clear water and bottoms of muck to sand and gravel (Scott and Crossman 1973). Numbers decrease in systems when turbidity increases or vegetation decreases. Seasonal vertical migrations suggest yellow perch move to follow a 20 °C isotherm (level of constant temperature) (Scott and Crossman 1973). Adults often move in loose aggregations, while the young reside closer to shore in schools of mixed species. Yellow perch are active all winter long.

Two representatives of the castomids family are in the HCC: the bridgelip sucker and largescale sucker. Little is known of the bridgelip sucker. It spawns in late spring, usually in deeper sandy areas, but also at times on gravelly or sandy shoals in lakes (Scott and Crossman 1973). Young largescale sucker are pelagic until they reach 18 mm TL and move toward the bottom into deeper water as they grow larger (Scott and Crossman 1973). The adults of both sucker species tend to inhabit shallow water. Bridgelip suckers prefer the cold water of small, swift rivers with gravel bottoms but can also be found where the current is more moderate and the bottom is sand and mud (Scott and Crossman 1973). Adult largescale suckers are often found in large numbers in weedy shore areas of lakes, backwaters, and stream mouths (Scott and Crossman 1973). Both species have been collected together in similar habitats in the HCC reservoirs.

Only a few cottids (sculpins) were sampled in the HCC reservoirs, and only one species was identified, the mottled sculpin (*Cottus bairdi*). Spawning occurs in the spring (~10 °C) (Scott and Crossman 1973). The male selects a spawning site under a ledge or rock, and then the female deposits the eggs on the underside of the ledge or rock (Scott and Crossman 1973). The mottled sculpin most often occurs on sandy bottoms in cool streams and lakes.

E.3.1.1.5.3. Distribution of Fish Communities in the HCC and Vicinity

The HCC fish community comprised 30 species (Table 5 in Chapter 3 of Technical Report E.3.1-5). Banded killifish (*Fundulus diaphanous*), eastern brook trout (*Salvelinus fontinalis*), blue catfish, coho salmon, dace (*Rhinichthys* species), Tui chub (*Gila bicolor*), Utah chub (*Gila atraria*), tadpole madtom, flathead catfish, fathead minnow (*Pimephales promelas*), and oriental weatherfish (*Misgurnus anguillicaudatus*) were sampled fewer than 10 times in the HCC reservoirs in all years combined (1991–2000). Seven families were represented in the

Applicant's sampling. By far, centrarchids were the most commonly collected family, with cottids collected the least (Figure 2 in Chapter 3 of Technical Report E.3.1-5).

E.3.1.1.5.3.1. Above Brownlee Reservoir

The reach above Brownlee Reservoir was sampled in 1995, 1996, 1997, and 2000, for a total distance of 26,500 meters electrofished. Smallmouth bass, largescale sucker, and common carp dominated the samples with mean catch per unit effort (CPUE, or the number of fish caught per the effort in time or distance) of 7.1, 4.3, and 1.9 fish per 100 meters, respectively (Figure 3 in Chapter 3 of Technical Report E.3.1-5). Oriental weatherfish, fathead minnow, banded killifish, Tui chub, and Utah chub were exclusively collected in this reach. Total length for smallmouth bass ranged from 38 to 482 mm, with the majority of fish below the 12-inch (305-mm) minimum size limit for harvest regulations in Idaho. Total length for largescale sucker ranged from 15 to 635 mm; for common carp, from 77 to 909 mm. The majority of fish in this reach had relative weights greater than 85, suggesting an overall balance in food supply. Proportional stock densities for game fish in this reach were within acceptable values for balanced populations (Table 14 in Chapter 3 of Technical Report E.3.1-5).

E.3.1.1.5.3.2. Brownlee Reservoir

Using electrofishing gear, the Applicant's biologists sampled a total of 53,520 meters of shoreline in Brownlee Reservoir from 1991 to 2000. Smallmouth bass were consistently the most abundant species encountered during the electrofishing surveys. Smallmouth bass, black crappie, and white crappie were ranked the top three species in abundance over all years sampled, with CPUE of 22.6, 10, and 7.4 fish per 100 meters of shoreline, respectively (Figure 3 in Chapter 3 of Technical Report E.3.1-5). Catches of largemouth bass were low and primarily limited to the reservoir above RM 105 and in the Powder River arm. Smallmouth bass TL was 20 to 490 mm and represented eight year classes. Most bass sampled were below the 12-inch (305-mm) minimum size limit for harvest regulations (Idaho and Oregon). Total length for black crappie and white crappie ranged from 11 to 375 mm and from 15 to 345 mm, respectively. Crappie populations in Brownlee Reservoir vary in species dominance from year to year. Relative weights for most species sampled in Brownlee Reservoir were greater than 85 (Chapter 3 of Technical Report E.3.1-5). Proportional stock densities for game fish varied (Table 11 in Chapter 3 of Technical Report E.3.1-5). Smallmouth bass were considered balanced in size structure, while proportional stock density values for white crappie indicated an imbalance, with higher numbers of quality fish.

E.3.1.1.5.3.3. Oxbow Reservoir

Oxbow Reservoir was sampled with electrofishing gear from 1993 to 2000, for a total of 9,700 meters of shoreline sampled. Dominant species were the same as in Brownlee Reservoir, but differed in order of abundance (white crappie, smallmouth bass, and black crappie). Mean CPUE for white crappie, smallmouth bass, and black crappie were 27.4, 16.1, and 12.8 fish per 100 meters of shoreline, respectively (Figure 3 in Chapter 3 of Technical Report E.3.1-5). Although TL range for smallmouth bass is similar to that found in Brownlee Reservoir, the implementation of a protected harvest slot limit of 12 to 16 inches (205–395 mm) has resulted in a slight redistribution of lengths. Total length ranges for crappie species were similar to those found in Brownlee Reservoir. Fish sampled in Oxbow Reservoir had relative weights above 88, a finding that indicates a balance in food supply. Proportional stock density values for game fish indicate a balance in size structure between stock and quality fish (Table 12 in Chapter 3 of Technical Report E.3.1-5).

E.3.1.1.5.3.4. Hells Canyon Reservoir

Hells Canyon Reservoir was sampled from 1993 through 2000, for a total distance of 19,100 meters of shoreline electrofished. The dominant species were white crappie, smallmouth bass, and black crappie with mean CPUE for white crappie, smallmouth bass, and black crappie of 12.9, 9.9, and 9.2 fish per 100 meters of shoreline respectively (Figure 3 in Chapter 3 of Technical Report E.3.1-5). Total length ranges for crappie species were similar to those found in Brownlee and Oxbow reservoirs, except that the minimum size collected was larger (35 mm). Smallmouth bass TL was 32 to 435 mm. Fish sampled in Hells Canyon Reservoir had relative weights above 88, a finding that indicates a balance in food supply. Game fish proportioned stock densities indicated a balance in size structure between stock and quality fish (Table 13 in Chapter 3 of Technical Report E.3.1-5).

E.3.1.1.5.4. Fish Communities in Downstream Areas Affected by the HCC

The Applicant did not sample this reach for resident nonsalmonids, but did consult the members of the Aquatic Resources Work Group and review the literature to obtain information. Native resident nonsalmonids found below the HCC are the largescale sucker, bridgelip sucker, mottled sculpin, shorthead sculpin (*Cottus conusus*), northern pikeminnow, longnose dace (*Rhinichthys cataractae*), chiselmouth, and Pacific lamprey (S. A. Grunder, IDFG, personal communication, April 17, 2000). Other nonsalmonid species that might possibly occur in the reach below the HCC are the peamouth, speckled dace (*Rhinichthys balteatus*), and redside shiner (*Richardsonius balteatus*) (S. A. Grunder, IDFG, personal communication, April 17, 2000). Incidental nonsalmonid fish caught by electrofishing in the free-flowing section of the Snake River (RM 145–RM 215) are dace species and the common carp, chiselmouth, largemouth bass, largescale sucker, northern pikeminnow, peamouth, redside shiner, sculpin species, and smallmouth bass (Nelle and Bennett 1998).

Lukens (1986) sampled resident game fish other than white sturgeon from Hells Canyon Dam to Lewiston, Idaho, using electrofishing gear. He collected black crappie, rainbow trout, channel catfish, smallmouth bass, and an occasional flathead catfish. Although anglers reported good catches of black crappie prior to this study, electrofishing produced very few fish. Lukens (1986) suggested that the crappie population below Hells Canyon Dam is regulated by recruitment from Hells Canyon Reservoir.

Catches of smallmouth bass dominated Lukens's (1986) sample. Nelle and Bennett (1998) estimated the expanded population of smallmouth bass (TL = 175 mm) for the section from Pittsburg Landing (RM 215) to Asotin, Washington (RM 145), to be 43,248 (678–87,919; 95% confidence interval), which equated to 397 fish/km. Lukens (1986) reported relative weights by 50-mm length group; they ranged from 73.1 to 109.3, with the lowest relative weights reported for the group of largest length. Smallmouth bass growth was better in 1985 than in 1965–1967 (Keating 1970, Lukens 1986, Nelle and Bennett 1998). Proportional stock densities were 35 and 50% in 1985 and 1986, suggesting that a population balanced in size structure exists in the reach below Hells Canyon Dam (Lukens 1986).

Channel catfish were collected by rod and reel from 1982–1984 as incidental take while sturgeon were sampled (Lukens 1986). While growth was slower than for fish from two locations in the upper Snake River, fish were longer lived in this reach. Fish ranged in age from 3 to 11 years.

E.3.1.2. Measures or Facilities Recommended by the Agencies

To consolidate measures, the Applicant has included measures or facilities recommended by the agencies in section E.3.1.3.3. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.3.1.3. Applicant's Existing and Proposed Measures or Facilities

E.3.1.3.1. Existing Measures or Facilities to Be Continued or Maintained

The Applicant proposes to continue or maintain three existing measures: the fall chinook plan, anadromous mitigation hatchery facilities, and the warmwater fish plan. These measures, as well as the various actions included in each, are described in the following sections.

E.3.1.3.1.1. Fall Chinook Plan

As part of the fall chinook plan, the Applicant implements actions to protect fall chinook during spawning and incubation periods and monitors redds and water temperatures. Each of these actions, as well as the costs associated with the fall chinook plan, is described in more detail in the following sections.

E.3.1.3.1.1.1. Fall Chinook Salmon Spawning and Incubation Protection

Since 1991, the Applicant has operated the reservoirs of the HCC during fall, winter, and early spring (October through May) in a manner to protect fall chinook spawning and incubating. This flow program provides stable flows during the fall spawning period. After the spawning period, the Applicant maintains the stable discharge level as a minimum discharge until emergence is estimated to be complete during the following spring. This program provides a stable, benign environment for spawning adults, thereby reducing the potential for redd abandonment that might occur if flows fluctuated widely. Another benefit of the stable spawning and incubation discharge is that shallow redds are protected from potential desiccation, which could result in a mortality loss of 100% for any dewatered redd.

The stable fall discharge level to be maintained below Hells Canyon Dam is determined each year before spawning begins. From 1991 through 2001, this discharge has generally been between approximately 8,000 and 13,000 cfs (Chapter 1 of Technical Report E.3.1-3). The target discharge level is based on forecasted inflows to the Brownlee Reservoir, predicted hydrologic-year type (low, medium, or high), and availability of habitat. The minimum discharge during the winter/spring incubation period has been decreased but is limited by the most critical shallow redd identified within the Hells Canyon reach. This minimum discharge has been decreased when inflow to Brownlee Reservoir or seasonal precipitation (usually snow-pack accumulation) has decreased below forecasted levels. As the escapement of adult fall chinook salmon has increased over recent years, aspects of the protective flow program have been coordinated with NMFS, as well as the USFWS and U.S. Army Corps of Engineers, to ensure that sufficient protection has been provided for this ESA-listed salmon stock.

Modifications of this flow program are currently being evaluated and explored in cooperation with agencies involved in recovering the Snake River fall chinook salmon. Analyses of how habitat availability changes with discharge have shown that sufficient habitat exists, even at flows less than 8,000 cfs, to provide for recovery of these fish (Chapter 3 of Technical Report E.3.1-3). The habitat/discharge models also indicate that moderate flow fluctuations (with respect to total stage change) during the spawning period may be attainable without reducing the availability of spawning habitat or hindering spawning behavior.

In the years after this protective flow program was begun, adult returns and the associated total number of redds upstream of Lower Granite Dam began to improve (Chapter 1 of Technical Report E.3.1-3). After the Nez Perce Tribe's juvenile supplementation program began in 1995, an effort that also increased the number of returning adults, it became more difficult to actually quantify benefits achieved with the protective flow program. However, the protective nature of the flow program cannot be denied. The area of the Snake River affected by the continuation of the fall chinook plan is shown in Figure E.3.1-4.

E.3.1.3.1.1.2. Fall Chinook Salmon Redd and Temperature Monitoring

Before 1991, surveys of fall chinook salmon redd in the Snake River downstream of the HCC were conducted on a very limited basis (Chapter 1 of Technical Report E.3.1-3). Also, information concerning habitat use by these fish and the quality of the environment within the Snake River was virtually nonexistent. After Snake River fall chinook salmon were listed under the ESA, the Applicant cooperatively joined federal, state, and tribal agencies to increase spawning survey efforts and supplement our base knowledge of the freshwater habitat use and requirements of this depleted fish stock.

Increased aerial and deep-water spawning surveys have allowed the Applicant to understand the overall timing and distribution of spawning within the Snake River and its tributaries (Chapter 1 of Technical Report E.3.1-3). An additional management benefit of these surveys is the identification of critically shallow redds each year, data that is important when determining whether the protective base flows can be modified during incubation if necessary. Also, the surveys help determine when spawning ceases, data that becomes the basis for estimating the end of emergence the following spring and delineating when the minimum protective flow can be relaxed.

The Applicant will continue to support and participate in spawning surveys to the extent that they provide data useful for managing the HCC in a manner that protects listed fall chinook salmon within the mainstem Snake River downstream of Hells Canyon Dam. Under current escapement levels upstream of Lower Granite Dam (up to approximately 6,000 adults), the relative proportion of spawning that occurs in the Snake River in habitat too deep to be observed from the air has been well documented (Chapter 1 of Technical Report E.3.1-3). Therefore, this portion of the spawning surveys will be discontinued until escapement levels significantly increase. Based on the Applicant’s spawning survey distribution data and habitat model results, an escapement level of approximately 20,000 adults over Lower Granite Dam will probably approach spawning capacity within the mainstem Snake River. At increments of escapement equal to 10,000, 15,000, and 20,000 adults, the Applicant will reevaluate the relative use of deep-water habitat during the first year of each escapement increment.

Water temperature monitoring within the mainstem Snake River and three major tributaries downstream of the HCC (Imnaha, Salmon, and Grande Ronde rivers) has also been ongoing since 1991. Thermal data are necessary for determining when juveniles emerge from the gravel. Using redd survey data and water temperature data, it is possible to estimate when emergence begins, peaks, and is probably completed. Understanding this process allows us to determine when the base minimum protective flow can be relaxed, virtually eliminating the risk of dewatering developing embryos.

Base flows in the lower Hells Canyon reach (downstream of the confluence of the Salmon River, or RM 188.2) increase significantly each year during the final phase of emergence (April through June) because of natural runoff within the Salmon River. Because flows in the lower reach generally increase to at least twice the volume of the previous fall spawning flows, there is no risk of decreased flows from the HCC dewatering redds downstream of the Salmon River. Therefore, measures designed to protect redds and developing embryos are most important for those juveniles remaining within the gravel between Hells Canyon Dam and the confluence of the Snake and Salmon rivers. The Applicant will continue to monitor water temperature during the early fall through late spring within the upper Hells Canyon reach (upstream of the confluence of the Salmon River) to determine when emergence in that river reach is complete and protective minimum flows can be relaxed each spring.

The area of the Snake River where redds will be surveyed and temperatures monitored as part of the fall chinook plan is shown in Figure E.3.1-4.

E.3.1.3.1.1.3. Costs of the Fall Chinook Plan

The Applicant estimates the following costs, based on a 30-year license period[7]:

Action	Cost (30 years)
Spawning and incubation protection flows	$ 75,000,000
Redd and temperature monitoring	$ 3,750,000
Total	$ 78,750,000

7. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC’s discretion for setting a new license term.

E.3.1.3.1.2. Anadromous Mitigation Hatchery Facilities

The Applicant currently operates and maintains four hatchery facilities and four adult traps to mitigate the effects of constructing and operating the HCC. In addition, the Applicant provides two 5,000-gallon-capacity fish tanker trailers for transporting salmon and steelhead smolts to various release sites and three 1,000-gallon-capacity adult fish trucks for relocating adult salmon and steelhead from traps to hatchery facilities. Descriptions of each hatchery facility are provided in the following sections, as well as in Technical Report E.3.1-4.

E.3.1.3.1.2.1. Oxbow Fish Hatchery

The Oxbow Fish Hatchery was constructed in 1961 pursuant to a FPC order dated November 11, 1960. The facility is located downstream of the Oxbow Power Plant on the Oregon shore of the Snake River immediately upstream of the mouth of Pine Creek (Figure 1 in Technical Report E.3.1-4). It originally consisted of a hatchery building for primary egg incubation, a clay-lined earthen adult holding pond, and a horseshoe-shaped incubation and rearing channel for final egg incubation and early rearing. Water was supplied to the hatchery from two 8,000-gallon per minute (gpm) pumps located in the Snake River. Temporary trapping facilities for collecting broodstock were initially located at the Oxbow Dam construction site.

This facility has seen numerous changes in its 40-year history. Fish culture equipment at Oxbow Fish Hatchery today consists of a concrete adult holding pond measuring 160 feet long by 70 feet wide by 5 feet deep (shown in this exhibit as 160 × 70 × 5 feet), a pond that accommodates both spring chinook and steelhead; a spawn building; two concrete raceways capable of rearing 200,000 fall chinook; and vertical stack incubators for spring chinook, fall chinook, and steelhead eggs. Water is supplied from two sources: up to 8,000 gpm of raw Snake River water is pumped to the adult holding ponds and raceways from one of two pumps located adjacent to the hatchery, and pathogen-free groundwater for egg incubation and fall chinook early rearing is supplied from one of two on-site groundwater wells. A 70-horsepower chiller cools incubation water as needed to regulate embryonic development. Finally, an office building, residence for a full-time employee, housing for temporary personnel, and various storage buildings are present. Current capacities of the various facilities at the Oxbow Fish Hatchery appear in Table 1 in Technical Report E.3.1-4. A plan view of the present-day hatchery is shown in Figure E.3.1-5. In addition, Technical Report E.3.1-4 includes further information about staffing levels, operational objectives, and fish culture activities.

An adult trapping facility is operated in conjunction with Oxbow Fish Hatchery. The trap is located 23 miles downstream of the hatchery on the Oregon shore of the Snake River immediately below Hells Canyon Dam. Adult spring chinook and steelhead broodstock trapped at this location are transferred to Oxbow Fish Hatchery in 1,000-gallon-capacity transport vehicles. The location of the Hells Canyon fish trap is shown in Figure 1 in Technical Report E.3.1-4, while a plan view of the trap is shown in Figure E.3.1-6. As a condition of the 1980 *Hells Canyon Settlement Agreement*, a floating barge trap is also maintained by the Applicant at Hells Canyon Dam to supplement collection of adult spring chinook and steelhead, as necessary.

E.3.1.3.1.2.2. Rapid River Fish Hatchery

Rapid River Fish Hatchery was constructed in 1964 on Rapid River, a tributary to the Little Salmon River, approximately 7 miles from the community of Riggins, Idaho (Figure 1 in Technical Report E.3.1-4). Originally constructed as an experimental facility for artificially propagating spring chinook, summer steelhead, and, to a lesser extent, fall chinook, poor success with the latter two species resulted in the hatchery focusing on spring chinook only.

Fish culture facilities at this hatchery include an incubation building housing 22 sixteen-tray vertical incubators, twelve 100 × 80 × 3-foot concrete raceways, a 200 × 80 × 3-foot earthen rearing pond with a capacity for 1 million smolts, a second earthen rearing pond (370 × 70 × 3 feet) with a capacity for 2 million smolts, an 80 × 25 × 6-foot concrete adult holding pond, and a 150 × 40 × 6-foot earthen adult holding pond. The hatchery operates on a total of 28 cfs of raw river water supplied entirely by gravity flow. Other facilities at the main hatchery include an office, three residences for full-time employees, crew quarters, a day-use park with public restrooms, and various feed and general storage buildings. An upstream migrant trap is located approximately 1.5 miles downstream of the main hatchery. Adult salmon are collected here and trucked to the holding ponds at the main hatchery in 1,000-gallon-capacity transport vehicles. Current capacities of the various facilities at the Rapid River Fish Hatchery appear in Table 2 in Technical Report E.3.1-4. A plan view of the present-day hatchery is shown in Figure E.3.1-7. In addition, Technical Report E.3.1-4 includes more information about staffing levels, operational objectives, and fish culture activities.

E.3.1.3.1.2.3. Niagara Springs Fish Hatchery

After experiencing low steelhead growth rates in relatively cold water at Rapid River Fish Hatchery, the Applicant sought a warmer water source at which to construct a steelhead facility. The appropriate site was found at Niagara Springs, a constant 59 °F (15 °C) spring water source flowing from the basalt cliffs of the Snake River canyon, approximately 10 miles south of Wendell, Idaho (Figure 1 in Technical Report E.3.1-4). Unlike the hatcheries previously constructed by the Applicant that were experimental and dealt with multiple species, Niagara Springs Fish Hatchery was designed and constructed as a dedicated steelhead hatchery. This facility was constructed in 1966 and released its first fish into the Pahsimeroi River in spring 1967.

Facility structures consist of a main hatchery building housing an office, shop, and incubation room equipped with 30 upwelling incubators and 21 associated 60-cubic-foot linear nursery vats; two storage buildings that house a water chiller, three raceway air blowers and various other equipment; nineteen 300 × 10 × 2.5-foot concrete raceways; two flow-through settling ponds; and four operator residences. The hatchery operates on 132 cfs of spring water supplied via gravity flow. The Applicant has also provided a visitor kiosk, public restrooms, and a 2-acre day-use park complete with picnic tables and fishing access. All recreation facilities are handicap accessible. Current capacities of the various facilities at Niagara Springs Fish Hatchery appear in Table 3 in Technical Report E.3.1-4. A plan view of the present-day hatchery is shown in Figure E.3.1-8. In addition, Technical Report E.3.1-4 includes more information about staffing levels, operational objectives, and fish culture activities.

E.3.1.3.1.2.4. Pahsimeroi Fish Hatchery

The last hatchery facility constructed by the Applicant as part of its mitigation program was Pahsimeroi Fish Hatchery. In November 1966, the Applicant began constructing the Upper Pahsimeroi Fish Hatchery approximately 14 miles above the mouth of the Pahsimeroi River (Figure 1 in Technical Report E.3.1-4). The site consisted of two 45 × 500-foot steelhead smolt acclimation ponds, feed storage and delivery equipment, and a two-bedroom home. The acclimation ponds received up to 10 cfs of water directly from the Pahsimeroi River. Each spring from 1967 through 1971, the Applicant transported steelhead smolts from Niagara Springs Fish Hatchery to the Upper Pahsimeroi Fish Hatchery for acclimation and eventual release into the Pahsimeroi River. Concurrently, the IDFG conducted extensive evaluation studies of this release strategy. Steelhead smolt acclimation was discontinued in 1972 after Reingold (1972) concluded that directly released steelhead smolts survived as well or better than acclimated smolts. Since then, all steelhead smolts have been directly released into the Pahsimeroi River immediately below the barrier weir at the lower hatchery site.

In October 1968, the Applicant constructed adult trapping and egg incubation facilities on the lower Pahsimeroi River at a location approximately 1 mile above its confluence with the main Salmon River (Figure 1 in Technical Report E.3.1-4). The Lower Pahsimeroi Fish Hatchery consists of a barrier weir across the Pahsimeroi River channel and a fish ladder leading to three 70 × 16 × 6-foot adult holding ponds, an egg incubation and office building equipped with twenty 16-tray stacks of vertical incubators, a pump house supplying 120 gpm of spring water for incubation, and a shop and dormitory complex for seasonal employees. Forty cubic feet of water for operating the fish ladder and adult holding ponds are supplied directly from the Pahsimeroi River via an open canal. Steelhead trapping and spawning began in 1969, with the first returns of smolts from Niagara Springs Fish Hatchery released in 1967. Steelhead trapping and spawning continue today.

After the *Hells Canyon Settlement Agreement* was implemented, the role of the Pahsimeroi Fish Hatchery was expanded to include the production of 1 million chinook smolts annually. While no changes to the facility were necessary to accommodate the additional steelhead eggs needed to double production at the Niagara Springs Fish Hatchery, a number of modifications were necessary to accommodate expanded chinook production. Four concrete raceways (100 × 4 × 3 feet) were constructed at the Lower Pahsimeroi Fish Hatchery, along with a pump house to supply 120 gpm of river water for chinook egg incubation. At the Upper Pahsimeroi Fish Hatchery, the steelhead acclimation ponds were shortened to 300 × 40 × 5 feet and equipped with outlet control structures and drum screens to facilitate their use as chinook rearing ponds. Finally, a walk-in freezer was added for the storage of fish food. Following the ESA listing of Snake River spring summer chinook and steelhead, drum screens were added to the hatchery water intake diversion canals at both the upper and lower hatchery sites to prevent wild fish from being entrained into the hatchery. Current capacities of the various facilities at both the upper and lower hatcheries appear in Table 4 in Technical Report E.3.1-4. Plan views of the present-day Pahsimeroi Fish Hatchery facilities are shown in Figure E.3.1-9 and Figure E.3.1-10. In addition, Technical Report E.3.1-4 includes more information about staffing levels, operational objectives, and fish culture activities.

The Applicant proposes to continue operating these facilities in a manner consistent with production capacities currently identified in the 1980 *Hells Canyon Settlement Agreement*. The Applicant also proposes a number of changes to structures and equipment, as necessary, to improve operational efficiency and fish quality. These improvements are detailed in section E.3.1.3.2.2.

E.3.1.3.1.2.5. Costs of Existing Mitigation Hatchery Facilities

The Applicant estimates the following costs:

Facility	Capital	O&M[a]	Total (30 years)
Oxbow Fish Hatchery	$ 2,900,000	$ 6,525,000	$9,425,000
Rapid River Fish Hatchery	$ 2,900,000	$15,950,000	$18,850,000
Niagara Springs Fish Hatchery	$ 2,900,000	$22,475,000	$25,375,000
Pahsimeroi Fish Hatchery	$ 2,900,000	$13,325,000	$16,225,000
Total	$ 11,600,000	$58,275,000	$69,875,000

a. O&M = operation and maintenance.

E.3.1.3.1.3. Warmwater Fish Plan

As part of the warmwater fish plan, the Applicant implements actions to protect resident centrarchids during spawning periods and to monitor populations. Each of these actions, as well as the costs associated with the warmwater fish plan, is described in more detail in the following sections.

E.3.1.3.1.3.1. Resident Centrarchid Spawning Protection

The Applicant conducted a field study to collect basic spawning information, in relation to water-level fluctuations, for smallmouth bass, crappie species, and channel catfish in the HCC (Chapter 1 of Technical Report E.3.1-5). Literature on water-level fluctuations and the spawning period reveals that stable water levels during the spawning period produce environmental conditions that favor reproductive success. Receding water levels during the spawning season lead to nest abandonment and desiccation. Although nest success does not ensure a strong year class, it may increase the chances of producing one. Therefore, regulation of water levels during the active spawning season would promote production of strong year classes. Operations that promote early spring filling and stable water levels through summer would achieve such conditions.

The Applicant assessed three mechanisms whereby the operation of the HCC could affect smallmouth bass and white crappie populations in Brownlee Reservoir: downstream export of fish from Brownlee Reservoir, water-level fluctuations affecting nesting success, and water temperature regimes affecting overwinter survival (Chapter 4 of Technical Report E.3.1-5). For the analyses, the Applicant used three hydrologic-year types (low, medium, and high) and two operational scenarios: proposed operations, based on how the HCC is currently operated, and full pool run-of-river operations.

For smallmouth bass, only the link between water-level fluctuations and nesting success (and therefore reproductive success) was substantially affected by reservoir operations. Though the proposed operations scenario incorporates guidelines for water levels that remain stable or gradually increase during the primary spawning period for smallmouth bass, some nests still fail because of increasing water levels. The more pronounced pattern of increased nesting success (from low to high hydrologic-year types) for the full pool run-of-river operations scenario than for the proposed operations scenario was due to more suitable temperature regimes associated with higher hydrologic-year types.

For white crappie, differences in reproductive success and the survival of age 1 and older fish were functions primarily of downstream export and secondarily of nesting success. For both operational scenarios, the potential negative effects of downstream export increased from low to high hydrologic-year types. The minor effects on nesting success can be attributed to white crappies' broader depth range for suitable nesting habitat and shorter development time from egg to dispersal than those for smallmouth bass. Because these biological characteristics make nesting success for white crappie much less vulnerable to water-level fluctuation, nesting success does not appear to be a major determinant of reproductive success.

For the proposed operations scenario, the Applicant would use a series of target elevations on specific dates as operational guidelines. Beginning on May 21, a 30-day period would be protected, during which time the reservoir would not be drafted more than 1 foot from the highest elevation reached during the 30-day period. The exception would be for system or economic emergencies. From the end of the 30-day period though July 4, the reservoir could be drafted more than 1 foot, but an elevation of at least 2,069 feet mean sea level would have to be maintained through July 4. The 30-day period beginning on May 21 would allow the Applicant to protect peak spawning periods identified for smallmouth bass (May 19 to June 1) and crappie (May 10 to 21 and again from June 8 to 24) in Brownlee Reservoir (Chapter 1 of Technical Report E.3.1-5).

Optimal nesting depths were identified for smallmouth bass and crappie during the study. Optimal nesting depths for smallmouth bass occur between 0.9 and 2.4 meters, while optimal nesting depths for crappie occur between 2.1 and 4.6 meters (Chapter 1 of Technical Report E.3.1-5). The limitations set on drafting during the 30-day period would protect the shallow nests from desiccation. Although, according to the study, the amount of filling over a nest did not affect nesting success, nesting success drastically declined when more than 1.2 meters of water was drafted during the active spawning period.

Year-class strength of smallmouth bass and nesting density were highly correlated in Brownlee Reservoir (Chapter 3 of Technical Report E.3.1-5). This correlation was further enhanced when nesting success was introduced, a finding that emphasizes the need to protect the spawning period to ensure a healthy smallmouth bass population.

The area of the HCC affected by continuing efforts to protect the centrarchid spawning period is shown in Figure E.3.1-11.

E.3.1.3.1.3.2. Warmwater Fish Population Monitoring

Since 1991, the Applicant has monitored the fish population in Brownlee Reservoir through use of boat-mounted electrofishing gear. Since 1993, all three reservoirs of the HCC have been surveyed in spring and fall using standard protocol (Chapter 3 of Technical Report E.3.1-5). The free-flowing reach between Swan Falls Dam and Farewell Bend at the upper end of Brownlee Reservoir has been monitored on approximately a 5-year increment. Data about basic population characteristics—such as species enumeration, relative abundance, condition, year-class strength, proportional stock density, and age and growth—were collected (Chapter 3 of Technical Report E.3.1-5). The Applicant then compared the five hydrologic-year types with CPUE, mean relative weights, relative year-class strength, and proportional stock density (Chapter 3 of Technical Report E.3.1-5). Species used in the comparison were black crappie, bluegill, channel catfish, common carp, largemouth bass, smallmouth bass, white crappie, and yellow perch. Of these species, only black crappie and smallmouth bass had significant correlations with hydrologic-year types. Black crappie relative weights and smallmouth bass CPUE had correlation coefficients of 0.96 ($P = 0.008$) and 0.91 ($P = 0.027$), respectively. Hydrologic-year type explained 92% of the variation in black crappie relative weights and 84% of the variation in smallmouth bass CPUE.

Continuing this monitoring would enable the Applicant to detect long-term effects from operations and varying hydrologic-year types on the fish populations. Also, because the fish populations in the reservoirs of the HCC are dynamic, regular monitoring would facilitate accurate description of changes to these fish populations.

The area of the HCC and vicinity included in the monitoring plan for warmwater fish is shown in Figure E.3.1-11.

E.3.1.3.1.3.3. Costs of the Warmwater Fish Plan

The Applicant estimates the following costs:

Action	Cost (30 years)
Resident centrarchid spawning protection	$ To be determined
Warmwater fish population monitoring	$ 1,500,000
Total	$ To be determined

E.3.1.3.2. New Measures or Facilities Proposed by the Applicant

The Applicant proposes three new measures or facilities: development and implementation of a native salmonid plan, upgrade and enhancement of anadromous mitigation hatchery facilities, and development and implementation of a white sturgeon plan. These measures, as well as the elements included in each, are described in the following sections.

E.3.1.3.2.1. Native Salmonid Plan

Resident native salmonids, especially bull trout, have been affected by the continued operation of the HCC. The primary effects include reduced connectivity of the HCC native salmonid populations with other populations, altered trophic structure resulting from losses of anadromous fish, and poor water quality related to low dissolved oxygen levels. In addition, the health of native salmonid populations has been largely influenced by degradations occurring in tributary habitats from various land-use activities. Such land uses include activities that have reduced riparian habitat and, in turn, affected habitat quality in rearing areas and migratory corridors (Technical Report E.3.1-7). Other land uses within tributaries include irrigation practices that have reduced instream flow, as well as unscreened irrigation diversion structures that allow rearing or migrating fish to be lost from the stream channel. Bull trout populations in the HCC and vicinity have been determined to be at high risk primarily because of low numbers, lack of trend information, reduced fluvial life history forms, and loss of connectivity among subpopulations (Chapter 2 of Technical Report E.3.1-7). Bull trout are listed as a threatened species under the protection of the ESA.

A native salmonid plan is intended to mitigate and enhance native populations of resident salmonids within the vicinity of the HCC, specifically within the Hells Canyon Complex Recovery Unit identified by the USFWS for the purposes of bull trout recovery, which contains two core areas (see section E.3.1.1.1.1.). This measure primarily includes the development of a plan to recover and restore bull trout populations associated with the Pine–Indian–Wildhorse core area and to determine the presence or absence of bull trout in Eagle Creek, a tributary in the lower portion of the Powder River core area, by using accepted protocol developed by the American Fisheries Society. This plan would be developed with state management agencies and the USFWS, through the formation of the Hells Canyon Native Salmonid Technical Advisory Committee (NSTAC). The Applicant assumes that actions undertaken to recover and restore bull trout would equally benefit other native salmonids such as redband trout. The plan would in turn provide upstream access to areas above Hells Canyon and Oxbow dams and reduce effects of degraded habitats from land uses within tributary habitats. Other elements included in the plan would address facilities for long-term monitoring of fluvial fish, experimentation to reduce the impacts of introduced brook trout into Indian Creek, and population monitoring.

Specifically, measures in the native salmonid plan include pathogen surveys in Pine and Indian creeks, modifications to the Hells Canyon fish trap, design and construction of the Oxbow fish trap, modification to culvert barriers associated with the reservoirs, enhancements of tributary habitats, input of nutrients into streams, survey of bull trout presence in Eagle Creek, installation of a permanent monitoring weir at Pine Creek, and long-term monitoring and suppression of brook trout in Indian Creek. These measures are detailed in the following sections.

E.3.1.3.2.1.1. Pathogen Survey in the Pine–Indian–Wildhorse Core Area

Justification

Passing fish from downstream of barriers to migration, such as Hells Canyon and Oxbow dams, to areas upstream of these barriers incurs certain risks of introducing pathogens to these upstream areas.

Generally, defining the risk associated with the potential transfer of pathogens cannot be readily achieved (Chapter 10 of Technical Report E.3.1-2). Part of the difficulty is the inability to sample live fish to determine the presence of a pathogen. Unless external symptoms of a disease are readily observable, there is generally no way of knowing whether a fish is a carrier of a particular pathogen. Pathogens of greatest risk include exotic pathogens such as *Myxobolus cerebralis*, the agent of whirling disease; those pathogens that were not known to occur above the HCC; or those that may have a limited distribution above the HCC. The Applicant would undertake actions to help determine the level of risk associated with passage. Such actions would include surveys of the basins within the Pine–Indian–Wildhorse core area to better define distribution of pathogens. The pathogen surveys would be concentrated in this core area to provide the necessary risk assessment associated with the passage measures proposed in this plan. Ultimately, the responsibility for determining the risk of pathogen transfer lies with the state management agencies and the USFWS.

Goal

The goal of this measure is to develop a pathogen risk assessment plan for the Pine–Indian–Wildhorse core area, under the guidance of qualified pathologists from the state management agencies and the NSTAC. Risk should be determined before passage measures and passage protocols are implemented.

Description

The Applicant proposes to develop, fund, and implement a pathogen risk assessment plan, together with Oregon and Idaho state fish pathologists, the NSTAC, for the Pine Creek, Indian Creek, and Wildhorse River basins. Following the initial assessment of pathogen risk, follow-up pathogen surveys at five-year increments would be part of a monitoring plan, if the initial risk of passing fish above Hells Canyon and Oxbow dams were accepted and fish passage were initiated.

Associated Benefits

Associated benefits include a better understanding of pathogen distribution within natural populations of fish. Currently, very little is known or understood about the role of pathogens in the ecology of natural populations.

Implementation or Construction Schedule

A pathogen risk assessment plan for these basins would be developed and implemented immediately after the license was issued. Such an assessment is part of the foundation for developing management actions as part of a plan for recovery and restoration. The goal would be to complete an initial assessment and determination of risk within two years after the license was issued.

Cost Estimate

The Applicant estimates the following costs:

Action	Cost (30 years)
Initial pathogen survey	$ 200,000
Incremental pathogen surveys every 5 years ($200,000 per year)	$1,000,000
Total	$1,200,000

Location Map

See Figure E.3.1-12 for the general location of pathogen survey areas, proposed as part of a native salmonid plan.

E.3.1.3.2.1.2. Hells Canyon Fish Passage Plan

Justification

All three dams in the HCC constitute migration barriers to fish. Historically, bull trout populations in the HCC and vicinity and downstream of the HCC may have been part of a larger metapopulation, with exchange of individuals among various local populations. While not every individual necessarily displayed a migratory life history, at least a certain component of the population did. The maintenance of migratory life histories has been identified as critical to the persistence and viability of bull trout populations (Technical Report E.3.1-7).

Redband trout and other native migratory fish species may have shared similar life histories as described for bull trout, with redband trout and white sturgeon also displaying anadromous life histories. Other native migratory species in the HCC may include bridgelip suckers, largescale suckers, northern pikeminnow, mountain whitefish, and white sturgeon. The dams also constitute barriers for obligate anadromous species such as chinook salmon and Pacific lamprey, although the focus of this plan is on species in which some individuals display potamodromous (freshwater) migrations, with the primary focus on bull trout, because of their protected status.

The importance of the migratory life histories for the persistence of other native species in the vicinity is not known, nor is the extent of spatial connectivity required to maintain the migratory life histories that are known. However, based on these species' present distribution and relative abundance, not only in the study area but throughout the Columbia River basin, the existing barriers do not seem to pose significant threats to their persistence and the existing connectivity may provide the necessary migratory components.

White sturgeon present a clear exception to this generalization. White sturgeon associated with the HCC are also known to migrate over large distances; however, anadromy of this species was probably limited before the HCC was constructed because of mainstem dams on the Columbia River. Because of their large size, sturgeon are less likely to use more traditional passage facilities associated with the passage of anadromous salmonids and, therefore, pose significant challenges related to passage. White sturgeon are not included in this passage plan, and specific measures for this species are discussed in section E.3.1.3.2.3.

Although there is a trap at Hells Canyon Dam as part of the anadromous mitigation hatchery program, it has not been used to allow upstream movement of resident species. The use of the trap for resident fishes is impaired because it has been modified to reduce the capture of smaller individuals. With these modifications, less culling is necessary in transporting anadromous adults to hatchery facilities. In addition, the trap is used only during periods of anadromous fish returns; it may not be operating when resident fish are migrating. No passage facilities are currently associated with Oxbow Dam or Brownlee Dam.

Goal

The goal of this measure is to create a two-phased fish passage plan—first at Hells Canyon Dam and second at Oxbow Dam—to allow for the capture and transport of resident salmonids and other species migrating upstream, as recommended by state fishery management agencies, to transfer them to areas above Hells Canyon and Oxbow dams.

Description

Phase One, the Hells Canyon Trap—In the first phase, the Applicant proposes to modify the existing trapping facility at Hells Canyon Dam to handle and capture all fish that migrate into the trap, including the anadromous species for which the trap was originally designed. The existing facility at Hells Canyon Dam currently incorporates a fish ladder design so that fish can actively migrate up and into a trap. The facility also includes a lift to allow fish to be transferred into a fish tanker for transport. The Applicant would modify the existing trap to capture smaller individuals, with the intent of being able to capture juvenile salmonids. In addition, trap operations would conceptually be expanded to include year-round captures of resident salmonids and other migratory fish species. The location of the trap currently limits its operation during discharges at Hells Canyon Dam that exceed 50 kcfs, and this limitation would continue, even with the new modifications. In addition, the trap operation may continue to be limited during extremely cold conditions that cause icing in the facility.

Salmonid movements would probably peak during the October to June months as fish moved into and from tributary habitats. This determination is based on observed movements of radio-tagged fish in studies conducted by the Applicant (Technical Report E.3.1-7). However, the abundance and timing of other migratory fish species that could be captured in the trap is unknown and poses several uncertainties relative to facility operations that may require periodic trap closures. The potential exists to capture very large numbers of nonsalmonid migratory species such as suckers. Limitation to the numbers of fish that can be physically handled and sorted is a concern that would have to be considered during plan development. Another potential limitation of the facility that would need to be considered is the recycling of anadromous fish into the trap. Current protocol of operating the trap allow the trap to close when quota for anadromous fish are met. This closure allows surplus hatchery fish to stay in the river, available for the recreational fishery. With the continual operations of the trap, anadromous hatchery returns would continuously be captured, often at a high rate. Specific passage protocols would need to be developed with the state (IDFG and ODFW) and federal agencies (USFWS and NOAA Fisheries) and regarding limitations of the trapping facility. Because of the uncertainties associated with this facility, an adaptive approach would be required to accommodate unforeseen and unanticipated complications.

Other modifications to this facility would accommodate a means for sorting and holding fish captured and for scanning PIT-tag returns. This need is based on the recommendation of some agencies. Current operations of the trapping facility require that hatchery and natural anadromous returns be sorted at the hatchery. Natural returns have to be trucked back to the river from the hatchery facility. The ability to sort and return fish at the trap facility and scan for marks or tags would be a valuable addition to the existing facility. In addition, the Applicant anticipates purchasing another fish tanker to accommodate transport of resident migratory fish captured in the trap.

There are several advantages of a trap over a ladder, including cost, the unproven success of a ladder the size of which would be required at Hells Canyon Dam, the ability to monitor and control species and numbers allowed to pass, and the ability to release fish upstream away from the immediate vicinity of the dam so that they are less likely to fall back over the dam. Monitoring the behavior of passed fish, especially bull trout, is an essential part of the fish passage plan.

Phase Two, the Oxbow Dam Trap—The second phase of the passage plan would be to construct a trap similar in operation and design to the Hells Canyon trap. This facility would incorporate a fish ladder so that migrating fish could ascend into the trap and a sorting and holding facility, similar in design to the existing trap at Hells Canyon Dam. The Oxbow trap is considered a second phase of the plan primarily because of concern expressed by some agencies on the uncertainties regarding the intent of resident salmonids captured in a trap and the priority of other measures for bull trout recovery. It may be uncertain, for example, whether a fish captured in a trap was there because of the attraction flow into the trap or whether it was exhibiting true volitional movement associated with a migration. These uncertainties may be especially true for bull trout that overwinter in the Oxbow Bypass segment of the reservoir. Most of the bull trout that the Applicant has captured in Hells Canyon Reservoir have been in the Oxbow Bypass (Chapter 4 of Technical Report E.3.1-2).

Another important management question concerning immediate implementation of passage at Oxbow Dam is the current status of fluvial fish in the Pine–Indian–Wildhorse core area. Currently, the only known fluvial fish within the core area are associated with Indian and Pine creeks, two systems already connected. It is believed that fluvial fish just within these two systems are extremely low in abundance (Chapter 4 of Technical Report E.3.1-7). The Wildhorse River is a highly hybridized bull trout population, and no fluvial bull trout have been documented to move into Oxbow Reservoir from the Wildhorse River. Only one local population in the Wildhorse River (Crooked River) can be accessed from Oxbow Reservoir because of a natural migration barrier at Bear Creek Falls, which precludes upstream access to Bear Creek and Lick Creek. If a bull trout were captured in the Oxbow trap and allowed to potentially move into the Wildhorse River, it may further dilute fluvial fish available to Pine and Indian Creek. This fish may also have a high chance of reproducing with either a hybrid bull trout or a brook trout, thereby wasting its reproductive potential. Given the very low abundance of fluvial fish associated with the HCC, it may make more sense from a management perspective to prevent migration of fluvial fish into Oxbow Reservoir until limiting factors within the tributary basins are addressed and fluvial fish within Pine and Indian creeks begin to recover.

The Applicant proposes that construction of the Oxbow trap be delayed a minimum of five years after the Hells Canyon trap is completed to allow for tributary enhancements to begin to take effect for bull trout in Pine and Indian creeks and the Wildhorse River. In addition, much can be learned from implementing trapping at Hells Canyon Dam regarding fish-behavior monitoring and trapping limitations that could influence design and implementation of the Oxbow trap.

Associated Benefits

No associated benefits are included with this measure.

Implementation or Construction Schedule

Implementing this measure would require several steps, each of which is listed below:

1. Develop a passage plan in conjunction with the pathogen risk assessment (see section E.3.1.3.2.1.1.) to develop operational protocols with the NSTAC and NOAA Fisheries. Such protocols would include operation period, sizes and species of fish to be transferred, and location of releases. The operation protocols would be developed within one year after the license was issued.

2. Develop detailed engineering plans for modifications to the existing trap and for the Oxbow trap within one year after the license was issued.

3. Implement construction of and modification to the existing facility pending decisions regarding the pathogen risk assessment. If state management agencies accept the risk of transferring pathogens by allowing fish to pass upstream of Hells Canyon Dam, modification of the existing trap would be completed within one year of that determination.

4. Begin construction of the Oxbow trap a minimum of 5 years after completion and operation of the Hells Canyon trap.

Cost Estimate

The Applicant estimates the following costs:

Action	Cost (30 years)
Capital construction	
Hells Canyon trap and holding/ sorting facility[a]	$ 2,800,000
Oxbow trap	$ 2,800,000
Fish tanker (2 at $200,000 each)	$ 400,000
Total capital	$ 6,000,000
O&M	
Hells Canyon trap ($400,000 per year after the first of the license)	$ 11,600,000
Oxbow trap ($250,000 per year after the first 6 years of the license)	$ 6,000,000
Total O&M	$ 17,600,000
TOTAL	$ 23,600,000

a. Assumes no major structural modification to the existing trap design

Location Map

See Figure E.3.1-12 for the location of the Hells Canyon and Oxbow fish traps. In addition, Figure E.3.1-6 provides a plan view of the existing Hells Canyon fish trap, proposed as part of a native salmonid plan.

E.3.1.3.2.1.3. Tributary Habitat Enhancements

Justification

Native resident salmonids depend on habitat quality within tributary basins during every life stage or life history, including spawning, incubation, rearing, resident subadults and adults, and fluvial subadults and adults. Fluvial life history forms also depend on mainstem habitats during a portion of their life, primarily during the winter. Therefore, high-quality habitat within the tributaries is essential to the recovery of native salmonids. Beyond the obvious blocked access and loss of anadromous fish, effects of HCC operations are impossible to quantify or separate from impacts of land-use activities outside the Applicant's control. The impacts of these land-use activities, which include livestock grazing along stream corridors and irrigation practices, are also difficult to quantify. To mitigate for unquantified effects associated with the HCC, the Applicant proposes activities to enhance tributary habitats that affect all life stages of resident salmonids.

Goal

The goal of this measure is to develop a tributary habitat enhancement plan with the NSTAC and private landowners within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the HCC reservoirs.

Description

The Applicant proposes to assemble a working group consisting of the NSTAC and private landowners. This working group would identify, prioritize, and recommend actions and measures primarily targeting benefit to bull trout within the HCC. Measures identified may include cooperative maintenance agreements. In such agreements, the Applicant would provide capital and construction costs, and the landowner would assume costs of operation and maintenance of the facility. Measures of priority would be those for which direct benefits to bull trout can be demonstrated. Such measures may be directed at the following types of impacts:

1. Culvert passage at small tributaries that drain into the HCC reservoirs and that could provide coldwater refuge to native salmonids.

2. Irrigation diversions that are along mainstem migration corridors or within primary spawning and rearing areas of bull trout. Implementation of this measure would depend on landowner maintenance agreements.

3. Land use effects on key riparian corridors that are currently in bull trout spawning and rearing areas or those that may extend the present range of spawning and rearing areas of bull trout.

The following is a list of potential measures:

- Construction of irrigation diversion screens.

- Conservation easement agreements.

- Construction of riparian corridor fences. Implementation of this measure would also depend on landowner maintenance agreements.

- Purchase or lease of water rights from willing sellers. These water rights would have to be those that can be demonstrated to provide improved instream flow in critical areas, especially those extending the coldwater refuge potential near the upper portions of streams that serve as spawning and rearing areas. This measure may apply only in Oregon tributaries.

- Land acquisition. This measure would include land along key riparian corridors only.

- Instream habitat enhancement measures. This measure would be directed at critical spawning and rearing areas.

Associated Benefits

Associated benefits include improvements in the integrity of the aquatic ecosystem, which would further benefit all forms of aquatic and terrestrial life. Recreation may also benefit indirectly by improvements to the health of fluvial fish in these basins. In addition, native salmonids may benefit from similar types of activities within or outside these targeted basins that are implemented through land acquisition measures identified for terrestrial resources (see section E.3.3.3.2.1.1.).

Implementation or Construction Schedule

Within one year after the license was issued, the Applicant would assemble the NSTAC, an interagency and landowner team, to help identify opportunities to enhance bull trout populations within these basins, determine the priority of measures, and develop an implementation plan for habitat enhancements. These opportunities must be prioritized according to which offer the greatest benefits to bull trout, regardless of agency missions or the proportion of money spent on agency-managed lands or private lands. In addition to prioritizing measures, this team would also inventory water diversions and develop the implementation schedule.

Cost Estimate

The Applicant proposes the following allocation on a capped total expense not to exceed $8,500,000:

Action	Cost (30 years)
Culvert modification and replacement (only culverts associated with small tributaries that pass under roads associated with the HCC reservoirs)	$ 1,000,000
Construction and capital costs of water diversion screens	$ 2,000,000
Tributary enhancements (prioritized by the NSTAC)	$ 5,500,000

Location Map

See Figure E.3.1-12 for the general location of the Pine–Indian–Wildhorse core area for tributary enhancement measures, proposed as part of a native salmonid plan.

E.3.1.3.2.1.4. Marine-Derived Nutrient Supplementation

Justification

The loss of anadromous salmonids to tributaries within the HCC led to the loss of marine-derived nutrients that had previously been imported every year in the form of salmon carcasses. Carcasses were used by both terrestrial and aquatic life through primary and secondary pathways (Cederholm et al. 1999). Effects of this loss probably vary among drainages, depending on other sources of nutrients available through natural basin characteristics or human activities. The loss of nutrients has possibly directly affected the productivity of bull trout and other native salmonids, especially within the rearing areas. Each year, as part of the mitigation hatchery program, adult salmon and steelhead carcasses are sent to landfills. In the new measures for operating the mitigation hatchery facilities (see section E.3.1.3.2.2.2. and section E.3.1.3.2.2.4.), the Applicant proposes to distribute carcasses, where appropriate, based on pathogen considerations in the basins and chemical treatments that may have occurred in the hatchery environment. In addition to or in place of the distribution of carcasses, alternative methods of nutrient supplementation would be explored, where appropriate.

Goal

The goal of this measure is to enhance the forage base within rearing areas of bull trout by supplying these areas with carcasses for primary and secondary nutrient uptake and/or supplementing these areas with alternative nutrient supplements. The area of this measure would be limited to basins within the Pine–Indian–Wildhorse core area.

Description

The Applicant proposes to distribute carcasses or alternative nutrient supplements within known bull trout rearing areas in the Pine–Indian–Wildhorse core area to enhance the forage base available to rearing salmonids.

Associated Benefits

Associated benefits beyond enhancing bull trout rearing areas include benefits to other aquatic life and terrestrial life that historically relied on this annual pulse of nutrients.

Implementation or Construction Schedule

Alternative nutrient supplements could be implemented once the license was issued. However, carcass distribution could only be implemented after a risk assessment of pathogen introduction was considered as part of an overall pathogen risk assessment plan (see section E.3.1.3.2.1.1.). The Applicant proposes to use the NSTAC for prioritizing and locating nutrient inputs.

Cost Estimate

Costs of this measure are included in section E.3.1.3.2.2.2. and section E.3.1.3.2.2.4. of the mitigation hatchery program, but the measure is integrated with the native salmonid plan.

Location Map

See Figure E.3.1-12 for the general location of the Pine–Indian–Wildhorse core area for the marine-derived nutrient supplementation measure, proposed as part of a native salmonid plan and mitigation hatchery program.

E.3.1.3.2.1.5. Eagle Creek Presence/Absence Survey

Justification

Little is known about the historic distribution and abundance of bull trout in basins associated with the HCC. There are anecdotal accounts of large fluvial bull trout in Eagle Creek in the 1940s and 1950s (Gildemeister 1992). According to Buchanan et al. (1997), a bull trout was captured by ODFW personnel in 1959 in Brownlee Reservoir. In a 1965 creel survey report, bull trout were documented in Eagle Creek and West Fork Eagle Creek. Today, the status of bull trout in the Eagle Creek basin remains unknown, but bull trout are believed to be very limited in abundance and distribution, if they are present at all. According to Buchanan et al. (1997), extensive snorkeling surveys conducted between 1991 and 1994 failed to find bull trout in Eagle Creek.

Prior to construction of Brownlee Reservoir, Eagle Creek supported chinook salmon and steelhead runs. With the failure of passage attempts at Brownlee Dam, anadromous fish were lost from the Eagle Creek basin and other basins associated with the HCC. The timeline of apparent disappearance of bull trout corresponds closely to the disappearance of anadromous fish from the basin. It is unknown whether the loss of anadromous fish is a causal mechanism to the decline of bull trout in Eagle Creek. There are several possible causal links. Losses of fluvial fish may have occurred when fish emigrated from Brownlee Reservoir during overwinter months and were unable to return to Eagle Creek because of the lack of fish passage. Loss of anadromous fish may have enabled introduced brook trout to better compete for available resources because of the altered trophic structure related to anadromous fish. Diversion screens designed for anadromous fish in Eagle Creek were no longer maintained after the loss of anadromous fish, which may have led to losses during downstream migrations. Other factors not related to Brownlee Reservoir, such as hybridization and competition with brook trout, may have contributed to the loss, even in the presence of anadromous fish. Likely, it was a combination of several of the factors described above, yet the decline seems linked to construction of the Brownlee Project. Much of the habitat in the upper portion of the basin appears relatively pristine (Buchanan et al. 1997), and brook trout are present in relatively high densities, a situation that will extremely complicate any recovery efforts.

The Applicant believes that, before development of recovery measures can be discussed, the first step should be addressing the current status of bull trout in Eagle Creek. Since Buchanan et al. (1997), specific protocols for conducting statistically valid presence/absences surveys for bull trout have been developed (Peterson et al. 2002), and such a survey is warranted in Eagle Creek.

Goal

The goal of this measure is to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek basin.

Description

The Applicant proposes to conduct surveys following protocols described in Peterson et al. (2002) in all of the major tributaries associated with the Eagle Creek basin, including Eagle Creek, West Eagle Creek, and East Fork Eagle Creek. The survey would likely be limited to July and August. In addition to the survey, the Applicant proposes to operate a temporary picket-style weir near the mouth during the fall months to possibly capture any remnant fluvial fish in the Eagle Creek basin. The Applicant anticipates that a three-year time period would be required to conduct a complete survey of the basin. The surveys would also include genetic sampling to examine the extent of hybridization with brook trout.

Associated Benefits

A complete species list and densities would also be developed for other fish species captured in the survey, especially brook trout and redband trout.

Implementation or Construction Schedule

The Applicant would develop a survey plan with the NSTAC within one year after a license was issued. The surveys would be initiated following approval of the plan. The Applicant anticipates three years to complete the survey.

Cost Estimate

The Applicant estimates the following costs:

Action	Cost (30 years)
Presence/absence survey for bull trout in the Eagle Creek basin (3 years at $200,000 per year)	$ 600,000

Location Map

See Figure E.3.1-12 for the general location of Eagle Creek basin for the Eagle Creek presence/absence survey, proposed as part of a native salmonid plan.

E.3.1.3.2.1.6. Permanent Monitoring Weir at Pine Creek

Justification

Very little is known about the fluvial component currently within the Pine Creek basin, and there is currently no means of establishing long-term trends of fluvial fish deemed to be critical to recovery of the core area. Trend information for fluvial bull trout using the mainstem Snake River is very difficult to obtain, especially given the low numbers of bull trout in the system. Although bull trout have been captured in Hells Canyon Reservoir (Technical Report E.3.1-7) and followed with radio telemetry into North Fork Pine Creek, these limited data are the only evidence available on fluvial bull trout in Pine Creek. The difficulty in operating temporary picket-style weirs in a stream the size of Pine Creek contributes to the lack of understanding. A picket-style weir was constructed in 1999 in Pine Creek by the Applicant; it was held in place with large jersey road barriers. The weir was only successful for one month after which a relatively minor rain event caused stream levels to rise, and the temporary structure could not be maintained. Therefore, the Applicant proposes to construct a more permanent weir facility at the mouth of Pine Creek to establish long-term trend monitoring of fluvial fish migrating upstream and downstream.

Goal

The goal of this measure is to establish a long-term trend monitoring program of fluvial fish migrating upstream and downstream in the Pine Creek system.

Description

The Applicant proposes to design, construct, and monitor a weir facility at Pine Creek. The collection weir would be designed to collect fish migrating downstream at flows of 500 cfs or less and upstream at flows of 1,500 cfs or less. The primary downstream monitoring would be during the fall months, and the 500-cfs design flow would capture 90% of the flows in October through December, based on the historical flow record at Pine Creek. At flows exceeding 500 cfs but less than 1,500 cfs, the entire river flow would not be able to be screened; however, the downstream trap could still operate with a reduced capture efficiency. At this time, the downstream capture efficiency at flows greater than 500 cfs is unknown. Upstream collections targeting bull trout would be associated primarily with spring months. An upstream ladder/trap would accommodate flows up to a 1,500-cfs design flow, which would capture 90% of the spring flows, based on the historical record. Flows exceeding 1,500 cfs would trigger the weir dam to lay down (by design) and allow high flows to pass. Once flows declined to levels below the 1,500-cfs design flow, the dam would erect again and allow the trap to function. Initially, the Applicant would monitor the weir and trap daily throughout the year, but monitoring during subsequent years might focus on specific time periods, such as October through June, when the Applicant has observed the most movement of fluvial bull trout in other tributaries.

Associated Benefits

Associated benefits include monitoring of not only bull trout, but also understanding the movement of other species to and from Pine Creek and establishing long-term trends.

Implementation or Construction Schedule

The Applicant would begin the engineering design within one year after the license was issued. The weir and trap would be constructed within two years after the license was issued. Then the trap would begin operation once it was completed.

Cost Estimate

The Applicant estimates the following costs:

Action	Cost (30 years)
Engineering design and construction	$ 2,500,000
O&M ($100,000 per year after the first year of the license)	$ 2,900,000
Total	$ 5,400,000

Location Map

See Figure E.3.1-12 for the general location of the permanent monitoring weir on Pine Creek, proposed as part of a native salmonid plan.

E.3.1.3.2.1.7. Long-Term Monitoring and Brook Trout Suppression in Indian Creek

Justification

Currently, the bull trout population within Indian Creek is highly hybridized with eastern brook trout (Technical Report E.3.1-7). This hybridization jeopardizes the viability of the bull trout population in Indian Creek and may eventually cause its extirpation from the Indian Creek system. In addition, a hybrid bull trout × brook trout captured in a downstream migrant weir in Indian Creek was subsequently followed by radio telemetry into the North Fork Pine Creek.

Therefore, the Applicant proposes to work with the IDFG to evaluate the feasibility of reducing the brook trout's influence in the Indian Creek system by some experimental measures. A suppression program would also include some level of population monitoring through the period of the license.

Goal

The goal of this measure is to evaluate the feasibility of, and possibly implement, a brook trout suppression program in Indian Creek, a program that could be applied to the Wildhorse River in the future. The program would be considered research and experimental.

Description

Specific methods for controlling brook trout have not been developed for inclusion in this license application.

Associated Benefits

An associated benefit includes a contribution to the scientific understanding of recovery options for bull trout in drainages where brook trout prevail.

Implementation or Construction Schedule

This research program could begin once a license was issued.

Cost Estimate

The Applicant estimates the following costs:

Action	Cost (30 years)
Field research and monitoring ($100,000 per year for 15 years)	$ 1,500,000

Location Map

See Figure E.3.1-12 for the general location of brook trout suppression and monitoring on Indian Creek, proposed as part of a native salmonid plan.

E.3.1.3.2.2. Anadromous Mitigation Hatchery Facility Upgrades and Enhancements

The proposal to upgrade and enhance facilities at the anadromous mitigation hatcheries includes measures for each of the four hatcheries. These measures, organized by hatchery, are detailed in the following sections.

E.3.1.3.2.2.1. Improvements to Pahsimeroi Fish Hatchery

The Applicant proposes three improvements at Pahsimeroi Fish Hatchery: control of pathogens, development of a locally adapted steelhead broodstock, and monitoring and evaluation of hatchery performance. Each of these improvements is discussed below.

Justification

Control of Pathogens—At Pahsimeroi Fish Hatchery, juvenile summer chinook salmon are incubated and reared on raw Pahsimeroi River water. This water source is known to contain *Myxobolus cerebralis*, the causative agent for whirling disease. Hatchery-reared smolts become infected with the pathogen and can then spread the disease as they migrate to and from the ocean. Smolt-to-adult survival is also thought to be compromised in individuals infected with whirling disease. Hatchery-reared chinook are also susceptible to whirling disease and other pathogens transferred by avian and mammalian predators that frequent the hatchery in search of food. Such pathogen transfers can result in significant fish mortality and diminished smolt-to-adult survival. They can also result in infection of wild fish populations.

Development of a Locally Adapted Steelhead Broodstock—Steelhead stock for the Pahsimeroi Fish Hatchery was derived in the mid-1960s from the out-of-basin transfer of wild steelhead originating in Snake River tributaries above Hells Canyon Dam. The stock has also been genetically influenced by B-run steelhead originating at Dworshak Fish Hatchery in the Clearwater River basin. Given the origin and mating history of Pahsimeroi Fish Hatchery's steelhead stock, NMFS did not include this stock in the ESU for listed Snake River summer steelhead. While out-of-basin transfers of anadromous fish stocks were once quite common, this practice is no longer acceptable because of the risk of genetic introgression with native populations. NMFS believes that development of a locally adapted steelhead stock to replace the current hatchery stock would enhance the stock structure and genetic integrity of listed Snake River steelhead (Herb Pollard, NMFS, personal communication).

Monitoring and Evaluation of Hatchery Performance—The Applicant's current mitigation hatchery program has no monitoring and evaluation component. Therefore, the IDFG is limited in its ability to evaluate hatchery performance for smolt-to-adult survival, stray rates, harvest contribution, and other criteria. Recent controversy over the effectiveness of hatchery programs suggests that ongoing monitoring and evaluation are necessary to improve the likelihood that desired program goals and objectives are attained.

Goals

Control of Pathogens—The goal of the pathogen control measure is to provide hatchery facilities that can incubate and rear juvenile summer chinook that do not exhibit clinical symptoms of whirling disease. Ultimately, pathogen control would also reduce the risk of pathogen spread to uninfected environments and promote the return of greater numbers of adult chinook for stock recovery, delisting, and harvest augmentation.

Development of a Locally Adapted Steelhead Broodstock—The goal of this measure is to develop a locally adapted steelhead broodstock. In theory, such a broodstock should be better suited to persist under the unique environmental conditions found in the upper Salmon River–Pahsimeroi River basin. Additionally, adult fish from a locally adapted stock should have greater homing fidelity and lower the risk of unwanted genetic introgression with the listed stock.

Monitoring and Evaluation of Hatchery Performance—The goal of this measure is to monitor and report performance of hatchery-reared fish relative to state, federal, and tribal fisheries management goals. Examples might include evaluation of harvest contribution, stray rates and locations, optimal smolt size at release, optimal release timing, and rates of residualism[8] under various release strategies. Findings from these efforts would be used to improve hatchery operations and maximize benefits while limiting potentially negative effects.

Descriptions

Control of Pathogens—Pathogens are most efficiently controlled through the development of a pathogen-free water source. The Applicant proposes to construct several groundwater wells that

8. Failure to undergo smoltification and migrate to the ocean.

would supply approximately 14 cfs of water for egg incubation and fish rearing. Preliminary investigations suggest that the upper hatchery site is best suited for this type of development. However, given that all existing incubation and early rearing containers are located at the lower hatchery site, implementing this measure would require that the Applicant construct new incubations facilities, concrete nursery raceways, feed storage facilities, and alarm systems at the upper hatchery site. Reliance on pumped water would also require that the Applicant install a redundant electrical power supply to guard against local power outages. Predator control devices, such as bird netting and perimeter fencing, would be incorporated into the construction plans to protect the rearing containers.

Development of a Locally Adapted Steelhead Broodstock—Development of this measure would require significant coordination between the Applicant, IDFG, and NMFS. Given the depressed status of native steelhead populations, the IDFG and NMFS would first identify suitable locations from which to obtain adult steelhead for hatchery purposes. Once suitable donor stocks were identified, the Applicant would again coordinate with the IDFG and NMFS to capture adult spawners, using either temporary weirs and traps or electrofishing gear. These spawners would then be relocated to the Pahsimeroi Fish Hatchery for spawning and incubation. Resulting progeny would be reared at Niagara Springs Fish Hatchery and marked before they were released into the Pahsimeroi River. These marks would differentiate them from the current hatchery stock. As adults returned to the hatchery, marked adults would be retained for spawning while unmarked adults would be removed from production. To avoid interrupting the significant sport fishery that exists for Pahsimeroi Fish Hatchery stock steelhead, the Applicant proposes that transition to a locally adapted stock be phased in over a period of 5 to 10 years. Collection of native spawners would be continued only until hatchery returns reached self-sustaining levels.

Monitoring and Evaluation of Hatchery Performance—The Applicant proposes to employ a full-time hatchery evaluation biologist to manage evaluation studies for all mitigation hatcheries. The biologist hired for this position would work closely with resource agency staff to design and conduct appropriate studies, as well as to collect and analyze necessary data. Using study results, the Applicant would then work with the IDFG to modify hatchery operations as necessary to maximize hatchery benefits.

Associated Benefits

Control of Pathogens—No associated benefits are anticipated.

Development of a Locally Adapted Steelhead Broodstock—No associated benefits are anticipated.

Monitoring and Evaluation of Hatchery Performance—Knowledge gained from this effort may apply to other hatchery programs within the region.

Implementation or Construction Schedules

Control of Pathogens—Engineering designs for construction of the well and modification of the upper hatchery site would be developed within one year, construction would begin within two years, and the facility would be ready for operation in the third year after the license was issued.

Development of a Locally Adapted Steelhead Broodstock—Within one year after the license was issued, the Applicant would consult and coordinate with state and federal resource agencies on issues related to developing a locally adapted steelhead broodstock. Adult steelhead identified as donor stock would first be collected within two years after the license was issued.

Monitoring and Evaluation of Hatchery Performance—The Applicant would create a full-time position for a hatchery evaluation biologist within one year after the license was issued.

Cost Estimates

The Applicant estimates the following costs associated with controlling pathogens:

Action	Cost (30 years)
Engineering design and construction	$ 6,300,000
O&M ($7,000 per year after the first year of the license)	$ 203,000
Total	$ 6,503,000

The Applicant estimates the following costs associated with developing a locally adapted steelhead broodstock:

Action	Cost (30 years)
Engineering design and construction	$ 20,000
O&M for 10 years ($15,000 per year)	$ 150,000
Total	$ 170,000

The Applicant estimates the following costs associated with monitoring and evaluating hatchery performance:

Action	Cost (30 years)
O&M ($50,000 per year after the first year of the license)	$ 1,450,000

Location Map

A general location map of the Pahsimeroi Fish Hatchery is shown in Figure E.3.1-3. Plan views of the Upper and Lower Pahsimeroi Fish Hatchery facilities are shown in Figure E.3.1-9 and Figure E.3.1-10.

E.3.1.3.2.2.2. Improvements to Oxbow Fish Hatchery

The Applicant proposes five improvements at the Oxbow Fish Hatchery: construction of adult holding pond and spawning facilities, expansion of the fall chinook rearing program, distribution of carcasses, general upgrades to the hatchery facilities, and monitoring and evaluation of hatchery performance. The Applicant also proposes to remove the floating barge trap located below Hells Canyon Dam. Each of the improvements is discussed below.

Justification

Construction of Adult Holding Pond and Spawning Facilities—The current adult holding pond and spawning facilities at Oxbow Fish Hatchery (Technical Report E.3.1-4) were constructed in 1965. While the pond design may have been state-of-the-art technology when the ponds were constructed, the design is inefficient by today's hatchery standards. Sorting, spawning, and hauling operations are labor intensive and impose unnecessary stress on fish. In addition, equipment maintenance and employee safety issues are difficult to address given the age and condition of the mechanical equipment.

Expansion of the Fall Chinook Rearing Program—Initial efforts to rear fall chinook at Oxbow Fish Hatchery met with limited success because of water quality and fish health issues (Technical Report E.3.1-4). More recent efforts incorporating the use of groundwater for incubation and early rearing show greater promise. However, the current production capacity is only about 200,000 subyearling smolts. Expanding the fall chinook program to 1 million smolts annually would allow the Applicant to contribute to efforts in stock recovery and harvest augmentation that are being developed by NMFS and other resource agencies for the Snake River downstream of Hells Canyon Dam.

Distribution of Carcasses—The loss of anadromous salmonids to tributaries within the HCC led to the loss of marine-derived nutrients that had previously been imported every year in the form of salmon carcasses. Carcasses were used by both terrestrial and aquatic life through primary and secondary pathways (Cederholm et al. 1999). Effects of this loss probably vary among drainages, depending on other sources of nutrients available through natural basin characteristics or human activities. The loss of nutrients has possibly directly affected the productivity of bull trout and other native salmonids, especially within the rearing areas. Each year, as part of the mitigation hatchery program, adult salmon and steelhead carcasses are sent to landfills. Under this measure, carcasses (or a suitable substitute) would be distributed above and within known bull trout rearing areas in the Pine–Indian–Wildhorse core area to enhance the forage base available to rearing salmonids.

General Upgrades to the Hatchery Facilities—From a fish culture perspective, much of the equipment and many of the structures at Oxbow Fish Hatchery are antiquated or deteriorated to the point that maintenance costs exceed equipment value. The condition and serviceability of Oxbow Fish Hatchery do not meet standards met by other hatcheries of comparable size and scope.

Removal of Floating Barge Trap—Before a permanent trapping structure was constructed below Hells Canyon Dam in 1983, floating barge traps were used to capture adult salmon and steelhead for hatchery purposes. As required by the *Hells Canyon Settlement Agreement*, the Applicant has maintained one floating barge trap to be used as necessary to supplement capture of adult salmon and steelhead. The permanent trap has been demonstrated to be highly efficient, thereby eliminating the need for a secondary trap. Since operation of the permanent trapping facility began in 1983, operation of the floating barge trap has been unnecessary to meet agency requests for adult capture.

Monitoring and Evaluation of Hatchery Performance—The Applicant's current mitigation hatchery program has no monitoring and evaluation component. Therefore, the IDFG is limited in its ability to evaluate hatchery performance for smolt-to-adult survival, stray rates, harvest contribution, and other criteria. Recent controversy over the effectiveness of hatchery programs suggests that ongoing monitoring and evaluation are necessary to improve the likelihood that desired program goals and objectives are attained.

Goals

Construction of Adult Holding Pond and Spawning Facilities—Several goals are associated with this measure. The first is to design and construct adult holding and spawning facilities appropriate to the scope of activities associated with spring chinook, steelhead, and fall chinook broodstock operations, while also allowing flexibility for future alterations. The second goal is to provide facilities that meet modern standards for fish culture techniques and fish health. The final goal is to provide facilities that meet all state standards for security, as well as employee and public safety.

Expansion of the Fall Chinook Rearing Program—The goal of this measure is to provide facilities capable of rearing up to 1 million subyearling fall chinook smolts annually for release into the Snake River.

Distribution of Carcasses—The goal of this measure is to distribute the carcasses of spawned steelhead into selected Snake River tributary basins for nutrient enrichment. Carcass analogs may be substituted, if appropriate. Ultimately, this effort would enhance the forage base within bull trout rearing areas by supplying these areas with nutrients for primary and secondary uptake.

General Upgrades to the Hatchery Facilities—The goal of this measure is to provide structures and equipment necessary to meet the scope of work for Oxbow Fish Hatchery safely and efficiently. All structures and equipment would meet accepted hatchery standards and compare well with other regional hatcheries of similar size and scope.

Removal of Floating Barge Trap—The goal of this measure is to eliminate equipment that is no longer needed for hatchery operation.

Monitoring and Evaluation of Hatchery Performance—The goal of this measure is to monitor and report performance of hatchery-reared fish relative to state, federal, and tribal fisheries management goals. Examples might include evaluation of harvest contribution, stray rates and locations, optimal smolt size at release, optimal release timing and rates of residualism under various release strategies. Findings from this work would be used to make improvements to hatchery operation and to maximize benefits while limiting potential negative impacts.

Descriptions

Construction of Adult Holding Pond and Spawning Facilities—With input from state resource agency personnel, the Applicant proposes to design and construct concrete holding ponds and spawning facilities for adult salmon and steelhead to meet the needs of the spring chinook, steelhead, and fall chinook mitigation programs. Structures would probably be similar in overall design and function to those found at other anadromous broodstock hatcheries in the region. All structures would meet standards set by the Integrated Hatchery Operations Team for density and flow indices, sanitation, and fish health. In addition, all structures would be designed so that adult salmon and steelhead can be segregated, crowded, and held by species, sex, listing status, or intended use.

Expansion of the Fall Chinook Rearing Program—With input from state resource agency personnel, the Applicant proposes to design and construct hatchery facilities—including groundwater wells, fish rearing containers, feed storage facilities, and predator control devices—necessary for the production of up to 1 million subyearling fall chinook. Facilities would also be designed to accommodate fish transport vehicles and fish-marking equipment provided by the IDFG.

Distribution of Carcasses—The Applicant proposes to distribute carcasses above and within known bull trout rearing areas in the Pine–Indian–Wildhorse core area to enhance the forage base available to rearing salmonids. This measure can only be implemented after risk of pathogen introduction is considered as part of an overall pathogen risk assessment plan (see section E.3.1.3.2.1.1.).

General Upgrades to the Hatchery Facilities—With input from state resource agency personnel, the Applicant proposes to design and construct a hatchery building with offices, maintenance shop, housing for temporary employees, egg incubation facilities, and general storage. Additional facility upgrades would include design and construction of a hatcherywide alarm system, visitor information kiosk, buildings for general equipment and chemical storage, and security fencing. The access road would also be resurfaced.

Monitoring and Evaluation of Hatchery Performance—The Applicant proposes to employ a full-time hatchery evaluation biologist to manage evaluation studies for all mitigation hatcheries. The biologist hired for this position would work closely with resource agency staff to design and conduct appropriate studies, as well as to collect and analyze necessary data. Using study results, the Applicant would then work with the IDFG to modify hatchery operations as necessary to maximize hatchery benefits.

Associated Benefits

Construction of Adult Holding Pond and Spawning Facilities—No associated benefits are anticipated.

Expansion of the Fall Chinook Rearing Program—No associated benefits are anticipated.

Distribution of Carcasses—Associated benefits beyond enhancing bull trout rearing area include benefits to other aquatic life and terrestrial life that historically relied on this annual pulse of nutrients.

General Upgrades to the Hatchery Facilities—Improved appearance of, function of, and public access to the Oxbow Fish Hatchery facility would enhance public relations for both the Applicant and the IDFG and promote public understanding of fisheries issues.

Removal of Floating Barge Trap—No associated benefits are anticipated.

Monitoring and Evaluation of Hatchery Performance—Knowledge gained from this effort may apply to other hatchery programs within the region.

Implementation or Construction Schedules

Construction of Adult Holding Pond and Spawning Facilities—Engineering designs for adult holding and spawning facilities would be developed within one year after the license was issued. These designs would be developed concurrently with the design of fall chinook rearing facilities and general hatchery upgrades. Construction would begin within two years, and the facility would be ready for operation in the third year after the license was issued.

Expansion of the Fall Chinook Rearing Program—Engineering designs for well construction and associated fall chinook rearing containers would be developed within one year after the license was issued. These designs would be developed together with the design of adult holding and spawning facilities and general hatchery upgrades. Construction would begin within two years, and the facility would be ready for operation in the third year after the license was issued.

Distribution of Carcasses—Outplanting of anadromous carcasses can be implemented after the pathogen risk assessment has been completed and resulting actions approved. The pathogen risk assessment would be implemented immediately after the license was issued. Then a specific stream reach may be selected and monitored over a five-year period for responses such as growth, condition factor, or density of bull trout for comparison with a similar stream system not receiving carcass plants. Carcasses would be distributed annually following spawning activities at the Applicant's hatchery facilities. At the end of the five-year monitoring period, the Applicant would evaluate the potential benefit of the program.

General Upgrades to the Hatchery Facilities—Engineering designs for a new hatchery building and associated site improvements would be developed within one year after the license was issued. Construction would begin within two years, and the facility would be ready for operation in the third year after the license was issued.

Removal of Floating Barge Trap—The barge trap would be dismantled and removed from the project area within one year after the license was issued.

Monitoring and Evaluation of Hatchery Performance—The Applicant proposes to create a full-time position for a hatchery evaluation biologist within one year after the license was issued.

Cost Estimates

The Applicant estimates the following costs associated with constructing adult holding pond and spawning facilities:

Action	Cost (30 years)
Engineering design and construction	$ 2,250,000
O&M ($2,000 per year after the first year of the license)	$ 58,000
Total	$ 2,308,000

The Applicant estimates the following costs associated with expanding the fall chinook rearing program:

Action	Cost (30 years)
Engineering design and construction	$ 2,500,000
O&M ($10,000 per year after the first year of the license)	$ 290,000
Total	$ 2,790,000

The Applicant estimates the following costs associated with distributing carcasses:

Action	Cost (30 years)
Capital investment in equipment	$ 33,000
O&M ($20,000 per year after the first year of the license)	$ 580,000
Total	$613,000

The Applicant estimates the following costs associated with upgrading the hatchery facilities:

Action	Cost (30 years)
Engineering design and construction	$ 500,000
O&M ($5,000 per year after the first year of the license)	$ 145,000
Total	$ 645,000

The Applicant estimates the following costs associated with monitoring and evaluating hatchery performance:

Action	Cost (30 years)
O&M ($50,000 per year after the first year of the license)	$ 1,450,000

Location Map

A general location map of Oxbow Fish Hatchery is shown in Figure E.3.1-3. A plan view of the Oxbow Fish Hatchery is shown in Figure E.3.1-5.

E.3.1.3.2.2.3. Improvements to Niagara Springs Fish Hatchery

The Applicant proposes five improvements at Niagara Springs Fish Hatchery: expansion of the hatchery building, acquisition of an additional smolt tanker, acquisition of a fish marking unit, upgrade of employee housing, and monitoring and evaluation of hatchery performance. Each of these improvements is discussed below.

Justification

Expansion of Hatchery Building—The current Niagara Springs Fish Hatchery building was constructed in 1966. It houses an office, shop, feed storage area, and egg incubation/nursery rearing area. Incubation and nursery rearing capacity (in both space and water volume) is marginally adequate for proper incubation and early rearing. Newly hatched steelhead fry quickly exceed recommended density and flow indices and must be moved to outdoor raceways prematurely. Overcrowding or excessive handling at this life stage is stressful and renders fry susceptible to disease. In addition, work space is insufficient for four full-time and two or three seasonal employees.

Acquisition of Additional Smolt Tanker—The Applicant currently owns two 5,000-gallon-capacity smolt tanker trailers. These trailers are used for approximately 47 days each spring to haul spring chinook, fall chinook, and steelhead smolts to various release locations. Transporting steelhead smolts dominates this effort, taking up to 45 days to complete. The IDFG suggests that this time should be reduced by 50% to enhance outmigration survival and reduce residualism (Chapman et al. 2000). The addition of one trailer would reduce the number of days required to transport steelhead smolts to 30.

Acquisition of Fish-Marking Unit—Fish marking is the foundation of many monitoring and evaluation activities. With the advent of ESA and mass marking for identifying hatchery fish for monitoring and selective fishery implementation, marking demands have increased substantially in recent years. Existing marking equipment owned by IDFG is insufficient to support current production at the Applicant's facilities, as well as proposed monitoring and evaluation programs. Additional equipment would be needed to meet increasing marking demands and ensure that fish could be marked with minimal handling and stress.

Upgrade of Employee Housing—The Applicant now provides one 14 × 70-foot, three-bedroom, one-bathroom mobile home for seasonal employees who are hired from outside the immediate vicinity. This facility is inadequate for hatchery needs since repair and maintenance costs exceed the value of the residence.

Monitoring and Evaluation of Hatchery Performance—The Applicant's current mitigation hatchery program has no monitoring and evaluation component. Therefore, the IDFG is limited in its ability to evaluate hatchery performance for smolt-to-adult survival, stray rates, harvest contribution, and other criteria. Recent controversy over the effectiveness of hatchery programs suggests that ongoing monitoring and evaluation are necessary to improve the likelihood that desired program goals and objectives are attained.

Goals

Expansion of Hatchery Building—The Applicant seeks to achieve two goals by implementing this measure. The first goal is to provide a hatchery building with adequate space and water volume to rear up to 2.1 million steelhead to a length of 2.5 inches before they are transferred to outdoor raceways. The second goal is to provide shop, feed storage, and employee work space that is consistent with the scope of hatchery operations and staffing.

Acquisition of Additional Smolt Tanker—The goal of this measure is to purchase one additional 5,000-gallon-capacity fish tanker trailer for use in transporting spring chinook, fall chinook, and steelhead smolts to various release sites.

Acquisition of Fish-Marking Unit—The goal of this measure is to purchase one fish-marking unit capable of clipping the adipose fins and tagging fish with coded wire. The availability of this additional equipment would allow the IDFG to mark more fish in a shorter time period and with less stress than was previously possible.

Upgrade of Employee Housing—The goal of this measure is to provide seasonal employee housing for up to four people, a size that compares with housing provided at other hatcheries in the region.

Monitoring and Evaluation of Hatchery Performance—The goal of this measure is to monitor and report performance of hatchery-reared fish relative to state, federal, and tribal fisheries management goals. Examples might include evaluation of harvest contribution, stray rates and locations, optimal smolt size at release, optimal release timing, and rates of residualism under various release strategies. Findings from these efforts would be used to improve hatchery operations and maximize benefits while limiting potentially negative effects.

Descriptions

Expansion of Hatchery Building—With input from state resource agency personnel, the Applicant proposes to design and construct a new incubation and nursery rearing area. The Applicant also proposes to design and construct a larger shop, feed storage area, and office facilities. These office facilities would include larger work stations and a dedicated conference room. The Applicant has not yet determined whether these enhancements would be modifications to the existing building or construction of a new building.

Acquisition of Additional Smolt Tanker—The Applicant proposes to contract with a reputable vendor to design and fabricate a smolt tanker trailer virtually identical to those currently owned and operated by the Applicant.

Acquisition of Fish-Marking Unit—The Applicant proposes to contract with a reputable vendor to design and fabricate a portable fish-marking unit similar to those currently used by the IDFG. Advancements in technology would be incorporated where possible.

Upgrade of Employee Housing—The Applicant proposes to design and construct a four-bedroom house. Housing would be complete with kitchen, dining room, living room, and separate bathrooms for men and women.

Monitoring and Evaluation of Hatchery Performance—The Applicant proposes to employ a full-time hatchery evaluation biologist to manage evaluation studies for all mitigation hatcheries. The biologist hired for this position would work closely with resource agency staff to design and conduct appropriate studies, as well as to collect and analyze necessary data. Using study results, the Applicant would then work with the IDFG to modify hatchery operations as necessary to maximize hatchery benefits.

Associated Benefits

Expansion of Hatchery Building—An associated benefit is increased efficiency in hatchery operations.

Acquisition of Additional Smolt Tanker—Because of a decreased number of days required to remove steelhead smolts from Niagara Springs Fish Hatchery, sanitation may be improved between brood years.

Acquisition of Fish-Marking Unit—An associated benefit would be reduced workload among other IDFG marking units.

Upgrade of Employee Housing—Providing better housing may allow the IDFG to attract skilled employees from outside the vicinity.

Monitoring and Evaluation of Hatchery Performance—Knowledge gained from this effort may apply to other hatchery programs within the region.

Implementation or Construction Schedules

Expansion of Hatchery Building—Engineering designs for expansions to the hatchery building would be developed within two years after the license was issued. Construction would begin within three years of license issuance.

Acquisition of Additional Smolt Tanker—A contract for fabrication of a smolt tanker trailer would be developed within two years after the license was issued. The tanker would be ready for use within three years of license issuance.

Acquisition of Fish-Marking Unit—A contract for fabrication of a fish-marking unit would be developed within two years after the license was issued. The marking unit would be ready for use within three years after license issuance.

Upgrade of Employee Housing—Engineering designs for the employee housing would be developed within two years after the license was issued. Construction would begin within three years of license issuance.

Monitoring and Evaluation of Hatchery Performance—The Applicant would create a full-time position for a hatchery evaluation biologist within one year after the license was issued.

Cost Estimates

The Applicant estimates the following costs associated with expanding the hatchery building:

Action	Cost (30 years)
Engineering design and construction	$ 1,000,000
O&M ($5,000 per year after the first year of the license)	$ 145,000
Total	$ 1,145,000

The Applicant estimates the following costs associated with acquiring an additional smolt tanker:

Action	Cost (30 years)
Engineering design and fabrication	$ 300,000
O&M ($5,000 per year after the first year of the license)	$ 145,000
Total	$ 445,000

The Applicant estimates the following costs associated with acquiring a fish-marking unit:

Action	Cost (30 years)
Engineering design and fabrication	$ 750,000
O&M ($5,000 per year after the first year of the license)	$ 725,000
Total	$ 1,475,000

The Applicant estimates the following costs associated with upgrading employee housing:

Action	Cost (30 years)
Engineering design and construction	$ 250,000
O&M ($5,000 per year after the first year of the license)	$ 145,000
Total	$ 395,000

The Applicant estimates the following costs associated with monitoring and evaluating hatchery performance:

Action	Cost (30 years)
O&M ($50,000 per year after the first year of the license)	$ 1,450,000

Location Map

A general location map of the Niagara Springs Fish Hatchery is shown in Figure E.3.1-3. A plan view of the Niagara Springs Fish Hatchery is shown in Figure E.3.1-8.

E.3.1.3.2.2.4. Improvements to Rapid River Fish Hatchery

The Applicant proposes six improvements at Rapid River Fish Hatchery: construction of an adult holding pond and spawning facility, distribution of carcasses, an upgrade of employee housing, a general upgrade of hatchery facilities, construction of an off-site smolt acclimation/adult collection facility, and monitoring and evaluation of hatchery performance. Each of these improvements is discussed below.

Justification

Construction of Adult Holding Pond and Spawning Facilities—The current adult holding ponds and spawning facilities at Rapid River Fish Hatchery (Technical Report E.3.1-4) were constructed in 1966 and are inefficient by today's hatchery standards. Sorting and spawning operations are labor intensive and impose unnecessary stress on fish. In addition, the ponds cannot be properly disinfected. The IDFG has demonstrated that prespawning mortality is higher in earthen holding ponds than that observed for conventional concrete holding facilities.

Distribution of Carcasses—The loss of anadromous salmonids to tributaries within the HCC led to the loss of marine-derived nutrients that had previously been imported every year in the form of salmon carcasses. Carcasses were used by both terrestrial and aquatic life through primary and secondary pathways (Cederholm et al. 1999). Effects of this loss probably vary among drainages, depending on other sources of nutrients available through natural basin characteristics or human activities. The loss of nutrients has possibly directly affected the productivity of bull trout and other native salmonids, especially within the rearing areas. Each year, as part of the mitigation hatchery program, adult salmon and steelhead carcasses are sent to landfills. Under this measure, carcasses (or a suitable substitute) would be distributed above and within known bull trout rearing areas in the Pine–Indian–Wildhorse core area to enhance the forage base available to rearing salmonids.

Upgrade of Employee Housing—The Applicant currently provides one 14 × 70-foot, three-bedroom, two-bathroom mobile home for seasonal employees who are hired from outside the immediate vicinity. This facility is inadequate to meet hatchery needs. Repair and maintenance costs exceed the value of the equipment.

General Upgrades to Hatchery Facilities—Rapid River Fish Hatchery has been in operation for nearly 40 years. Many of the hatchery structures and features are outdated or inadequate by today's hatchery standards. Improvements would increase operational efficiency and worker safety.

Construction of Smolt Acclimation/Adult Collection Facility—While current recreational fisheries for spring chinook salmon originating at the Rapid River Fish Hatchery include approximately 25 miles of the Little Salmon River, the majority of angling effort is concentrated in approximately 4 miles of the Little Salmon River located between the mouth of Rapid River and the confluence with the main Salmon River. Construction of an acclimation facility on the Little Salmon River (above the mouth of Rapid River, between approximately RM 18.6 and RM 21.1) would provide an alternate site for the IDFG to release a portion of the hatchery's smolt production. Returning adult spring chinook would then be distributed over a larger area, providing greater harvest opportunity for recreational and tribal anglers. Construction of an adult collection facility (trap) at the same location would provide an additional opportunity to collect hatchery broodstock. Currently, the IDFG releases most spring chinook smolts directly from Rapid River Fish Hatchery to ensure adequate broodstock escapement. An additional adult collection facility would facilitate larger off-site smolt releases and improve harvest opportunities, without risk of creating inadequate adult returns for broodstock purposes.

Monitoring and Evaluation of Hatchery Performance—The Applicant's current mitigation hatchery program has no monitoring and evaluation component. Therefore, the IDFG is limited in its ability to evaluate hatchery performance for smolt-to-adult survival, stray rates, harvest contribution, and other criteria. Recent controversy over the effectiveness of hatchery programs suggests that ongoing monitoring and evaluation are necessary to improve the likelihood that desired program goals and objectives are attained.

Goals

Construction of Adult Holding Pond and Spawning Facilities—The goal of this measure is to provide facilities that meet modern standards for fish culture techniques and fish health.

Distribution of Carcasses—The goal of this measure is to distribute the carcasses of spawned steelhead into selected Snake River tributary basins for nutrient enrichment. Carcass analogs may be substituted, if appropriate. Ultimately, this effort would enhance the forage base within bull trout rearing areas by supplying these areas with nutrients for primary and secondary uptake.

Upgrade of Employee Housing—The goal of this measure is to provide seasonal employee housing for up to four people, a size that compares favorably with housing provided at other hatcheries in the region.

General Upgrades to Hatchery Facilities—The goal of this measure is to provide structures and equipment necessary to meet the scope of work for Rapid River Fish Hatchery safely and efficiently. All structures and equipment would meet accepted hatchery standards and be comparable to those of other regional hatchery facilities of similar size and scope.

Construction of Smolt Acclimation/Adult Collection Facility—The goal of this measure is to distribute returning hatchery-origin adult spring chinook over a larger area to enhance harvest opportunity for recreational and tribal anglers.

Monitoring and Evaluation of Hatchery Performance—The goal of this measure is to monitor and report performance of hatchery-reared fish relative to state, federal, and tribal fisheries management goals. Examples might include evaluation of harvest contribution, stray rates and locations, optimal smolt size at release, optimal release timing, and rates of residualism under various release strategies. Findings from these efforts would be used to improve hatchery operations and maximize benefits while limiting potentially negative effects.

Descriptions

Construction of Adult Holding Pond and Spawning Facilities—With input from state resource agency personnel, the Applicant proposes to design and construct concrete adult salmon holding ponds and spawning facilities that meet the needs of the spring chinook mitigation program. Structures would probably be similar in overall design and function to those found at other anadromous broodstock hatcheries in the region. All structures would meet standards set by the Integrated Hatchery Operations Team for density and flow indices, sanitation, and fish health.

Distribution of Carcasses—The Applicant proposes to distribute carcasses above and within known bull trout rearing areas in the Pine–Indian–Wildhorse core area to enhance the forage base available to rearing salmonids. This measure can only be implemented after risk of pathogen introduction is considered as part of an overall pathogen assessment plan (see section E.3.1.3.2.1.1.).

Upgrade of Employee Housing—The Applicant proposes to design and construct a four-bedroom house. Housing would be complete with kitchen, dining room, living room, and separate bathrooms for men and women.

General Upgrades to Hatchery Facilities—With input from state resource agency personnel, the Applicant proposes to make numerous upgrades to Rapid River Fish Hatchery. These upgrades include expanding the existing egg incubation and office/shop buildings to provide more work space, replacing the hatchery water diversion structure, constructing a visitor center complete with handicap-accessible public restrooms, remodeling full-time employee residences, installing an automatic sprinkler system for the hatchery grounds and park, and resurfacing of all hatchery roads.

Construction of Smolt Acclimation/Adult Collection Facility—With input from state resource agency personnel, the Applicant proposes to acquire sufficient property and design and construct a smolt acclimation facility in the vicinity of Stinky Springs (RM 18.6 to RM 21.1) on the Little Salmon River. Facilities would be capable of accommodating approximately 300,000 spring chinook smolts for acclimation and volitional release. The Applicant also proposes to construct a fish ladder and adult collection facility at the same location. Adults trapped at this site would be loaded onto trucks and transferred daily to holding facilities at Rapid River Fish Hatchery.

Monitoring and Evaluation of Hatchery Performance—The Applicant proposes to employ a full-time hatchery evaluation biologist to manage evaluation studies for all mitigation hatcheries. The biologist hired for this position would work closely with resource agency staff to design and conduct appropriate studies, as well as to collect and analyze necessary data. Using study results, the Applicant would then work with the IDFG to modify hatchery operations as necessary to maximize hatchery benefits.

Associated Benefits

Construction of Adult Holding Pond and Spawning Facilities—Improved holding conditions may enable hatchery personnel to reduce chemicals currently used to control fungal infections in adult chinook.

Distribution of Carcasses—Associated benefits beyond enhancing bull trout rearing areas include benefits to other aquatic life and terrestrial life that historically relied on this annual pulse of nutrients.

Upgrade of Employee Housing—Skilled labor in the vicinity of Rapid River Fish Hatchery is difficult to find. By providing better housing accommodations, the IDFG may be able to attract skilled employees from outside the immediate vicinity.

General Upgrades to Hatchery Facilities—Improved appearance, function, and public access to Rapid River Fish Hatchery would enhance public relations for both the Applicant and IDFG and promote public awareness of fisheries issues.

Construction of Smolt Acclimation/Adult Collection Facility—No associated benefits are anticipated.

Monitoring and Evaluation of Hatchery Performance—Knowledge gained from this effort may apply to other hatchery programs within the region.

Implementation or Construction Schedules

Construction of Adult Holding Pond and Spawning Facilities—Engineering designs for adult holding and spawning facilities would be developed within one year, construction would begin within two years, and the facility would be ready for operation in the third year after the license was issued.

Distribution of Carcasses—Outplanting of anadromous carcasses can be implemented after the pathogen risk assessment has been completed and resulting actions approved. The pathogen risk assessment would be implemented immediately after the license was issued. Then a specific stream reach could be selected and monitored over a five-year period for responses such as growth, condition factor, or density of bull trout for comparison with a similar stream system not receiving carcass plants. Carcasses would be distributed annually following spawning activities at the Applicant's hatchery facilities. At the end of the five-year monitoring period, the Applicant would evaluate the potential benefit of the program.

Upgrade of Employee Housing—Engineering designs for employee housing would be developed within two years after the license was issued. Construction would begin within three years of issuance.

General Upgrades to Hatchery Facilities—Engineering design for all items identified for this measure would be developed within two years after the license was issued. Construction would begin within three years of license issuance.

Construction of Smolt Acclimation/Adult Collection Facility—Efforts to purchase property would begin within one year after the license was issued. Engineering design would begin immediately following property acquisition and be completed within one year. Construction is anticipated to take an additional year to complete.

Monitoring and Evaluation of Hatchery Performance—The Applicant would create a full-time position for a hatchery evaluation biologist within one year after the license was issued.

Cost Estimates

The Applicant estimates the following costs associated with constructing adult holding pond and spawning facilities:

Action	Cost (30 years)
Engineering design and construction	$ 1,250,000
O&M ($2,000 per year after the first year of the license)	$ 58,000
Total	$ 1,308,000

The Applicant estimates the following costs associated with distributing carcasses:

Action	Cost (30 years)
Capital investment in equipment	$ 33,000
O&M ($20,000 per year after the first year of the license)	$ 580,000
Total	$613,000

The Applicant estimates the following costs associated with upgrading employee housing:

Action	Cost (30 years)
Engineering design and construction	$ 50,000
O&M ($5,000 per year after the first year of the license)	$ 145,000
Total	$ 195,000

The Applicant estimates the following costs associated with making general upgrades to hatchery facilities:

Action	Cost (30 years)
Engineering design and construction	$ 750,000
O&M ($5,000 per year after the first year of the license)	$ 145,000
Total	$ 895,000

The Applicant estimates the following costs associated with construction of the smolt acclimation/adult collection facility:

Action	Cost (30 years)
Engineering design and construction	$ 1,000,000
O&M ($10,000 per year after the first year of the license)	$ 290,000
Total	$ 1,290,000

The Applicant estimates the following costs associated with monitoring and evaluating hatchery performance:

Action	Cost (30 years)
O&M ($50,000 per year after the first year of the license)	$ 1,450,000

Location Map

A general location map of the Rapid River Fish Hatchery is shown in Figure E.3.1-3. A plan view of the Rapid River Fish Hatchery is shown in Figure E.3.1-7.

E.3.1.3.2.3. Snake River White Sturgeon Conservation Plan

The Applicant proposed the *Snake River White Sturgeon Conservation Plan* (WSCP) as a means of developing and implementing conceptual protection, mitigation, and enhancement (PM&E) measures directed at white sturgeon populations for impacts of mainstem Snake River hydroelectric projects operated by the company. The WSCP (IPC 2003) evolved from the recognition that many aspects of Snake River white sturgeon life history and behavior were poorly understood and that factors influencing the health and viability of these populations likely operated differently among reaches. In addition, because little information was available for sturgeon populations in most of the river segments, how actions in one reach might influence the population in another reach was difficult to assess.

The Applicant conducted sturgeon population assessments in the Snake River from Shoshone Falls downstream to the confluence of the Snake and Salmon rivers from 1991 to 2001.

While obtaining information on population status and resource issues across many reaches has involved a tremendous time commitment, this holistic approach has allowed for the development of riverwide measures that are anticipated to provide overall the greatest benefits to Snake River white sturgeon. The White Sturgeon Technical Advisory Committee (WSTAC) was also established in 1991 to provide technical guidance with white sturgeon research activities undertaken by the Applicant during its relicensing efforts. Since its formation, representatives from state, federal, and tribal entities have participated in WSTAC meetings to review study results and resource issues affecting Snake River white sturgeon. During this time, information presented at WSTAC meetings included 1) status surveys of Snake River sturgeon populations, 2) limiting factors for each reach, and 3) modeled results of the population viability analysis (PVA) specific to reaches of the Snake River. In addition, WSTAC participants developed a list of PM&E measures and discussed recommended PM&E measures. All of this information has formed the basis on which the WSTAC developed recommended measures for the Applicant to include in the WSCP and submit to FERC.

The WSCP (IPC 2003) is intended to serve as a master plan for guiding the implementation of feasible mitigation measures for Snake River white sturgeon populations impacted by the Applicant's hydroelectric projects. These measures are designed to help ensure their long-term persistence and restore opportunities for beneficial use. The geographic scope of the WSCP includes the Snake River from Shoshone Falls (the natural upstream boundary at RM 614) downstream to Lower Granite Dam (RM 107.5). The WSCP describes measures and strategies for Snake River white sturgeon that the Applicant would implement once the plan is accepted and new project licenses are issued by FERC. Effective implementation of the WSCP would require continuing adaptation based on research and monitoring of sturgeon status, limiting factors, and population responses to potential mitigation measures. This WSCP should not be viewed as a management plan, nor is it intended to replace existing management plans for Snake River white sturgeon. The Applicant recognizes the jurisdiction and management and protection responsibilities of state fish and wildlife agencies and Native American tribes. The following descriptions of proposed mitigation measures are those measures proposed (as defined in the WSCP [IPC 2003]) for white sturgeon in reaches associated with the HCC.

E.3.1.3.2.3.1. Assessment of Water Quality-Related Impacts on Early Life Stages of White Sturgeon in the Swan Falls Dam–Brownlee Reach

Justification

The reach between Swan Falls Dam and Brownlee Dam (also known as the Swan Falls–Brownlee reach) is characterized as having 117.7 miles of free-flowing river and associated habitat, the longest free-flowing section remaining in the Snake River. The reach terminates in Brownlee Reservoir, the largest storage reservoir in the HCC. Of the free-flowing section, the upper 13.7 miles immediately downstream of Swan Falls Dam to Walters Ferry appear to have many of the hydrologic and geomorphologic characteristics necessary for sturgeon spawning and rearing (Chandler and Lepla 1997, Chapter 2 of Technical Report E.3.1-6). The middle 104-mile segment of this reach is characterized by numerous shallow, braided island channels with infrequent pools. Some areas within this section are suitable for sturgeon rearing. Although the lower impounded section is seasonally suitable for sturgeon rearing, it develops large areas of unsuitable dissolved oxygen conditions during most years (Technical Report E.2.2-2).

Comparison of population assessments (Reid et al. 1973, Reid and Mabbot 1987, Chapter 1 of Technical Report E.3.1-6) has shown that sturgeon abundance between Swan Falls and Brownlee dams has changed little since the 1970s and that the population still consists primarily of subadult and adult fish (Chapter 1 of Technical Report E.3.1-6). Despite the presence of suitable hydrology and physical habitats expected to support population maintenance and growth (Chandler and Lepla 1997), sturgeon recruitment in this reach of the Snake River has been largely unsuccessful (Chapter 1 of Technical Report E.3.1-6). Results from movement and spawning studies suggest that, although spawning is successful (since fertile eggs were collected during the studies), the resulting effort is unrecognized in the stock structure. This poor recruitment is probably a result of poor water quality conditions in the Swan Falls–Brownlee reach. Results of a PVA model of factors controlling white sturgeon recruitment in the Snake River indicated that water quality was the primary factor limiting sturgeon between Swan Falls and Brownlee dams and that restoring recruitment would be unattainable unless water quality conditions were improved (Chapter 3 of Technical Report E.3.1-6).

Degraded water quality in the lower section of this reach (Brownlee Reservoir) has historically impacted white sturgeon. During July 1990, at least 28 adult white sturgeon were killed near the upper end of the reservoir (transition zone) as a result of lethal dissolved oxygen conditions of less than 1 mg/l (IDFG 1990). High summer temperatures combined with high nutrient loading have been identified as contributors to the lethal conditions. Brownlee Reservoir's in-reservoir processing of these nutrient influxes—coming from agricultural activity and municipal wastes flowing in from the surrounding watersheds—typically culminates in severely degraded water quality during dry and normal hydrologic years. Only in wet years are summer inflows high enough to prevent large amounts of algae from accumulating and producing anoxic conditions in the reservoir (Technical Report E.2.2-2.). The Applicant has proposed to improve dissolved oxygen levels in Brownlee Reservoir as part of its relicensing efforts for the HCC (see section E.2.4.2.1.).

Improvements to water quality in the riverine section between Swan Falls Dam and Brownlee Reservoir are also currently being developed through processes for the draft *Middle Snake River–Succor Creek Total Maximum Daily Load* (IDEQ 2002) and *Snake River–Hells Canyon Total Maximum Daily Load*[9] (the latter of which is referred to in this exhibit as the draft TMDL) (IDEQ and ODEQ 2001). Pollutants identified in the 303 (d) listing of the river segment between Swan Falls Dam and Brownlee Reservoir include bacteria, pesticides, nutrients, nuisance algae, mercury, sediment, temperature, and dissolved oxygen (IDEQ and ODEQ 2001). However, given the basin size and complexity of issues encompassed by these TMDLs (varying hydrology, pollutant processing, transport characteristics, anthropogenic influences, and others), the extent of and time frame for water quality improvement is uncertain.

The effects that degraded water quality has had on white sturgeon recruitment in the riverine section of this reach are still poorly understood. When considering the life history strategies that sturgeon use, biologists suspect that recruitment breaks down in the early life stages, the most fragile and variable for sturgeon. Further investigation regarding degraded water quality in riverine habitats associated with early life stage development should be conducted to determine whether contaminants and water temperature are contributing to poor recruitment. For instance, studies conducted in the Kootenai River have shown very high mortality of incubating white sturgeon eggs that have been coated with suspended solids and then incubated in unfiltered water from the Kootenai River. Organic matter and contaminants from suspended solids and river water

9. All references to the draft Snake River–Hells Canyon TMDL are based on the December 2001 draft.

were likely the primary sources of bacteria and fungi and contributed to low survival of the embryos (Kruse 2000). The Swan Falls–Brownlee reach receives very high organic loading from the surrounding watersheds (Harrison et al. 1999, Technical Report E.2.2-2). This additional burden may be affecting the survival of incubating sturgeon eggs. Additionally, the bioaccumulation of contaminants in adult sturgeon may be passed through the eggs or sperm and affect the embryos, although the overall effect of these pollutants on sturgeon reproduction and survival is largely unknown.

Identifying the impact that degraded water quality has on early life stage survival may lead us to a clearer understanding of the mechanisms influencing recruitment within this sturgeon population. Identifying the factors, specific to the early life stages, that is limiting recruitment would be crucial for determining appropriate follow-up measures to restore white sturgeon in the Swan Falls–Brownlee reach. For instance, if study results show that water quality is not limiting early life stage survival, then translocation efforts (section E.3.1.3.2.3.2.) to increase sturgeon productivity may be a desirable option. However, if early life survival cannot be supported under existing water quality conditions, then hatchery supplementation (section E.3.1.3.2.3.3.) using conservation aquaculture practices may be an interim measure to increase population abundance until habitats are restored.

Objective

The objective[10] of this measure is to assess potential effects of water quality on early life stage survival of white sturgeon in the Swan Falls–Brownlee reach.

Description

The impacts of degraded water quality in the Swan Falls–Brownlee reach would be evaluated for the egg, larval, and young-of-year life stages of white sturgeon. Evaluations on egg survival would focus primarily on contaminant exposure associated with riverine habitats during spawning and incubation. This task could be accomplished by comparing contaminant uptake and survival rates for incubating eggs between natural in-river conditions and controlled laboratory environments. A combination of field and laboratory treatment groups would be used to

10. The term "objective" is used in this application's discussion of the five measures proposed as part of the WSCP since that term is used in the plan itself.

determine contaminant uptake of embryos when they are exposed to riverbottom sediments, suspended solids (organics), and river water. Field treatment groups would be de-adhesed with riverbottom sediments associated with spawning areas below Swan Falls Dam and reared on-site with filtered and unfiltered river water. Laboratory treatment groups would be de-adhesed with clean, neutral media and reared on filtered water for control comparisons. Bioassays of treatment groups would also be conducted to determine the bioaccumulated contaminant concentrations (metals, organochlorine pesticides, and PCBs [a family of highly toxic compounds that have been banned in the United States]) resulting from parental contribution, riverbottom de-adhesion media, and suspended solids in river water.

The effect of water quality on larval and young-of-year survival would focus primarily on water temperature. Peak summer temperatures in the lower river above Brownlee Reservoir were as high as 28.8 °C during 2002, a level that may prove lethal for early life stages of white sturgeon. Laboratory trials would be conducted to determine mortality rates associated with increasing water temperatures. Temperature tolerances of larval and age 0 sturgeon would be compared with temperature regimes occurring in the Swan Falls–Brownlee reach to determine whether existing conditions are limiting survival and recruitment for early life stages of white sturgeon.

Associated Benefits

Associated benefits include the potential increase in white sturgeon productivity and persistence of this population in the Swan Falls–Brownlee reach. In addition, knowledge gained as the Applicant identifies water quality conditions that are limiting to early life stages may apply to other reaches of the Snake River. Water quality improvements resulting from study findings may also benefit other native fauna.

Implementation or Construction Schedule

The Applicant would begin implementation of the proposed measure within one year after the license was issued for the HCC. The Applicant anticipates that two years would be required to complete field and laboratory studies.

Cost Estimate

Conducting a two-year study on assessing the potential effects of water quality on early life stage survival of white sturgeon in the Swan Falls–Brownlee reach is estimated to cost $326,000.

Location Map

The Swan Falls–Brownlee reach for which this water quality assessment is proposed is shown in Figure E.3.1-13.

E.3.1.3.2.3.2. Translocation of Reproductive-Sized White Sturgeon to Increase Spawner Abundance and Population Productivity

Justification

Based on the Applicant's 1996–1997 population assessment for the Swan Falls–Brownlee reach, the white sturgeon population within this segment of the Snake River is low in abundance and displays little evidence of recruitment (Chapter 1 of Technical Report E.3.1-6). Catch rates and overall numbers of sturgeon sampled (n = 42) in this reach were very low, with most fish captured near the upper end of the reach between Swan Falls and Walters Ferry. Recruitment levels appear to have remained poor since earlier IDFG surveys (Reid et al. 1973, Reid and Mabbot 1987): the population consisted primarily of subadult and adult sturgeon, and few fish were less than 92 cm TL. Results from a 1995 IDFG mail survey for sturgeon anglers also showed a similar trend. These results reported only 7% of the sturgeon as measuring less than 92 cm (IDFG 1996), a finding that further supports the Applicant's observations of poor recruitment. The continuing presence of some small sturgeon indicates that recruitment is occurring at very low levels. Results from the Applicant's 1996–1997 population assessment estimated that the number of annual female spawners in the population was low (n = 7), suggesting that future recruitment levels will probably remain low (Chapter 1 of Technical Report E.3.1-6). These levels may be below those necessary to sustain this population without intervention. Translocating reproductive-sized sturgeon could be used as a potential tool for improving white sturgeon productivity between Swan Falls and Brownlee dams. Adult translocation would increase the number of mature fish within the population, thereby increasing opportunities for natural production. However, the feasibility of this measure would first depend on improving water quality within this reach.

As discussed above in section E.3.1.3.2.3.1. and in Chapter 3 of Technical Report E.3.1-6, severe water quality degradation, particularly in the lower river and Brownlee Reservoir, appears to be limiting white sturgeon in this reach. PVA model simulations have indicated that water quality is the primary factor limiting white sturgeon recruitment in the Swan Falls–Brownlee reach (Chapter 3 of Technical Report E.3.1-6). Specifically, dissolved oxygen levels in the transition zone of Brownlee reservoir should be improved before translocation efforts are undertaken. The Applicant has proposed to improve dissolved oxygen levels in Brownlee Reservoir by using aeration (see section E.2.4.2.1.).

Implementation of translocation efforts would also depend on study results (section E.3.1.3.2.3.1.) evaluating whether degraded water quality conditions associated with riverine habitats are limiting early life stage survival of white sturgeon. If study results show that water quality conditions are not limiting early life stage survival and that natural production can be supported under existing conditions, then translocation of reproductive-sized sturgeon to the Swan Falls–Brownlee reach could be used as a method to increase spawn numbers and restore sturgeon productivity. Similar actions, such as trawl-and-haul supplementation, have been used to improve white sturgeon productivity in the impounded reaches of the lower Columbia River (Kern et al. 2001).

Determining a suitable source, or donor, population(s) for translocation to the Swan Falls–Brownlee reach would be decided pending results about reservoir aeration (section E.2.4.2.1.) and the assessment of water on the early life stage survival of white sturgeon (section E.3.1.3.2.3.1.). A PVA risk analysis of genetic and demographic costs incurred by the source and recipient populations would be evaluated prior to implementation.

Objective

The objective of this measure is to translocate reproductive-sized white sturgeon into the Swan Falls–Brownlee reach to increase spawner abundance and improve population productivity.

Description

The Applicant proposes to use the capture and transport techniques to translocate white sturgeon to the Swan Falls–Brownlee reach on an experimental basis. These efforts would involve a two-phased approach. During Phase 1, the Applicant would begin translocating reproductive sturgeon to evaluate spawning success of transplanted spawners. Radio telemetry would be used to monitor spawning behavior and identify key spawning locations. After spawning, the Applicant would try to recapture telemetered spawners to surgically confirm whether these selected individuals had indeed spawned. Pending successful spawning by transported individuals, Phase 2 efforts would begin with the translocation of reproductive-size sturgeon to increase spawner abundance and population productivity. A population assessment would be conducted following Phase 2 translocation to evaluate recruitment success. Sturgeon capture would rely on the same collection gear and handling protocols that the Applicant used previously to capture sturgeon in the Snake River. Captured fish would be transported in a trailer-mounted tank designed for this purpose.

Specific details (number, lengths, source population, frequency, and others) associated with this proposed measure would be developed in cooperation with state resource agencies and the WSTAC. The population viability model developed by the Applicant and Oak Ridge National Laboratory could be used to help evaluate and quantify the potential costs and benefits to the source and recipient sturgeon populations. The Applicant acknowledges that decisions regarding translocation of white sturgeon are rightfully those of the managing resource agencies and would require extensive and continual involvement from these agencies. The Applicant also recognizes the jurisdiction, management, and protection responsibilities of the IDFG and ODFW for white sturgeon management in Snake River reaches associated with the HCC.

Associated Benefits

Associated benefits of implementing this measure are numerous. Simulation modeling showed that translocation could substantially benefit recipient populations and increase the number of viable populations. Currently, only two viable populations exist in the Snake River, those below both Bliss and Hells Canyon dams. After water quality conditions have improved, translocation of white sturgeon into the Swan Falls–Brownlee reach would benefit the existing population by increasing the number of sturgeon in the reach and ultimately providing more available spawners to bolster future recruitment levels. The stock assessment in the Swan Falls–Brownlee reach found a small population of white sturgeon made up primarily of subadult and adult fish but few juveniles. Recent studies evaluating genetic variability of white sturgeon in the Columbia River basin suggest that the evidence of developing substructures has not yet been realized in Snake River populations (Anders et al. 2000, Anders and Powell 2002). Presumably, evidence of genetic substructure developing among these artificial reaches would not be expected due to their artificiality (as some downstream migration is known to occur) and their relatively short-term existence under these conditions (relative to sturgeon generations) (Paul Anders, University of Idaho, personal communication); however, translocation of white sturgeon would provide a surrogated gene flow to this reach and help mediate for the lack of connectivity and loss of historical gene flow.

Implementation or Construction Schedule

Translocation of white sturgeon to the Swan Falls–Brownlee reach efforts could be implemented within one year after a new license was issued for the HCC. However, feasibility of translocation would also depend on improved dissolved oxygen conditions in the transition zone of Brownlee Reservoir and study results from the assessment of water quality on early life stage survival of white sturgeon (section E.3.1.3.2.3.1.). For planning purposes, if study results indicate water quality would not be limiting, Phase 1 efforts would operate on an experimental basis for two to four years to determine whether transported adults spawn in the Swan Falls–Brownlee reach. If spawning is confirmed, translocation efforts would continue on an annual basis (Phase 2) for a period of ten years. After that time, the feasibility of translocation to enhance population productivity and recruitment would be reviewed based on a population assessment. If study results indicate feasibility, the translocation efforts would continue on an annual basis for the duration of the new license for the HCC or until target goals were met. Periodic reviews of the translocation program would be based on future population assessments.

Cost Estimate

For planning purposes, the cost of translocating white sturgeon into the Swan Falls–Brownlee reach for the duration of a new 30-year license for the HCC is estimated to be $552,000.

Location Map

The Swan Falls–Brownlee reach, which would be the recipient reach for translocation efforts, is shown in Figure E.3.1-13.

E.3.1.3.2.3.3. Development of Experimental Conservation Aquaculture Plan

Justification

Conservation aquaculture represents an adaptive approach that prioritizes preservation of wild populations, along with their locally adapted gene pools, phenotypes, and behaviors (Anders 1998). Sturgeon conservation aquaculture has been implemented in the Kootenai River (USFWS 1999) and is being explored as a potential means for rebuilding sturgeon populations in the upper reaches of the Columbia River basin (UCWSRI 2002). Evaluations of released hatchery-produced sturgeon species in several systems indicate that hatchery-produced sturgeon can survive to adulthood and contribute to fisheries and spawning populations, particularly in depressed populations (Secor et al. 2000, Smith et al. 2002). Demographic modeling suggests that using hatchery-produced fish might be an effective means to restore populations because survival rates at critical early life stages can be increased many fold over wild survival rates (Gross et al. 2002). Also, abundances can be more rapidly recovered because degraded and lost spawning and nursery habitats can be "circumvented" by rearing early life stages in artificial environments (Ireland et al. 2002).

The IDFG's fisheries management plan for 2001–2006 lists five policies governing white sturgeon management in Idaho; one is that "[s]turgeon populations may be supplemented with native stocks where necessary to maintain future management options, to research survival rates, or to utilize suitable rearing habitat where natural recruitment does not exist" (IDFG 2001). On an experimental basis, limited numbers of hatchery-propagated white sturgeon have been released in several reaches of the Snake River, including the Shoshone Falls–Upper Salmon Falls, Lower Salmon Falls–Bliss, Bliss–C.J. Strike, Brownlee–Oxbow, and Oxbow–Hells Canyon reaches. The decision to develop a conservation aquaculture program for the Swan Falls–Brownlee reach would largely depend on results from the assessment on early life stage survival (see section E.3.1.3.2.3.1.), and the management directives by the IDFG and ODFW. For instance, if study results from section E.3.1.3.2.3.1. show that natural production cannot be supported under existing water quality conditions, then opportunities to develop a conservation aquaculture program for the Swan Falls–Brownlee reach may be investigated with the IDFG and ODFW. Conservation aquaculture could be used as a potential tool to bypass current recruitment bottlenecks and replace failed natural recruitment as an interim measure to maintain adequate population size and genetic variability until water quality conditions become adequate to support natural recruitment.

Although applying conservation aquaculture holds promise for sturgeon, such programs are largely experimental and have yet to demonstrate long-term effectiveness in preserving sturgeon populations. Using hatchery-based programs may prove to be effective for restoring juvenile and adult abundances; however, there is still no guarantee that such an effort would catalyze natural recovery. Restoring habitats suitable for natural recruitment would also be required (Secor et al. 2002).

Objective

The objective of this measure is to maintain adequate population size and genetic variability of white sturgeon in the Swan Falls–Brownlee reach using conservation aquaculture.

Description

A conservation aquaculture program should contain measures that minimize both genetic risks to existing wild sturgeon populations in the Snake River and demographic risks of removing broodstock on the productivity of source populations. Careful design incorporating broodstock collection, mating protocols, and release numbers should be considered to balance family groups and avoid genetic swamping. Protocols should also include actions that minimize the risk of inbreeding and reduce the potential for selecting maladaptive traits in the released sturgeon. Protocols should also be established requiring selective marking of the hatchery fish with passive integrated transponder (PIT) tags and/or removal of various scute patterns to differentiate release groups and assist with future evaluations of survival rates, condition factor, growth rates, and movement behavior. These follow-up population assessments (section E.3.1.3.2.3.4.) would be required to determine whether the hatchery program provided the intended benefits and information for adaptive management as the program developed. The plan should also incorporate rigorous protocols for fish health to limit disease risks in hatchery and wild fish.

Specific components for developing a conservation aquaculture program may include tasks such as those identified in the recovery plan for the Kootenai River population of white sturgeon (USFWS 1999):

- Develop genetic preservation guidelines (that is, breeding plan) for broodstock collection and mating design options
- Determine suitable source population(s) for broodstock collection
- Develop appropriate broodstock collection protocols
- Determine appropriate production goals
- Develop fish health plan for hatchery-reared white sturgeon
- Develop tagging protocols to differentiate hatchery-reared white sturgeon from wild stocks
- Develop release plans
- Develop policy for hatchery-reared white sturgeon produced in excess of program needs
- Develop monitoring plans to evaluate performance and contribution of hatchery-released white sturgeon

A suitable facility for spawning and rearing hatchery-produced white sturgeon could be existing facilities and sturgeon culture expertise at the College of Southern Idaho in Twin Falls.

Associated Benefits

Conservation aquaculture could be used as a potential tool to bypass current recruitment bottlenecks and replace failed natural recruitment as an interim measure to maintain adequate population size and genetic variability until water quality conditions become adequate to support natural recruitment.

Implementation or Construction Schedule

Following the issuance of a new license for the HCC, the decision to develop a conservation aquaculture program would depend on study results from the assessment of water quality on early life stage survival (section E.3.1.3.2.3.1.) and management directives by the IDFG and ODFW. For planning purposes, a conservation aquaculture program would be conducted on an experimental basis for a period of ten years to increase population abundance. Within six years of initiating the program, a population assessment (section E.3.1.3.2.3.4.) would be conducted to evaluate survival/growth rates of stocked fish and determine whether conservation aquaculture had provided intended benefits and should be continued or whether alternative mitigation measures were warranted.

Cost Estimate

The costs associated with this measure would depend on the level of production and duration of the program required to meet program goals. For cost estimation at this time, the Applicant considered two people sampling for up to three months (February to April) a reasonable effort to capture annual broodstock consisting of at least one female and two male sturgeon. The Applicant also assumed two family groups of 500 fish per family to calculate the facility costs (feed, labor, PIT tags, and others) associated with spawning and rearing of progeny for one year prior to stocking. Based on these assumptions, the annual cost associated with broodstock collection and rearing of progeny for one year is estimated at $84,000. For planning purposes, the cost to support an experimental conservation aquaculture program over a ten-year period in the Swan Falls–Brownlee reach is estimated at $840,000.

Location Map

The Swan Falls–Brownlee reach, which would be the recipient reach for an experimental conservation aquaculture program, is shown in Figure E.3.1-13.

E.3.1.3.2.3.4. Periodic Population Assessments

Justification

Conducting periodic population assessments (long-term monitoring) is especially applicable for a species such as white sturgeon. White sturgeon possess unique life history traits such as longevity, high fecundity, delayed maturation, and protracted spawn intervals. For example, some individuals can reach 20 feet in length and more than 100 years in age (Scott and Crossman 1973). Male sturgeon probably mature starting around 12 years old, while females normally require longer periods, generally 15 to 32 years (PSMFC 1992). Spawn periodicities also vary between the sexes, with males likely reproducing every two to four years but females at no less than five-year intervals (Conte et al. 1988, Chapman et al. 1996, Anders et al. 2002). Given the unique life history characteristics of this species and the limited historical baseline data on Snake River sturgeon populations, population assessments using standardized collection gear and sampling protocols is critical for evaluating changes in future sturgeon population demographics.

Swan Falls–Brownlee Reach—Past population assessments (Reid et al. 1973, Reid and Mabbot 1987, Chapter 1 of Technical Report E.3.1-6) between Swan Falls and Brownlee dams have shown that white sturgeon abundance is low and recruitment levels have remained poor. As efforts to increase sturgeon abundance (either through natural or artificial means) are undertaken, periodic population assessments would be necessary to monitor population changes and determine the effectiveness of the implemented measures. For instance, if white sturgeon were translocated (see section E.3.1.3.2.3.2.), a comprehensive population assessment would be conducted following the completion of Phase 2 to determine whether translocation had provided the intended benefits. These assessments allow the approach to remain adaptive and to provide the means to determine whether alternative mitigation measures are warranted. However, a more intensive monitoring program may be associated with a conservation aquaculture program (see section E.3.1.3.2.3.3.), to evaluate whether use of hatchery fish is helping meet program goals. For example, stocking numbers may need to be adjusted depending on survival and growth rates. Monitoring results can be incorporated into the PVA to evaluate expected population demographics, assist with decision points, and refine risk/benefit predictions of alternative measures. These population assessments would probably provide valuable feedback to resource agencies and help them determine future management policies for Snake River white sturgeon populations.

Brownlee–Hells Canyon Reach—Past population assessments in Oxbow and Hells Canyon reservoirs shown that, while white sturgeon continue to persist, their numbers are likely very low compared to what once existed there. Assessments conducted by the IDFG, ODFW, and the

Applicant found only a few wild sturgeon remaining within these segments (Chapter 1 of Technical Report E.3.1-6). Low numbers (n = 263) of hatchery-propagated juvenile sturgeon have been released into Oxbow and Hells Canyon reservoirs by the IDFG and Nez Perce Tribe. Periodic population assessments would be conducted in Oxbow and Hells Canyon reservoirs to monitor the status of existing wild and hatchery sturgeon.

Hells Canyon–Lower Granite Reach—The Hells Canyon–Lower Granite reach of the Snake River supports the largest naturally reproducing population of white sturgeon in Idaho. Population assessments between 1970 and 2001 showed positive trends in recruitment, indicating successful reproduction and growth of this population. Juvenile sturgeon less than 92 cm TL continue to dominate the population, and size groups greater than 92 cm TL have steadily increased since the 1970s. Survival estimates are also similar to those observed in several other Snake River populations, while mean relative weight of the population has not declined over the course of the past 30 years. The sturgeon population below Hells Canyon Dam is genetically diverse and exhibits a healthy population structure, based on the current stock structure dominated by juveniles, wide range of size classes, and stages of maturity from immature juveniles to reproductive adults.

Through periodic population assessments in the Hells Canyon–Lower Granite reach, the Applicant would monitor temporal population trends and evaluate the effectiveness of proposed measures, such as those designed to improve water quality. These assessments would also allow the Applicant to identify unforeseen risks before viability and persistence were threatened. Given that this reach represents the second stronghold reach for Snake River white sturgeon, PM&E measures associated with this and adjacent reaches must not threaten the viability and persistence of this population. For example, if future translocation actions use the Hells Canyon–Lower Granite sturgeon population as a donor source for rebuilding upstream populations, the benefits and risks of translocation on donor/source population demographics and genetic implications would be evaluated using the PVA model. Population monitoring would also be conducted at ten-year intervals and provide valuable feedback to resource agencies to help them determine future management directives for Snake River white sturgeon populations.

Objective

The objective of this measure is to monitor population status of white sturgeon in the Swan Falls–Brownlee, Brownlee–Hells Canyon, and Hells Canyon–Lower Granite reaches of the Snake River.

Description

The Applicant proposes to conduct periodic population assessments of white sturgeon in Snake River reaches between Swan Falls and Lower Granite dams every 10 years during the new license period established for the HCC. For example, based on a 30-year license, a total of three stock assessments (at 10-year intervals) would be conducted for sturgeon populations in these reaches.

Sampling during these surveys would be done with standardized collection gear (setlines and gill nets) and sampling protocols consistent with previous Snake River sturgeon surveys conducted by the Applicant. The Applicant would monitor population demographics—including abundance, population structure, and temporal trends—by periodically assessing populations. Captured sturgeon would be examined for PIT tags to distinguish between wild and hatchery stocks. All unmarked fish would be fitted with 125-kHz PIT tags and scute removal patterns to serve as permanent external marks. Surveys would rely on mark-recapture sampling to determine population abundance and would include collection of biological (abundance, maturation, growth, and survival rates) and genetic (see section E.3.1.3.2.3.5.) information so that population productivity could be evaluated.

Associated Benefits

Periodic population assessments would be compared with past Snake River sturgeon surveys to evaluate changes in population and the effectiveness of measures proposed by the Applicant benefiting Snake River white sturgeon, such as the measure to improve water quality in reaches associated with the HCC (see section E.2.4.2.1.). Stock assessments would also provide valuable information regarding changes in stock status for resource agencies to use in developing future management decisions for Snake River white sturgeon populations. Additionally, the population data would help improve the existing population viability model developed by the Applicant to assist with identifying costs and benefits of alternative and adaptive management actions.

Implementation or Construction Schedule

The Applicant would implement the proposed measure within one year after the new license was issued for the HCC. At the onset of the surveys, specific study methodology would be discussed with the WSTAC, an advisory group that includes representatives from managing resource agencies.

Cost Estimate

The cost associated with conducting three population assessments at 10-year intervals between Swan Falls and Lower Granite dams for the duration a new 30-year license for the HCC is estimated at $2,465,000.

Location Map

The reaches of the HCC and downstream of the HCC to be monitored for white sturgeon over the life of the new license are shown in Figure E.3.1-13.

E.3.1.3.2.3.5. Monitoring of Genotypic Frequencies

Justification

Sturgeon require a mosaic of habits to complete all life stages. Many of the artificially created bounds that have been placed on these fish have acted to reduce the effective population size of sturgeon within such areas. This loss in effective population size leads to the potential loss of genetic variation by inbreeding and genetic drift, both of which may contribute to a population decline (Chapter 3 of Technical Report E.3.1-6). Although current evidence suggests that no significant genetic differences exist among Snake River white sturgeon (Paul Anders, SP Cramer & Associates, Inc., personal communication), effective long-term management requires that genetic diversity be monitored as one of the potential population responses to proposed mitigation measures. For example, a potential measure should favorably affect, or at least not reduce genetic variability and diversity of, the recipient population. Similarly, if a measure involves a source population (such as translocation), the source population should not be impaired.

Five dams (and approximately 250 river miles) separate the two Snake River reaches that support self-sustaining populations (Bliss to C.J. Strike and Hells Canyon to Lower Granite dams). One of the guiding principles in determining appropriate PM&E measures was to protect these stronghold populations from risk. A shift in the genotypic frequency within these sturgeon populations is possible as new individuals are incorporated into them or as individuals are removed from them to supplement other reaches. Because these two populations are currently healthy and sustaining, they offer the greatest means of identifying trends in genetic integrity.

The measure of developing a program to monitor genetics would apply to all reaches of the Snake River from Shoshone Falls to Lower Granite Dam. The plan would primarily monitor and track any changes to the genotypic frequencies within each subpopulation with the intent of identifying potential genetic bottlenecks before they occur. To evaluate the potential of these problems occurring in any one segment, the entire Snake River within the Applicant's study area needs to be sampled for genetic integrity. This plan would use the present data collected by the Applicant as a baseline. In the future, genetic material would be collected as population assessments were conducted for each reach.

Objective

The objective of this measure is to monitor the genotypic frequencies of Snake River white sturgeon between Shoshone Falls and Lower Granite dams.

Description

The Applicant, with input from qualified geneticists, would continue to monitor genotypic frequencies of Snake River white sturgeon for comparison with existing information. This program would use the existing wild juvenile and adult white sturgeon genetics information, collected by the Applicant during the 1996–2001 field seasons, as a baseline data set. The levels of genetic diversity found within and among the various reaches of the Snake River would help establish desired future conditions for each reach.

The most recent genetic information for Snake River white sturgeon was collected by the Applicant and analyzed at the University of Idaho (Anders and Powell 1999, 2002; Anders et al. 2000). Only those reaches where significant reproduction was known to occur (Bliss–C.J. Strike and Hells Canyon–Lower Granite populations) were used in the analysis. Additional samples collected by the Applicant from other Snake River reaches would be analyzed and interpreted to further establish the baseline for genetic diversity. Future collections would target the progeny or subsequent generations of the fish that were included in the baseline data set. Under natural conditions, no changes in genotypic frequencies would be expected to occur within the period of a new project license or an even longer period. However, implementation of some measures (such as translocation) may potentially alter genetic frequencies and increase diversity at a faster rate than what might naturally occur. Other potential measures, such as amplifying successful family group genes through artificial propagation, may decrease genetic diversity. Identifying such measures and their future potential for maintaining or enhancing genetic diversity is key to implementing a successful plan.

Data collection would include collecting a small (1 cm^2) amount of fin tissue from sturgeon following an agreed-upon sampling regime. Geneticists from the Center for Salmonid and Freshwater Species at Risk at the University of Idaho or from another qualified facility would process (extract the DNA) and interpret the results.

Associated Benefits

Although current evidence suggests that no significant genetic differences exist among Snake River white sturgeon (Paul Anders, SP Cramer & Associates, Inc., personal communication), effective long-term management requires that genetic diversity be monitored as one of the potential population responses to proposed mitigation measures. Many of the measures recommended by the WSTAC and proposed by the Applicant are largely experimental in nature, taking an adaptive approach. In order to ensure that implemented measures are having the intended benefit of ensuring and not harming long-term persistence, analysis of how the population's genetic component is responding is essential. For example, a potential measure should favorably affect, or at least not reduce genetic variability and diversity of, the recipient population. Similarly, if a measure involves a source population (such as in translocation), the source population should not be impaired.

Implementation or Construction Schedule

The Applicant would implement the proposed measure within one year after the license was issued. Tissue samples for genetic evaluation would be taken concurrently with periodic population assessments. At the onset of the surveys, specific study methodology would be discussed with the WSTAC, an advisory group that includes representatives from managing resource agencies, as well as with qualified geneticists.

Cost Estimate

The cost of monitoring genotypic frequencies for white sturgeon populations associated with the HCC is estimated to be $68,000.

Location Map

The reaches of the HCC and downstream of the HCC to be monitored for white sturgeon genetics over the life of the new license are shown in Figure E.3.1-13.

E.3.1.3.3. Measures or Facilities Recommended by the Agencies

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft

License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.3.1.3.3.1. Accepted or Conditionally Accepted Measures or Facilities

Bureau of Land Management comment letter, dated January 9, 2003

BLM2-190

> The BLM believes that the Applicant should include inventories of the Eagle Creek Basin in the plan. Bull trout were present until the 1980s and have been thought to be extirpated although no thorough studies of the wilderness reaches of Eagle Creek have been conducted to determine whether remnant populations remain.

Response

The Applicant agrees that an effort should be made to assess the presence or absence of bull trout in the Eagle Creek basin. The Applicant believes that an American Fisheries Society-accepted survey protocol for assessing the presence or absence of bull trout should be employed in the Eagle Creek basin. To this end, the Applicant has proposed an additional PM&E measure (see section E.3.1.3.2.1.3.) in the native salmonid plan to address the status of bull trout in the Eagle Creek basin by performing such a survey. The Applicant believes that a thorough assessment of bull trout in the basin is necessary before any serious discussion of reintroduction or other potential restoration measures can occur.

NOAA Fisheries comment letter, dated January 9, 2003

NMFS1-18

> We also note that IPC proposes to modify the fish trap at Hells Canyon Dam to facilitate the capture of bull trout. Any modification to the trap or operations affecting the handling or transportation of anadromous salmonids should made in cooperation with and after receiving the approval of NOAA Fisheries. Because the use of this trap is likely to expand in future years, we recommend that IPC consider modifying the trap to provide the ability to hold and

> sort adult salmon and steelhead. The reasons for modifying the trap would include: (1) allowing for trapping of one species or stock (i.e. hatchery-produced fall chinook) while releasing other species or stocks (i.e. steelhead or naturally produced chinook); (2) facilitating trapping of fall chinook brood stock; and (3) allowing selective trapping of bull trout (if U.S. Fish and Wildlife Service, or the other fish management agencies, agree that this is desirable).

Response

The Applicant concurs with NOAA Fisheries (also known as NMFS) concerning the potential modifications of the Hells Canyon fish trap to aid in sorting and selecting species or stocks. The Applicant would include NOAA Fisheries and other fish management agencies in discussions regarding trap modifications.

U.S. Forest Service comment letter, dated January 8, 2003
USFS2-13

> The Forest Service maintains that IPC should include inventories of the Eagle Creek Basin in the plan. Bull trout were present until the 1980s but have been thought to be extirpated although no thorough studies of the wilderness reaches of Eagle Creek have been conducted to determine whether remnant populations remain.

Response

The Applicant agrees that the presence or absence of bull trout in Eagle Creek has not been confirmed and that a substantial effort should be directed toward an assessment of the presence or absence of bull trout in the Eagle Creek basin. The Applicant believes that an American Fisheries Society-accepted survey protocol for assessing the presence or absence of bull trout should be performed in the Eagle Creek basin. To this end, the Applicant has proposed an additional PM&E measure in the native salmonid plan (see section E.3.1.3.2.1.3.) to address the status of bull trout in the Eagle Creek basin by performing such a survey.

USFS2-32

> The Forest Service agrees that the 10-year monitoring plan [for white sturgeon] should be implemented on the free flowing reaches of the Snake River. However, monitoring of populations in Hells Canyon Reservoir should be included in this schedule.

Response

The Applicant agrees with the USFS comment and is proposing to conduct stock assessments under the 10-year monitoring plan for Oxbow and Hells Canyon reservoirs.

Idaho Department of Fish and Game comment letter, dated January 10, 2003

IDFG1-60

> Fish Marking-Marking is the foundation of many hatchery monitoring and evaluation activities. With the advent of ESA and mass marking for hatchery fish identification for monitoring and selective fishery implementation, marking demands have increased substantially. While IPC has provided funds on an annual basis to mark fish as part of their existing program, there has not been sufficient support for necessary upgrades and changes in technology. Capital improvements in fish marking are necessary for current production implementation as well as future M&E program development. Current marking trailers used at IPC hatcheries are past the life expectancy of this equipment and need to be replaced. There is enough marking conducted for IPC to support a Mass Automated Tagging Unit as well as ad-clipping equipment kept on site at Niagara Springs.

Response

The Applicant concurs with the IDFG's assessment of the need to replace existing marking equipment and has included a proposal to provide a new marking trailer.

E.3.1.3.3.2. Rejected Measures or Facilities and Explanations for Rejection

Bureau of Land Management comment letter, dated January 9, 2003

BLM2-183

> The BLM recommends that the Applicant fund a permanent anadromous fish reintroduction committee. The committee members would include at least the Tribes, ODFW, IDFG, IPC, WDFG, NOAA Fisheries, USFS and BLM. The purpose of the committee would be to continue exploring all aspects of reintroducing anadromous fish. They would be charged with, but not limited to; recommending studies to verify Applicant assumptions concerning habitat quality and quantity, fall chinook egg to smolt survival in Snake River above the HCC, and smolt migration through the HCC, ect. [sic]

Response

It is the Applicant's position that the studies conducted and provided in the DLA were sufficient and adequate to address the questions relating to the feasibility of reintroducing anadromous fish. The Applicant believes that its studies were comprehensive and included all aspects of reintroduction that needed to be considered, and they provided enough information to make an informed decision about reintroducing anadromous fish above and within the HCC.

BLM2-185

> The BLM suggests that the [hatchery] mitigation program should set up an annual budget for meeting the 1,000,000 fall chinook smolt target. When eggs are not available to meet production targets, the surplus funds should be used to improve other hatchery operations or enhance habitat.

Response

The Applicant disagrees with the BLM's suggestion that the Applicant budget for the production of 1 million fall chinook annually and then spend the money to improve other hatchery functions in those years when sufficient eggs are not available to meet production targets. The Applicant intends to provide sufficient funding for all of its mitigation hatcheries, regardless of fluctuations in production. With adequate funding provided to each facility annually, the Applicant does not understand how creation of "surplus" funding would improve hatchery operations. In addition, the Applicant has proposed tributary habitat enhancement measures as part of the native salmonid plan. It is the Applicant's position that the funds currently proposed for this measure are sufficient to make significant habitat enhancements for native salmonids associated with the HCC.

BLM2-186 and BLM2-187

> The BLM supports the native fish plan proposed by the Applicant. However, the BLM believes the Applicant should stock adult surplus hatchery steelhead captured below Hells Canyon Dam into Pine Creek as part of this plan, as long as IDFG and ODFW agree. Summer steelhead would spawn in their historic habitat now used by isolated bull trout populations. Carcasses would provide marine-derived nutrients to the stream and riparian zone. The juveniles would provide forage for bull trout. Surviving smolt would be trapped at the weir to be constructed at the mouth of Pine Creek. The smolt would then be transported and released below Hells Canyon Dam. The progeny of stocking adult steelhead could be used to determine summer steelhead production levels for Pine Creek. These actual smolt numbers could be used to verify the Applicant's estimates in E.3.1-2 chapter 8 of the anadromous fish reintroduction studies.
>
> Stocking of summer steelhead in Indian Creek and Wildhorse River should also be considered if IDFG and ODFW agree. This would provide forage for bull trout and marine-derived nutrients to these streams. The proposed fish-trap at Oxbow dam would facilitate the transport of steelhead over Oxbow dam so they could access Wildhorse River.

Response

Stocking of surplus hatchery adults is currently done at the discretion of state management agencies. Surplus adult hatchery steelhead captured at Hells Canyon Dam are stocked into Hells Canyon Reservoir by the IDFG on an annual basis when returns are sufficient. The

Applicant's temporary picket-style weir operations associated with fall trapping during relicensing studies suggested that, based on the number of juvenile redband trout captured, many of these steelhead may have ascended Indian Creek and spawned successfully. It seems reasonable that stocked adult steelhead also ascend Pine Creek to spawn. The Applicant's permanent monitoring weir proposed for Pine Creek may permit an evaluation of the extent of adult steelhead migrating into Pine Creek and allow some assessment of juvenile emigration into the reservoir, at least within the flow ranges that the operations of the weir would be designed to accommodate.

BLM2-188

> IPC conducted a literature review for Pacific lamprey. They made no recommendations to compensate for the loss of this anadromous fish that once accessed habitat above the HCC. Pacific lamprey have difficulty ascending the dams on the Columbia and Snake River. They are believed to have no fidelity to their natal streams. The BLM believes that mitigation recommendations should be developed for the loss of Pacific lamprey. The BLM recommends that the Applicant and the appropriate State and Federal agencies cooperate to reintroduce Pacific lamprey to streams within or above the HCC. A trap and haul of adult lamprey from Bonneville dam to within and above the HCC could be developed as a pilot research project. Based on available information, the lamprey should stay in the streams where they are stocked and spawn. Based on the literature review by the Applicant, juvenile lamprey are believed to pass through turbines without being harmed.

Response

The Applicant does not propose mitigation for Pacific lamprey. However, the Applicant biologists seriously doubt that transporting Pacific lamprey from below Bonneville Dam (removing them from known production areas) to reaches of the Snake River and tributaries upstream of the HCC would result in increasing the population of these fish, nor is this a sound and viable strategy for ensuring the continued existence and enhancement of a species under consideration for listing under the ESA. If the replacement of marine-derived nutrients is the true issue, there are alternate methods that can accomplish this, such as those proposed in the native salmonid plan. Finally, pre-impoundment conditions are not considered the baseline conditions from which FERC measures project impacts in relicensing proceedings. Rather, FERC measures project impacts based on the project as it exists and is operated at the expiration of the prior license. As passage for lamprey was not an issue when the project was originally licensed and because there is no evidence that the lack of passage or the operations of the HCC detrimentally affect the present status of Pacific lamprey in habitats downstream of the HCC, or other species upstream of the HCC because of the lack of lamprey, the Applicant does not propose to provide passage for this species in the present relicensing effort. While Pacific lamprey will remain blocked from historic habitat upstream of the HCC, significant habitat remains accessible throughout the numerous Snake and Columbia river tributaries downstream; there is no evidence that the presence and operations of the HCC have an effect on the population dynamics of Pacific lamprey using that tributary habitat (the depressed nature of the lamprey of the Willamette River is an example). Also, as the reviewers continually point out that they expect Pacific lamprey have little to no fidelity to natal habitat, efforts to increase the abundance of this species should not need to rely on providing access to blocked habitat as long as habitat in downstream tributaries remains available.

BLM2-190

> The trap and haul method of reintroduction [of bull trout] planned for Hells Canyon and Oxbow dams should be considered for Brownlee Dam if the technique is successful at the other two.

Response

It is the Applicant’s opinion that passage facilities other than those proposed are not warranted because the biological benefit to fish species of the HCC is questionable at this time relative to the costs associated with construction and O&M. The Applicant believes that the current proposal would allow opportunity to continue learning about the potential use and benefit of passage facilities and behavior of fish species associated with passage. The Applicant is not convinced that passing bull trout at Brownlee Dam would aid in the restoration of bull trout to areas upstream of Brownlee Reservoir where the species does not currently exist.

BLM2-191

> The BLM believes that the Applicant should provide a complete monitoring plan for native fish. It is unclear how the Applicant plans to monitor the results of implementing the native fish plan. The plan should include proposed, sampling locations, target species, as well as temporal and spatial schedules. The monitoring plan should be subject to scientific peer review.

Response

The Applicant's proposed native salmonid plan is intended to mitigate for and enhance native populations of resident salmonids. This plan would be developed with state management agencies and the USFWS. The Applicant's proposed native salmonid plan includes facilities for long-term monitoring of fluvial bull trout, long-term experimentation to reduce the impacts of introduced brook trout in Indian Creek, and long-term population monitoring. Sampling locations, target species, and temporal and spatial scales for sampling would be determined in consultation with state management agencies and the USFWS.

NOAA Fisheries comment letter, dated January 9, 2003

NMFS1-17

> NOAA Fisheries recommends that IPC fund a detailed monitoring and evaluation program aimed at quantifying the stray rates of their hatchery mitigation steelhead into natural production areas. This study should also contain a genetic monitoring component to determine whether the hatchery fish are having an effect on the natural fish. Should the results of this study indicate that natural populations are being only slightly impacted, facility or operational modifications will be minimal. To the extent that this study indicates that the natural populations are being substantively impacted, large modifications to the existing facilities (or new facilities) may be required in addition to modifications to operations. This study should specifically evaluate both the lower and upper Salmon River IPC steelhead programs.

Response

The Applicant has proposed funding a detailed monitoring and evaluation program as part of a new FERC license for the HCC. The details and scope of such a program are in the developmental stages. The Applicant acknowledges that the issue of hatchery steelhead straying into natural steelhead production areas is complex, not only in the context of monitoring and evaluating the phenomenon, but also in its implications for fishery management. The use of traditional monitoring and evaluation techniques, such as marked group releases using coded wire tags and PIT tags, may provide insights into the migration characteristics and utilization of the Applicant's hatchery steelhead. However, it is important to point out that the identification and quantification of hatchery steelhead straying into natural production areas and the impact of hatchery fish on natural fish at a genetic level is complex and, from an analytical context, represents a monumental effort, with inherent uncertainties. Past efforts by agency biologists to operate weirs during spring months on high-elevation Salmon River tributaries and to conduct spawning-ground surveys during highly turbid conditions associated with spring runoff have proven to be largely unsuccessful. To date, even the most basic genetic and life history comparisons between hatchery-origin and natural fish in the Salmon River have not been conducted. Addressing the issues identified by NOAA Fisheries would require the use of new and unconventional fisheries techniques (some of which are still in developmental stages) that are both time consuming and expensive. Moreover, the issue of steelhead straying is affected by management policies of the resource agencies, as well as by activities of third parties, that are unrelated to either HCC impacts or the HCC hatchery compensation program. Introgression of hatchery fish into wild steelhead populations in the Salmon River during the past 30 years may prove problematic to certain evaluation studies recommended by NOAA Fisheries. In introgressed populations, analytical methods currently available to fisheries biologists lack sufficient capability of differentiating between present day genetic impacts of hatchery-origin fish and those that occurred in prior generations. With no baseline understanding of the natural populations genetics as a point of reference, study results may be inconclusive and of no value for modifying or improving hatchery practices and fisheries management decision making.

The Applicant is committed to working with NOAA Fisheries and other fishery managers on these issues. However, the Applicant's obligations to fund monitoring and evaluation must be consistent with its share of responsibility for such impacts. For instance, determination of the level of the Applicant's participation must consider that the Salmon River basin has been heavily influenced by hatchery-origin steelhead and managed for maximum harvest opportunity for nearly 30 years. The Applicant should not be caught in the middle when conflicts occur between this harvest objective and recovery objectives for natural steelhead.

NMFS1-20

> [NOAA Fisheries] recommend that IPC establish and annually fund a multi-agency technical committee consisting of interested Federal, state, and tribal agencies, as well as interested non-governmental organizations to assist IPC in developing and implementing biological and engineering studies necessary to fully evaluate the potential for successfully reintroduce anadromous fish upstream of the project. These studies would include, but are not necessarily be limited to, the following: (1) radio-telemetry or acoustic-tag studies aimed at identifying the most suitable collection (juveniles) or release (adults) locations upstream of the project; (2) redd monitoring and egg to fry survival studies to determine if water quality parameters have improved sufficiently to meet the requirements of incubating fry; and (3) engineering feasibility studies to identify the most promising and cost-effective site-specific options for mainstem fish collection facilities.

Response

The Applicant believes that sufficient studies were conducted to address the issue of reintroduction and that the biological studies requested by NOAA Fisheries were not necessary to address that issue. The Applicant does not concur with NOAA Fisheries that its studies were deficient in addressing the questions regarding the feasibility of reintroducing anadromous fish.

NOAA Fisheries comments at the joint agency meeting, held March 5 and 6, 2003

Recommended full-scale analysis of selective withdrawal at the HCC

Response

The Applicant rejects the NOAA Fisheries recommendation to install a selective withdrawal system for Brownlee Reservoir. The HCC, under its current configuration and operations, already provides water quality benefits to downstream anadromous fish. Temperature conditions below the HCC comply with temperature standards more frequently than water flowing into Brownlee Reservoir does. NMFS' recommendation apparently is based on its view that temperature conditions below the HCC adversely affect anadromous fish. The Applicant responds to this assertion in its Response to Comment NMFS1-7, which states:

> IPC does not agree with NOAA Fisheries' conclusions regarding temperature impacts below the HCC.
>
> 1. *Impacts conclusion*
>
> While IPC concurs that the HCC alters the thermal regime below Hells Canyon Dam, it does not agree that such alterations are substantial nor that they adversely impact anadromous fish below the HCC. Implicit in NOAA's comments is the notion that the water temperature conditions below the HCC are substantially different from historic conditions in the Snake River and that this adversely impacts anadromous fish below the HCC. While present-day temperatures downstream of the HCC are generally cooler than present-day upstream temperatures during springtime and summer, the temperatures below the HCC may more closely mimic pre-development (historic) conditions than do current-day conditions. Qualitatively, anthropogenic development of the watershed likely increased springtime temperatures from historic conditions, especially during low-flow years. In fact, the Environmental Protection Agency (EPA) has previously recognized that flow depletion from storage and irrigation diversion and that surface return of irrigation water warmed on fields act together to raise prevailing water temperatures (EPA 1974). It is therefore reasonable to conclude that present-day springtime river temperatures are warmer than historic springtime temperatures. As such, efforts to change the thermal regime downstream of the HCC to more closely match the regime above the HCC may actually move the thermal regime below the HCC further from historic conditions.

2. *Emergence timing*

IPC does not agree with NOAA Fisheries' speculation that the delay in late winter/spring warming is *likely* to negatively affect emergence timing of fry and thus the migration timing of juveniles. IPC believes that there is very little evidence to support this speculation. NOAA Fisheries cites the DLA, supporting studies, and peer-reviewed articles, specifically Connor et al. 2002 (W. P. Connor, H. L. Burge, R. Waitt, and T. C. Bjornn, 2002, "Juvenile life History of Wild Chinook Salmon in the Snake and Clearwater Rivers," *North American Journal of Fisheries Management* 22:703-712), as supporting its speculation.

The DLA and supporting studies cited by NMFS do not support this speculation. The DLA (section E.3.1.4.3.1.2., page E.3-218) states that the HCC has led to *a generally warmer incubation* period for fall chinook salmon than what occurred historically (pre-project) below the Hells Canyon Dam location. IPC believes the focus on the thermal differences should be on total thermal unit accumulation, not just a period within the incubation period. This warmer incubation period, based on thermal unit accumulation (see Technical Report E.3.1-2, Chapter 5, section 3.3.), has resulted in an earlier emergence of fall chinook juveniles than what occurred pre-project below the present location of Hells Canyon Dam.

Nor do Connor et al. (2002) support the NOAA Fisheries' conclusion. Connor et al. (2002) compare the Marsing reach (historical spawning areas upstream of Brownlee Reservoir) with the present-day contemporary spawning areas of the upper Snake River (Hells Canyon Dam to Salmon River), lower Snake River (Salmon River to the upper end of Lower Granite Reservoir), and Clearwater River. Connor et al. (2002) did not make any conclusions or even reference the effects of the HCC temperature alterations on the present-day thermal regime below Hells Canyon Dam. The only reference Connor et al. (2002) make to the HCC is that it blocked access to the historical production area in the Marsing reach.

Connor et al. (2002) concluded that dam construction changed juvenile fall chinook salmon life history in the Snake River basin by shifting production to areas with relatively cooler water temperatures and comparatively lower growth opportunity. IPC does not disagree with the conclusions of Connor et al. (2002).

IPC interprets this to mean that now a higher proportion of the total production of fall chinook occurs in the lower Snake and Clearwater rivers than historically occurred in these areas. This higher percentage of production now occurring in these presumably cooler environments has led to the additional presumption that the habitat supports higher percentages of yearling outmigrants than what may have occurred historically. (Uncertainty as to this latter presumption stems from the lack of sufficient evidence to determine what proportion of yearling outmigrants historically occurred in these areas.)

Historically, contemporary spawning areas supported less of the total production than they do today. The “cooler environments” were not caused by dam construction, and they were likely cooler, historically, than the HCC environment, and the evidence supports that they were even colder before the HCC was built. The effect of the HCC is that it blocked access to the upstream production area and it warmed the incubation environment downstream of the HCC. This accelerated emergence in the upper Hells Canyon and lower Hells Canyon reaches to be closer to what the Marsing reach was, but the overall production potential is likely lower than what historically occurred. The Clearwater River is unaffected by the HCC.

Connor et al. (2002) did not present any information regarding the pre-Hells Canyon thermal regime (i.e., the area downstream of the present-day site of Hells Canyon Dam) relative to the present-day Hells Canyon thermal regime. It is important to emphasize that the Marsing reach information presented in Connor et al. (2002) cannot be used to represent the pre-Hells Canyon area prior to construction. There are several large tributaries that enter the Snake River between the Marsing reach and the Hells Canyon reach that significantly change the thermal regime. Also, before the HCC was constructed, there were an additional 100+ miles of river flowing through a steep, incised canyon that during the winter period would have continued to cool the river relative to the Marsing reach and relative to the area that now represents inflows to Brownlee Reservoir.

From information presented in Technical Report E.3.1-2, Chapter 5, it is evident that the thermal regime below Hells Canyon Dam was a much colder thermal regime than the present-day environment and much colder than the Marsing reach. Emergence time is now closer to what occurred in the Marsing reach than prior to construction of Brownlee Dam. If the HCC were not present, the thermal regime below the HCC would support a later emergence than what occurs currently.

This does not support or refute the findings of Connor et al. (2002). Based on median emergence dates, the Marsing reach had earlier emergence than what is seen currently below Hells Canyon Dam, and the emergence today is earlier than what the pre-HCC emergence would have been (DLA and Technical Report E.3.1-2, Chapter 5). However, there is substantial overlap in the distributions of emergence.

Connor et al. (2002) cite Mains and Smith (E. M. Mains and J. M. Smith, 1964, “The Distribution, Size, Time, and Current Preferences of Seaward Migrant Chinook Salmon in the Columbia and Snake Rivers,” Washington Department of Fisheries, Fisheries Research Papers 2[3]:5-43) to support that the *entire* chinook outmigration upstream (at least upstream of Rkm 132, the location of Central Ferry) was complete by the end of June in 1954 and 1955, prior to construction of the HCC and the lower Snake River dams. Spawning occurred in the Marsing reach as discussed in Connor et al. (2002) and there is good evidence that spawning occurred in the lower Snake River upstream of Rkm 132 between the site of Lower Granite Dam and the confluence of the Clearwater River (L. A. Fulton, 1968, “Spawning Areas and Abundance of Chinook Salmon in the Columbia River Basin: Past and Present,” U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Washington, DC, Special Scientific Report, Fisheries 571; Z. Parkhurst, 1950, “Survey of the Columbia River and its tributaries,” Part VI, U.S. Fish and Wildlife Service, Special Scientific Report, Fisheries No. 39, 58 p.). Yet, despite the colder thermal regime and later emergence, the fish that were spawned in the lower Snake River and above Rkm 132 were still past Rkm 132 by the end of June, whereas today, on average, only 50% of the smolts pass Lower Granite Dam by the end of June.

IPC believes that the construction of Lower Granite Reservoir is the cause for the delay in passing the Lower Granite Dam site today relative to 1954 and 1955, prior to the construction of Lower Granite Dam. IPC believes that this explanation for the delay is the most reasonable conclusion, since construction of a large slackwater environment significantly reduces the water velocities that outmigrating smolts rely on.

3. *migrating and spawning adults*

NOAA Fisheries' conclusion that delays in the fall cooling *likely* affect migrating and spawning adults has not been empirically demonstrated for free-ranging fall chinook salmon in the Snake River (see discussion in Technical Report E.3.1-2, Chapter 5, section 3.1.).

4. *project delays fall cooling which is likely to affect…some redds.*

As stated in the DLA and in Technical Report E.3.2-1 (Chapter 5, section 3.2.), the delay in fall cooling is likely affecting less than 2% of the redds in an average spawning distribution.

5. *the altered thermal regime…likely impacts…resident fish and other "cold-blooded" organisms.*

There is no evidence that the altered thermal regime *likely* impacts resident fish and other "cold-blooded" organisms. This is entirely speculative on the part of NOAA Fisheries.

6. *We recommend that IPC use the operations and water quality models to refine our understanding of project effects.*

> IPC believes that project effects were appropriately and adequately evaluated. The two operational scenarios analyzed by IPC provide an adequate assessment of project-related impacts for purposes of developing mitigation measures at relicensing. The two scenarios also effectively bracket other potential scenarios. Therefore, comparisons of the two modeled scenarios provide appropriate and relevant information about the effects of project operations.
>
> Additionally, the modeled proposed operations represent the typical operating guidelines or constraints that IPC currently follows. Therefore, for the purposes of comparative analyses as presented in this application, modeled proposed operations are representative of IPC's current operations. The modeling of the impact of current operations on existing environmental conditions provides the relevant information necessary for the FERC to make relicensing decisions.

If temperature is an issue for downstream anadromous fish, a comprehensive watershed approach would be a more appropriate way to address the issue than arbitrarily and inequitably requiring the Applicant to further improve conditions.

U.S. Fish and Wildlife Service comment letter, dated January 24, 2003
USFWS1-68

> The Service strongly suggests that adequate protections need to be implemented and enforced to assure that supplemental flows released into the Pahsimeroi River remain there to benefit fishery resources. The Service suggests that a valid State of Idaho beneficial use water right needs to be designated for any quantity of water added to the Pahsimeroi River in the name of an entity such as the Idaho Department of Fish and Game. This would have the effect of preventing other parties from appropriating waters added to the Pahsimeroi River because of their senior water rights. The Service suggests that this is among issues that should be dealt with and resolved by an interagency interdisciplinary group.

Response

While Idaho law recognizes that minimum stream flow for the protection of fish and wildlife habitat, aquatic life, recreation, aesthetic beauty, navigation and transportation, and water quality are a beneficial use of water, it does not allow private appropriators to acquire water rights for such instream uses. Only the Idaho Water Resource Board may file an application to appropriate water for the purposes of a minimum stream flow. Such applications are filed with the Idaho Department of Water Resources and may be approved by the Director, after notice and hearing (I.C. § 42-1503).

U.S. Fish and Wildlife Service comment at the joint agency meeting, held March 5 and 6, 2003

Recommended movement of ramping-rate measurement points closer to Hells Canyon Dam

Response

The Applicant believes that the current point of measurement (Johnson Bar) should continue to serve as the point of measurement for license requirements. The location has served as an established point of reference that recreational and commercial users recognize and rely on. In addition, the stage versus flow relationship is well established with a long period of record.

U.S. Forest Service comment letter, dated January 8, 2003

USFS2-1

The Forest Service maintains that IPC should fund an anadromous fish re-introduction working group that would continue to develop plans for reintroduction during the term of the license. The work group would gather and analyze information that could lead to reintroduction during the term of the license on habitat, passage, and marine-derived nutrients. The Forest Service would work with the other fisheries and land management agencies to develop a common agency position on anadromous fish reintroduction.

Response

It is the Applicant's position that the studies provided in the FLA are adequate to address questions relating to the feasibility of reintroducing anadromous fish. The Applicant's studies address all aspects of reintroduction that need to be considered, and they provide enough information to make an informed decision. The Applicant does not believe that it is necessary to form such a working group to gather and analyze additional data. The Applicant believes that data presented in Technical Report E.3.1-2 demonstrate that reintroduction is not feasible unless significant changes in survival occur in populations that are currently present in the Snake River basin downstream of the HCC. The existing studies addressed issues of habitat and passage in the technical report. The Applicant also proposed PM&E measures to address loss of marine-derived nutrients in basins immediately associated with the HCC.

USFS2-7

> The Forest Service maintains that mitigation recommendations should be developed for the continued loss of Pacific lamprey.

Response

At present, IPC does not propose mitigation for Pacific lamprey because there is no evidence that the proposed ongoing operations of the HCC will have an adverse affect on Pacific lamprey. Pre-project conditions are not considered the baseline conditions from which FERC measures project impacts in relicensing proceedings. Rather, FERC measures project impacts based on the project as it exists and is operated at the expiration of the prior license. Passage for lamprey was not an issue when the project was originally licensed because there was no evidence that the lack of passage or the operations of the HCC would detrimentally affect the status of Pacific lamprey. Neither the circumstances nor available information have changed and IPC does not propose to provide passage for this species in the present relicensing effort. While Pacific lamprey will remain blocked from historic habitat upstream of the HCC, significant habitat remains accessible throughout the numerous Snake and Columbia river tributaries downstream; and there is no evidence to indicate that either the presence or operations of the HCC have an effect on the population dynamics of Pacific lamprey using that tributary habitat (the depressed nature of the lamprey of the Willamette River is an example). Also, as the reviewers continually point out that they expect Pacific lamprey have little to no fidelity to natal habitat, efforts to increase the abundance of this species should not need to rely on providing access to blocked habitat as long as habitat in downstream tributaries remains available.

USFS2-8

> The hatchery mitigation program will be continued. IPC plans to upgrade their facilities to meet new objectives and standards for hatcheries in the Columbia Basin. The number of hatchery-produced fish will remain approximately the same. However, it is believed that the upgraded facilities will meet the smolt targets set in the *Hells Canyon Settlement Agreement* more than in the past. Previously, IPC met their targets approximately 70% of the time. IPC will try to increase their fall chinook production to meet the original 1,000,000 smolt target. Meeting that target is dependent on eggs from the Washington Department of Fisheries Lyons Ferry Hatchery. The Forest Service maintains that the mitigation program should annually set up a budget for meeting the 1,000,000 fall chinook smolt target. When eggs are not available to meet production targets, the surplus funds should be used to improve other hatchery operations or enhance habitat.

Response

The Applicant disagrees with the USFS suggestion that the Applicant budget for the production of 1 million fall chinook annually and then spend the money to improve other hatchery functions in those years when sufficient eggs are not available to meet production targets. The Applicant intends to provide sufficient funding for all of its mitigation hatcheries, regardless of fluctuations in production. With adequate funding provided to each facility annually, the Applicant does not understand how creation of "surplus" funding would improve hatchery operations.

USFS2-13

> The trap and haul method of reintroduction [of bull trout] planned for Hells Canyon and Oxbow dams should be considered for Brownlee Dam if the technique is successful at the other two.

Response

The Applicant is of the opinion that passing bull trout at Brownlee Dam would not restore bull trout to areas upstream of Brownlee Reservoir where the species does not currently exist. Passage facilities other than those proposed by the Applicant are not warranted because the biological benefit to fish species of the HCC is questionable relative to the costs associated with construction and O&M. The Applicant believes that the current proposal would allow opportunity to continue learning about the potential use and benefit of passage facilities and behavior of fish species associated with passage.

The Applicant reported in Technical Report E.3.1-7 that bull trout were not found in Brownlee Reservoir or in the mainstem Snake River above Brownlee Dam during ten years of sampling. The Applicant is not convinced that passing bull trout at Brownlee Dam will restore bull trout to areas upstream of Brownlee Reservoir where the species currently does not exist because of severe habitat alteration and multiple barriers. The Applicant proposes in the license to evaluate the presence or absence of bull trout in Eagle Creek since their presence there has not been confirmed (see section E.3.1.3.2.1.5.).

The Applicant believes that its proposed PM&E measures adequately and appropriately address project-related impacts to redband trout and bull trout populations associated with the HCC. The Applicant also believes that, once implemented, its proposed native salmonid plan would ensure the maintenance, enhancement, and protection of redband and bull trout habitat and associated populations in the vicinity of the HCC. Further effort in basins outside the project area is beyond the scope of the project and related impacts. The Applicant believes that resources directed toward HCC bull trout and redband populations are appropriate to address project-related impacts. Populations outside the project area have been impacted by a host of factors that are not related to the HCC. The Applicant chose to focus its native salmonid plan on bull trout in the Pine–Indian–Wildhorse core area because these populations are currently at high risk for extinction and because they are directly affected by the HCC. Under the native salmonid plan, the Applicant's plans to address specific issues related to habitat by working with a management group comprising state management agencies, tribes, the USFWS, private landowners, and federal land managers.

The U.S. Fish and Wildlife Service (USFWS) listed distinct population segments (DPS) of bull trout in the Klamath and Columbia river basins as threatened species under the Endangered Species Act (ESA) on June 10, 1998 (63 FR 31647). Nearly 18 months later, the USFWS expanded the listing to include all populations of bull trout in the coterminous United States (64 FR 58910; November 1, 1999). These listings were the culmination of an administrative and judicial process initiated by the filing of a petition in 1992 to list bull trout as an endangered species throughout its range in the United States. In October 2002, the USFWS issued a *Bull Trout Draft Recovery Plan*. The ESA listing, review, and recovery process is a sequenced and logical progression that anticipates that, as the process unfolds, new and better information about the status, habitat, and biological needs of the listed species will be available and that this information will assist in developing a recovery strategy for the species. Reasoned decision making depends upon this progression and this new information stream. On March 28, 2003, IPC submitted comments on the *Bull Trout Draft Recovery Plan* and also submitted comments on the draft designation of critical habitat for the listed bull trout in May 2003. In the context of the relicensing of the HCC, IPC has analyzed the impact of the HCC on local bull trout populations and developed protection, mitigation, and enhancement (PM&E) measures to adequately address those impacts. These measures are detailed in the FLA, section E.3.1.3.2.1. IPC intends to continue participating in the critical habitat designation and recovery processes initiated by the USFWS, as well as continue working with the states of Idaho and Oregon and interested stakeholders to address issues related to bull trout.

U.S. Forest Service comment at the joint agency meeting, held March 5 and 6, 2003

Recommended PM&E measure for sediment transport

Response

Based on the results of sediment transport studies relative to fishery resources (such as spawning gravel stability) (see Technical Report E.1-1), the Applicant believes that PM&E measures specific to sediment transport are not warranted.

> Recommended in-depth analysis of sustainable habitat for reintroduction purposes

Response

It is the Applicant's position that the studies conducted to address feasibility of reintroducing anadromous fish were adequate to conclude that the likelihood of successfully establishing self-sustaining anadromous fish populations upstream of Hells Canyon Dam is very low. Conditions along the migratory corridor in the lower Snake and Columbia rivers and in the ocean, together with ocean harvest and in-river adult survival, reduce smolt-to-adult returns to levels below those necessary to maintain basin production potential and possibly population self-sustenance. Most populations of anadromous fish in the Snake River basin (below Hells Canyon Dam) have reached extremely low levels, a situation that has led to their protection under the ESA. It is not reasonable to expect that populations could be sustained upstream of the HCC when they currently continue at such low levels downstream of the HCC.

Idaho Department of Fish and Game comment letter, dated January 10, 2003
IDFG1-50

> We expect IPC to be proactive and propose PM&E measures to mitigate for the extirpation of this native species within and above the Hells Canyon complex. The IDFG recommends that IPC investigate the effects of the Hells Canyon projects on lamprey distribution and abundance downstream. According to current information regarding the status of Pacific lamprey, there are still questions about its distribution and abundance. We believe that warrants assessment by IPC so that appropriate PM&E measures can be proposed.

Response

Pre-impoundment conditions are not considered the baseline conditions from which the Federal Energy Regulatory Commission (FERC) measures project impacts in relicensing proceedings. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

There is no evidence that the existence and operations of the Hells Canyon Complex affects the population dynamics of Pacific lamprey. Pacific lamprey spawn and rear in tributary streams, not within the mainstem Snake River, these fish are not blocked or denied access to tributaries downstream of the Hells Canyon Complex. Passage at federally owned and operated hydro-projects of the Lower Columbia and Lower Snake Rivers are more likely to affect the ability and timing of Pacific lamprey adults reaching available habitat in tributaries downstream of the Hells Canyon Complex. Populations of Pacific lamprey are also highly depressed within the Clearwater, Grande Ronde, Salmon, and Imnaha River sub-basins, and this is not due to the presence or operations of the Hells Canyon Complex, but again is more likely due to the common Lower Columbia and Lower Snake river hydro-projects.

IDFG1-58

> Although the IDFG is in agreement with IPC over the need for an M&E program, we disagree with the proposal to directly hire a hatchery evaluation biologist, overseen by IPC. We believe

a hatchery evaluation biologist that is employed by IDFG would be much more effective and provide more benefit to the overall program.

Response

The Applicant appreciates the IDFG's support for a monitoring and evaluation program under the terms of a new FERC license for the HCC. Despite the IDFG's argument to the contrary, the Applicant stands by its proposal to fund a full-time Applicant-employed evaluation biologist. The IDFG's argument for an IDFG-employed evaluation biologist centers around the benefits and efficiencies associated with the evaluation biologist being employed by a public resource agency. The IDFG cites such things as interagency cooperation, integration of research and management direction, and the IDFG's substantial experience and knowledge in this area as abilities that it can use to ensure greater communication and cooperation among everyone involved in hatchery operation and fisheries management. The Applicant agrees that these attributes are of critical importance to conducting meaningful monitoring and evaluation programs but sees no reason why the programs could not be developed as effectively by the Applicant. The Applicant disagrees with the assertion that results (from monitoring and evaluation research) would be more effectively understood and used by managers if they were generated by the IDFG because it is the hatchery operator. The Applicant further objects to the statement that hatchery implementation or other management recommendations to be implemented by IDFG would receive more internal support because there would be a direct link from technical staff to policy makers. These generalized statements suggest an inappropriate disregard for information generated outside of IDFG that might be contrary to existing information, but nonetheless have scientific validity. These statements also suggest that the Applicant's scientific staff is unable to appropriately monitor and analyze the data or that they reject scientific information that may be contrary to its interests. The statements, and their underlying implications, are not only unsupported but untrue. The Applicant has in the past, and intends in the future, to maintain an active role in operation and management of its hatchery facilities. It has a competent biological staff and a wide range of resources to complement IDFG's experience and knowledge. Moreover, as evidenced by the diversity and complexity of scientific studies conducted in support of this license application, the Applicant is capable of conducting an effective hatchery monitoring and evaluation program.

IDFG1-59

Current Production at Anadromous Mitigation Hatchery Facilities—Modern hatchery management protocols do not measure program success by juvenile production levels. Instead, objectives reflect the purposes of hatchery production (e.g., societal use, sport fisheries, restoration). The mitigation program needs to include life cycle survival objectives or adult return objectives to capture the expected benefits of the program. Production of juvenile hatchery salmon and steelhead has no societal, ecological, or mitigation benefit if no adults return. Consideration of juvenile performance measures, such as a survival goal from hatchery release to Lower Granite Dam would be appropriate to capture aspects of the rearing cycle significantly affected by the IPC program.

We agree that, in the near future, the proposed production of spring chinook, summer chinook, and steelhead should continue within current production levels. With a new M&E protocol in place, IPC and IDFG will be able to measure whether those production levels meet the established societal and ecological goals. Because fall chinook mitigation production has not been fully implemented, we recommend a phased approach using a base production of 200,000 to 500,000 juveniles that is tied to answering specific M&E questions needed to demonstrate likely success of the program within the context of existing regional fall chinook programs. This would be an important step to support the additional capital construction needed to rear the full complement of one million fall chinook at Oxbow Hatchery. This approach would provide for alternative mitigation, if achieving tributary fishery benefit or other desired objectives does not appear feasible over the long-term.

Response

While Oxbow Hatchery itself has a current capacity of approximately 200,000 fall chinook, the Applicant has contracted with ODFW to rear up to 800,000 additional fall chinook smolts (pending egg availability from Lyons Ferry Hatchery). The combination of the Applicant's and the contracted facilities to rear 1 million fall chinook smolts meets with the approval of all signatories to the *Hells Canyon Settlement Agreement* and fulfills all of the Applicant's obligations for artificial production of fall chinook under the existing license for the Hells Canyon

Complex. The Applicant acknowledges IDFG's desire to produce up to 1 million fall chinook at Oxbow Hatchery and has included plans in the license (see section E.3.1.3.2.2.) to expand the facility to meet this level of production (assuming sufficient ground water availability).

The Applicant acknowledges the IDFG's desire to maintain current production levels for spring chinook, summer chinook, and steelhead and to adopt a phased approach to expanding the level of fall chinook production upward from its current level. The Applicant also agrees that implementation of proposed monitoring and evaluation programs would facilitate an assessment of hatchery contribution to sport and tribal harvest and lifecycle survival rates. Information gained from these efforts would be useful for improving program efficiencies and making fishery management decisions. While the Applicant appreciates the value of information gained from monitoring and evaluation, it does not believe that it is appropriate to use this information to measure mitigation. Specifically, the Applicant does not support the concept of mitigation being measured in terms of producing specific numbers of adult salmon and steelhead annually. Smolt-production goals were derived from estimates of adults lost to construction and operation of the HCC multiplied by agency-expected smolt-to-adult survival rates. Therefore, a logical connection between the level of hatchery production and the desired number of adults returned already exists. Changes in smolt-to-adult survival rates, harvest rates, and other factors make it impossible to ensure the return of a precise number of adults annually. Since all survival factors are beyond the Applicant's control once smolts are released from the hatcheries, measuring mitigation requirements in terms of adults produced would impose an unfair burden on the Applicant. The current mitigation hatchery program is measured in terms of providing hatchery facilities with sufficient capacity to meet smolt-production goals. The agencies supported this method of measurement, as evidenced by sworn testimony of agency biologists before the FERC during negotiations of the *Hells Canyon Settlement Agreement*. The Applicant believes that this remains the most reasonable means to assign mitigation requirements.

IDFG1-60

> *Pahsimeroi Fish Hatchery*—The existing facilities will not support rearing one million summer chinook smolts in a disease-free water supply to prevent whirling disease, which could affect ESA-listed and unlisted hatchery chinook produced at the facility. Production

> wells and facilities are required to be built at the upper Pahsimeroi Hatchery Facility and include sufficient raceway space to rear up to 1 million fingerlings to a minimum of 90 mm before being exposed to raw river water. A reliable alarm system needs to be incorporated for the production wells, including a backup generator system to maintain well water flows during power outages. IPC has done preliminary well drilling, field well tests, and may possibly have the new wells and early rearing tanks construction planned for 2003 or 2004. Because of the location of the well construction, new facilities at the upper ponds will be required, which IPC has described in the draft license application. IPC has advised IDFG that it will address this critical health issue in a timely manner and it is imperative that this issue be addressed under the current license requirements.

Response

Whirling disease has been present in the upper Salmon River basin for over 15 years. During that time, the IDFG has continually operated two whirling disease-positive hatchery facilities (Pahsimeroi and Sawtooth) in that drainage, which, according to its claims, places hatchery-reared listed and unlisted chinook at elevated risk of disease. Given that the lack of a pathogen-free water source has not changed IDFG operations, the Applicant does not see how development of pathogen-free water should be a condition of the current FERC license. The Applicant has conducted preliminary investigations into enhancements described by the IDFG and is willing to begin implementation of these measures in advance of a new FERC license for the HCC if appropriate PM&E “credit” is received. However, the Applicant remains firm in its position that these measures be considered PM&E measures under a new FERC license.

IDFG1-61

> *Transportation*—As a function of hatchery operation, IPC needs to assist with the management of the adults returning to the hatcheries. The IDFG utilizes surplus adults from the existing IPC program in many ways, including offsite fisheries in historical habitat such as the Boise River or recycling in current fisheries, or hauling steelhead to the Little Salmon River per the request of the Nez Perce Tribe and NOAA-Fisheries for natural production augmentation. The purchase of at least an additional adult fish truck is needed to facilitate

these management activities, a direct result of the hatchery program. Because of the distance and species overlap, there should be adult transportation ability for the concurrent adult steelhead programs at Pahsimeroi and Oxbow hatcheries, and for concurrent adult chinook programs at Pahsimeroi and Rapid River/Oxbow hatcheries.

Response

Under the terms of the *Hells Canyon Settlement Agreement*, all surplus adults trapped at the Applicant's facilities are made available to the agencies to use at their discretion and expense. The Applicant has routinely made such surpluses available to the IDFG and has voluntarily accepted the cost of relocating these fish to desired locations using a combination of the Applicant's and IDFG's transport vehicles. The Applicant is willing to continue this practice and believes that it can accommodate the cost of such measures within the scope of hatchery operating costs described in section E.3.1.3.1.2. The Applicant does not agree with the need for an additional Applicant-owned transport vehicle to accomplish this task. The Applicant currently provides three 1,000-gallon transport vehicles for transporting adult salmon and steelhead from trapping facilities to hatchery holding ponds and for distributing adult surpluses. While trapping operations involve use of these vehicles for several months each year, the distribution of surplus fish is limited to a few days annually. Purchasing an additional vehicle solely for such limited use is not cost effective. The IDFG already owns several adult transport vehicles. The Applicant believes that it is most cost effective to reimburse the IDFG for the use of these units when they are needed to distribute surplus fish produced by the Applicant's mitigation hatchery program.

IDFG1-62

Fishery Access as Mitigation—The Hells Canyon Complex resulted not only in the loss of salmon and steelhead habitat and the resulting production, particularly for fall chinook, but it also resulted in the loss of fishing area for chinook and steelhead. Although IPC implemented juvenile hatchery production to mitigate for the production loss, the loss of stream miles for fishery opportunity has not been addressed by the existing settlement agreement. We recommend this be addressed as a PM&E. It is clear that management of a hatchery program is much broader and complex than just producing juvenile hatchery fish. The IDFG believes the primary objective of the IPC programs is to provide societal use, primarily in the form of harvest opportunity. The programs produce mitigation benefit when adults return and when anglers can get access to them. As an aspect of continuing the hatchery mitigation programs, we recommend that IPC work with the fishery management agencies to initiate funding to enhance or develop fishery access linked to the treaty and non-treaty instate fisheries supported by their hatchery programs.

Response

The Applicant currently provides a number of recreational facilities within the project boundary and is proposing development of even more as part of the new license. These facilities are based on recreation use and user preference studies and adequately protect, mitigate, or enhance recreation access. IDFG's comment does not provide enough detail to evaluate its request for further development of fishing access. However, the Applicant opposes acquiring easements or fee titles to properties for public access that are not associated with ongoing operation of the HCC. The Applicant is not responsible for determining the best societal use of adult salmon and steelhead produced by its hatchery facilities. This decision and all management implications associated with providing benefits to society are the responsibility of others. The Applicant suggests that issues of access be resolved collectively with the tribes with treaty-reserved fishing rights, USFS, BLM, Idaho Department of Parks and Recreation, and others.

IDFG1-76

We definitely believe the scope of the tributary enhancement measures must be expanded to tributaries other than Pine Creek, Indian Creek, and the Wildhorse River. Tributaries upstream of Brownlee Dam should be included (e.g. Brownlee Creek, Weiser River) as well as the feasibility of future passage above Brownlee Dam. Operation of Brownlee Reservoir can negatively impact salmonids in the tributaries to and upstream of Brownlee Pool. These salmonids move extensively. For example, an adult wild redband trout moving out of Brownlee Creek into Brownlee Reservoir was captured and radio tagged by IPC in the fall of 2001. IPC tracked it to near the upper end of the reservoir where it was lost. It was eventually harvested in the Weiser River near Cambridge, Idaho the following spring (about eight months after being tagged). The trout had traveled over 100 miles. The IDFG believes the Weiser River drainage warrants inclusion by the IPC for future enhancement and restoration. At the time of closure of the Hells Canyon Complex, spring/summer chinook salmon and steelhead were still present in the Weiser River. The extirpation of anadromous species from the Weiser River undoubtedly affected resident salmonids through the loss of marine derived nutrients and the available prey base. While IPC's mitigation hatcheries in part compensated for the loss of anadromous species present at closure, there has been no mitigation for resident salmonid species. The IDFG thinks it is important to include the Weiser River in the mitigation package. The drainage has significant potential for enhancing bull trout, redband trout, and mountain whitefish as it is a highly productive river system. There is much that can be done habitat-wise in the drainage to improve conditions for restoring sport fisheries for native salmonids.

Response

The Applicant does not believe that tributary enhancement measures should be extended beyond the HCC to the Weiser River basin. Bull trout and redband trout in the Weiser River basin are located over 100 miles from Brownlee Dam in the headwaters of the drainage. The lower Weiser River has been significantly impacted by land-use activities, and irrigation diversions are common. Many of these diversions are probably barriers under all but the highest of flows. Summer water temperatures in the lower Weiser River become lethal for salmonids. The Applicant finds it difficult to conceive that redband and bull trout populations in the Weiser River basin are affected by the HCC. The Applicant believes that its proposed PM&E measures for redband and bull trout are adequate and appropriate for impacts related to the HCC.

The Applicant believes that passage facilities other than the ones proposed are not warranted because the biological benefit to fish species of the Hells Canyon Complex is questionable relative to the costs associated with the construction and O&M. The Applicant believes that the current proposal will allow opportunity to continue to learning about the potential use and benefit of passage facilities and behavior of fish species associated with passage.

The Applicant reported in Technical Report E.3.1-7 that bull trout were not found in Brownlee Reservoir or in the mainstem Snake River above Brownlee Dam during ten years of sampling. The Applicant finds no supporting evidence that passing bull trout at Brownlee Dam will restore bull trout to areas upstream of Brownlee Reservoir, where the species currently does not exist because of severe habitat alteration and multiple barriers. The Applicant proposes in the FLA to evaluate the presence or absence of bull trout in Eagle Creek, since bull trout presence there has not been confirmed (see section E.3.1.3.2.1.5.).

The Applicant believes that its proposed PM&E measures adequately and appropriately address project-related impacts to redband trout and bull trout populations associated with the HCC. The Applicant also believes that, once implemented, its proposed native salmonid plan would ensure the maintenance, enhancement, and protection of redband and bull trout habitat and associated populations in the vicinity of the HCC. Further effort in basins outside the project area is beyond the scope of the project and related impacts. The Applicant believes that resources directed toward HCC bull trout and redband populations are appropriate to address project-related impacts. Populations outside the project area have been impacted by a host of factors that are not related to the HCC. The Applicant chose to focus its native salmonid plan on bull trout in the Pine–Indian–Wildhorse core area because these populations are currently at high risk for extinction and because they are directly affected by the HCC. Under the native salmonid plan, the Applicant's plans to address specific issues related to habitat by working with a management group comprising state management agencies, tribes, the USFWS, private landowners, and federal land managers.

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IDFG1-92

> The IDFG policy goals and principles relative to anadromous fish management are as follows:
>
> IPC project operations and mitigation measures must support and contribute to sustainable recovery of salmon and steelhead stocks to provide consistent and diverse fisheries for fall chinook salmon, summer steelhead and spring/summer chinook salmon. Hatchery production will continue as a primary mitigation tool for lost fish and fisheries due to the Hells Canyon Complex. Mitigation will be replacement or compensation of lost habitat capacity of naturally produced fish, usually for harvest opportunity. The success of mitigation measures will be measured by fisheries achieved, not smolts produced.
>
> IPC must support hatchery operations conducted in a manner that minimizes impacts to naturally produced salmon, steelhead, and other native species, complies with the Endangered Species Act, and is consistent with Columbia Basin regional Artificial Production Review policies. Artificial production facilities will be operated in compliance with all applicable fish health guidelines and facility operation standards and protocols. Mitigation fish releases will not introduce pathogens not already existing in the local population and IPC propagation facilities will not significantly increase the levels of existing pathogens.

The new license should include appropriate monitoring and evaluation protocols as well as adaptive management provisions so that funding and other resources are available during the license term to respond to new information and management direction. IPC mitigation should achieve the non-monetary societal benefits for which the mitigation program is designed, including fishable conditions/fishing access. IPC mitigation measures and project operation will contribute to the IDFG goal of improving survival of salmon and steelhead leaving Idaho and returning from the ocean.

Response

Monitoring and evaluation programs proposed by the Applicant would assess the relative contribution of fish produced in the Applicant's hatcheries to sport and tribal harvest within the Columbia River basin. The Applicant believes that this assessment would satisfy the IDFG's concerns for evaluating the "success" of the program. The Applicant maintains that adult returns should not be the basis for mitigation. Basing mitigation on the annual production of a specific number of adults salmon and steelhead places an unfair burden on the Applicant for something over which it has no control.

IDFG1-93

Improvements to Pahsimeroi Fish Hatchery—The IDFG recommends developing a program to first assess if the current harvest mitigation program is negatively affecting the productivity or precluding recovery capabilities of listed steelhead, and to incorporate a planning process responsive to M &E findings. There is substantial information needed to make an informed decision about the risks and benefits of either continuing to use the current broodstock for a largely harvest mitigation program or mining listed steelhead for the program, and whether steelhead supplementation holds sufficient promise to consider different broodstocks for different objectives. A key would be demonstrating that the potential negative effects of the current broodstock (hatchery steelhead spawning in natural habitat with each other or natural steelhead) really pose risk to natural steelhead rebuilding.

Current productivity response by Snake River steelhead to improved survival conditions (better outmigration conditions and more productive ocean conditions) suggests that the current hatchery program is not limiting and may not be affecting natural steelhead productivity. However, investigation to support or refute NOAA Fisheries perceptions is needed prior to disrupting a successful fishery mitigation program. We recommend this strategy be "front-loaded" with the appropriate groundwork to determine if there is a problem and the scope of the problem in order to conduct a benefit-risk assessment, both to wild fish production and the hatchery supported fishery program. This should be completed prior to implementation planning and decisions. Because we expect that any program implementation would include significant planning and monitoring requirements to monitor performance of the new hatchery broodstock (in the hatchery, in fisheries, and in the environment), along with performance of the natural population being mined for the hatchery production, we suspect that IPC has underestimated the annual cost of this potential program.

In the general comments section, we discuss key requirements at Pahsimeroi Hatchery to address fish health issues for current production. The following section identifies capital construction recommendations that are not specifically tied to the near-term resolution of fish health issues:

- Replace and redesign current fish weir—all metal panels need to be replaced with aluminum conduit panels, keyways to install panels need to be constructed, and an overhead hoist system extending the full length of weir should be added.

- Redesign male holding pond—the male holding pond should be redesigned to segregate spawned and unspawned adult male steelhead and salmon for multipurpose use and to avoid sorting ripe males.

- Install a drain system on the intake box of the holding ponds—a drain system is needed to keep water out of the intake box during the winter to keep it from freezing and to flush small fish that get trapped.

Response

The Applicant's proposal to develop a locally adapted steelhead broodstock at Pahsimeroi Fish Hatchery is based on information from NOAA Fisheries personnel indicating a desire to eliminate the use of nonendemic steelhead stocks in the upper Salmon River basin. The Applicant agrees that, prior to implementing program modifications, a defined management plan must first be developed though consultation with the state agencies, tribes, and NOAA Fisheries.

With regard to specific improvements to Pahsimeroi Fish Hatchery associated with the adult weir, male holding pond, and holding pond intake box, the Applicant believes that it can implement the desired measures within the scope of the proposed annual operating budget presented in section E.3.1.3.1.2.5.

IDFG1-96

> *Improvements to Rapid River Fish Hatchery*—IPC proposals to construct adult holding pond and spawning facilities and upgrade employee housing generally concur with IDFG recommendations. We consider these proposals a high priority for current and future operations at Rapid River Hatchery. Because adult outplanting is a key management tool at Rapid River Hatchery for subsistence use, fishery recycling, and natural production purposes, new construction needs to incorporate adult sorting and holding needs for multiple outplanting activities to avoid continual sorting through ponds holding fish for broodstock, causing stress and increasing the potential for prespawn mortality.
>
> Regarding use of carcasses from Rapid River Hatchery, the IDFG reiterates the need for a pathogen survey prior to implementing this measure. Use of carcass analogs may provide an alternative approach if there are disease issues with use of carcasses. Annually, spawned carcasses are relatively abundant. Utilization of unspawned carcasses for nutrient enhancement would need to be considered in concert with the other annual management needs for the adults, primarily subsistence, fishery use, and natural production enhancement.

There are additional improvements needed at Rapid River Hatchery that should be included in the PM&E package. The current location of the migration barrier and fish trap requires additional and redundant operational procedures at Rapid River Hatchery. The Rapid River fish trap is only a short distance from the Rapid River complex. Currently, adult spring chinook salmon are transported to the hatchery in tankers because the adult trap is not on-site. Transportation causes additional stress, can cause damage to the adults, and is labor intensive. In addition, fish trap security is difficult to enforce due to the off-site location of the fish trap. Other migratory and resident species are guided into the trap because it is the only available corridor to follow. However, the trap is beneficial because it serves a key management role by precluding passage of unwanted anadromous species into the Rapid River drainage. Precluding passage of hatchery steelhead into Rapid River, which is a wild native steelhead sanctuary, is a particularly important mitigation measure for the hatchery steelhead program to support harvest in the Little Salmon River. IPC should work with the fishery agencies to determine if moving the trap to the Rapid River Hatchery may potentially eliminate the need for a full-time migration barrier as long as species could still be sorted during key migration periods and sufficient chinook broodstock could be trapped. By not handling all fish destined for Rapid River, the stress to these species would be reduced along with the hatchery workload. Investigation is needed to determine if some sort of removable migration barrier would be feasible. If feasible to move the trap, an additional benefit would be increased angler opportunity in Rapid River, which is utilized as a treaty fishing site.

Regardless of the longer-term decision regarding the trap site, the current velocity barrier at the fish trap is deteriorating and is a safety concern. Several of the sidewall supports are in the advanced stages of dry rot and decay. The floor of the structure also currently poses a safety hazard.

Rapid River Hatchery is critical to the IDFG's goals of providing sportfishing opportunity for hatchery spring chinook, particularly within the current ESA management context. Although sport fisheries are not possible in all years, treaty and non-treaty fisheries targeting Rapid River Hatchery spring chinook in the Little Salmon River drainage have been the most consistent in the state. However, fishing access is limited. In years of full production, a component of smolts have been released in the upper Little Salmon River to "spread out" adult returns and thus fishing pressure. However, because these smolt releases do not contribute to broodstock collection, the IDFG has taken a conservative approach regarding off-site smolt release. The ability to collect adult chinook salmon and steelhead in the upper Little Salmon River mainstem or tributary mouth, generally in the vicinity of Stinky Springs, would be a substantial benefit to the IPC mitigation program. This would provide contingency backup for broodstock collection for the spring chinook program and would allow more emphasis on spreading out smolt releases in the Little Salmon River with less risk to broodstock collection. This would have a positive effect on fisheries by providing additional areas for fishing. Should the IDFG and IPC determine that a localized broodstock is necessary for the Little Salmon River component of the IPC steelhead mitigation program (rather than using progeny from adults trapped at Pahsimeroi Hatchery or the Hells Canyon trap), a combination of adult hatchery steelhead intercepted at Rapid River hatchery and in the upper Little Salmon River could be utilized to support the hatchery program. We recommend IPC integrate into the PM&E proposal, an investigation into an additional trapping site in the Little Salmon River.

There are several capital needs for the hatchery that the IDFG believes are important for inclusion in the PM&E measures but are of secondary priority to constructing adult holding pond and spawning facilities and upgrading of employee housing. These are as follows:

- Replacement of the gasoline back-up pump motor—the current backup motor in the pump house building is 16 years old. A new commercial grade motor would elevate system dependability.

- Replacement of the office building, shop, and break room/wet lab—The office building was constructed in 1961. The office area is in the old freezer storage area. The building also contains the shop, small lab, wet lab (the old incubation room), and visitor area.

- Installation of a new well house and domestic water system—The well casing nearest the hatchery intake is currently not being used. The demand on the existing system is at or near maximum capacity. The existing well and domestic water system provides water for numerous areas. Three permanent residences, the hatchery office, the Haz-Mat building, HP-2, the dormitory, the public restroom building, the incubation building, and the lawn area by the visitor parking area are all plumbed into the existing system. In addition, the water source is used for irrigating the residence lawn areas and portions of the hatchery grounds. An additional water system would substantially reduce the demand on the existing system and increase the water pressure of both systems. The increased well system would allow hatchery personnel the opportunity to install an automatic sprinkler system around much of the grounds area. Current irrigation practices are flooding the aquifer during the summer months and causing water test results to exceed safe limits.

- Replacement of wooden diversion dam with hydraulic/manual operated floodgates Removing and installing dam boards is a laborious and dangerous situation. Although no serious injuries have resulted, many minor injuries have occurred. The equipment and dam boards are extremely heavy and awkward to use. Rapid River flow rates can fluctuate dramatically during the spring and much of the required work occurs during the evening hours when visibility is limited. A new structure could address many safety issues and increase upstream and downstream migration success of many species that utilize the Rapid River corridor.

- Modification of public restrooms so access complies with (Americans with Disabilities Act (ADA) criteria—Current access to the public restrooms does not comply with ADA criteria.

- Replacement of catwalks on raceways and rearing pond #2 (RP #2) – The catwalks are old and rusting and are a safety concern. Many of the welds have broken causing an uneven walking surface to occur. The catwalks on RP-1 have been replaced.

- Relocation and reconstruction of fenced storage area—Much of the newly installed fencing was destroyed recently during a mudslide. The integrity of the perimeter was compromised allowing cows, deer, and the public access. The current situation is a safety concern and needs to be rectified. The following recommendations are considered third in priority to the above, but reflect measures that would significantly improve the living conditions for permanent employees, who must live on-site.

- Construction of kitchen/dining room additions to Residences #2 and #3 and remodel kitchen/dining area and laundry room bathroom in Residence # 1—Kitchen and dining room additions to Residences #2 and #3 would be a great improvement. Kitchen counters are in need of replacement. Current accommodations are small, confined, and difficult to work in. Adequate space is available behind both residences for a nice addition. The kitchen and dining area in Residence #1 is in need of repair. The linoleum floor is very worn. The kitchen counter tops are faded, cracked, and absent in places. In addition, some of the kitchen cabinets need to be reinstalled for better access. The laundry room bathroom/shower is poorly designed and of limited function. For example, the shower stall is located directly in front of the central heating unit access panel. When the fan motor needs to be replaced, the shower stall will have to be removed to access the fan motor. There is no washbasin in the bathroom and no storage.

- Pave hatchery road to hatchery residences—The gravel in the road causes damage to the Exmark mower, drifts into the lawns, and is not aesthetically pleasing. Paving would be a nice improvement to the housing area. In addition, it would allow children and adults the opportunity to rollerblade, bike, and perform many other children's activities away from the main road.

Response

The Applicant appreciates the IDFG's support for construction of new adult holding and spawning facilities at Rapid River Fish Hatchery. The Applicant understands the need for multiple holding containers to minimize repetitive handling stress and maximize efficiency. Engineering design of holding facilities would take these needs into consideration and be available for the IDFG to review prior to construction.

Following completion of appropriate pathogen surveys, the Applicant intends to use only spawned carcasses for nutrient-enhancement efforts. The Applicant would also consider carcass analogs as an alternative to whole carcasses.

The IDFG suggests in this comment that the Applicant investigate feasibility of relocating the migration barrier and adult trap closer to the main Rapid River Fish Hatchery to minimize fish handling stress, reduce the workload, and increase trap security. The Applicant believes that this request is unjustified. Regardless of the trap's location, all fish captured must be anesthetized and interrogated for marks, tags, and such before being placed in holding ponds. The IDFG has provided no evidence to demonstrate that the added step of placing fish in a 1,000-gallon vehicle for a 10-minute ride to the hatchery holding ponds is having a detrimental effect on survival. Additionally, the added work associated with this short transfer of fish by truck from trap to hatchery seems insignificant in relation to the extensive effort associated with trap interrogation and sorting and spawning activities. With regard to trap security, the Applicant acknowledges that this issue was a significant concern at one time. However, the Applicant made significant improvements to the trap in 1993 that have virtually eliminated theft and vandalism. Finally, the Applicant does not believe that construction of a temporary migration barrier in proximity to Rapid River Fish Hatchery is feasible, given the period of operation and nature of the Rapid River drainage. The IDFG operates the adult trap for steelhead and chinook annually from mid-March through mid-September. Flows during this period range from 28 to over 1,300 cfs. Due to the steep topography of the drainage, Rapid River is subject to dramatic increases in discharge associated with rapid snowmelt and intense storm events. The Applicant does not believe that a temporary migration barrier could withstand these conditions and still function to limit access of unwanted anadromous fish. The Applicant will investigate the deterioration of the migration barrier and make necessary repairs.

The Applicant acknowledges the IDFG's desire to create additional angling opportunities in the Little Salmon River and the need to provide smolt-release/adult-capture facilities in the vicinity of Stinky Springs. The Applicant included a PM&E proposal to investigate and construct structures to address this need (see section E.3.1.3.2.2.4.).

In its comments, the IDFG identified a number of improvements to Rapid River Fish Hatchery that it believes would benefit fish culture, hatchery employees, and the public. To address these items, the Applicant included a proposal for general hatchery upgrades to its list of PM&E measures in section E.3.1.3.2.2.4. With the exception of items discussed below, the Applicant concurs with the IDFG's recommendations and will make necessary improvements.

Replacement of office building—The Applicant disagrees that this building should be demolished and replaced. The current office building was constructed in 1964 (not 1961) and is still sound.

The Applicant believes that it is more cost effective to expand and upgrade the existing structure to meet current program needs than to replace it.

Installation of a new well house and domestic water system—There is no information to suggest that the existing domestic water system is at or near maximum capacity. The Applicant installed an ultraviolet treatment system over a year ago to ensure that drinking water met all state standards; pressure tanks and submersible pumps were maintained or replaced as needed; and the well continued to supply an adequate volume of water to meet all hatchery needs. An automated sprinkler system is included in the general hatchery upgrades discussed above (see section E.3.1.3.2.2.4.) but would likely be supplied by river water or a dedicated well so that it did not impact the domestic system.

Replacement of wooden diversion dam with hydraulic/manual operated floodgates—The Applicant acknowledges the need to make improvements to the wooden diversion dam at Rapid River Fish Hatchery. However, the Applicant believes that it is premature to assume that any improvements would involve hydraulic or manually operated floodgates. The Applicant's engineers would evaluate options to determine the most suitable means of replacing the current structure.

IDFG1-104

> The IDFG does not support reintroducing anadromous fish upstream of Hells Canyon Dam as a near-term goal, *but* believes it should not be discounted as a long-term goal, even into the next license period. We cannot predict future habitat or technology conditions that may allay many of the concerns with reintroduction identified by IPC and the IDFG and thus, options should remain open for future action. A key indicator for future actions should be the sustainability of anadromous populations downstream from the Hells Canyon hydroelectric complex. The sustainability of populations should serve as the model for considering the long-term reintroduction of anadromous fish upstream of Hells Canyon Dam.

> We recommend IPC incorporate a measure that links reintroduction decisions and planning to demonstrated achievement of smolt-to-adult survival rates that support sustain ability and recovery. The Northwest Power Planning Council's draft mainstem amendment recommends a 2 to 6 percent smolt to adult return (SAR) as an interim biological objective for their Fish and Wildlife Program. We believe this is a reasonable measure to use as a "target" for initiation of planning reintroduction; there are others that likely should also be included.

Response

The Applicant agrees with the IDFG that the sustainability and recovery of populations downstream of the HCC should serve as an indicator for feasibility of reintroduction upstream of the complex. Clearly, if anadromous fish cannot be sustained downstream of the HCC, they will definitely not be sustained upstream, given the many additional challenges these fish would face. If the smolt-to-adult returns of wild populations of anadromous fish approached the 2 to 6% range consistently, ESA protection might no longer be necessary. If hatchery returns were also in this range, there would be significant hatchery-return surplus to provide additional fisheries elsewhere.

However, smolt-to-adult returns downstream of the HCC, although a major component of the question of feasibility, are only one aspect of sustainability above Hells Canyon Dam. The Applicant believes that habitat quality needs to significantly improve in the mainstem Snake River and within the tributaries. As pointed out in many of the comments, significant steps are being taken to improve water quality and habitats through initiations of TMDL requirements. However, successful implementation of all aspects of the TMDL have yet to be demonstrated and, as acknowledged in comments to the Applicant's draft license application, may take many years, even beyond the context of this HCC license.

Passage issues above the HCC are significant even beyond consideration of the mainstem HCC dams. Multiple tributary dams and hundreds of water diversions would block access to much of the habitat that could support anadromous fish. Multiple diversions would need to be screened to prevent loss of juvenile fish as they outmigrate. The ability to pass anadromous smolts through large mainstem projects remains a challenge downstream of the HCC, and passing anadromous smolts would only be less successful in an impoundment the size of Brownlee Reservoir.

Oregon Department of Fish and Wildlife comment letter, dated January 10, 2003
ODFW1-114

> IPC should continue collecting information about Pacific lamprey that may be using tributaries below Hells Canyon Dam. IPC should develop and propose measures for inclusion in the FLA to mitigate for impacts to Pacific lamprey caused by ongoing operations of the HCC.

Response

The Applicant does not propose mitigation for Pacific lamprey. Pre-project conditions are not considered the baseline conditions from which the Federal Energy Regulatory Commission (FERC) measures project impacts in relicensing proceedings. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

There is no evidence that the existence and operations of the Hells Canyon Complex affects the population dynamics of Pacific lamprey. Pacific lamprey spawn and rear in tributary streams, not within the mainstem Snake River, these fish are not blocked or denied access to tributaries downstream of the Hells Canyon Complex. Passage at federally owned and operated hydro-projects of the Lower Columbia and Lower Snake Rivers are more likely to affect the ability and timing of Pacific lamprey adults reaching available habitat in tributaries downstream of the Hells Canyon Complex. Populations of Pacific lamprey are also highly depressed within the Clearwater, Grande Ronde, Salmon, and Imnaha River sub-basins, and this is not due to the presence or operations of the Hells Canyon Complex, but again is more likely due to the common Lower Columbia and Lower Snake river hydro-projects.

ODFW1-151

> Based on the information provided in this report [Technical Report E.3.1-2 Chapter 9], ODFW recommends that IPC work closely with fisheries agencies and tribes to identify those fish passage concepts that are most promising for testing at the project, and begin to design prototypes as part of a fish passage plan. This major component of a fish passage plan needs to be evaluated on site while other parts, such as tributary habitat restoration and fish pathogen risk assessment, are being implemented. A fish passage plan would include the following evaluations:
>
> a) Reservoir hydraulics modeling to refine operations or structural changes that will assist juvenile migration through the reservoirs and project facilities.
>
> b) Physical modeling and prototype testing of alternative juvenile fish collection and turbine intake screening structures.
>
> c) Test releases of excess hatchery juvenile fish to monitor their movement through tributaries and reservoirs and their collection at traps and other prototype systems. Measure survival and collection efficiency for each species and life stage tested.
>
> d) As other components of the Plan reach benchmarks indicating high likelihood of success, installation of screening and collection facility that has shown to be most effective based on modeling and prototype testing.

ODFW believes that sufficient information already exists to implement "c" above in specific tributaries. A juvenile collection trap could be installed in Pine Creek and Eagle Creek (tributary to the Powder River), and IPC could release hatchery fish surplus to current mitigation requirements into these tributaries. ODFW would assist IPC in identifying stocks to utilize and requesting approvals for such test releases.

Finally, as mentioned above, the high costs and low likelihood of successful reservoir and turbine passage should not dissuade IPC, fisheries agencies and tribes from pursuing fish passage with a phased-in approach. Trap and haul and tributary collection are relatively low cost options that should be tested in prototype as part of a comprehensive fish passage plan. Sufficient habitat still exists and potential problems may not be insurmountable to reestablishing passage.

In order to assure compliance with Oregon's fish passage laws, ODFW recommends IPC work with state and federal agencies and tribes to either develop a comprehensive fish passage plan or request a waiver of fish passage from the Oregon Fish and Wildlife Commission.

Response

It is the Applicant's position that the studies conducted to address feasibility of reintroducing anadromous fish were adequate to conclude that the likelihood of successfully establishing self-sustaining anadromous fish populations upstream of Hells Canyon Dam at this time is very low. As those studies show, conditions along the migratory corridor in the lower Snake and Columbia rivers and in the ocean, together with ocean harvest and in-river adult survival, reduce smolt-to-adult returns to levels below those necessary to maintain basin production potential and possibly population self-sustenance. Most populations of anadromous fish in the Snake River basin (below Hells Canyon Dam) have reached extremely low levels, a situation that has led to their protection under the ESA. It is not reasonable to expect that populations could be sustained upstream of the HCC when they currently continue at such low levels downstream of the HCC.

The ODFW acknowledges in this comment that the Applicant's estimation of costs for these passage facilities are within what ODFW would expect "(if not low)" for a project the size of the

HCC. The ODFW further acknowledges that, along with the high costs of passage facilities, there is a low likelihood of successful reservoir passage or turbine passage but maintains that this should not dissuade the Applicant's efforts. The Applicant disagrees with the ODFW. The Applicant believes that, given not only the low likelihood of success of reservoir passage but also the low likelihood of successfully establishing reintroduced populations because of the factors affecting existing runs of anadromous fish, the cost associated with passage and reintroduction is not in the public interest. As to compliance with the Oregon's fish passage law, Congress, in the Federal Power Act, has preempted Oregon’s fish passage law as it purports to apply to federally licensed hydropower projects.

ODFW1-158

> Mitigation requirements for Project impacts to anadromous fish should be based on potential adult returns to the mouth of the Columbia River of fish that could have been produced in areas within and above HCC. ODFW does not recommend increasing production at IPC’s hatchery facilities. Rather, ODFW recommends habitat restoration measures and flow augmentation to increase natural fish production.

Response

The *original* mitigation hatchery capacities were based on maximum counts of record at Brownlee and Oxbow dams from 1957 to 1959. However, hatchery capacities were later revised upward to a level that the NMFS, ODFW, IDFG, and Washington Department of Game and Department of Fisheries agreed were sufficient to mitigate for all numerical losses of anadromous fish associated with construction and operation of the HCC. As part of an uncontested offer of settlement filed with FERC jointly by the Applicant and the agencies in 1980, hatchery production goals for steelhead doubled from 200,000 to 400,000 pounds annually; spring/summer chinook production goals increased from 3 million to 4 million smolts annually; and fall chinook production goals were reinstated at 1 million smolts annually. By entering into the *Hells Canyon Settlement Agreement* on February 24, 1980, the State of Oregon agreed that the level of hatchery production agreed upon constitutes full and complete mitigation for all numerical losses of salmon and steelhead caused by or in any way associated with the construction of and operation within the existing license for FERC Project No. 1971.

Current mitigation requirements are based on adult returns of fish that could have been produced within and above the HCC. They are simply expressed in terms of smolt equivalents. Current smolt-production goals were derived from estimates of adults lost to construction and operation of the HCC multiplied by agency-expected smolt-to-adult survival rates. Therefore, a logical connection between the level of hatchery production and the desired number of adults returned already exists. Changes in smolt-to-adult survival rates, harvest rates, and other factors make it impossible to ensure the return of a precise number of adults annually. Since all survival factors are beyond the Applicant's control once smolts are released from the hatcheries, measuring mitigation requirements directly in terms of adults produced would impose an unfair burden on the Applicant. The current mitigation hatchery program is measured in terms of providing hatchery facilities with sufficient capacity to meet smolt-production goals. The agencies supported this method of compliance measurement, as evidenced by sworn testimony of agency biologists before the FERC during negotiations of the *Hells Canyon Settlement Agreement*. The Applicant believes that this remains the most reasonable means to assign mitigation requirements.

With regard to the ODFW's desire to pursue habitat restoration and flow augmentation to enhance natural fish populations, the Applicant believes that the measures proposed in the license application are adequate to mitigate the impacts of continued operation of the HCC. Nevertheless, migration survival and its relation to flow is debatable and recent reports indicate that higher flows do not necessarily equate to higher survival. In fact, in a recent review of flow augmentation, the Independent Scientific Advisory Board found that stabilization of flows through the lower Snake River hydroprojects could have a more beneficial effect of survival of juvenile salmonids than simply adding a volume of water (Review of flow augmentation: update and clarification, 2003, (ISAB 2003-1), Northwest Power Planning Council, Portland, OR. 67 pp.).

ODFW1-166

> [Relative to Native Salmonids] IPC should comply with the provisions of Oregon's Fish Passage Law (ORS 509.580 509.645). The compliance includes IPC proposing measures for providing upstream and downstream passage or work with ODFW to obtain a fish passage waiver from the Oregon Fish and Wildlife Commission.

Response

In the Federal Power Act, Congress has preempted Oregon's fish passage law as it purports to apply to federally licensed hydropower projects.

ODFW1-167

> IPC should provide mitigation for native salmonid populations, including redband trout, above Brownlee Dam and within smaller tributaries in addition to the Pine-Indian Wildhorse core area. Mitigation for bull trout should focus on objectives identified in the Draft Recovery Plan. IPC should participate on the multi-agency technical team.

Response

The Applicant has expanded the native salmonid plan to include addressing specific culverts associated with passage into tributaries from Brownlee Reservoir (see Chapter 4 of Technical Report E.3.1-7 for a complete list) that present migration barriers to redband trout. In addition, the Applicant agrees that the presence or absence of bull trout in Eagle Creek has not been confirmed and that a substantial effort should be directed toward an assessment of the presence or absence of bull trout in the Eagle Creek basin. The Applicant believes that an American Fisheries Society-accepted survey protocol for assessing the presence or absence of bull trout should be performed in the Eagle Creek basin. To this end, the Applicant has proposed an additional PM&E measure (see section E.3.1.3.2.1.3.) in this application to address the status of bull trout in the Eagle Creek basin by performing such a survey. The Applicant believes that a thorough assessment of bull trout in the basin is necessary before any serious discussion of reintroduction or other potential restoration measures can occur. It is important to remember that a number of potential limiting factors would have to be addressed in the Eagle Creek basin before any restoration effort would be successful. These include addressing the presence of an abundant brook trout population, migration barriers within Eagle Creek, irrigation diversions in the lower basin, and food supply for a fluvial life history.

The Applicant did not address bull trout in the upper Powder River basin because these populations are isolated in headwater areas above Thief Valley Dam and are not impacted by operation of the HCC.

The Applicant believes that its proposed PM&E measures adequately and appropriately address the protection, maintenance, and enhancement of redband and bull trout populations associated with the HCC. The Applicant's native salmonid plan is intended to mitigate for and enhance native populations of resident salmonids by implementing measures to maintain and enhance redband and bull trout populations associated with the HCC and should therefore not include tributaries upstream of the HCC.

The Applicant has proposed measures, not directly associated with the native salmonid plan, at Brownlee Reservoir that are designed to maintain and enhance redband trout populations. Measures proposed by the Applicant to improve water quality conditions in Brownlee Reservoir would benefit redband trout by providing suitable rearing and adult habitat during summer months.

The Applicant has been an active participant in the Hells Canyon Complex Recovery Unit Team (see section E.3.1.1.1.1.) for bull trout and will continue to work on bull trout maintenance and recovery measures through the Hells Canyon NSTAC (see section E.3.1.3.2.1.) and other technical teams as necessary. The U.S. Fish and Wildlife Service (USFWS) listed distinct population segments (DPS) of bull trout in the Klamath and Columbia river basins as threatened species under the Endangered Species Act (ESA) on June 10, 1998 (63 FR 31647). Nearly 18 months later, the USFWS expanded the listing to include all populations of bull trout in the coterminous United States (64 FR 58910; November 1, 1999). These listings were the culmination of an administrative and judicial process initiated by the filing of a petition in 1992 to list bull trout as an endangered species throughout its range in the United States. In October 2002, the USFWS issued a *Bull Trout Draft Recovery Plan*.

The ESA listing, review, and recovery process is a sequenced and logical progression that anticipates that, as the process unfolds, new and better information about the status, habitat, and biological needs of the listed species will be available and that this information will assist in developing a recovery strategy for the species. Reasoned decision making depends upon this progression and this new information stream. On March 28, 2003, IPC submitted comments on the *Bull Trout Draft Recovery Plan* and also submitted comments on the draft designation of critical habitat for the listed bull trout in May 2003. In the context of the relicensing of the HCC, IPC has analyzed the impact of the HCC on local bull trout populations and developed protection, mitigation, and enhancement (PM&E) measures to adequately address those impacts. These measures are detailed in the FLA, section E.3.1.3.2.1. IPC intends to continue participating in the critical habitat designation and recovery processes initiated by the USFWS, as well as continue working with the states of Idaho and Oregon and interested stakeholders to address issues related to bull trout.

ODFW1-173

> IPC should provide downstream passage of native salmonids, in addition to upstream passage, at Hells Canyon and Oxbow dams. If passage is supported by ODFW, IDFG, and the USFWS, operational protocols should be developed in consultation with these agencies. The traps should be designed to allow passage of fish smaller than 300 mm and year-round operation. Modifications should also be made that allow sorting at the trap site. Monitoring plans need to be developed and implemented by IPC to assess success and survival of passed fish. Construction and O & M cost estimates should be clearly described in the FLA.

Response

The Applicant agrees that the development of a fish passage plan needs to be closely coordinated with state and federal fishery managers. The Applicant acknowledges the ODFW's concern regarding the passage of juvenile salmonids less than 300 mm and would consider this in the design criteria of the trap modifications at Hells Canyon and the development of the Oxbow fish trap. It is also the Applicant's intent to operate the facilities on a year-round basis unless flows or icing prohibit trap operations. The Applicant also concurs with the need for on-site sorting as part of the hatchery program rather than transporting fish to the Oxbow Fish Hatchery first. Considerations of holding and sorting facilities would be part of design considerations. The O&M costs associated with this facility have been modified and include the trapping of salmon and steelhead.

As stated by ODFW, upstream and downstream passage facilities were not included for Brownlee Dam, and downstream passage facilities were not proposed for Oxbow or Hells Canyon Dam. The Applicant believes that passage facilities other than the ones proposed are not warranted because the biological benefit to fish species of the HCC is questionable relative to the costs associated with the construction and O&M. The Applicant believes that the current proposal will allow opportunity to continue learning about the potential use and benefit of passage facilities and behavior of fish species associated with passage.

ODFW1-179

> ODFW expects hatchery production will continue as one of many mitigation tools for lost fish and fisheries due to the HCC. One of ODFW's visions of successful mitigation from hatchery production is fisheries achieved, not smolts produced. With current mitigation programs, Oregon fishers and fisheries get minimal benefits at best. Fishery opportunities in Oregon are severely limited by planting location and angler access. A disproportionate number of releases occur in Idaho. In this relicensing, ODFW expects to work with IPC to make better use of the hatchery product. For example, as suitable mitigation for lost fisheries, ODFW believes IPC should assist with investigating fishery opportunities in Oregon. One opportunity could be a

fall steelhead fishery in the Powder River below Mason Dam. IPC would need to acquire water rights or agreements to release water to make this water fishable. Other opportunities for increased fisheries in Oregon could be increasing releases at Hells Canyon Dam, improving the quality of fish released at the dam (no high titers for BKD) and operate the trap at Hells Canyon Dam through July 01. Alternative hatchery mitigation could be development of a rainbow trout program. Fish could be reared for release at sublegal size (6-7") in Phillips and Brownlee reservoirs.

Response

The Applicant shares the vision of successful mitigation being expressed as fisheries achieved. However, the Applicant does not agree that mitigation should be measured in terms of producing a specific number of adults annually. Smolt-production goals were derived from estimates of adults lost to construction and operation of the HCC multiplied by agency-expected smolt-to-adult survival rates. Therefore, a logical connection between the level of hatchery production and the desired number of adults returned already exists. Changes in smolt-to-adult survival rates, harvest rates, and other factors make it impossible to ensure the return of a precise number of adults annually. Since all survival factors are beyond the Applicant's control once smolts are released from the hatcheries, measuring mitigation requirements in terms of adults produced would impose an unfair burden on the Applicant. The current mitigation hatchery program is measured in terms of providing hatchery facilities with sufficient capacity to meet smolt-production goals. The agencies supported this method of compliance measurement, as evidenced by sworn testimony of agency biologists before the FERC during negotiations of the *Hells Canyon Settlement Agreement*. The Applicant believes that this remains the most reasonable means to assign mitigation requirements.

The ODFW asserts that Oregon anglers and fisheries get minimal benefit from the Applicant's mitigation hatchery program due to limited planting locations and angler access. The ODFW expects to work with the Applicant during the relicensing process to make better use of the hatchery product. By way of example, the ODFW suggests establishing a fall steelhead fishery in the Powder River below Mason Dam.

Under the current mitigation program, parties to the *Hells Canyon Settlement Agreement* may, at their discretion, agree to modify the numbers of smolts produced and release locations as described in the agreement. Additionally, the Applicant makes all surplus fish available to the parties for use at their discretion. Given that a mechanism already exists to effect the type of changes that ODFW desires, it is unclear why it does not do so under the current agreement. To illustrate, the Applicant trapped a combined total of 6,561 surplus steelhead at the Hells Canyon fish trap in the fall seasons of 2001 and 2002. The IDFG moved 2,203 fish to the Boise River; the Nez Perce Tribe moved 2,109 fish to the Little Salmon and Salmon rivers; and the ODFW instructed Oxbow Fish Hatchery staff to release 2,249 fish into Hells Canyon Reservoir. It is unclear why ODFW is not capitalizing on this opportunity to place fish in more desirable locations, nor is it clear what more the Applicant could do to benefit Oregon anglers.

The Applicant disagrees with the ODFW's suggestion that the Applicant acquire water rights in the Powder River below Mason Dam to make it fishable for surplus steelhead. The Applicant has no stake in water-use issues in the Powder River basin. The ODFW should pursue this issue with the Oregon Water Resources Department.

The Applicant's mitigation hatchery program is designed to replace lost harvest opportunity for anadromous fish. Given that it is relatively successful at doing so, the Applicant does not see a need to develop alternative forms of mitigation such as stocking resident trout in Brownlee or Phillips reservoirs.

ODFW1-182

> In coordination with ODFW, develop a long-term, comprehensive monitoring and evaluation program for all four hatcheries. Include monitoring of straying on spawning grounds. IPC should expand Oxbow Hatchery for fall chinook salmon broodstock collection and spawning. In addition, IPC should work with ODFW to investigate and supply alternative fisheries in Oregon.

Response

The Applicant has proposed development of monitoring and evaluation programs for each of its hatchery facilities. After a new license has been issued for the HCC, the Applicant anticipates coordinating the details of such programs with the ODFW, as well as with the IDFG, NOAA Fisheries, and others.

The Applicant believes that it is premature to expand Oxbow Fish Hatchery for fall chinook broodstock collection. This issue would be better suited for evaluation in the context of development of an overall management/recovery plan for Snake River fall chinook.

The Applicant currently makes surplus adult spring chinook and steelhead from Oxbow Fish Hatchery available to agencies and tribes for use at their discretion. The Applicant is committed to this continued cooperative effort.

ODFW2-2

> IPC needs to comply with the provisions of Oregon's Fish Passage Law [relative to white sturgeon] (ORS 509.580-509.645). IPC needs to propose measures for providing upstream and downstream passage or work with ODFW to obtain a fish passage waiver from the Oregon Fish and Wildlife Commission.

Response

In the Federal Power Act, Congress has preempted Oregon's fish passage law as it purports to apply to federally licensed hydropower projects. White sturgeon do not use traditional fish passage facilities. In addition, the Applicant does not see a benefit for passing sturgeon into Oxbow or Hells Canyon reservoirs because of the inability to sustain a population of sturgeon within these pools. The Applicant believes that white sturgeon would benefit more by allowing them to stay within the free-flowing reach of the Snake River below Hells Canyon where their reproductive potential can be better realized. After water quality concerns are addressed in

Brownlee Reservoir and in the free-flowing section upstream of Brownlee Reservoir, it may be beneficial to enhance this reach with reproductive sturgeon. This could be accomplished by translocating individual fish from a source reach such as below Hells Canyon or in the middle Snake River. This management action is similar in concept to the “trawl and haul” approaches currently employed by the ODFW in the lower Columbia River impoundments as a means of passage because of the infeasibility of volitional sturgeon passage.

Oregon Department of Fish and Wildlife comment at the joint agency meeting, held March 5 and 6, 2003

Recommended minimum flow of 5,000 cfs in the Oxbow Bypass

Response

The Applicant does not believe that a minimum flow of 5,000 cfs in the Oxbow Bypass reach is necessary to protect or enhance habitat for the key species identified by the Aquatic Resources Work Group (see Technical Report E.2.3-1). Bull trout and redband trout habitat for adults and subadults declines with increasing flow in the bypass, as it does below Hells Canyon Dam (Technical Report E.2.3-2). Fall chinook spawning habitat does increase with increasing flows, and a minimum of 5,000 cfs may provide some habitat suitable for fall chinook salmon spawning. However, spawning habitat for fall chinook salmon is currently underseeded below Hells Canyon Dam. As such, spawning habitat availability is not currently limiting fall chinook salmon. White sturgeon spawning habitat also increases with increasing flow in the Oxbow Bypass. However, there is suitable habitat in the tailrace below the Oxbow Powerhouse. In addition, other analyses on limiting factors of white sturgeon suggest that the short reservoir reach and larval drift may be limiting white sturgeon in Hells Canyon Reservoir and precluding the establishment of a sustaining population (see Chapter 1 of Technical Report E.3.1-6). Habitat availability for adult and juvenile white sturgeon does not have a strong relationship with flow but does gradually decrease with increasing flow, similar to habitats below Hells Canyon Dam.

Oregon Hydroelectric Application Review Team comment letter, dated January 10, 2003

HART1-14

> It is important for IPC to provide more details about hatchery mitigation monitoring in its final application. This program should include monitoring of hatchery-wild fish interactions, monitoring of several tributaries to determine the extent and potential impact of hatchery straying, and funding for a fish pathologist. The proposed funding level appears insufficient to conduct needed monitoring.

Response

Once a new license is issued for the HCC, the Applicant will work with agencies and tribes to formulate and prioritize specific details of a comprehensive monitoring and evaluation program for each hatchery facility. Specific budget details would also be determined at that time. The Oregon Hydroelectric Application Review Team (HART) provides no basis for its request to fund a fish pathologist. As part of ongoing hatchery operations, the Applicant currently funds, and will continue to fund, IDFG fish health professionals. There is no justification for additional fish pathology staff.

Burns Paiute Tribe comment letter, dated January 8, 2003

BPT1-9

> The Tribe requests IPC to conduct a complete risk assessment of reintroducing anadromous fish. A pathogen risk assessment is crucial to develop potential mitigation measures for Project impacts to Tribal resources. (T.R. E.3.1-2 Chapter 10). A pathogen risk assessment needs to be coordinated with the all Subbasin stakeholders, including but not limited to Tribes, states, and federal agencies. IPC has not studied the impacts of the loss of anadromous fish to resident fish. The draft application merely identifies that the loss of anadromous fish affect the community structure and prey base of aquatic organisms. IPC's proposed mitigation measures include distributing salmon carcasses along streams as well as truck and haul live anadromous fish to areas that are currently blocked. Potential production and the presence of

carcasses will enrich the food web to more historical levels. However, IPC limits these proposed measures to a few streams within the Project Study Area. The Tribe wants this mitigation measure to be expanded to include all tributaries and streams associated with the historical range of anadromous fish. This would also require a pathogen risk assessment to subbasins in Oregon and Idaho.

Response

The Applicant notes here its serious reservations, discussed at more length in the Applicant's response to the comments of the Burns Paiute Tribe on the Draft License Application, concerning the Tribe's alleged legal entitlements. The Applicant believes that the proposed mitigation measures in this final license application adequately address project impacts. The Applicant believes that to expand components of its proposed native salmonid plan to all tributaries and streams associated with the historical range of anadromous fish is outside the scope of impacts specific to the HCC. As described in detail (in this exhibit and Chapters 4 and 5 of Technical Report E.3.1-2), many of the basins associated with historical anadromous production were already blocked from anadromous fish prior to construction of the HCC. The Applicant has focused the native salmonid plan and measures associated with the plan to tributaries immediately associated with the HCC.

Finally, pre-project conditions are not considered the baseline conditions from which the Federal Energy Regulatory Commission (FERC) measures project impacts in relicensing proceedings. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

Nez Perce Tribe comment letter, dated January 10, 2003

NPT1-15

> *Fish Passage Measures* – As more fully explained in the attached report, the Applicant should develop a phased, integrated passage study PM&E that includes: (1) planting fish upstream in selected tributaries to evaluate their ability to survive; (2) funding the development of a watershed recovery plan that would allow for a prioritized and integrated approach; and (3) examine the development of trap and haul facilities at all three locations. As a component of fish passage studies, the Applicant should organize a cooperative multi-agency group to evaluate monitoring results and recommend specific adjustments to study process.

Response

Based upon the information available, including the studies initiated in connection with relicensing efforts, the Applicant maintains that the recommended PM&E measures associated with anadromous fish are adequate. The Nez Perce Tribe suggests that the Applicant undertake several additional measures associated with the potential passage and reintroduction of anadromous fish above the HCC. In light of the present condition of upstream habitat and water quality, the Applicant contends that such efforts are not appropriate. These habitat and water quality conditions are the result of natural and anthropogenic influences. Efforts are underway to improve water quality, and the Applicant, through the draft Snake River–Hells Canyon TMDL and other water quality projects, is a participant in such efforts. While water quality and habitat above the HCC must improve before reintroduction of anadromous fish should be considered, it is not the only variable that must improve before reintroduction becomes possible. The populations of anadromous fish that currently must negotiate eight downstream hydroelectric projects, owned and operated by the federal government, and that use habitat below the HCC of good to excellent quality are exceedingly depressed and not self-sustaining. Passing those same fish upstream of three additional hydroelectric projects, into habitat of questionable quality, would not increase their abundance or sustainability or lead to recovery of the ESA-listed species; it would likely only complicate attempts to achieve sustainability or recovery.

NPT1-16

> *Sturgeon Measures* – The Applicant should develop measures to improve water quality, especially oxygen and temperature, in the reservoirs should encompass the deep water habitat occupied by rearing white sturgeon. The Applicant needs to include measures to establish a put-grow-and take sturgeon fishery in Hells Canyon and Oxbow Reservoirs, where natural reproduction has been eliminated due to the project.

Response

The Applicant has proposed measures to improve water quality in HCC (see section E.2.4.2.). The Applicant does not support hatchery supplementation in Oxbow and Hells Canyon reservoirs. Disease outbreaks or genetic implications potentially accruing from selective hatchery practices could introduce unnecessary risk to the adjacent downstream Hells Canyon–Lower Granite sturgeon population, which currently represents one of only two stronghold populations of this species in the Snake River. The Applicant believes that it is unnecessary to put this stronghold population at potential risk by introducing the potential for interactions with hatchery-produced sturgeon that may move downstream from a put-grow-and-take sturgeon fishery in the HCC reservoirs. The Applicant further questions whether there is support from the ODFW and IDFG for developing a put-grow-and-take sturgeon fishery in Oxbow and Hells Canyon reservoirs.

NPT1-17

> *Flows Measures* – In general, the Applicant needs to develop a flow program that mitigates downstream project impacts to both water quality, fisheries, and fisheries habitat. The Tribe specifically reference and adopts the flow related comments submitted by the CRITFC on the draft license application. Flow operations should be coordinated with the Tribe and other fish managers through the federal Adaptive Management Process.

Response

PM&E measures proposed by the Applicant will improve water quality conditions (elevate DO and reduce the potential of elevated TDG during periods of spill) within and below the HCC, as well as provide adequate protection for spawning and incubating ESA-listed Snake River fall chinook salmon. The proposed measures will also benefit other aquatic species residing downstream of the Hells Canyon Dam. The comment of the Nez Perce Tribe does not specify what “impacts” that the HCC allegedly has on flows that may be detrimental to downstream water quality, fisheries, and fisheries habitat but simply adopted the flow-related comments submitted by CRITFC. CRITFC’s comments generally relate to summer flow augmentation measures implemented to allegedly benefit anadromous fish downstream of the HCC (“allegedly” because regional interests continue to question the efficacy of flow augmentation measures, most recently in the form of a report completed by the Independent Scientific Advisory Board: *Review of Flow Augmentation: Update and Clarification* [February 10, 2003]). The summer flow augmentation program bears no relationship to HCC project-related impacts to listed fall chinook. A more complete review of the last decade of salmon recovery efforts reveals that NMFS and other federal interests have been engaged in complex, and at times contentious, efforts to recover ESA-listed species that have been adversely impacted by federal actions, including federally authorized development; that the flow augmentation program is a by-product of those efforts; *and* that the Applicant has cooperated with those efforts despite having no legal obligation to do so.

NPT1-18

> *Ramping Measures* – The Applicant should examine and implement a program to mitigate the impacts of ramping rates to cultural resources, riparian habitat, and fishery resources. The Tribe specifically reference and adopts the ramping related comments submitted by the CRITFC on the draft license application.

Response

The Applicant maintains that the relicensing studies and resulting recommended measures for the HCC are adequate. The referenced ramp rates taken from Hunter (1992) were developed for a river system with a significantly different morphology than what is present in the Hells Canyon reach of the Snake River. Therefore, conclusions reached by Hunter (1992) are not transferable or applicable to Hells Canyon. The morphology of the system described by Hunter (1992) is characterized by having a low-gradient, meandering, broad, and shallow channel with many braided-channel island complexes. The Hells Canyon reach of the Snake River has a relatively high gradient; has steep, cliff-like banks; and lacks braided-channel island complexes.

Nez Perce Tribe comment at the joint agency meeting, held March 5 and 6, 2003

Recommended studies of reintroduction (conducted in consultation with the Nez Perce Tribe) and follow-up to those studies

Response

It is the Applicant's position that studies conducted to address feasibility of reintroducing anadromous fish were adequate to conclude that the likelihood of successfully establishing self-sustaining anadromous fish populations upstream of Hells Canyon Dam is very low. Conditions along the migratory corridor in the lower Snake and Columbia rivers and in the ocean, together with ocean harvest and in-river adult survival, reduce smolt-to-adult returns to levels below those necessary to maintain basin production potential and possibly population self-sustenance. Most populations of anadromous fish in the Snake River basin (below Hells Canyon Dam) have reached extremely low levels, a situation that has led to their protection under the ESA. It is difficult to believe that populations could be sustained upstream of the HCC when they currently continue at such low levels downstream of the HCC.

Shoshone-Bannock Tribes comment at the joint agency meeting, held March 5 and 6, 2003

Recommended funding for full tribal participation in technical and policy discussions with the FERC, agencies, and IPC

Response

The Applicant notes its serious reservations, discussed at more length in its responses to the Shoshone-Bannock Tribes' comments on the Draft License Application. The Applicant nevertheless welcomes tribal participation, but the Applicant believes that it is the responsibility of the tribes to fund their own participation.

Recommended trust fund established now to fund reintroduction efforts over time

Response

It is the Applicant's position that studies conducted to address feasibility of reintroducing anadromous fish were adequate to conclude that the likelihood of successfully establishing self-sustaining anadromous fish populations upstream of Hells Canyon Dam at this time is very low. Conditions along the migratory corridor in the lower Snake and Columbia rivers and in the ocean, together with ocean harvest and in-river adult survival, reduce smolt-to-adult returns to levels below those necessary to maintain basin production potential and possibly population self-sustenance. Most populations of anadromous fish in the Snake River basin (below Hells Canyon Dam) have reached extremely low levels, a situation that has led to their protection under the ESA. It is difficult to believe that populations could be sustained upstream of the HCC when they currently continue at such low levels downstream of the HCC.

Recommended 1,350 cfs in the Oxbow Bypass

Response

The Applicant does not believe that a minimum flow of 1,350 cfs in the Oxbow Bypass reach is necessary to protect or enhance habitat for the key species identified by the Aquatic Resources Work Group (see Technical Report E.2.3-1). Bull trout and redband trout habitat for adults and subadults declines with increasing flow in the bypass, as it does below Hells Canyon Dam (Technical Report E.2.3-2). Fall chinook spawning habitat does increase with increasing flows;

however, a minimum of at least 5,000 cfs or higher would be required to provide some habitat suitable for fall chinook salmon spawning. However, spawning habitat for fall chinook salmon is currently underseeded below Hells Canyon Dam. As such, spawning habitat availability is not currently limiting fall chinook salmon, and 1,350 cfs would not provide suitable habitat. White sturgeon spawning habitat also increases with increasing flow in the Oxbow Bypass, although 1,350 cfs would not provide additional early life history habitat for white sturgeon in the bypass. However, there is sufficient habitat in the tailrace below the Oxbow Powerhouse, regardless of flow in the bypass. In addition, other analyses on limiting factors of white sturgeon suggest that the short reservoir reach and larval drift may be limiting white sturgeon in Hells Canyon Reservoir and precluding the establishment of a sustaining population (see Chapter 1 of Technical Report E.3.1-6). Habitat availability for adult and juvenile white sturgeon does not have a strong relationship with flow but does gradually decrease with increasing flow, similar to habitats below Hells Canyon Dam.

In addition, increasing the flow would not result in substantive improvements to either water quality or habitat. Oxygen conditions throughout much of the Oxbow Bypass reach are determined by oxygen levels in water being discharged from Brownlee Reservoir. Likewise, while Brownlee Reservoir is generally improving downstream water temperatures for coldwater biota, temperature conditions in the bypass do not always meet standards. However, the main factor controlling temperatures in the bypass is the temperature of water being released upstream. Increasing the minimum flow would provide little or no improvement to water quality conditions in the bypass but simply result in an additional amount of degraded water passing through the Oxbow Bypass.

> Recommended risk assessment to the spiritual concerns of the tribe, conducted relative to the fisheries PM&E measures

Response

The Applicant notes its serious reservations, discussed more fully in its responses to the comments of the Shoshone-Bannock Tribes to the Draft License Application, concerning the Tribes' alleged treaty entitlements to take fish off of its reservation. That point aside, the question of alleged spiritual or cultural harm purportedly associated with the federal authorization of the development of hydropower resources and the operation and relicensing of hydropower projects is not a matter for which in general the law provides a remedy, and the Federal Power Act certainly does not provide a basis for contending otherwise. Indeed, the federal courts have ruled such claims non-redressable.

E.3.1.4. Anticipated Impacts on Fish and Snail Resources

E.3.1.4.1. Anticipated Impacts of Continued Operation on Fish and Snail Resources of the HCC and Vicinity

E.3.1.4.1.1. White Sturgeon

E.3.1.4.1.1.1. Blocked Access and Loss of Connectivity

Historically, white sturgeon could move freely between the Snake and Columbia rivers and up the Snake River as far as Shoshone Falls (Cochnauer et al. 1985). The mobility of this fish gave it access to diverse spawning, rearing, and feeding habitats in the Snake River. This access was effectively reduced or halted by the construction and operation of irrigation and hydroelectric dams. Dams alter sturgeon population dynamics and habitats by isolating populations, creating an imbalance between upstream and downstream migration rates, and converting free-flowing river to impounded reservoir habitat. A model simulation of river fragmentation and its effects on the population viability of white sturgeon showed that persistence declined as populations and habitats became increasingly fragmented (Jager et al. 2001).

Under the Applicant’s proposed measures, the presence of the HCC would continue to be a barrier to white sturgeon populations in these Snake River reaches. The projects would prohibit volitional upstream movement and impede, if not also prevent, most life stages from moving downstream. Sturgeon can still move downstream past the projects either by being entrained through the hydroelectric project or by passing over the dam during spill events. However, as body length increases, sturgeon that are entrained have increased risk of being struck by a turbine (up to a threshold where girth then restricts passage through turbine intake screens). In addition, the fate of spilled fish is largely unknown and probably depends on site and flow. Successful downstream sturgeon movement has been observed for sturgeon in the middle Snake River at Bliss and C.J. Strike dams based on PIT-tag recapture data (Lepla and Chandler 1995, 1997).

The heterogeneity of habitat within segments, particularly in reaches downstream of Swan Falls and Hells Canyon dams, mediates some effects of blocked access. Below Hells Canyon Dam, the Snake River is free flowing for 107 miles before it enters Lower Granite Reservoir. The diversity of habitats within this section appears adequate to support all life stages of white sturgeon in this population. Stock assessments by Coon et al. (1977), Lukens (1984), and the Applicant made downstream of Hells Canyon Dam have indicated that juvenile fish smaller than 92 cm TL continue to dominate the population, while size groups larger than 92 cm TL have steadily increased since the 1970s. Chapter 1 of Technical Report E.3.1-6 discusses the current sturgeon population below Hells Canyon Dam, one that is genetically diverse and exhibits a healthy population structure, based on the current stock structure dominated by juveniles, wide range of size classes, and stages of maturity from immature juveniles to reproducing adults. The Swan Falls Dam to Brownlee Dam reach is also one of the longest free-flowing segments remaining in the Snake River. Although the geomorphic characteristics in this section differ from those below Hells Canyon Dam, areas within this reach can also provide suitable habitats for early to adult life stages (Chandler and Lepla 1997, Chapter 2 of Technical Report E.3.1-6). However, water quality would have to improve significantly before white sturgeon productivity could be restored within this segment (Chapters 1 and 3 of Technical Report E.3.1-6, Technical Report E.2.2-2).

The river segments between Brownlee and Hells Canyon dams are relatively short and consist primarily of impounded reservoir habitat. Reservoir habitat may provide some benefits to white sturgeon. For example, the relative weight of individuals caught in reservoirs with good water quality tended to be higher than that of individuals caught in free-flowing sections of the Snake River (Chapter 1 of Technical Report E.3.1-6). However, two commonly cited drawbacks of reservoir habitat for sturgeon are poor water quality and lack of turbulent flow conditions for spawning (Jager et al. 2001). The Applicant’s stock assessment between Brownlee and Hells Canyon dams (Chapter 1 of Technical Report E.3.1-6) indicated that the status of white sturgeon within these two reservoirs has remained unchanged over the last 30 years. Welsh and Reid (1971) concluded that, although anglers have captured a few sturgeon in the tailrace of Brownlee Dam, the species is probably not abundant in Oxbow Reservoir and not present in Hells Canyon Reservoir. Little or no detectable presence of white sturgeon was also common in the short reaches associated with the middle Snake River between Upper Salmon Falls and Bliss dams. Not only does the relative closeness of adjacent dams limit the amount of available habitat, but the short distance between dams probably also contributes more to downstream losses of sturgeon than longer reaches do, particularly for sturgeon in the early life stages. A population viability analysis of Snake River white sturgeon highlighted larval export, in addition to poor water quality, as a primary factor limiting simulated recruitment in Oxbow and Hells Canyon reservoirs (Jager et al. 2000, Chapter 3 of Technical Report E.3.1-6).

The loss of connectivity between the reaches can also isolate white sturgeon genetically. However, recent studies evaluating genetic variability of white sturgeon in the Columbia River basin indicate that such genetic isolation has not yet been realized in Snake River populations (Anders and Powell 2002). When three impounded reaches of the Snake River reaches are considered, there does not appear to be a genetic substructure established between reaches. Genetic variation among these isolated groups is not unlike the variation seen within them. Anders and Powell (2002) failed to find significant differences ($P < 0.05$) in haplotype frequencies between samples of 20 fish from paired locations within the Snake River. In their analysis, they used an iterative chi-square test comparing samples from the Little Goose, Hells Canyon, and C.J. Strike reaches of the Snake River. Investigators would not expect to see evidence of genetic substructure developing among these reaches because of the reach-imposed artificiality (since some downstream migration is known to occur) and the relatively short-term existence under these conditions (relative to sturgeon generations) (Paul Anders, University of Idaho, personal communication). One option for mediating the loss of connectivity and historical gene flow, to some degree, involves the translocation of white sturgeon. In the case of Snake River white sturgeon, given widely distributed common haplotypes and empirically documented migration and estimated gene flow measures (Anders et al. 2002), translocation among adjacent areas could increase the probability of natural production and provide surrogated gene flow. This increased natural production and surrogated gene flow could increase, rather than decrease or threaten, variability within and among populations, especially in areas that are currently devoid of fish because of fragmentation and habitat alteration (Paul Anders, University of Idaho, personal communication).

E.3.1.4.1.1.2. Water Quality

Dissolved Oxygen

Currently, dissolved oxygen levels in the HCC do not always meet the Idaho and Oregon water quality standards. Nor are they adequate to support all designated beneficial uses (Technical Report E.2.2-2). Low dissolved oxygen levels in the reservoirs and downstream of Hells Canyon Dam can result in suboptimal or, in some cases, lethal conditions for white sturgeon. A population viability analysis model of factors controlling white sturgeon recruitment in the Snake River showed that water quality was the primary factor limiting sturgeon between Swan Falls and Hells Canyon dams. It also showed that reestablishment of recruitment in the Swan Falls to Brownlee reach would not be attainable unless water quality were improved. In the shorter river segments between Brownlee and Hells Canyon dams, simulated recruitment was also limited by larval export and the lack of spawners (Chapter 3 of Technical Report E.3.1-6). Under existing water quality conditions, modeling simulations (CE-QUAL-W2) of the full pool run-of-river and proposed operations scenarios showed no significant changes in water quality for white sturgeon.

Because the effects of the HCC on water quality are related to the quality of inflowing water, describing the continuing impact on water quality requires assumptions about inflows. Specific actions taken by the Applicant would have varying responses, depending on future conditions of the inflows. For purposes of this assessment, the Applicant assumed that inflows to the project would meet targets identified in the TMDL. In addition, the Applicant assumed that, if targets identified in the TMDL were met, all beneficial uses would be supported.

Improvements to the existing levels of nutrients and organic matter in the inflowing water would substantially improve dissolved oxygen throughout the project area. In fact, the Applicant modeled that circumstance in the TMDL process and found that improvement of inflowing water alone may enable oxygen targets in Brownlee Reservoir to be met. However, given the uncertainty associated with predicting responses to dramatic improvements in inflowing water, the Applicant proposes to implement aeration in the transition zone of Brownlee Reservoir at the level identified in the TMDL (see section E.2.4.2.1.). Both the IDEQ and ODEQ have predicted, through the TMDL process, that reduced inflowing nutrients and organic matter, along with the Applicant's proposed level of aeration, would lead to dissolved oxygen levels that comply with state standards.

The Applicant has proposed turbine aeration at the Brownlee Project to further improve downstream oxygen levels, as identified in the TMDL (see section E.2.4.2.2. and section E.2.4.2.3.). Quantifying the oxygen levels that would ultimately occur downstream of the project area once the Applicant's mitigation measures were implemented is impossible at this time. However, given the absence of obvious downstream impairments from current low dissolved oxygen levels, continuing impacts related to future dissolved oxygen levels within and downstream of the HCC should be minimal. The Applicant's effectiveness monitoring plan (proposed as part of the measures discussed in section E.2.4.2.) would improve the likelihood that oxygen supplementation measures were implemented in the most efficient, effective, and practical way. Under the proposed measures for water quality improvements, the Applicant anticipates substantial benefits for white sturgeon, particularly sturgeon using the transition zone in Brownlee Reservoir (see section E.3.1.3.2.3.1.).

Temperature

White sturgeon are considered a cool- or coldwater species, classifications that suggest they are better suited to water temperatures below 25 °C. Water temperatures from 18 to 22 °C are optimal for white sturgeon growth, while the upper lethal threshold temperature likely occurs somewhere between 28 and 30 °C. Maximum water temperatures in the Snake River above Brownlee Reservoir (near Weiser, Idaho) can reach 27 °C. In Brownlee Reservoir, maximum water temperatures near the surface (< 1 meter) during July and August can range from 24.4 to 31.0 °C, which is within the upper lethal limits for sturgeon. No lethal temperatures for sturgeon have been observed downstream of Brownlee, Oxbow, or Hells Canyon dams.

A water temperature target of 17.8 °C for the Snake River has been identified in the TMDL (IDEQ and ODEQ 2001) to protect coldwater biota. However, the TMDL process determined that temperature conditions were not a result of controllable anthropogenic (human related) activities, so no temperature-specific improvements are expected with implementation of the TMDL. Therefore, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the HCC, water temperature will undoubtedly continue to exceed the standard for coldwater biota throughout the Snake River system. Water temperatures within the HCC and downstream will be no exception. The presence and existing operational configuration of the HCC will continue to support a more coldwater-oriented aquatic community downstream of Brownlee Dam than the aquatic community in Brownlee Reservoir or the 100-mile reach of river upstream of the reservoir does. Maximum summer temperatures of inflowing water will continue to exceed 26 °C, while outflows will remain near 23 °C. Retention of the warm summer inflows in the reservoirs, especially Brownlee Reservoir, will continue to delay fall cooling of outflows relative to inflows. The Applicant's modeling showed that temperature conditions within and downstream of the HCC are affected, both in magnitude and timing, by inflowing temperature conditions (Technical Report E.2.2-2). Despite the generally improved conditions for coldwater biota downstream of Brownlee Dam, temperatures will annually exceed the Idaho and Oregon standards for coldwater biota because of the warm Snake River inflows.

E.3.1.4.1.2. Native Resident Salmonids

E.3.1.4.1.2.1. Blocked Access and Connectivity

With the Applicant's proposed measures for providing upstream passage at Hells Canyon and Oxbow dams, effects associated with blocked access and reduced connectivity should be substantially reduced for populations of native salmonids within the Pine–Indian–Wildhorse core area, including smaller tributaries documented to support redband trout (see measures detailed in section E.3.1.3.2.1.). In addition, proposed measures to construct irrigation diversion screens at key diversions within the Pine Creek basin should substantially reduce the nonproject-related impacts that are associated with downstream losses of fluvial salmonids in Pine Creek (see section E.3.1.3.2.1.4.). With the proposed measures, downstream migrations through project facilities may continue. Because the Applicant did not document downstream migrations of bull trout through powerhouse and turbine pathways (primarily because of the very low numbers of fish captured in the reservoir), potential loss has not been quantified. Radio-tagged bull trout in Hells Canyon Reservoir did not migrate downstream out of the reservoir during the monitoring period; however, the sample size of radio-tagged bull trout was extremely small, for the most part because of the difficulty in capture, given the very low numbers.

The Applicant has documented low percentages of downstream migrations of radio-tagged redband trout in all three reservoirs of the HCC (Chapter 4 of Technical Report E.3.1-7, IPC unpublished data). Downstream emigration from one reservoir to another occurred infrequently during our radio-telemetry studies. Between December 1998 and June 2001, the Applicant's biologists observed 7 rainbow trout (5.3% of all reservoir trout) move from the reservoir where they were originally tagged to an adjacent reservoir downriver (Chapter 4 of Technical Report E.3.1-7). Three fish originally tagged in Hells Canyon Reservoir were found in the Snake River below Hells Canyon Dam, and 4 fish tagged in Oxbow Reservoir were later found downstream in the Oxbow Bypass reach (Oxbow Dam to the Oxbow Powerhouse). All of these movements occurred during periods when the respective projects were spilling water; survival based on observed fish movements was 100%. A spill of 100 cfs is continuously maintained from Oxbow Reservoir to the Oxbow Bypass to provide the required minimum flow. Although spill was occurring, whether these fish passed downstream in spill or through the powerhouse is unknown. During winter 2001–2002, 20 rainbow trout were radio-tagged from a downstream migration weir in Brownlee Creek. One fish (5%) migrated downstream of Brownlee Dam in April after spending much of the winter in Brownlee Reservoir. No spill was occurring during this period, so the fish passed through the Brownlee Powerhouse. It was captured on hook and line by an angler in the tailrace of Brownlee Dam.

Fish migrating downstream through project facilities run a risk of mortality associated with blade strikes, pressure changes, and fish size. If fish pass downstream through spill gates during times of spill, probability of mortality is much less. Under the Applicant's proposed measures (see section E.3.1.3.2.1.2. and section E.3.1.3.2.1.3.), native salmonids moving downstream out of Oxbow and Hells Canyon reservoirs could return, although fish from Brownlee Reservoir could not. Native salmonids in Brownlee Reservoir would be limited to redband trout, hatchery rainbow trout, or mountain whitefish. Currently, bull trout do not occupy any of the drainages within immediate access to Brownlee Reservoir.

E.3.1.4.1.2.2. Water Quality

Dissolved Oxygen

Because the effects of the HCC on water quality are related to the quality of inflowing water, describing the continuing impact on water quality requires assumptions about inflows. Improvements to the existing levels of nutrients and organic matter in the inflowing water would substantially improve dissolved oxygen throughout the project area. Specific measures proposed by the Applicant to address low dissolved oxygen (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) would have varying responses, depending on future conditions of the inflows.

For purposes of this assessment, the Applicant assumed that the inflows to the project would meet targets identified in the TMDL. In addition, the Applicant assumed that, if targets identified in the TMDL were met, all beneficial uses would be supported.

Under current conditions, dissolved oxygen levels reach critically low levels during summer and would be unable to support rainbow trout for periods of time throughout much of the reservoir reaches. The Applicant calculated the number of days during which the reservoir volumes were at a dissolved oxygen suitability value of 0.5 or less (suitability values are on a scale of 0 to 1, with 1 being optimal and 0 being lethal), using modeled output from reservoir water quality models (CE-QUAL-W2) (Technical Report E.3.1-1). Comparisons of the proposed operations scenario with the full pool run-of-river scenario (without proposed measures to address dissolved oxygen) demonstrated very little difference between the two scenarios (Technical Report E.3.1-1). However, differences were substantial among hydrologic years. The number of days during which reservoir salmonid suitability was less than 0.5 was greatest among all locations during extremely low-flow years but substantially improved in medium- to extremely high-flow years. Periods of low dissolved oxygen in Oxbow and Hells Canyon reservoirs are generally longer than periods in Brownlee Reservoir are, primarily because of the influence of low dissolved oxygen levels in the releases from Brownlee Dam for an extended period.

The effect of low dissolved oxygen during the summer on rainbow trout is uncertain, largely because temperature during much of the same period is also unsuitable, again because of inflowing conditions. Salmonids must seek out colder refugia, generally associated with tributary habitats, areas that would also be higher in dissolved oxygen content. However, the measures proposed by the Applicant may benefit rainbow trout in Brownlee Reservoir substantially. Currently, Brownlee Reservoir has a significant quantity of coldwater refuge that could be suitable for rainbow trout if dissolved oxygen levels improve. With improvements in dissolved oxygen levels proposed by the Applicant, Brownlee Reservoir could become substantially more productive for rainbow trout, and the quality of the fishery for year-round angling could improve.

Temperature

Native resident salmonids are especially sensitive to warm temperatures. Redband trout are less sensitive than other salmonids are; however, when temperatures start to exceed approximately

20 °C, suitability quickly declines (Chapter 1 of Technical Report E.3.1-7). During summer, regardless of operational scenarios, temperatures in the HCC reservoirs rapidly become unsuitable for resident salmonids (Technical Report E.3.1-1). Temperatures in the inflows to the Snake River are also unsuitable and largely drive temperature conditions in the reservoirs. Therefore, for redband trout to sustain natural populations associated with the HCC, they must seek out colder environments during summer. This necessity largely influenced the evolution of various life history traits, such as fluvial life histories that involve significant migration from mainstem habitats to tributary habitats. Fluvial migrations reduce the negative effects of warm temperatures to these species.

The TMDL determined that temperature conditions were not a result of controllable anthropogenic activities, so no temperature-specific improvements are expected with implementation of the TMDL (IDEQ and ODEQ 2001). Therefore, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the Applicant's projects, water temperature will undoubtedly continue to exceed the standard for coldwater biota throughout the Snake River system. Maximum summer temperatures of inflowing water will continue to exceed 26 °C, while outflows will remain near 23 °C. The Applicant's modeling showed that temperature conditions within and downstream of the HCC are affected, both in magnitude and timing, by inflowing temperature conditions (Technical Report E.2.2-2).

The necessity for native resident salmonids to seek out colder refugia emphasizes how important high-quality habitats in tributaries to the Snake River are to these fish. In fact, the availability of coldwater habitats largely determines the rearing capacity of native salmonids associated with the HCC (Chapter 4 of Technical Report E.3.1-7). Habitat enhancement measures proposed by the Applicant for Pine Creek (see section E.3.1.3.2.1.4.) should significantly benefit natural populations of native salmonids in Pine Creek. In addition, the Applicant's proposed measures (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) to enhance dissolved oxygen levels in Brownlee Reservoir should substantially benefit redband trout by allowing them additional refuge in the deeper waters of Brownlee Reservoir, areas currently unsuitable because of low dissolved oxygen levels.

E.3.1.4.1.3. Resident Nonsalmonids

E.3.1.4.1.3.1. Reservoir Operations

Under the existing measures, the Applicant expects the continuing impacts to closely reflect the modeled output summarized below (for more detail, see Chapter 4 of Technical Report E.3.1-5).

The Applicant used a model developed by Clark et al. (1997, 1998) to compare the effects of the proposed operations scenario on the reproductive success of centrarchids in Brownlee Reservoir with the effects of the full pool run-of-river scenario during three hydrologic-year types (high-, medium-, and low-flow years). Model output consisted of number of eggs, number of fry, number of swimups, daily nest density, number of successful nests, number of nest failures due to drafting, number of nest failures due to filling, and number of nest failures due to other causes.

Modeled nest densities for smallmouth bass indicate that spawning is initiated and finished earlier in low-flow years regardless of operational scenario (Chapter 4 of Technical Report E.3.1-5.) Under proposed operations, peaks in nest densities vary somewhat with hydrologic-year type; multiple subpeaks are evident in medium- and high-flow years but not in low-flow years. Under full pool run-of-river operations, peaks in nest densities are of equal magnitude, regardless of hydrologic-year type.

Nesting success for smallmouth bass, as measured by the total number of swimups at the end of the nesting season, differs both for operational scenario and hydrologic-year type (Chapter 4 of Technical Report E.3.1-5). For all year types, nesting success is greater under the full pool run-of-river scenario. In addition, the pattern of increasing nesting success from low- to high-flow years is more pronounced under the full pool run-of-river scenario. Differences in nesting success observed among the three hydrologic-year types are caused by differences in temperature regime, while differences within a hydrologic year are caused by changes in water level. During a high-flow year, a larger mass of cold water is replaced by warmer spring runoff, a situation that creates a longer period of optimal spawning conditions under both operational scenarios (optimal beginning spawning temperature is 15 to 18 °C [Chapter 1 of Technical Report E.3.1-5]). However, a rapid increase in water level under proposed operations during medium- and high-flow years promotes higher rates of nest failure because of increased water depths that decrease overall nesting success. Under the full pool run-of-river scenario, water level remains the same for all hydrologic-year types.

Modeled nest densities for white crappie indicate that spawning is also initiated and finished earlier in low-flow years, regardless of operational scenario. Peak nest densities generally increase from low- to high-flow years under both operational scenarios, and multiple subpeaks are evident in all six frequency distributions.

Nesting success for white crappie differs for both hydrologic-year type and operational scenario (Chapter 4 of Technical Report E.3.1-5). As for smallmouth bass (and for the same reasons), differences in nesting success observed among the three hydrologic-year types are caused by differences in temperature regime, while differences within year type are caused by changes in water level. However, the effects of increases in water level on nesting success by white crappie are not as dramatic as those for smallmouth bass because of differences in white crappies' preferred nesting depth and the development time from egg to dispersal of young from the nest. The optimal nesting depth for smallmouth bass is 2.9 to 7.9 feet; and for white crappie, 6.8 to 15.1 feet (Chapter 1 of Technical Report E.3.1-5). The mean development time for smallmouth bass is twice as long as that for white crappie (14.5 days for smallmouth bass but 7.3 days for white crappie [Chapter 1 of Technical Report E.3.1-5]). These differences enable white crappie to capitalize on variable temperature regimes and water levels during the nesting period more successfully than smallmouth bass can.

The Applicant assessed three mechanisms whereby the operation of the HCC reservoirs can affect centrarchid populations: downstream export of fish from Brownlee Reservoir, water-level fluctuations, and water-temperature regime during winter (Chapter 4 of Technical Report E.3.1-5). Of the three mechanisms evaluated for smallmouth bass, only water-level fluctuations as they relate to nesting success (and therefore reproductive success) were substantially affected by operational scenario and hydrologic-year type. The pattern of increasing nest success from low- to high-flow years was somewhat more pronounced under the full pool run-of-river scenario than under the proposed operations scenario. The effects of operational scenario and hydrologic-year type on downstream export and overwinter survival are apparently not a concern for smallmouth bass. The differences in operational scenario and year type are likely to affect annual population growth rate more by affecting reproduction than by affecting survival.

Of the three mechanisms evaluated for white crappie, mostly downstream export, but also water-level fluctuations as they relate to nesting success, was affected by operational scenario or hydrologic-year type (Chapter 4 of Technical Report E.3.1-5). The white crappie, a pelagic species, is highly susceptible to increases in flow, especially during early life stages and cold months. Flow differences between year types enhanced the negative effects of downstream export under both operational scenarios. Differences in operational scenario and hydrologic-year type are likely to affect annual population growth rate by simultaneously affecting both reproduction and survival.

Population levels of warmwater resident nonsalmonids are expected to remain as they currently are (Chapter 3 of Technical Report E.3.1-5). The highest level of effects to smallmouth bass and white crappie will occur during high-flow years but for differing reasons. Smallmouth bass will be impacted primarily because their nests are more likely to be inundated from the severe flood-control drawdowns that occur in early spring. All age classes of crappie are more likely to be affected during periods of high flow in late winter, while age 0 crappie are more affected during periods of high flow throughout the year.

E.3.1.4.1.3.2. Water Quality

Dissolved Oxygen

Because the effects of the HCC on water quality are related to the quality of inflowing water, describing the continuing impact on water quality requires assumptions about inflows. Improvements to the existing levels of nutrients and organic matter in the inflowing water would substantially improve dissolved oxygen throughout the project area. Specific measures proposed by the Applicant to address low dissolved oxygen (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) would have varying responses, depending on future conditions of the inflows. For purposes of this assessment, the Applicant assumed that the inflows to the project would meet targets identified in the TMDL. In addition, the Applicant assumed that, if targets identified in the TMDL were met, all beneficial uses would be supported.

Under current operations, dissolved oxygen levels for resident nonsalmonids were represented by smallmouth bass and channel catfish requirements (Technical Report E.3.1-1). Smallmouth bass in Brownlee Reservoir are not subjected to effects of low dissolved oxygen, primarily because of the depths at which they commonly reside (generally the top 10 meters in littoral, or shore, areas). However, dissolved oxygen suitability in Oxbow and Hells Canyon reservoirs decreases substantially during summer, primarily influenced by outflows from the Brownlee Powerhouse. Very little difference in dissolved oxygen suitability was evident between the proposed operations and full pool run-of-river scenarios. However, differences were substantial in suitability among hydrologic-year types. In extremely low- and low-flow years, dissolved oxygen levels in Oxbow and Hells Canyon reservoirs remain below a suitability value of 0.5 for much longer than they do during medium- and high-flow years. During extremely high-flow years, none of the reservoirs have dissolved oxygen levels that would affect smallmouth bass. Impacts to channel catfish are similar to those for smallmouth bass, except in Brownlee Reservoir during low-flow years. Then catfish can be subjected to low dissolved oxygen levels, primarily because of the deeper habitat use assumed for channel catfish (Technical Report E.3.1-1).

Temperature

Populations of warmwater game fish are not affected by warm summer temperatures associated with the Snake River basin. These fish are not native to the Northwest and are generally associated with warmer environments. Therefore, temperature conditions in the Snake River are not necessarily optimal for growth of these species because these temperatures are cooler than in the species' endemic range. Temperatures become optimal only for a brief period, especially for channel catfish. In addition, there are no temperature-related impacts resulting from operations of the HCC (Technical Report E.3.1-1).

E.3.1.4.2. Anticipated Impacts of Continued Operation on Fish and Snail Resources of Downstream Areas Affected by the HCC

E.3.1.4.2.1. White Sturgeon

E.3.1.4.2.1.1. Operations

Habitat for Spawning, Incubation, and Larvae

The modeled availability of spawning habitat for white sturgeon in the upper Hells Canyon reach (Salmon River to the Hells Canyon Dam) was proportionate to the magnitude of hydrologic-year type, regardless of operational scenario. The medium- to extremely high-flow years accounted for considerably more modeled habitat available to spawning sturgeon than the extremely low- and low-flow years did (Technical Report E.2.3-2).

Analysis conducted by the Applicant (Technical Report E.2.3-2) showed significant reductions in modeled habitat under the modeled proposed operations scenario than under the full pool run-of-river scenario for spawning white sturgeon in the upper Hells Canyon reach during the period modeled (April 12 to June 23) across all five hydrologic-year types. Reductions in modeled habitat from Hells Canyon Dam to the mouth of the Salmon River (expressed as weighted usable area or WUA) under modeled proposed operations averaged between 8.8 and 15.9% over all five years. Within these average reductions in modeled habitat, there were maximum daily reductions of 20 to 35% under modeled proposed operations. Overall, reductions in modeled habitat under modeled proposed operations were due to load-following operations, although most reductions during the high- and extremely high-flow years were attributable to Brownlee Reservoir operations that reduced discharge below Hells Canyon Dam. Exceedance plots for the five hydrologic years showed that 90% of the hourly observations of modeled habitat under modeled proposed operations were at least 76 to 85% of the habitat available under full pool run-of-river operations. Relative daily fluctuations (that is, modeled proposed operations habitat as a percentage of full pool run-of-river operations habitat) were the most pronounced during the extremely low- and low-flow years and ranged up to 75%. Absolute daily fluctuations (that is, habitat as a percentage of total reach area) in modeled habitat, while less than relative fluctuations, still ranged up to 19% of the total reach area.

As for the spawning life stage, habitat availability for white sturgeon incubation modeled in the upper Hells Canyon reach was proportionate to the magnitude of hydrologic year, regardless of operational scenario. The medium- to extremely high-flow years provided similar amounts of availability and accounted for significantly more modeled incubation habitat than the extremely low- and low-flow years did.

Modeled proposed operations influenced modeled habitat availability for the white sturgeon incubation life stage in the upper Hells Canyon reach during the period modeled (April 12 to June 29) across all five hydrologic years analyzed. This operational scenario showed significant reductions in habitat during the extremely low- and low-flow years. Modeled proposed operations decreased habitat (WUA) an average of 17.2 and 27.9% during the extremely low- and low-flow years, respectively. Within the large reductions in habitat during the dry years, there were maximum daily reductions in modeled habitat that ranged as high as 61% (extremely low-flow year) and 63% (low-flow year). Comparatively, average reductions in modeled habitat under modeled proposed operations during the medium-, high-, and extremely high-flow years ranged between 2.5 and 4.8%. Daily maximum reductions in habitat ranged up to 30% during the medium-flow year and 9 and 7% during the high- and extremely high-flow years, respectively. Exceedance plots of hourly modeled habitat (expressed as hourly weighted usable area, or HWUA) showed that 90% of the observations under modeled proposed operations were at least 67 and 56% of the habitat available under full pool run-of-river operations during the extremely low- and low-flow years, respectively. Hourly observations of modeled habitat under modeled proposed operations were between 90 and 94% of the habitat under full pool run-of-river operations 90% of the time during the medium-, high-, and extremely high-flow years. Relative daily fluctuations (modeled proposed operations as a percentage of full pool run-of-river operations) exceeded 100% several times during the extremely low- and low-flow years and ranged up to 47% during the medium-flow year. Relative daily fluctuations were generally less than 10% during the high- and extremely high-flow years. Absolute daily fluctuations (modeled habitat as a percentage of the total reach area) ranged as high as 11 and 16% during the extremely low- and low-flow years, respectively. Absolute daily fluctuations during the medium-flow year ranged up to 9% but were typically less than 2% during the high- and extremely high-flow years.

The spatial distribution of incubation habitat modeled in the 2-D sites showed that habitat fragmented and fluctuated in suitability at discharges less than 20 kcfs. However, modeled habitat appeared continuous at discharges between 20 and 30 kcfs.

Habitat for white sturgeon larvae followed a similar trend to habitat shown for the other early life stages of sturgeon: habitat availability modeled in the upper Hells Canyon reach was proportionate to the magnitude of hydrologic year, regardless of operational scenario. The medium- to extremely high-flow years accounted for considerably more modeled habitat available to the larvae life stage than the extremely low- and low-flow years did.

As for the incubation life stage, modeled habitat for white sturgeon larvae in the upper Hells Canyon reach was influenced by modeled proposed operations during the period modeled (April 23 to July 23) across all five hydrologic years. This modeled habitat was significantly reduced during the extremely low- and low-flow years. Modeled proposed operations resulted in average reductions in modeled habitat of 16.4 and 24.8% during the extremely low- and low-flow years, respectively, and of 0.9 and 4.9% for the medium- and extremely high-flow years, respectively. Daily maximum reductions in modeled habitat across the five years ranged as high as 18 to 68%. Exceedance plots of HWUA showed that 90% of the observations under modeled proposed operations were at least 64 and 62% of the habitat under full pool run-of-river operations during the extremely low- and low-flow years, respectively. Hourly observations of modeled habitat under modeled proposed operations were between 93 and 95% of the habitat under full pool run-of-river operations 90% of the time during the medium-, high-, and extremely high-flow years. Relative daily fluctuations in modeled habitat exceeded 100% during both the extremely low- and low-flow years and ranged as high as 37 to 76% between the medium-, high-, and extremely high-flow years. Absolute daily fluctuations were between 9 and 18% across all five hydrologic years. The spatial distribution of larvae habitat modeled in the 2-D sites showed that habitat largely fluctuated in suitability at discharges less than 30 kcfs, but that it was often fragmented at discharges less than 20 kcfs.

Habitat for Young-of-Year, Juveniles, and Adults

Overall, the magnitude of hydrologic year was proportionate to modeled habitat for young-of-year white sturgeon, regardless of operational scenario. The highest flows associated with the wet hydrologic years generally resulted in lower habitat availability than did the lowest flows associated with the dry hydrologic years.

Modeled young-of-year habitat in the upper Hells Canyon reach was influenced by modeled proposed operations, but it was not significantly affected by full pool run-of-river operations during the five hydrologic years analyzed. The average reduction in modeled habitat in the upper Hells Canyon reach under modeled proposed operations was 3.6% or less for all hydrologic years except the low-flow year, during which the average decrease in habitat was 5.5%. Within these average impacts, there were maximum daily reductions in habitat as high as 7% (for the extremely high-flow year) to 15% (for the high-flow year). These larger reductions in modeled habitat under modeled proposed operations were not frequent: 90% of the hourly observations of modeled habitat (WUA) under modeled proposed operations were at least 93 to 96% of the habitat under full pool run-of-river operations across the five hydrologic years. While relative daily fluctuations in modeled habitat approached 20% during the low-flow year, absolute daily fluctuations were 1 to 2% during the five years analyzed.

The spatial distribution of young-of-year habitat modeled in the 2-D sites showed that habitat changes very little in absolute area between discharges of 10 and 30 kcfs (Technical Report E.2.3-2). Considering that the average reductions in modeled habitat under modeled proposed operations were minor for the upper Hells Canyon reach (and most of the 2-D sites) and absolute fluctuations in habitat were very low (as evidenced by the 2-D spatial habitat plots), the Applicant concluded that modeled habitat for young-of-year white sturgeon, although it is influenced by modeled proposed operations, is not significantly affected during the five hydrologic years analyzed.

Under either operational scenario, no trend was apparent between modeled habitat for juvenile white sturgeon in the upper Hells Canyon reach and magnitude of hydrologic year. Regardless of operational scenario, modeled habitat averaged between 94.0 and 95.3% of maximum levels across the five hydrologic years analyzed.

There was essentially no difference between habitat availability for juvenile white sturgeon in the upper Hells Canyon reach modeled under modeled proposed operations and full pool run-of-river operations. The average reduction in modeled habitat under proposed operations was less than 0.7% across the five hydrologic years analyzed. Similarly, the average increase in modeled habitat under modeled proposed operations for the five hydrologic years was less than 1.1%. The largest daily reduction in habitat was 4% during the extremely low-flow year. Exceedance plots of HWUA across all five years showed that 90% of the observations of modeled habitat under modeled proposed operations were at least 99% of the habitat available under full pool run-of-river operations. Relative daily fluctuations in habitat were less than 4% during the five hydrologic years. Absolute daily fluctuations were 1 to 2% under modeled proposed operations across the five hydrologic years.

The availability of adult white sturgeon habitat modeled in the upper Hells Canyon reach was essentially equal between modeled proposed operations and full pool run-of-river operations during the extremely low- and low-flow years. The average decrease in modeled habitat under modeled proposed operations during these two years did not exceed 1.1%. Modeled proposed operations showed slightly greater influence on modeled habitat during the medium-, high-, and extremely high-flow years although average reductions in modeled habitat throughout the period were less than 3.1%. Exceedance plots of hourly WUA (HWUA) across all five years showed that 90% of the observations of modeled habitat under modeled proposed operations were at least 96% of the habitat available under full pool run-of-river operations. Relative and absolute daily fluctuations in modeled habitat both ranged less than 8% across the five hydrologic years.

Operational Assessment for White Sturgeon Habitat

Modeled habitat availability for the early white sturgeon life stages (spawning, incubation, and larvae) was proportionate to the magnitude of hydrologic year in the upper Hells Canyon reach. The Applicant's analysis of the two operational scenarios showed that modeled proposed operations significantly reduced modeled habitat for these early life stages during the extremely low- (1992) and low-flow (1994) years. Modeled habitat under modeled proposed operations for the spawning life stage during the medium-, high-, and extremely high-flow years was less than modeled habitat under the full pool run-of-river operations scenario, and it was primarily influenced by load-following operations during the dry hydrologic years. Spawning habitat, modeled to increase with discharge, was also influenced by Brownlee Reservoir operations during the wet hydrologic years since reservoir storage decreased discharge (and therefore habitat) below Hells Canyon Dam. Conversely, the Applicant's assessment found that modeled habitat for the young-of-year, juvenile, and adult life stages was not influenced greatly by discharge and was therefore not affected by modeled proposed operations across any of the hydrologic years. While the Applicant's study documents differences in modeled habitat availability between these two operational scenarios for early life stages of white sturgeon in the upper Hells Canyon reach, there is no evidence that the sturgeon population below Hells Canyon Dam is affected by these modeled changes in habitat.

Population assessments of white sturgeon conducted by the Applicant in the upper Hells Canyon reach also do not indicate that recruitment is limited by HCC operations (Chapter 1 of Technical

Report E.3.1-6). Stock assessments by Coon et al. (1977), Lukens (1984), and the Applicant have found that juvenile fish smaller than 92 cm TL continue to dominate the population and that size groups larger than 92 cm TL have steadily increased since the 1970s. Chapter 1 of Technical Report E.3.1-6 concluded that the current sturgeon population below Hells Canyon Dam is genetically diverse and exhibits a healthy population structure, based on the current stock structure dominated by juveniles, wide range of size classes, and stages of maturity from immature juveniles to reproducing adults. White sturgeon below Hells Canyon Dam inhabit the entire free-flowing reach of the Snake River as well as Lower Granite Reservoir, a distance of about 140 river miles. The Applicant's habitat estimates and operational impact analysis apply to the upper 60 river miles, or 43% of the total area used by the population. Within the free-flowing Snake River (Asotin to Hells Canyon Dam), our analysis represents about 59% of the river potentially used by the life stages. Therefore, the reductions in modeled habitat that are described in this assessment apply only to the upper reach of the Snake River below Hells Canyon Dam. The assessment does not describe impacts to all of the habitat available to the Hells Canyon white sturgeon population. The Applicant has completed an instream flow assessment of the lower Hells Canyon reach (Salmon River to Asotin) and included modeled habitat estimates in Technical Report E.2.3-2.

E.3.1.4.2.1.2. Water Quality

Dissolved Oxygen

Water quality below Hells Canyon Dam does not meet state standards for dissolved oxygen during brief periods of most years. Dissolved oxygen levels measured in the tailrace of Hells Canyon Dam can drop as low as 2.8 mg/L for several weeks during late summer. This condition probably persists for only a few miles below Hells Canyon Dam. Habitat data collected by the Applicant over telemetered sturgeon 9 miles downstream of the dam showed recovery of dissolved oxygen levels near 7 mg/L as a result of reaeration from upstream rapids.

Although low dissolved oxygen levels in the vicinity of Hells Canyon Dam's tailrace are not lethal to white sturgeon, such levels are considered suboptimal. Klyashtorin (1974) studied the dissolved oxygen thresholds of four Russian species of sturgeon (0.36 kilogram) over a range of oxygen and temperature levels and found that dissolved oxygen values less than 4.5 mg/L reduced growth, while levels less than 1.8 mg/L were lethal at upper temperature ranges. Because of similar responses among these four sturgeon species, Klyashtorin (1974) speculated that other members of the sturgeon family might have dissolved oxygen sensitivities similar to those species investigated.

The potential effects of water quality conditions to the white sturgeon population below Hells Canyon Dam are not readily apparent, probably because such events are relatively brief and restricted to the uppermost section of this reach. In fact, no white sturgeon mortalities related to water quality have been recorded for the reach below Hells Canyon Dam. Stock assessments downstream of Hells Canyon Dam—conducted by Coon et al. (1977), Lukens (1984), and the Applicant—have indicated that juvenile fish smaller than 92 cm TL continue to dominate the population, while size groups larger than 92 cm TL have steadily increased since the 1970s. Chapter 1 of Technical Report E.3.1-6 concluded that the current sturgeon population below Hells Canyon Dam is genetically diverse and exhibits a healthy population structure, based on the current stock structure dominated by juveniles, wide range of size classes, and stages of maturity from immature juveniles to reproducing adults.

Regardless, dissolved oxygen levels measured in the tailrace of Hells Canyon Dam are considered suboptimal for white sturgeon. Measures proposed by the Applicant in section E.2.4.2. would improve water quality for white sturgeon in this upper section of river and benefit individuals in the population that are residing between Granite Rapids and the tailrace of Hells Canyon Dam. Three of the measures propose to improve dissolved oxygen levels in the releases at Brownlee Dam through aeration and turbine venting (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) and should reduce or eliminate unsuitable conditions and potential impacts experienced by white sturgeon downstream of Hells Canyon Dam. Physical water quality models indicate that improvements to dissolved oxygen levels from these measures would carry through the Oxbow and Hells Canyon reservoirs and into the tailwater downstream of Hells Canyon Dam (Technical Report E.2.2-2). However, the Applicant recognizes significant uncertainty associated with identifying specific features and effects of these measures at this time. Because of this uncertainty, the Applicant proposes that the specific details regarding design, location, and operation, as well as an effectiveness monitoring plan, be developed through consultation with both the IDEQ and ODEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of the relicensing process for the HCC. As mentioned in section E.2.4.2., the goals of the proposed dissolved oxygen measures are to ensure that oxygen levels in the water below Hells Canyon dam meet Idaho dissolved oxygen standards. Improvements in the levels of nutrients and organic matter in inflows to the project would also substantially improve dissolved oxygen throughout the project area.

Total Dissolved Gases

Total dissolved gas conditions in the releases from Hells Canyon Dam do not meet the Idaho or Oregon standards for total dissolved gas during spills exceeding 2,500 cfs (Technical Report E.2.2-4). Because the white sturgeon is a benthic species, high total dissolved gas levels probably do not affect most life stages. Larval white sturgeon may run the greatest risk of being affected since this life stage typically coincides with spring runoff. Upon hatching, larval sturgeon enter the water column and use the river currents to disperse downstream of spawning and incubation areas. During periods of spill, dispersing larvae could be vulnerable to the high total dissolved gas. However, the depth at which white sturgeon larvae disperse downstream is unknown (Counihan et al. 1998), including the depth they use below Hells Canyon Dam. Given a general rule of 10% reduction in total dissolved gas for every meter of depth, larvae dispersing at depths of more than 2 to 3 meters would have sufficient hydrostatic pressure to compensate for the high total dissolved gas levels. The IDFG determined that very little trauma from high total dissolved gas occurs in white sturgeon below Hells Canyon Dam. IDFG personnel noted that gas bubble disease was only observed in years with extremely high spill and is probably not a significant source of risk for white sturgeon in the Hells Canyon–Lower Granite reach (T. Cochnauer, IDFG, personal communication to WSTAC, May 8, 2001). Regardless, total dissolved gas levels do not meet the state standards, and measures proposed by the Applicant to lower total dissolved gas levels during spill events may also benefit white sturgeon.

The Applicant also proposes to install flow deflectors on Hells Canyon Dam (see section E.2.4.2.4.) to alter the spillway hydrodynamics during spill events of less than 30,000 cfs. These flow deflectors should substantially reduce the potential for continuing downstream impacts. The deflectors are expected to control gas levels during all but the highest 2% of flows. While the Applicant cannot quantify what the total dissolved gas levels would be after the deflectors were installed, similar measures at other federal and public utility district projects on the Snake and Columbia rivers have significantly improved total dissolved gas conditions. The

Applicant's effectiveness monitoring plan (proposed as part of the measure detailed in section E.2.4.2.4.) would improve the likelihood that continuing impacts from elevated total dissolved gas levels were reduced.

Temperature

A water temperature target of 17.8 °C for the Snake River has been identified in the TMDL (IDEQ and ODEQ 2001) to protect coldwater biota. However, the TMDL also determined that temperature conditions were not a result of controllable anthropogenic activities, so no temperature-specific improvements are expected with implementation of the TMDL. Therefore, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the Applicant's projects, water temperature will undoubtedly continue to exceed the standard for coldwater biota throughout the Snake River system. Water temperatures within the HCC and downstream will be no exception. Maximum summer temperatures of inflowing water will continue to exceed 26 °C, while outflows will remain near 23 °C.

White sturgeon are considered a cool- or coldwater species, classifications that suggest they are better suited to water temperatures below 25 °C. Water temperatures from 18 to 22 °C are optimal for white sturgeon growth, while the upper lethal threshold temperature probably occurs somewhere between 28 and 30 °C. Summer water temperatures below Hells Canyon Dam generally peak near 23 °C, so they are considered below the upper lethal limit. Peak summer water temperatures below Hells Canyon Dam are also similar to the summer highs recorded in the Salmon River (about 24–25 °C), a natural and undammed river. Peak summer water temperatures below Hells Canyon Dam do not appear to be a significant source of risk to white sturgeon. Stock assessments by Coon et al. (1977), Lukens (1984), and the Applicant downstream of Hells Canyon Dam have indicated that juvenile white sturgeon smaller than 92 cm TL continue to dominate the population, while size groups larger than 92 cm TL have steadily increased since the 1970s. Chapter 1 of Technical Report E.3.1-6 concluded that the current white sturgeon population below Hells Canyon Dam is genetically diverse and exhibits a healthy population structure, based on the current stock structure dominated by juveniles, wide range of size classes, and stages of maturity from immature juveniles to reproducing adults.

E.3.1.4.2.2. Native Resident Salmonids

E.3.1.4.2.2.1. Operations

Modeled habitat for redband trout overwintering (the period from October 15 to May 31) in the upper Hells Canyon reach was inversely related to magnitude of hydrologic year. The extremely low- and low-flow years accounted for higher amounts of WUA (as a percentage of maximum WUA) than the medium-, high-, and extremely high-flow years.

Modeled redband trout habitat was influenced somewhat by modeled proposed operations (relative to full pool run-of-river operations) across all five of the hydrologic years analyzed. Modeled proposed operations resulted in average reductions in modeled habitat of 3.4 and 2.5% in the upper Hells Canyon reach during the extremely low- (1992) and low-flow (1994) years, respectively. Within these average reductions, there were maximum daily reductions in habitat up to 20% (1992) and 19% (1994). These larger reductions in habitat represented "worst-case" conditions for modeled habitat under modeled proposed operations (relative to habitat available under full pool run-of-river operations) for redband. Exceedance curves of hourly modeled habitat (modeled proposed operations as a percentage of full pool run-of-river operations) showed that these larger reductions occurred infrequently during the period. In fact, during the extremely low-flow year, reductions of 15 to 20% (under modeled proposed operations) occurred 0.7% of the period modeled for redband trout, while during the low-flow year, reductions of 15 to 19% occurred 0.3% of the period. Exceedance plots of HWUA showed that 90% of the observations under modeled proposed operations were within 8% of the habitat under full pool run-of-river operations. While relative daily fluctuations in habitat (modeled proposed operations as a percentage of full pool run-of-river operations) during this period ranged from 20 to 30%, absolute daily fluctuations in habitat (WUA as a percentage of total reach area) did not exceed 7% and was typically less than 5% under modeled proposed operations. Modeled redband trout habitat between operational scenarios in the upper Hells Canyon reach was similar for the medium-, high-, and extremely high-flow years: the reduction in WUA under modeled proposed operations was between 4.3 and 4.1%. Like the extremely low- and low-flow years, reductions in habitat are larger under modeled proposed operations within these average metrics, but they represent infrequent occurrences throughout the period. Hourly WUA under modeled proposed operations was within 8% of that for full pool run-of-river operations 90% of the time during the medium-flow year and within 6 and 5% of full pool run-of-river operations during the high- and extremely high-flow years, respectively. Daily fluctuations in habitat, which were moderate during the medium-flow year, were reduced during the high- and extremely high-flow year.

The spatial distribution of modeled habitat in the 2-D sites showed that modeled habitat for redband trout fluctuated in suitability rather than patch location between discharges of 10 and 30 kcfs. Effects to redband trout habitat in the upper Hells Canyon reach appeared minimal under modeled proposed operations when all hourly occurrences during the modeled overwintering period were considered. Minimum flows associated with the fall chinook plan are important for redband trout modeled habitat because they protect the range of discharges at which redband trout habitat is maximized and influenced the most by load-following operations. Minimum flows from the fall chinook plan provide this protection for all but 6 days (97%) of the modeled overwintering period for redband trout. Average reductions in modeled habitat varied across the five hydrologic years and were less than 5% when compared with full pool run-of-river operations during the same period. While the overall influence of modeled proposed operations to modeled habitat in the Hells Canyon reach during the redband trout period does not appear significant, there are occurrences when daily reductions and fluctuations in habitat do appear significant. It is important to note that these are fluctuations and reductions relative to habitat under full pool run-of-river operations. Actual fluctuations and reductions in modeled habitat were considerably less when habitat measured as a percentage of total reach area was considered. Additionally, individual 2-D sites showed reductions in habitat under modeled proposed operations that, relative to full pool run-of-river operations, were more pronounced than in the reachwide analysis. As stated earlier, the actual fluctuations in habitat under modeled proposed operations were less than relative comparisons with full pool run-of-river operations. It is important to note that fluctuations in modeled habitat do not necessarily equate to modeled habitat changing from suitable to unsuitable. The result means that, as flows change, suitability of habitats changes, thereby changing the total amount of modeled habitat available. It does not necessarily mean that the occupied habitat becomes unsuitable and necessitates a move by the fish. Changes in suitability across flows mean just that, habitats are still suitable, just at a different index level. For example, if all habitat cells in a grid changed from 0.5 suitability to 0.3 suitability during load following, then a fluctuation in modeled habitat would be seen. But by definition, a suitability of 0.3 is still suitable and was found to provide habitat for some number of fish when the HSC was being developed from field observations of the species habitat use. There is a difference between habitat patches disappearing between flows and habitat suitability changing between flows. The best way to present these data is through the habitat spatial distribution maps of the 2-D sites. The spatial distribution of modeled habitat in these 2-D sites showed that the majority of the predicted habitat was continuous at three different flows within the range of project operations. If habitat of any suitability stays continuous across the range of operational flows (10 to 30 kcfs in the habitat spatial distribution maps), then it could be argued that a fish would not necessarily need to move during load-following operations since habitat of some suitability is still available. It is, however, unknown what behavior redband trout exhibit under different operational scenarios since this assessment looked at modeled habitat availability and not modeled habitat use or behavior. But certain assumptions can be made from the analysis, suggesting that movements may not be obligatory. While reductions in habitat under modeled proposed operations are occasionally significant, they are short lived (1–2 hours, as modeled by CHEOPS™), and their effect on a subadult/adult trout that is overwintering in the mainstem river is unknown. The timing (within a life cycle) and duration of specific flow conditions often determine their ecological significance (Poff et al. 1997). The Applicant believes that habitat minimums occurring for short durations during an adult overwintering period probably do not limit redband trout in the Hells Canyon reach. Average reductions in habitat are probably more indicative of habitat conditions throughout the period. Habitat fluctuations during the overwintering period may not be as critical and limiting to a generalist species such as redband trout (rainbow trout) as habitat fluctuations during the spawning and incubation periods would be.

E.3.1.4.2.2.2. Water Quality

Dissolved Oxygen

The current effect of low dissolved oxygen levels on native resident salmonids below the HCC is uncertain but limited both spatially and temporally. Spatially, low dissolved oxygen levels are generally in the reach of river from Hells Canyon Dam to Wild Sheep Rapids where discharge from Hells Canyon Dam (and ultimately Brownlee Dam) influences the levels. Suitability of dissolved oxygen in this reach can drop to near-lethal levels. After water is spilled over several large rapids, it reaerates. Temporally, low dissolved oxygen levels are primarily associated with late summer and early fall and begin to improve by the first of October (Technical Report E.3.1-1). This window of low dissolved oxygen varies according to hydrologic-year type. Extremely low- and low-flow years have a much longer duration of low dissolved oxygen levels than medium- to extremely high-flow years do. Because temperatures for salmonids during this period are also low in suitability, resident salmonids may be more closely associated with tributary habitats or confluence areas with cold refugia. Such refuge areas probably also have higher dissolved oxygen levels.

Three of the measures proposed by the Applicant to improve dissolved oxygen levels in the release at Brownlee Dam include aeration and turbine venting (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) and should reduce or eliminate unsuitable conditions and potential impacts experienced by native resident salmonids. Physical water quality models indicate that improvements to dissolved oxygen levels from these measures would carry through the Oxbow and Hells Canyon reservoirs and into the tailwater downstream of Hells Canyon Dam (Technical Report E.2.2-2). However, the Applicant recognizes significant uncertainty associated with identifying specific features and effects of these measures at this time. Because of this uncertainty, the Applicant proposes that the specific details regarding design, location, and operation, as well as an effectiveness monitoring plan, be developed through consultation with both the IDEQ and ODEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of TMDL implementation and the 401 certification process for the HCC. As mentioned in section E.2.4.2., the goals of the proposed dissolved oxygen measures are to enhance oxygen levels in the waters below Hells Canyon Dam. Improvements in the levels of nutrients and organic matter in inflows to the project would also substantially improve dissolved oxygen throughout the project area.

Total Dissolved Gases

Under current operations, few effects related to high total dissolved gas levels have been observed on fish in the Hells Canyon reach (above Lower Granite Reservoir to Hells Canyon Dam). Occasionally, symptoms of gas bubble trauma have been identified on adult anadromous salmonids returning to Hells Canyon Dam during periods of spill. How susceptible fish populations and individual fish are to high total dissolved gas largely depends on the depth distribution of the fish species and life stages. Effects of high total dissolved gas to fish and invertebrates are reduced by depth. For every 1 meter in depth, effects are essentially reduced by 10%. For example, if surface total dissolved gas saturation is 120%, a fish at 1 meter in depth experiences conditions equivalent to 110%; at 2 meters in depth, conditions are equivalent to

100%. During periods commonly associated with high spill, redband trout are in the Snake River and could be susceptible to high total dissolved gas levels. The depth distribution of redband trout measured over locations where the fish were radio-tagged suggests a range between 1 and 10 meters in depth, with a peak in frequency of observations between 2 and 4 meters (Chapter 1 of Technical Report E.3.1-7). With this depth distribution, few effects are anticipated from high levels of total dissolved gas.

The Applicant proposes to install flow deflectors on Hells Canyon Dam (see section E.2.4.2.4.) to alter the spillway hydrodynamics during spill events of less than 30,000 cfs. These flow deflectors should substantially reduce the potential for continuing downstream impacts. The deflectors are expected to control gas levels during all but the highest 2% of flows. While the Applicant cannot quantify what the total dissolved gas levels would be after the deflectors were installed, similar measures at other federal and public utility district projects on the Snake and Columbia rivers have significantly improved total dissolved gas conditions. The Applicant's total effectiveness monitoring plan (proposed as part of the measure detailed in section E.2.4.2.4.) would improve the likelihood that continuing impacts from elevated total dissolved gas levels were reduced.

Temperature

Like salmonids within the HCC, native resident salmonids below the HCC are limited in their distribution by warm summer temperatures. Therefore, they must seek cold refuge, generally within the tributaries. Riverine mainstem environments may have additional refuge areas associated with hyporheic upwelling that would not be available in reservoir habitats.

A water temperature target of 17.8 °C for the Snake River has been identified in the TMDL (IDEQ and ODEQ 2001) to protect coldwater biota. However, the TMDL also determined that temperature conditions were not a result of controllable anthropogenic activities, so no temperature-specific improvements are expected with implementation of the TMDL. As a result, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the Applicant's projects, water temperature will undoubtedly continue to exceed the standard for coldwater biota throughout the Snake River system. Water temperatures within the HCC and downstream will be no exception. Maximum summer temperatures of inflowing water will continue to exceed 26 °C, while outflows will remain near

23 °C. Retention of the warm summer inflows in the reservoirs, especially Brownlee Reservoir, will continue to delay fall cooling of outflows relative to inflows.

The effects of delayed fall cooling on resident salmonids are negligible because of the refuge they must already seek during summer. Resident salmonids typically move into the mainstem Snake River when temperatures in the tributary habitats cool, a time that usually corresponds with cooling in mainstem habitats (Chapter 4 of Technical Report E.3.1-7).

E.3.1.4.3. Anticipated Impacts of Continued Operation on Threatened and Endangered Species

E.3.1.4.3.1. Anadromous Fish

E.3.1.4.3.1.1. Anticipated Continuing Impacts within the HCC and Vicinity

Construction of the HCC blocked access to a number of tributary basins above Hells Canyon Dam: Pine Creek; Indian Creek (joining the Snake River in Hells Canyon Reservoir); Wildhorse River (Oxbow Reservoir); Eagle Creek (lower Powder River); Burnt River; Weiser River; Malheur River; and the lower portions of the Owyhee, Payette, and Boise rivers. Of these basins, only Pine Creek, Indian Creek, Wildhorse River, Eagle Creek, and the Weiser River were the primary producers of anadromous fish (spring/summer chinook salmon and steelhead) before HCC construction. The mainstem Snake River was also producing fall chinook salmon up to Swan Falls Dam.

Under the Applicant's proposed measures, Brownlee Dam would continue to block anadromous fish from access to historical anadromous habitats upstream. With the existing fish trap at Hells Canyon Dam and the proposed fish trap at Oxbow Dam, anadromous adults could access tributaries within Hells Canyon and Oxbow reservoirs for production purposes. However, under the Applicant's proposed measures, populations of anadromous fish within these basins would probably not be self-sustaining. There are no downstream bypass or collection facilities proposed for Oxbow or Hells Canyon dams to increase survival of smolts migrating downstream through the HCC. The use of the Hells Canyon fish trap would continue for capturing anadromous hatchery adults as part of the existing mitigation hatchery program.

In a study of reintroduction alternatives (Chapter 11 of Technical Report E.3.1-2), the Applicant determined that natural populations of anadromous fish would probably not sustain themselves upstream of Hells Canyon, even with bypass or collection facilities at these two dams, under conditions existing downstream of Hells Canyon Dam. Conditions along the migratory corridor in the lower Snake and Columbia rivers and in the ocean, together with ocean harvest and in-river adult survival, reduce smolt-to-adult returns to levels below those necessary to maintain basin production potential and possibly population self-sustenance. Most populations of anadromous fish in the Snake River basin (below Hells Canyon Dam) have reached extremely low levels, a situation that has led to their protection under the ESA.

In addition, the quality of existing habitat upstream of Hells Canyon Dam is questionable regarding its ability to produce anadromous smolts. The Applicant's studies of habitats in the tributary basins suggest that many requirements would have to be met before reintroduction could be successful (Chapter 4 of Technical Report E.3.1-2). Some of the most daunting requirements include passage at tributary dams that blocked access to anadromous fish habitat even before the HCC was constructed. In areas that would be accessible with passage at the HCC or other dams owned by the Applicant, successful reintroduction would be impaired by severe habitat degradation within these tributaries, including increased instream temperatures and low instream flows. One of the most pervasive forms of habitat degradation includes widespread irrigation throughout many of these basins. Irrigation has degraded many tributaries' ability to produce anadromous fish through a combination of influences: reduced streamflows, partial and complete migration blockages, and unscreened water withdrawals that remove rearing or migrating fish from the stream corridor. Virtually no area within the tributary habitats has been unaffected by irrigation practices. The effects of irrigation were evident even before the HCC was constructed. Many of the accessible habitats no longer supported anadromous fish, including the lower Boise and Payette rivers and much of the Malheur and Burnt rivers. In areas that were still producing anadromous fish before the HCC was constructed, spring chinook salmon production had been reduced, primarily because of irrigation-related habitat impacts. These basins include both the Weiser River and Pine Creek (Chapter 4 of Technical Report E.3.1-2).

Whether fall chinook can be successfully reintroduced in historical habitats is also questionable. Studies by the Applicant indicate that, even with very high survival of naturally produced fall chinook to the tailrace of Lower Granite Dam, production could not be maintained unless smolt-to-adult survivals increased significantly (Technical Report E.3.1-2). Even with collection facilities in place at Brownlee Dam to pass smolts downstream around Oxbow and Hells Canyon dams or with up to 50% of the migrating smolts collected at the top of Brownlee Dam and transported to below Hells Canyon Dam, survival would not be great enough to maintain production potential. Snake River fall chinook were viable below Swan Falls Dam before the HCC was built. However, during this period, there were no dams in the lower Snake River and only three dams in the lower Columbia River. Fall chinook salmon reintroduced into the Marsing reach (Swan Falls Dam to Marsing) today would need to pass through or be transported around the three dams of the HCC, four dams in the lower Snake River, and four dams in the Columbia River before they reached the ocean. The effects of conditions today are evident below Hells Canyon Dam where spawning and rearing habitats are significantly underseeded (Technical Reports E.2.3-2 and E.3.1-2). Since 1975, naturally produced fall chinook salmon have remained at precariously low levels. Only recently, with heavy supplementation of hatchery-reared fall chinook salmon, have adult returns increased to levels above 1,000 individuals. However, returns of wild adult fall chinook salmon still remain very low.

In addition to problems associated with low smolt-to-adult returns, mainstem habitat conditions have probably deteriorated above Hells Canyon Dam since 1958. To evaluate present-day conditions, the Applicant studied historical spawning areas once used below Swan Falls Dam. Construction of artificial redds suggested that survival of incubating eggs is questionable. Studies of substrate materials from the riverbed, extracted through freeze-coring techniques and then analyzed, found that sediment permeability and particle size distribution are within ranges that would support survival comparable to production areas below Hells Canyon Dam and in the Hanford reach (Priest Rapids Dam to above the confluence of the Snake River) of the Columbia River. However, studies of dissolved oxygen levels in areas that would represent an egg pocket within an artificial redd suggest a lower survival potential (Technical Report E.3.1-5) because dissolved oxygen levels were low during the post-hatch, pre-emergent fall chinook life stage. The apparent contradiction between sediment permeability and particle size distribution results and dissolved oxygen levels requires some discussion. Freeze-core techniques eliminate the top 150 to 200 mm of bed material, which may represent an area of fine sediment accumulation. Redd construction likely washes away fine sediments and leaves the redd environment clean of fines. However, in a system with high amounts of suspended sediments, the redd can be capped through the incubation period with these fine sediments. This cap can reduce the potential for oxygen-rich river water to move through the gravel and, therefore, reduce dissolved oxygen levels during the later part of incubation, especially if the fine sediment is high in organic matter and bacterial content (Chapter 5 of Technical Report E.3.1-2). Currently, the Snake River is listed by the EPA as impaired regarding nutrient and sediment levels.

For these reasons, reintroducing anadromous fish to contribute to their recovery would probably be unsuccessful (Chapter 11 of Technical Report E.3.1-2). In addition, the Applicant is uncertain about a source of spring chinook salmon that would represent the ESU of Snake River spring chinook salmon (Chapters 10 and 11 of Technical Report E.3.1-2, Technical Report E.3.1-4). However, if self-sustenance is not required, anadromous fish could be reintroduced to meet other goals. Such goals include releases of surplus adults in Pine Creek, Indian Creek, or Wildhorse River for trophic enhancement of native resident salmonid populations associated with Hells Canyon and Oxbow reservoirs (in addition to the measure proposed in section E.3.1.3.2.1.5.) or for harvest opportunities of surplus hatchery adults. The IDFG has already supplemented harvest programs with surplus adult spring chinook and steelhead in Hells Canyon Reservoir and in the Boise and Payette rivers.

E.3.1.4.3.1.2. Anticipated Continuing Impacts on Downstream Areas Affected by the HCC

Operational Impacts to Anadromous Fish

Spawning Habitat—Comparing the effects of modeled proposed operations and full pool run-of-river operations to the fall chinook spawning life stage is unique because stable flows, not fluctuating flows, characterize modeled proposed operations during the modeled period of October 21 through December 11 (Technical Report E.2.3-2). The Applicant voluntarily initiated the fall chinook plan in fall 1991 to provide stable habitat (through stable discharge) for fall chinook salmon that spawn in the Hells Canyon reach (see section E.3.1.3.1.1.). Discharge from Hells Canyon Dam is maintained at a steady, stable level during the spawning season. This stable flow is then maintained as a minimum discharge throughout the incubation period until fry emergence is considered complete. Stable flow levels depend on the magnitude of the hydrologic year and were modeled at 9 kcfs (extremely low- and low-flow years), 11.5 kcfs (medium-flow year), and 13 kcfs (high- and extremely high-flow years). Stable flow levels of 9 kcfs resulted in the highest amount of modeled habitat available, while stable flows of 13 kcfs resulted in the lowest. Habitat availability modeled under modeled proposed operations was at least 87% of the maximum for more than 95% of the spawning period, regardless of hydrologic year. Spawning habitat under full pool run-of-river operations varied with hydrologic year. Habitat availability under modeled proposed operations averaged about 87% of the maximum during the high- and extremely high-flow years, while full pool run-of-river operations averaged 76 and 67% of maximum during the high- and extremely high-flow years, respectively.

The operational analysis clearly shows that higher flows affect the habitat available to fall chinook spawning in the Hells Canyon reach above the Salmon River (upper Hells Canyon reach). Flows released under modeled proposed operations provide near-maximum habitat conditions that are steady and stable. Flows under full pool run-of-river operations are most detrimental to the availability of spawning habitat during high- and extremely high-flow years. Contrary to the stable flows under modeled proposed operations, flows under full pool run-of-river operations fluctuate daily.

Rearing Habitat—Juvenile fall chinook habitat, modeled from March 15 to June 15, was lowest in availability during the high- and extremely high-flow years under both modeled proposed operations and full pool run-of-river operations (Technical Report E.2.3-2). There was no difference between operations for juvenile fall chinook modeled habitat during the extremely low- (1992) and low-flow (1994) years. For these two dry years, the average decrease in habitat under modeled proposed operations was less than 2%, and the average increase in habitat under modeled proposed operations was less than 5.3%. Relative daily fluctuations in modeled habitat (modeled proposed operations as a percentage of full pool run-of-river operations) of 10 to 13% during the low-flow year were not considered significant because absolute daily fluctuations in habitat (habitat as a percentage of total reach area) were about 0.1% under modeled proposed operations. Modeled habitat was not significantly reduced during the medium-flow year under modeled proposed operations: the average reduction in habitat was only 2.3% relative to full pool run-of-river operations. Habitat was increased by an average of 19.6% under modeled proposed operations during the medium-flow year (1995) since flood-control operations during May reduced discharge in the upper Hells Canyon reach (when Brownlee Reservoir is being refilled),

resulting in more habitat available than under full pool run-of-river operations.
Brownlee Reservoir operations affected juvenile rearing habitat significantly during the high- and extremely high-flow years of 1999 and 1997, respectively. High discharge under modeled proposed operations before May 1 reduced habitat availability relative to full pool run-of-river operations during both the high- and extremely high-flow years. Average reductions in modeled habitat for the juvenile rearing period were 10.5 and 11.2% for the high- and extremely high-flow years, respectively. Flood-control operations after May 1 reduced discharge in the upper Hells Canyon reach under modeled proposed operations and increased modeled habitat over the amount available under full pool run-of-river operations. The average increase in habitat under modeled proposed operations was 35.3 and 44.7% during the high- and extremely high-flow years, respectively. Unlike short-term peaks in habitat associated with load following, these increases in habitat from flood-control operations lasted longer (throughout the month of May and the first of June) during both the high- and extremely high-flow years. The frequencies of hourly decreases and increases in modeled habitat were about equal (49 and 51%) under modeled proposed operations during these two wet hydrologic years. Increases in habitat under modeled proposed operations were up to 84% (high-flow year) and 74% (extremely high-flow year), compared with decreases in habitat under modeled proposed operations of 15%.

Modeled habitat at the Fish Trap Bar 2-D site was spatially distributed into two patches, with the largest occurring at Fish Trap Bar itself. This habitat patch fluctuated in area but did not appear to fragment across the range of discharges within the plant capacity for Hells Canyon Dam. The gradient of this sandbar, while suitable as juvenile rearing habitat, does not entrap or strand juvenile chinook during downramping operations of the Hells Canyon Power Plant. Rearing habitat modeled at the Pine Bar 2-D site was spatially distributed into four habitat patches, with the largest at Pine Bar itself. Modeled habitat at Pine Bar increased to a maximum near 20 kcfs and then fragmented into two patches between 20 and 30 kcfs.

Water Quality Impacts to Anadromous Fish

Total Dissolved Gases—Under current operations, few effects related to high total dissolved gas have been observed. Occasionally, symptoms of gas bubble trauma have been identified on adult anadromous salmonids returning to Hells Canyon Dam during periods of spill. However, no symptoms of gas bubble trauma have been observed on juvenile fall chinook salmon in sampling conducted by the USFWS (William Connor, USFWS, Ahsahka, ID, personal communication). However, their uppermost sampling location has been approximately 20 miles downstream of the HCC where total dissolved gas levels would have dissipated. How susceptible fish populations and individual fish are to high total dissolved gas largely depends on the depth distribution of the fish species and life stages. As mentioned previously, effects to fish and invertebrates of high total dissolved gas are reduced by depth (generally 10% for every meter of depth).

The Applicant proposes to install flow deflectors on Hells Canyon Dam (see section E.2.4.2.4.) to alter the spillway hydrodynamics during spill events of less than 30,000 cfs. These flow deflectors should substantially reduce the potential for continuing downstream impacts. The deflectors are expected to control gas levels during all but the highest 2% of flows. While the Applicant cannot quantify what the total dissolved gas levels would be after the deflectors were installed, similar measures at other federal and public utility district projects on the Snake and Columbia rivers have significantly improved total dissolved gas conditions. The Applicant's total effectiveness monitoring plan (proposed as part of the measure detailed in section E.2.4.2.4.) would improve the likelihood that continuing impacts from elevated total dissolved gas levels were reduced.

Dissolved Oxygen—Under current conditions, dissolved oxygen levels may affect adult fall chinook salmon and steelhead returning to the uppermost sections of the Snake River below Hells Canyon Dam. Dissolved oxygen suitability for adult salmonids is significantly reduced at concentrations of less than 7.0 mg/L when water temperatures are greater than 17.0 °C (Chapter 2 of Technical Report E.3.1-3). After about October 1 each year, dissolved oxygen concentrations within the Snake River immediately below Hells Canyon Dam increase steadily, while water temperatures decrease. Given these occurrences, suitability for adult salmonids continually increases. Immediately downstream of Hells Canyon Dam to approximately RM 241.2 (Wild Sheep Rapids), dissolved oxygen concentrations are generally less than 6.0 mg/L from August 1 through October 31. Water temperatures in this same river reach generally drop below 17.0 °C by about October 15 each year. Also, dissolved oxygen concentrations tend to increase gradually as the water passes through numerous rapids and reaerates downstream of Hells Canyon Dam. Therefore, for low dissolved oxygen levels, the area of potential impact is a 6.5-mile section of river from Hells Canyon Dam downstream to just below Wild Sheep Rapids.

Adult steelhead begin passing lower Granite Dam in significant numbers by about August 1 each year (U.S. Army Corps of Engineers count data). Adult fall chinook salmon begin passing by about August 18 each year (U.S. Army Corps of Engineers count data). Fall chinook spawning within the Snake River has been documented to begin as early as the first week of October (Chapter 1 of Technical Report E.3.1-3).

The effect of low dissolved oxygen levels on prespawn steelhead and fall chinook adults is uncertain. The adults and gametes of each species are at risk of direct mortality and decreased viability, respectively. However, these risks are probably extremely low. First, there have never been any observed prespawn mortalities reported downstream of Hells Canyon Dam, nor does evidence indicate that prespawn adults remain for extended times within this upper river section when observed dissolved oxygen levels are low. Additionally, adult steelhead captured in mid-October at the fish trap directly downstream of Hells Canyon Dam do not exhibit signs of stress from exposure to significantly low dissolved oxygen levels (Paul Abbott, IPC, personal communication). With respect to fall chinook salmon, the amount of potential spawning habitat upstream of Wild Sheep Rapids is limited, as evidenced by the numerous, large rapids that are relatively steep; the lack of potential spawning gravels; and the small numbers of redds observed annually in that section (< 1.5% of all spawning observed upstream of Lower Granite Dam) (Chapter 1 of Technical Report E.3.1-3). Finally, observed fall chinook spawning within the Snake River upstream of Wild Sheep Rapids generally occurs after about November 1 each year, a time by which any risks from low dissolved oxygen have passed.

The effects of low dissolved oxygen levels on the survival and development of incubating eggs are slightly better understood. Again, very little spawning habitat for fall chinook salmon exists upstream of Wild Sheep Rapids. Since intensive spawning surveys were initiated in 1991, less than 1.5% of all spawning observed upstream of Lower Granite Dam has occurred within the 6.5-mile upper section of the Snake River between Wild Sheep Rapids and Hells Canyon Dam (Chapter 1 of Technical Report E.3.1-3). Also, spawning within this upper section generally occurs after November 1, when risks from low dissolved oxygen have passed. In addition, the character of the spawning substrates, or incubation environment, is high quality, having a low percentage of fine materials and relatively high permeability (Chapter 3 of Technical Report E.3.1-3). These factors result in an increased ability to transport dissolved gases to and metabolic waste from developing embryos. Finally, several studies have concluded that, within the early stages of embryonic development, salmonids can tolerate very low dissolved oxygen conditions (< 4.0 mg/L) without adverse effects, such as increased mortality before or after hatching, increased incubation time, or development of abnormalities (Alderdice et al. 1958, Silver et al. 1963, Shumway et al. 1964, Piper et al. 1982). These authors all concluded that, during initial embryonic development, gravel permeability and velocity of hyporheic water (both of which characterize the ability for metabolic wastes to be removed) are more important than high dissolved oxygen levels. They defined the critical period, when elevated concentrations of dissolved oxygen are required, as occurring after hatching. At this time, metabolic activity and the consumption of dissolved oxygen increase, and a higher concentration of oxygen becomes vital. By the time this phase occurs within the Snake River, levels of dissolved oxygen are at saturation and remain so until after emergence from the gravel is complete.

Three of the measures proposed by the Applicant to improve dissolved oxygen levels in the release at Brownlee Dam include aeration and turbine venting (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) and should reduce or eliminate unsuitable conditions and potential impacts experienced by anadromous fish in the section of river described above. Physical water quality models indicate that improvements to dissolved oxygen levels from these measures would carry through the Oxbow and Hells Canyon reservoirs and into the tailwater downstream of Hells Canyon Dam (Technical Report E.2.2-2). However, the Applicant recognizes significant uncertainty associated with identifying specific features and effects of these measures at this time. Because of this uncertainty, the Applicant proposes that the specific details regarding design, location, and operation, as well as an effectiveness monitoring plan, be developed through consultation with both the IDEQ and ODEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of TMDL implementation and the 401 certification process for the HCC. As mentioned in section E.2.4.2., the goals of the proposed dissolved oxygen measures are to enhance oxygen levels in the waters below Hells Canyon dam. Improvements in the levels of nutrients and organic matter in inflows to the project would also substantially improve dissolved oxygen throughout the project area.

Temperature—Retention of the warm summer inflows in the reservoirs, especially Brownlee Reservoir, will continue to delay fall cooling of outflows relative to inflows. The Applicant's modeling showed that temperature conditions within and downstream of the HCC are affected, both in magnitude and timing, by inflowing temperature conditions (Technical Report E.2.2-2). Despite the generally improved conditions for coldwater biota downstream of Brownlee Dam, temperatures will annually exceed the Idaho and Oregon standards for coldwater biota because of the warm Snake River inflows.

The impact of delayed fall cooling on anadromous fish downstream of the HCC is uncertain. To assess the relative impacts of exposure to temperatures resulting from operations of the HCC, the Applicant compared temperature data sets representing various reaches of the Snake River: above C.J. Strike Dam, below Swan Falls Dam, below the Weiser River, from Hells Canyon Dam to the Salmon River (upper Hells Canyon reach), and from the Salmon River to Asotin, Washington (lower Hells Canyon reach) (Chapter 5 of Technical Report E.3.1-2). Another data set (Oxbow reach, or more specifically Oxbow, Oregon) represented the Snake River in 1954 through 1956 before the HCC was constructed (pre-HCC). During October, all monthly mean temperatures in all reaches declined to below 14 °C, except in the upper Hells Canyon reach, which had a mean monthly temperature of 16.4 ºC. However, by the third week in October, temperatures in all reaches, including upper Hells Canyon, declined to below 14.5 °C (Table 1 in Chapter 5 of Technical Report E.3.1-2). Adult fall chinook in the upper Hells Canyon reach are exposed to just as high temperatures during the early migration period (pre-September 15) as adult fall chinook were before construction of Hells Canyon Dam. However, construction of the HCC extended their exposure to water temperatures above 14.5 °C by approximately two to three weeks over reaches upstream of the HCC. Most of the reaches, including the pre-HCC Oxbow reach, were approximately 10 °C by the end of October, whereas the present-day Hells Canyon reach averages about 13.5 °C.

Returning prespawn fall chinook salmon are exposed to warm temperatures for two to three weeks longer because of the HCC. However, no effects to free-ranging adult chinook salmon of this prolonged exposure to elevated temperatures have been empirically demonstrated. Temperatures occurring during this extended exposure are declining from between 16 and 18 °C to 14.5 °C. These lower temperatures are within the suitability range for migrating adults (Poole et al. 2001, Technical Report E.3.1-3) and for optimal swimming speed (Poole et al. 2001), but they are slightly above the range suitable for gamete viability during holding (> 13–16 °C, Poole et al. 2001). Experiments cited as reference for potential effects of elevated temperatures on gamete viability used adults held in holding ponds, and subsequent incubation temperatures were held relatively high throughout the entire period (McCullough 1999). How these findings based on confined fish compare with the effects likely to free-ranging fish is unknown. Their responses may be site specific and stock specific. In a free-flowing river, thermal refugia are associated with hyporheic upwelling, deep pools, and tributary inflows. In addition, temperatures are typically cooler throughout most of the incubation period in a natural setting than in these experiments.

There is apparently no effect of the prolonged exposure to warmer temperatures in the fall on spawn timing (Chapter 5 of Technical Report E.3.1-2, Chapter 1 of Technical Report E.3.1-3). No evidence indicates that the timing of fall chinook spawning has been significantly changed with the altered thermal regime or that spawn time among various reaches in which historical spawning occurred are significantly different. An interview in Evermann (1896) suggests that spawning near Glenns Ferry in the upper Snake River was nearly completed by mid-November. In another account in Evermann, Liberty Millet of Salmon Falls (upper Snake River) thought salmon spawning peaked in mid-October. If Millet's account was accurate, spawning in the upper Snake River may have occurred slightly earlier than is observed today. Spawn time after Swan Falls Dam was constructed probably peaked during mid- to late October and was probably complete by the end of the first week in November (Richards 1959). Current surveys below Hells Canyon Dam indicate that, from 1993 to 2001, approximately 85% of spawning was completed by the end of the first week in November, with some spawning extending even into December (Chapter 1 of Technical Report E.3.1-3). However, these spawning surveys below Hells Canyon Dam are much more intensive than any surveys or casual observations in the pre-Swan Falls Dam period and much more intensive than the redd surveys in the Marsing reach reported by Richards (1959). Possibly, spawning in all reaches extended into December at low numbers but was simply not observed or reported. The Applicant concludes that present-day spawn timing downstream of the Hells Canyon reach is similar to historical spawn timing throughout the Snake River. Connor (2001) also concluded that spawn time between the Marsing reach and present-day Hells Canyon Dam had not significantly changed.

Incubating fall chinook eggs in redds constructed early in the spawning period may be affected by the prolonged cooling effect in the fall, although this effect has not been documented with field studies for the upper and lower Hells Canyon reaches of the Snake River. Indications from studies in hatchery settings having mean daily temperatures that decline in ranges similar to those observed for these early redds show reduced survivals (McCullough 1999). Olson and Foster (1955) found in their study of fall chinook in the Hanford reach of the Columbia River that, if temperatures during initial spawn were less than or equal to 16 °C, survival was at least 90%. When initial temperatures were 18.4 °C, survival was 21%. This finding is especially significant since the thermal regime immediately before and at initiation of spawning for fall chinook salmon in the Hanford reach compares well with the thermal regime observed below Hells Canyon Dam. Therefore, any stock-specific adaptations are probably similar to those of Snake River fish (Dauble and Watson 1997).

In the upper Hells Canyon reach, temperatures above 16 °C occur on average between October 10 and 18: the literature suggests that redds constructed during this time may have lower survival rates than redds constructed later, although this effect has not been documented with field studies for the Hells Canyon reach of the Snake River. Redds constructed after this period have equal probabilities of survival regardless of the temperature at which they were constructed. Given these probabilities, fewer than 2% of the redds in an average spawning distribution would be affected by elevated temperatures.

In addition to prolonging the fall cooling of water temperatures, the HCC has also led to generally warmer conditions during much of the incubation period for fall chinook salmon, a conclusion that is based on water temperatures at the oxbow for 1954 through 1956 (Figures 3–5 in Chapter 5 of Technical Report E.3.1-2). The comparison among Snake River sections demonstrates that emergence timing was probably correlated with river mile, with fish farther upstream in the Snake River emerging earlier than fish downstream. Because of thermal unit accumulation, the altered thermal regime below Hells Canyon Dam has shifted current emergence to an earlier date than would have been seen in the same reach before the HCC. Present-day emergence dates are similar to those for the Weiser reach (confluence of the Weiser River to the upper end of Brownlee Reservoir) (Figure 6 in Chapter 5 of Technical Report E.3.1-2). The range of emergence in the upper Hells Canyon reach is wider than what occurred in other reaches, overlapping the range of the upper Snake River and of the Marsing and Weiser reaches (Figure 7 in Chapter 5 of Technical Report E.3.1-2). Despite the wider range, median emergence dates are similar between the Weiser and upper Hells Canyon reaches.

Although the present-day Hells Canyon reach is warmer during the incubation period than it was before HCC construction, the entire production area available today (including the Clearwater and Grande Ronde rivers and the upper and lower Hells Canyon reaches) is cooler than the area above the HCC was historically. That is, even though emergence times overlap with those that occurred in both the upper Snake River (above C.J. Strike Dam) and Marsing reaches and even though thermal unit accumulation occurs at a faster rate, fish emerge into a cooler thermal regime than fish historically did above the HCC. However, because of the earlier emergence, fall chinook produced in the upper Hells Canyon reach have a greater growth potential than fall chinook did that were produced in the same reach during the pre-HCC era (Chapter 5 of Technical Report E.3.1-2).

Despite the cooler regime at emergence, fall chinook growth rates in the Hells Canyon reach appear to be exceptional. Connor et al. (1997) reported growth rates of 1.4 millimeters per day (mm/day), a rate that is among some of the highest observed in the Northwest Region. For example, subyearling chinook salmon that were held at constant temperature at Lyons Ferry Hatchery (on the lower Snake River) have an average growth rate of 0.7 mm/day (Lyons Ferry Hatchery unpublished data). Monthly mean temperature values for March, April, and May for the upper Hells Canyon reach are 6.3, 10, and 13.8 °C, respectively (Table 1 in Chapter 5 of Technical Report E.3.1-2). Optimal temperatures for juvenile chinook range from 10 to 15 °C (Chapter 2 of Technical Report E.3.1-3). Raleigh et al. (1986) noted that chinook salmon fry tended to reenter the gravel when temperatures were below 8 °C. In the Hells Canyon reach, during the earlier portion of the emergence period, fish may remain in the gravel and not actually emerge until sometime later, under warmer conditions. Faster growth rates are probably initiated toward the beginning of April below Hells Canyon, whereas pre-HCC, growth was initiated in the first part of March in the reaches above Hells Canyon. In the pre-HCC Oxbow reach, thermal conditions in April through May were comparable with current conditions below Hells Canyon Dam.

Temperature analysis conducted for the various sections of the Snake River indicates that fall chinook emergence and growth initiation are positively correlated with river mile. Fish in the farthest reaches upstream probably emerged and initiated growth the earliest, but they also had the greatest distance to travel. Fall chinook in the upper Snake River reach had at least 450 km farther to migrate than fish in the reach below Hells Canyon did. Fish in the Marsing reach had approximately 300 km farther to travel than fish in the reach below Hells Canyon did. Raymond (1979) reported that migration rates of juvenile salmon in free-flowing reaches ranged from 24 km/day to 54 km/day, depending on the magnitude of the hydrologic-year type. Using the highest rate, fish from the Marsing and upper Snake River reaches were estimated to take about six to nine days to reach the area below Hells Canyon Dam. Under the lowest migration rate, migration time would essentially double. However, because fall chinook salmon commonly intersperse rearing (feeding and quiescent behaviors) and active migration (Dauble et al. 1989), their migration is not continuous. Therefore, these estimates would probably be minimum migration times.

Because of the earlier emergence and growth potential, fish in the upper Snake River were, on average, physically ready to migrate before fish in the lower reaches. In addition, they may have attained a larger size because of the increased growth potential. Larger size would have been beneficial, given the longer distance they had to migrate (based on the assumption that larger fish can migrate faster) (Tiffan et al. 2000). Despite estimates of travel time, the actual amount of time fish from the upper reaches would have taken to arrive to the area that is now Lower Granite Reservoir is unknown. Possibly, when fish from the upriver reaches were arriving in the Hells Canyon reach, fish in that reach were approaching readiness to smolt. In this case, the outmigration in the lower river may have been a single pulse of fish from all reaches of the Snake River during a relatively confined period. Mains and Smith (1964) reported that the entire migration period in the early 1950s (pre-Brownlee Dam) was completed by the end of June. This migration presumably included fish produced below Marsing and below Hells Canyon, as well as fish produced in areas now inundated by Lower Granite Reservoir. If emergence were completed in the Hells Canyon reach near the first of June and the growth rate were 1.4 mm/day, these fish would be approaching 80 mm (based on an assumed emergence length of 35 mm) (Connor 2001). This size is at the lower end of the size ranges of fish captured by Mains and Smith (1964) at Central Ferry (located on the Snake River approximately 80 km downstream of Lewiston) by the end of June. Today, fish in the Hells Canyon reach emerge earlier than fish in the pre-HCC Hells Canyon reach did. Even with the delayed growth potential of the earlier emergers, these fish should have outmigration times similar to, if not earlier than, those reported by Mains and Smith. Yet today, on average, less than 50% of the fall chinook outmigration is complete by the end of June (Connor 2001).

In addition, today's later migrations include fish produced in the lower Clearwater, Grande Ronde, and Imnaha rivers. According to Connor (2001), no evidence indicates that these rivers historically supported viable populations of fall chinook. Yet today, increased numbers of fall chinook naturally spawn in these rivers (Chapter 1 of Technical Report E.3.1-3) because of increased supplementation efforts and possibly because of an altered thermal regime related to the construction of Dworshak Dam on the North Fork Clearwater River. Connor (2001) concluded that chinook produced in the Clearwater River emerge later than fish in the Snake River and subsequently outmigrate much later. These Clearwater River fish undoubtedly make up a significant portion of the fish migrating later through the Snake River system over what was observed by Mains and Smith (1964). Thermal conditions of the Snake River do not influence emergence timing in the Clearwater River. If salmon were produced historically in the Clearwater River (at least to the mid-1950s), they would have entered a warmer Snake River than they do today. In fact, conditions may have been such that an alternate life history of yearling migration, rather than subyearling migration, would have prevailed, as is observed today for a small percentage of the Clearwater River fish (Connor 2001).

Another confounding factor in migration timing is the presence of the lower Snake River reservoirs. As discussed above, there is no evidence that the timing of adult migration and spawning has significantly changed from that of the pre-HCC era. All chinook historically produced above the Lower Granite Dam site had completed migration by the end of June. Emergence timing is earlier today in the Hells Canyon reach than it historically was. Growth potential, based on thermal conditions, appears to be similar to that in the pre-HCC Hells Canyon reach. The most profound change for migrating juvenile chinook in this reach is construction of the lower Snake River reservoirs.

Reservoir construction increased the river's mean cross-sectional area. This increase significantly reduces water velocity for an extended length of the river. Several studies have focused on factors that influence salmon migration rates through reservoirs. Raymond (1979) measured the difference in migration rates in free-flowing sections and in reservoir reaches and found that the rates of fish migrating through reservoirs was one-half to one-third the rate through free-flowing reaches. Conducting a three-year study of migration rates of juvenile fall chinook salmon, Venditti et al. (2000) found that migration rates mirrored reservoir water velocity. They listed several factors that could influence migration rates of juvenile salmonids but found that water velocity was the only variable that followed the pattern of migration rates they observed. Connor (2001) concluded that migration rates increase with increased flow (used as a surrogate for water velocity), provided that juveniles were physiologically and behaviorally ready to migrate.

Slower migration rates through reservoir environments increase risks of exposure to warming temperatures and predation. Connor (2001) concluded that increases in flow and decreases in water temperature increase salmon smolt survival. If water temperatures rise too quickly to levels approaching 20 °C, reduced physiological processes can decrease fish survival because they increase fish's vulnerability to predation, stress, and disease (McCullough 1999, Connor 2001). McCullough (1999) discussed land-use practices in tributaries that have led to more rapid temperature increases in spring and summer. Effects of land uses were probably evident in the area upstream of the HCC before the complex was constructed (Chapter 4 of Technical Report E.3.1-2). Water temperatures in the pre-HCC era increased at a faster rate than they do today below Hells Canyon Dam, and they were warmer in June than they are today. The mean monthly temperature for June in the pre-HCC Oxbow reach was 19.2 °C, whereas in recent years represented in the Applicant's data, mean water temperatures are 16.8 °C in the upper Hells Canyon reach and 15.7 °C in the lower Hells Canyon reach (Chapter 5 of Technical Report E.3.1-2).

Present-day temperature conditions below the HCC through June are more suitable for migrating than temperatures of inflows to the HCC are or temperatures during the pre-HCC period would have been. However, delays to migrations through the lower Snake River reservoirs subject smolts that are migrating later to elevated water temperatures. So, although the later-emerging tributary fish, such as those produced in the Clearwater River, do not enter the Snake River under thermally favorable conditions, they would also have experienced such temperature conditions before the HCC was constructed. These unfavorable thermal conditions may partly explain why the Clearwater River was not historically known to support a viable population of fall chinook. The same could probably be said for the Salmon River. However, fish produced in the Clearwater River today must also pass through Lower Granite Reservoir and possibly other lower Snake River reservoirs, further exacerbating risks to their survival.

Impacts of Continued Hatchery Operations

Twelve stocks of anadromous fish in the Snake and Columbia river basins are listed as threatened or endangered. According to NMFS (1999), artificial propagation programs could adversely affect listed salmon and steelhead through operation of hatchery facilities, interaction between hatchery and natural populations in the natural environment, and collection of broodstock. More specifically, hatchery actions could affect listed fish by causing mortality directly (through predation, broodstock collection, and disease transmission) or indirectly (through genetic and ecological interactions in the natural environment) (NMFS 1999). Despite these assertions, NMFS (1999) acknowledges that the absence of long-term monitoring programs makes quantifying the effect of hatchery operations on threatened and endangered species difficult. NMFS (1995, 1999) and the IDFG (1993a,b; 2000) summarized the effects of hatchery operations, including those of the Applicant hatcheries, on threatened and endangered species from a qualitative standpoint. The Applicant relied heavily on their work to evaluate potential impacts from continued operation of its mitigation hatcheries.

For the most part, hatchery-produced smolts released from the Applicant's facilities do not overlap natural spawning and rearing habitats occupied by listed species. This separation, in both location and time, between hatchery stocks and listed stocks reduces the chance of negative interactions. The IDFG evaluated possible effects of the hatcheries, based on competition and predation, genetic introgression, and pathogen transfer. The analysis failed to demonstrate that hatchery smolts were competing with or preying on listed species. Likewise, the IDFG was unable to show that pathogens, transferred by hatchery fish, were killing listed species. The Applicant summarized pathogen occurrences at its hatchery facilities (Technical Report E.3.1-4). In addition to the IDFG's assessment of genetic introgression, the Applicant (Technical Report E.3.1-4) demonstrated that adult salmon and steelhead produced at its hatcheries do stray from their home ranges. However, their stray rates are consistent with those reported in the literature for other stocks and do not indicate detrimental effects to listed species.

In all cases, the IDFG's conclusions were the same: while the level of incidental take was unquantifiable, continued operation of the Applicant's hatchery program would not jeopardize the continued existence of the various listed species. Since 1992, NMFS has concurred with this analysis by annually issuing or renewing section 10 incidental take and direct take permits to the IDFG to continue operating the Applicant's hatchery program. The *Biological Opinion on Artificial Propagation in the Columbia River Basin* (NMFS 1999) contains a similar analysis and conclusion regarding operation of the Applicant's hatchery facilities. The one exception to these findings involved the risk of genetic introgression associated with releasing Oxbow Hatchery stock steelhead smolts into the lower Salmon River. NMFS concluded that the use of this nonendemic stock of steelhead in the lower Salmon River posed a significant risk to listed Snake River summer steelhead. By restricting the use of Oxbow Hatchery stock steelhead, the IDFG was able to continue the Applicant's hatchery program and avoid jeopardizing listed Snake River steelhead (Technical Report E.3.1-4).

E.3.1.4.3.2. Bull Trout

E.3.1.4.3.2.1. Anticipated Continuing Impacts within the HCC and Vicinity

Blocked Access and Loss of Connectivity

With the Applicant's proposed measures for providing upstream passage at Hells Canyon and Oxbow dams, effects associated with blocked access and reduced connectivity should be substantially reduced for populations of bull trout within the Pine–Indian–Wildhorse core area. In addition, proposed measures to construct irrigation diversion screens at key diversions within the Pine Creek basin should substantially reduce the nonproject-related impacts that are associated with downstream losses of fluvial bull trout in Pine Creek. Bull trout will continue to be blocked from access to habitats above Brownlee Dam. However, there are currently no bull trout populations associated with tributary habitats directly associated with Brownlee Reservoir.

Under the proposed measures, fish may continue to migrate downstream through project facilities. The Applicant did not document any bull trout migrating downstream through the powerhouses and turbines, so the potential loss has not been quantified, primarily because of the very low numbers of fish captured in the reservoirs. Radio-tagged bull trout in Hells Canyon Reservoir did not migrate downstream out of the reservoirs during the monitoring period, but again, the sample size of radio-tagged bull trout was extremely small. Fish migrating downstream through project facilities run a risk of mortality associated with blade strikes, pressure changes, and fish size. If fish pass downstream through spill gates during times of spill, probability of mortality is much less. The Applicant's proposed measures for the tributaries (see section E.3.1.3.2.1.4.) are designed to mitigate for unquantifiable losses that may occur during downstream passage.

Water Quality Impacts to Bull Trout

Dissolved Oxygen—Because the effects of the HCC on water quality are related to the quality of inflowing water, describing the continuing impact on water quality requires assumptions about inflows. Improvements to the existing levels of nutrients and organic matter in the inflowing water would substantially improve dissolved oxygen throughout the project area. Specific actions taken by the Applicant (see section E.2.4.2.) would have varying responses, depending on future conditions of the inflows. For purposes of this assessment, the Applicant assumed that the inflows to the project would meet targets identified in the TMDL (IDEQ and ODEQ 2001). In addition, the Applicant assumed that, if targets identified in the TMDL were met, all beneficial uses would be supported.

Under current conditions, dissolved oxygen levels reach critically low levels during summer and would be unable to support bull trout for periods of time throughout much of the reservoir reaches. Using modeled output from reservoir water quality models (CE-QUAL-W2), the Applicant calculated the number of days during which the reservoir volumes were at a dissolved oxygen suitability value of 0.5 or less (Technical Report E.3.1-1). Comparisons of the modeled proposed operations with the full pool run-of-river operations (without proposed measures to address dissolved oxygen) demonstrated very little difference between the two scenarios (Technical Report E.3.1-1). However, differences were substantial among hydrologic years. The number of days during which reservoir salmonid suitability was less than 0.5 was greatest among all locations during extremely low-flow years but substantially improved in medium- to extremely high-flow years. Periods of low dissolved oxygen in Oxbow and Hells Canyon reservoirs are generally longer than periods in Brownlee Reservoir, primarily because of the influence of low dissolved oxygen levels in the release from Brownlee Dam for an extended period.

The effect of low dissolved oxygen during the summer on bull trout in the HCC reservoirs is uncertain, largely because temperature during much of the same period is also unsuitable, again because of inflowing conditions. Salmonids must seek out colder refugia, generally associated with tributary habitats, which would also be higher in dissolved oxygen content.

Temperature—Cold water is commonly associated with bull trout and considered critical as a habitat requirement (Balon 1980, Rieman and McIntyre 1993). Bull trout have a narrower preference range than other salmonids (Chapter 1 of Technical Report E.3.1-7), and summer maximum temperatures are considered a limiting factor for juvenile and adult bull trout (Buchanan and Gregory 1997). Further evidence of their temperature preference is their increasing abundance in northern latitudes and increasing elevations (Haas and McPhail 1991, Rieman and McIntyre 1995, Dunham and Rieman 1999). When temperatures start to exceed about 12 °C, suitability quickly declines. Regardless of operational scenario, during summer, temperatures in the HCC reservoirs and mainstem habitats both above and below the HCC rapidly become unsuitable for supporting bull trout (Technical Report E.3.1-1). Therefore, for bull trout to sustain fluvial life histories within the HCC, they must seek colder environments during summer. Significant migrations of bull trout have been observed by the Applicant (Chapter 4 of Technical Report E.3.1-7) during spring and fall. These spring migrations are associated with warming Snake River environments when bull trout move high up into tributary habitats.

The TMDL (IDEQ and ODEQ 2001) determined that temperature conditions were not a result of controllable anthropogenic activities, so no temperature-specific improvements are expected with implementation of the TMDL. As a result, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the Applicant's projects, water temperature will undoubtedly continue to exceed the standard for coldwater biota throughout the Snake River system. Maximum summer temperatures of inflowing water will continue to exceed 26 °C, while outflows will remain near 23 °C. The Applicant's modeling showed that temperature conditions within and downstream of the HCC are affected, both in magnitude and timing, by inflowing temperature conditions (Technical Report E.2.2-2).

The necessity for bull trout to seek out colder refugia emphasizes how important high-quality habitats in tributaries to the Snake River are to these fish. In fact, availability of coldwater habitats largely determines the rearing capacity and therefore population abundance of bull trout associated with the HCC (Chapter 4 of Technical Report E.3.1-7). Habitat enhancement measures proposed by the Applicant for Pine Creek (see section E.3.1.3.2.1.4.) should significantly benefit natural populations of bull trout.

E.3.1.4.3.2.2. Anticipated Continuing Impacts in Downstream Areas Affected by the HCC

Operational Impacts to Bull Trout

Bull trout habitat was modeled in the upper Hells Canyon reach during an overwintering period (October 15–May 31) similar to redband trout. In general, habitat responses for bull trout were similar to those modeled for redband trout. The most habitat was available during low-flow years, with the least amount available during high-flow years, regardless of operational scenario.

The average reduction in bull trout habitat availability in the upper Hells Canyon reach under modeled proposed operations (compared with full pool run-of-river operations) ranged from 2.9% during the extremely low-flow year (1997) to 5.4% during the high- (1999) and extremely high-flow (1997) years. While average reductions in bull trout habitat were less than 5.5% under modeled proposed operations across the five hydrologic years, there were daily maximum reductions in habitat as high as 21% during the medium-flow year. These maximum daily reductions represented “worst-case” conditions during the bull trout period. The durations of these reductions were very short (1 hour), and as shown by exceedance curves of hourly modeled habitat, they occur infrequently during the period. In fact, during the medium-flow year, reductions in habitat of 15 to 21% (under proposed operations) occurred just 1.5% of the bull trout period, while reductions of 13 to 18% occurred 1.0% of the period during the extremely low- and low-flow years. Exceedance plots of HWUA showed that 90% of the observations under modeled proposed operations were within 6 to 9% of the habitat available under full pool run-of-river operations across all five years. Relative daily fluctuations in habitat during this period ranged up to 27%, but absolute daily fluctuations in habitat ranged up to 7% under modeled proposed operations.

Overall, impacts to bull trout habitat availability in the Hells Canyon reach appeared minimal under modeled proposed operations (relative to full pool run-of-river operations) when all hourly occurrences during the modeled overwintering period were considered. As with redband trout, minimum flows associated with the fall chinook plan are important for bull trout modeled habitat because they protect the range of discharges at which bull trout habitat is maximized and influenced the most by load-following operations. Minimum flows from the fall chinook plan provide this protection for all but 6 days (97%) of the bull trout modeled overwintering period. While average reductions did not exceed 5.5% across the five years, relative daily reductions and fluctuations in habitat are more significant. As stated earlier, these fluctuations and reductions are relative to habitat under full pool run-of-river operations and were higher than absolute fluctuations in modeled habitat. Also, as stated earlier for redband trout, fluctuations in modeled habitat do not necessarily equate to modeled habitat changing from suitable to unsuitable, thus requiring a fish to move during load-following operations. While individual 2-D sites showed reductions in habitat under modeled proposed operations that, relative to full pool run-of-river operations, were more pronounced than in the reachwide analysis, the spatial distribution of modeled habitat in these 2-D sites showed that the majority of the predicted habitat was continuous at three different flows within the range of project operations. The duration of larger reductions in habitat under modeled proposed operations is short lived (1–2 hours, as modeled by CHEOPS). The effect that these short-lived reductions may have on a subadult/adult bull trout that is overwintering in the Snake River is unknown. As with redband trout, the Applicant believes that habitat minimums occurring for short durations during the bull trout overwintering period probably do not limit bull trout in the Hells Canyon reach. Radio-tagging studies of bull trout suggest very little movement by these fish, often for long periods (Technical Report E.3.1-7). During the winter, bull trout are often found within a few meters of previous locations over a several-week period, a finding that suggests changes in habitat experienced by bull trout may also be influenced by the microscale habitat refugia (velocity and cover shelters) rather than by changes represented in our modeling. Average reductions in habitat are probably more indicative of habitat conditions throughout the period and were found to be within 5.5% of the habitat available under full pool run-of-river operations.

Water Quality Impacts to Bull Trout

Total Dissolved Gases—Under current operations, few effects related to high total dissolved gas levels have been observed on fish in the Hells Canyon reach, especially bull trout since they are seldom found below Hells Canyon Dam. Occasionally, symptoms of gas bubble trauma have been identified in adult anadromous salmonids returning to Hells Canyon Dam during periods of spill. How susceptible fish populations and individual fish are to high total dissolved gas largely depends on the depth distribution of the fish species and life stages. Effects to fish and invertebrates of high total dissolved gas are reduced by depth (generally 10% for every meter of depth). Bull trout are in the Snake River during periods commonly associated with high spill and could be susceptible to high total dissolved gas levels. Depth distribution of bull trout measured over radio-tag locations suggests a depth range between 1 and 8 meters, with a peak in frequency of observations between 2 and 3 meters. With this depth distribution, few effects are anticipated from high levels of total dissolved gas. During the period of spill, bull trout are generally quite active and beginning to move back into the tributaries (Technical Report E.3.1-7).

The Applicant proposes to install flow deflectors on Hells Canyon Dam (see section E.2.4.2.4.) to alter the spillway hydrodynamics during spill events of less than 30,000 cfs. These flow deflectors should substantially reduce the potential for continuing downstream impacts. The deflectors are expected to control gas levels during all but the highest 2% of flows. While the Applicant cannot quantify what the total dissolved gas levels would be after the deflectors were installed, similar measures at other federal and public utility district projects on the Snake and Columbia rivers have significantly improved total dissolved gas conditions. The Applicant's total effectiveness monitoring plan (proposed as part of the measure detailed in section E.2.4.2.4.) would improve the likelihood that continuing impacts from elevated total dissolved gas levels were reduced.

Dissolved Oxygen—The current effect of low dissolved oxygen levels to bull trout below the HCC is uncertain but limited both spatially and temporally. Spatially, low dissolved oxygen levels are generally in the reach of river from Hells Canyon Dam to Wild Sheep Rapids where discharge from Hells Canyon Dam (and ultimately Brownlee Dam) influences the levels. Suitability of dissolved oxygen in this reach can drop to near-lethal levels. After water is spilled over several large rapids, it reaerates. Temporally, low dissolved oxygen levels are primarily associated with late summer and early fall and begin to improve by the first of October (Technical

Report E.3.1-1). This window of low dissolved oxygen varies according to hydrologic-year type. Extremely low- and low-flow years have a much longer duration of low dissolved oxygen levels than medium- to extremely high-flow years do. Because temperatures for bull trout during this period are also low in suitability, bull trout are generally more closely associated with tributary habitats or confluence areas with cold refugia. Such refuge areas probably also have higher dissolved oxygen levels. Captures of downstream migrants indicated that bull trout start to move into the Snake River after tributary temperatures begin to decline and Snake River water temperatures begin to increase in suitability.

Three of the measures proposed by the Applicant to improve dissolved oxygen levels in the release at Brownlee Dam include aeration and turbine venting (see section E.2.4.2.1., section E.2.4.2.2., and section E.2.4.2.3.) and should reduce or eliminate unsuitable conditions and potential impacts experienced by native resident salmonids. Physical water quality models indicate that improvements to dissolved oxygen levels from these measures would carry through the Oxbow and Hells Canyon reservoirs and into the tailwater downstream of Hells Canyon Dam (Technical Report E.2.2-2). However, the Applicant recognizes significant uncertainty associated with identifying specific features and effects of these measures at this time. Because of this uncertainty, the Applicant proposes that the specific details regarding design, location, and operation, as well as an effectiveness monitoring plan, be developed through consultation with both the IDEQ and ODEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of TMDL implementation and the 401 certification process for the HCC. As mentioned in section E.2.4.2., the goals of the proposed dissolved oxygen measures are to improve oxygen levels in the waters below Hells Canyon Dam. Improvements in the levels of nutrients and organic matter in inflows to the project would also substantially improve dissolved oxygen throughout the project area.

Temperature—As discussed for bull trout within the HCC and vicinity, bull trout below the HCC are limited in their distribution by warm summer temperatures. Therefore, they must seek cold refuge, generally within the tributaries. Bull trout have been observed to migrate significant distances (commonly over 100 km) as they return to upper portions of tributaries such as the Imnaha River. These migrations typically correspond to warming river habitats occurring in late April to early May (Chapter 4 of Technical Report E.3.1-7). Although bull trout have been observed at all times of the year in the mainstem Snake River below the HCC, summer observations have been limited to the coldwater plumes associated with coldwater tributaries such as Sheep and Granite creeks (IPC unpublished data).

A water temperature target of 17.8 °C for the Snake River has been identified in the TMDL (IDEQ and ODEQ 2001) to protect coldwater biota. However, the TMDL also determined that temperature conditions were not a result of controllable anthropogenic activities, so no temperature-specific improvements are expected with implementation of the TMDL. As a result, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the Applicant's projects, water temperature will undoubtedly continue to exceed the standard for coldwater biota throughout the Snake River system. Water temperatures within the HCC and downstream will be no exception. Maximum summer inflowing temperatures will continue to exceed 26 °C, while outflows will remain near 23 °C. Retention of the warm summer inflows in the reservoirs, especially Brownlee Reservoir, will continue to delay fall cooling of outflows relative to inflows.

The effects of delayed fall cooling on bull trout are negligible because of the refuge they must already seek during summer. Bull trout typically move into the mainstem Snake River when temperatures in the tributary habitats cool, a time that usually corresponds with cooling in mainstem habitats (Chapter 4 of Technical Report E.3.1-7). October and November represent peak periods when fish move out of the tributaries to the Snake River, generally when mainstem Snake River temperatures are descending rapidly.

E.3.1.4.3.3. Idaho Springsnail and Bliss Rapids Snail

The Idaho springsnail is an integral and functional component of the aquatic ecosystem in the Snake River upstream of Brownlee Reservoir. Because the Idaho springsnail is found exclusively upstream of Brownlee Reservoir and therefore above any of the effects of project operations, continued operation of the project should have no effect on the species.

Because the 4 potential Bliss Rapids snails collected below Hells Canyon Dam cannot be definitively identified, the Applicant cannot conclusively identify continuing impacts to the species. If present, the Bliss Rapids snail appears to be a minor component within the aquatic ecosystem downstream of Hells Canyon Dam. Despite relatively extensive sampling downstream of Hells Canyon Dam, only five potential Bliss Rapids snails were collected (Technical Report E.3.1-8). One was collected in 1998 and three in 2002. If the four individuals are Bliss Rapids snails, they were found approximately 300 miles downstream of the species historic range, or any other present-day colonies. Therefore, their importance to continued species survival or as indicators of ecosystem integrity is questionable. If they are present, continued operation of the HCC, as proposed by the Applicant, would probably not affect the survival and persistence of the Bliss Rapids snail. If they are present, continued operations may even benefit the species by being a factor in providing additional suitable habitat beyond its historic range.

E.3.1.4.4. Anticipated Incremental Impacts of New Development

Because the Applicant proposes no new development of project works at the HCC, no incremental impacts of such new development are anticipated. Any impacts associated with added facilities are discussed in sections detailing those measures.

E.3.1.4.5. Anticipated Incremental Impacts of Changes in Operation

Because the Applicant proposes no changes to current operations at the HCC, no incremental impacts of such changes are anticipated. Any impacts associated with operations are discussed in sections detailing various aquatic species.

E.3.1.5. Materials and Information on Measures and Facilities

All materials and information regarding existing measures and facilities to be continued by the Applicant are included in section E.3.1.3.1. All materials and information regarding measures and facilities proposed by the Applicant are included in section E.3.1.3.2.

E.3.1.6. Consultation

For a summary of consultation efforts to date for the Hells Canyon Complex, see the Consultation Appendix.

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Table E.3.1-1 A list of fish families and species within the Hells Canyon Complex and in the Snake River upstream and downstream of the Hells Canyon Complex, including general descriptions of the distribution and status.

Family	Species		Distribution[a]	Native/ Introduced	Status
Scientific Name	Common Name	Scientific Name			Federal[b], Idaho[c], Oregon[d]
Petromyzontidae	Pacific lamprey	*Lampetra tridentata*	Below	Native	SC, E, N
Acipenseridae	White sturgeon	*Acipenser transmontanus*	Both	Native	SC, SC, N
Clupeidae	American shad	*Alosa sapidissima*	Below[e]	Introduced	Not listed
Salmonidae	Coho salmon	*Oncorhynchus kisutch*	HCC	Introduced[f]	Not listed
	Coho salmon	*O. kisutch*	Below	Native	Extinct
	Sockeye salmon/ kokanee	*Oncorhynchus nerka*	HCC	Native	LE, E, A
	Chinook salmon	*Oncorhynchus tshawytscha*	Below	Native	Fall—LT, E, T Spring/summer—LT, E, T
	Mountain whitefish	*Prosopium williamsoni*	Both	Native	Not listed
	Cutthroat trout	*Salmo clarki*		Introduced[g]	Not listed
	Rainbow trout[h]	*Oncorhynchus mykiss*			
	Steelhead	*O. m. gairdneri*	Both	Native	LT, SC, A
	Redband trout	*O. m. gairdneri*	Both	Native	SC, SC, N
	Rainbow trout (coastal)	*O. m. irideus*	Both	Introduced	Not listed
	Brown trout	*Salmo trutta*	HCC	Introduced	Not listed
	Brook trout	*Salvelinus fontinalis*	Both	Introduced	Not listed
	Bull trout	*Salvelinus confluentus*	Both	Native	LT, SC, N

Table E.3.1-1 A list of fish families and species within the Hells Canyon Complex and in the Snake River upstream and downstream of the Hells Canyon Complex, including general descriptions of the distribution and status.

Family	Species		Distribution[a]	Native/ Introduced	Status
Scientific Name	Common Name	Scientific Name			Federal[b], Idaho[c], Oregon[d]
Cyprinidae	Chiselmouth	*Acrocheilus alutaceus*	Both	Native	Not listed
	Common carp	*Cyprinus carpio*	Both	Introduced	Not listed
	Utah chub	*Gila atratia*	HCC	Native	Not listed
	Tui chub	*Gila bicolor*	HCC	Introduced	Not listed
	Peamouth	*Mylocheilus caurinus*	Both[i]	Native	Not listed
	Fathead minnow	*Pimephales promelas*	HCC	Introduced	Not listed
	Northern pikeminnow	*Ptychocheilus oregonensis*	Both	Native	Not listed
	Longnose dace	*Rhinichthys cataractae*	Below[i]	Native	Not listed
	Speckled dace	*Rhinichthys osculus*	Both[i]	Native	Not listed
	Redside shiner	*Richardsonius balteatus*	Below[i]	Native	Not listed
Catostomidae	Bridgelip sucker	*Catostomus columbianus*	Both	Native	Not listed
	Largescale sucker	*Catostomus macrocheilus*	Both	Native	Not listed
Cobitidae	Oriental weatherfish	*Misgurmus anguillicaudatus*	HCC	Introduced	Not listed
Ictaluridae	Brown bullhead	*Ictalurus nebulosus*	HCC	Introduced	Not listed
	Channel catfish	*Ictalurus punctatus*	Both	Introduced	Not listed
	Blue catfish	*Ictalurus furcatus*	HCC	Introduced	Not listed
	Tadpole madtom	*Noturus gyrinus*	HCC	Introduced	Not listed
	Flathead catfish	*Pylodictis olivaris*	HCC	Introduced	Not listed

Table E.3.1-1 A list of fish families and species within the Hells Canyon Complex and in the Snake River upstream and downstream of the Hells Canyon Complex, including general descriptions of the distribution and status.

Family	Species		Distribution[a]	Native/ Introduced	Status
Scientific Name	**Common Name**	**Scientific Name**			**Federal[b], Idaho[c], Oregon[d]**
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*	HCC	Introduced	Not listed
	Warmouth	*Lepomis gulosus*	HCC	Introduced	Not listed
	Bluegill	*Lepomis macrochirus*	Both	Introduced	Not listed
	Smallmouth bass	*Micropterus dolomieu*	Both	Introduced	Not listed
	Largemouth bass	*Micropterus salmoides*	HCC	Introduced	Not listed
	White crappie	*Pomoxis annularis*	Both	Introduced	Not listed
	Black crappie	*Pomoxis nigromaculatus*	Both	Introduced	Not listed
Percidae	Yellow perch	*Perca flavescens*	HCC	Introduced	Not listed
Cottidae	Mottled sculpin	*Cottus bairdi*	Both[i]	Native	Not listed
	Shorthead sculpin	*Cottus confusus*	Below	Native	Not listed

a. Fish sampled or reported within the Hells Canyon Complex (HCC), the Snake River below Hells Canyon Dam (below), or both.
b. Federal key: LE = listed endangered, LT = listed threatened, PE = proposed endangered, PT = proposed threatened, C = candidate species, SC = species of special concern with conservation agreements.
c. Idaho key: E = endangered, T = threatened, P = protected nongame species, C = candidate species, SC = species of special concern, U = unprotected nongame species.
d. Oregon key: E = endangered, T = threatened, P = proposed for listing, C = candidate species, S = species of special concern with conservation agreements, N = not listed, A = not applicable.
e. Possibly located below Hells Canyon Dam based on 18,400 adult returns over Lower Granite Dam in 2001.
f. Native stock extinct; coho presence a result of hatchery stockings.
g. Native species to Idaho, but not to HCC project area. Presence in HCC project area is a result of mountain lake stockings.
h. As described by Behnke (1992).
i. Reported as possibly located below Hells Canyon Dam by S.A. Grunder (IDFG, personal communication, April 17, 2000).

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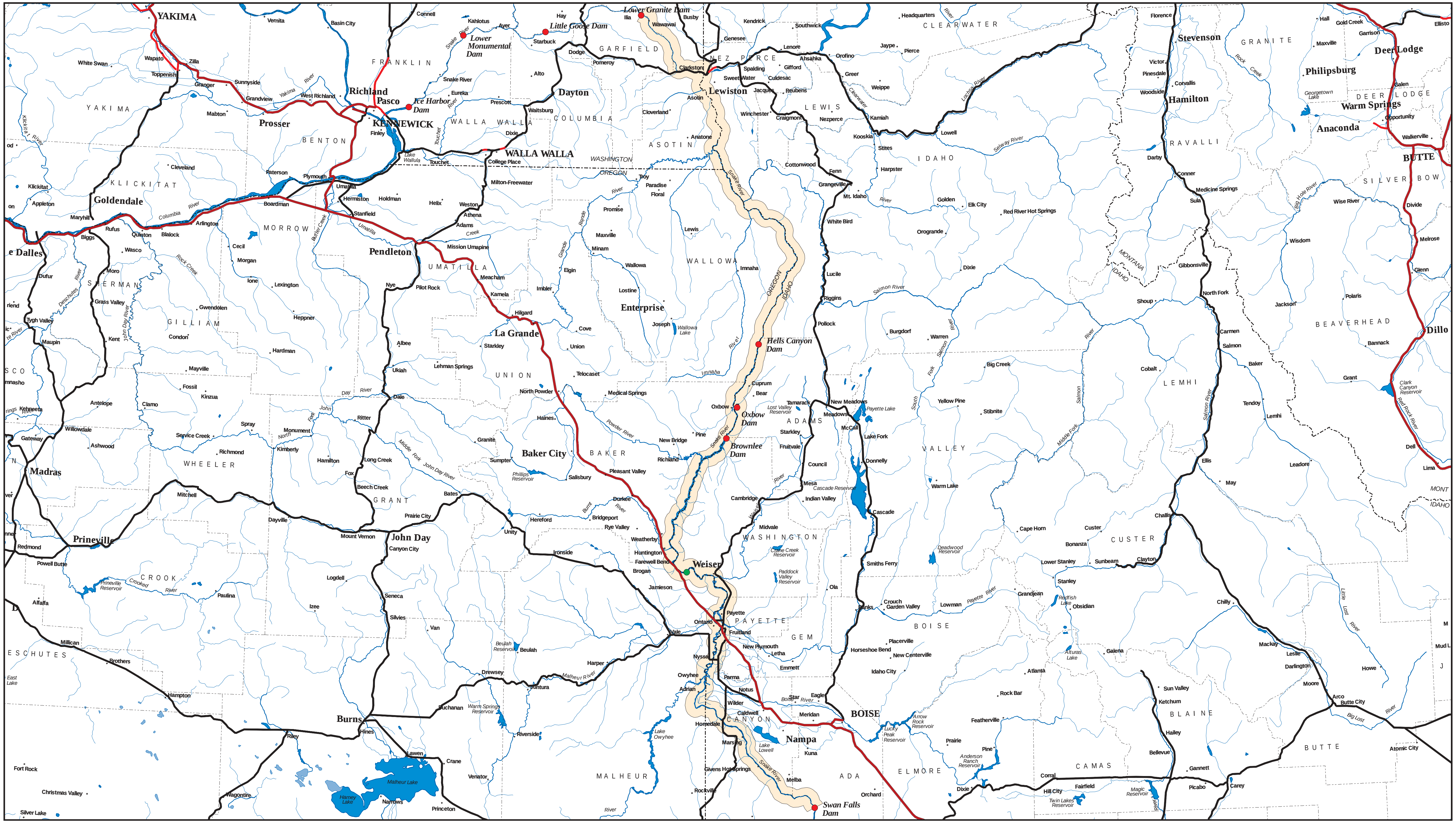

Vicinity Map

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Study Area
- Lakes or Reservoirs
- Dry Lake
- Mainstem Snake River Dams
- Cobb Rapids

GN
MN
0°08'
2 MILS
17°30'
311 MILS

UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.1- 1

Study Area from Swan Falls Dam to Lower Granite Dam

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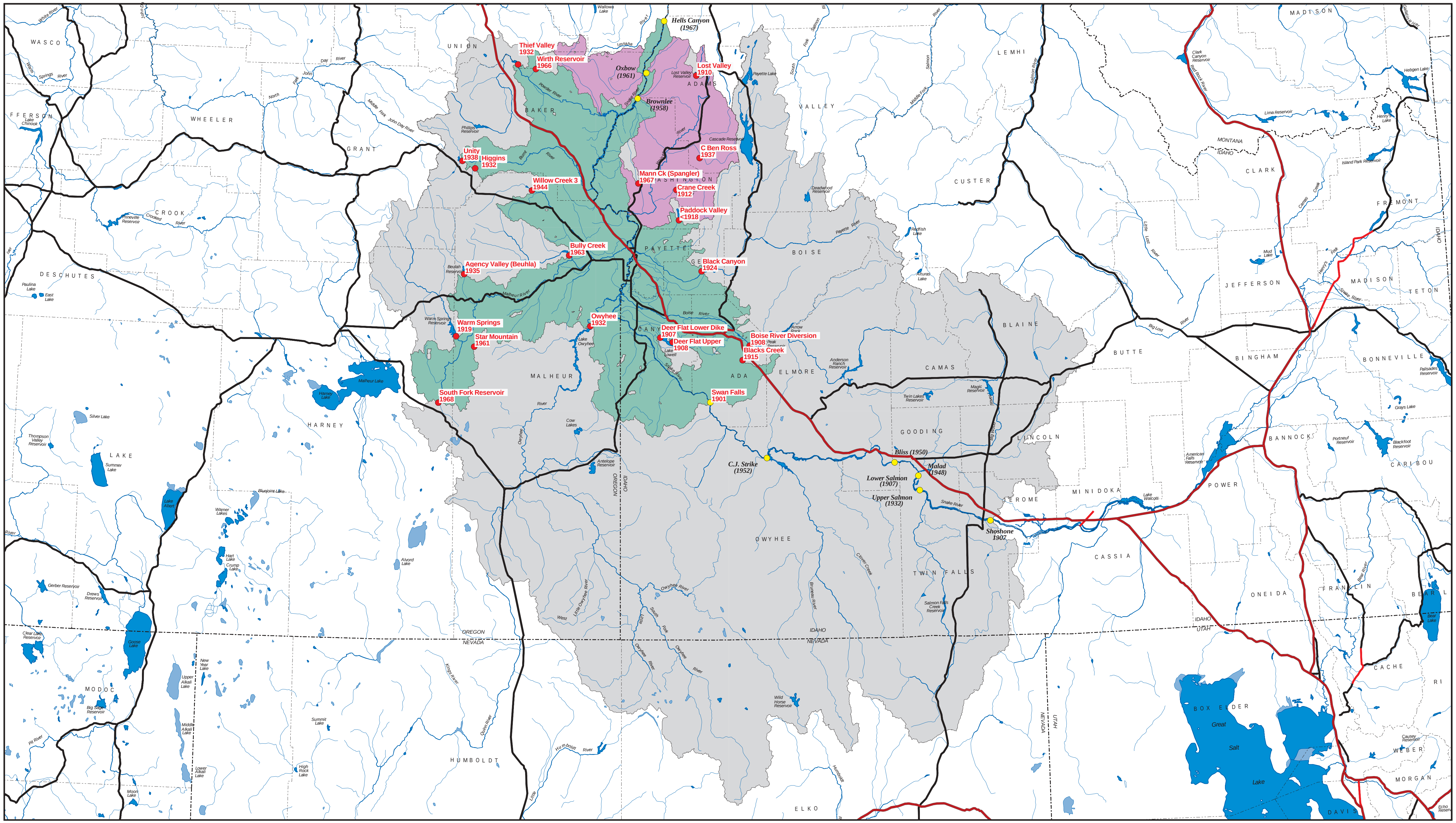

Vicinity Map

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Lakes or Reservoirs
- Dry Lake
- Blocked Basins
- Accessible Areas Prior to Closure
- Basins Producing Fish Prior to Closure
- IPC Dams (Year Constructed)
- Terminus Dams (Year Constructed)

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.1- 2

Study Area from Hells Canyon Dam to Shoshone Falls Dam

SCALE 1: 850,000

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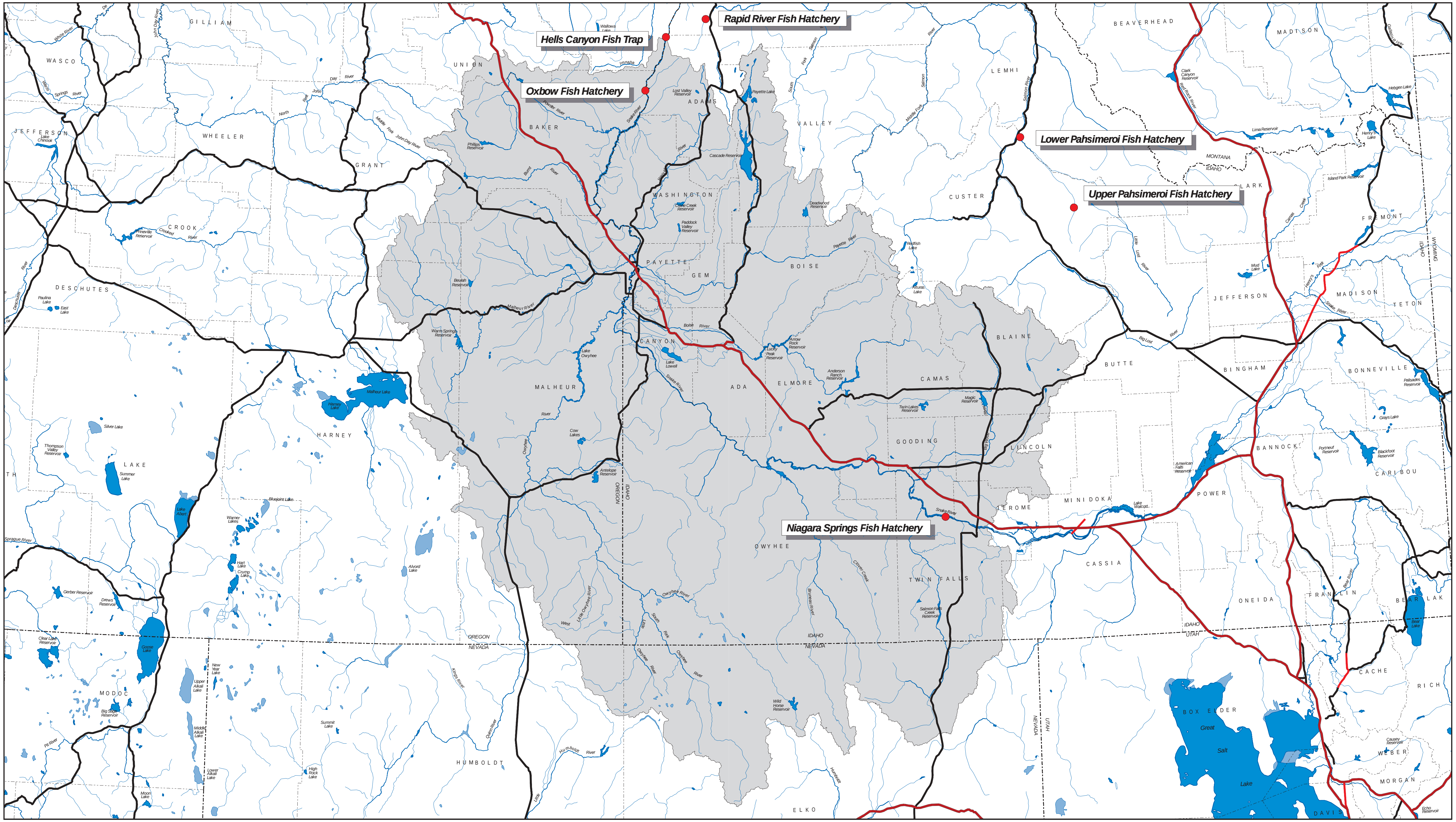

Vicinity Map

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Lakes or Reservoirs
- Dry Lake
- Hells Canyon Study Area
- IPC Hatchery Facility

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.1-3

Location of Idaho Power Company Hatchery Facilities

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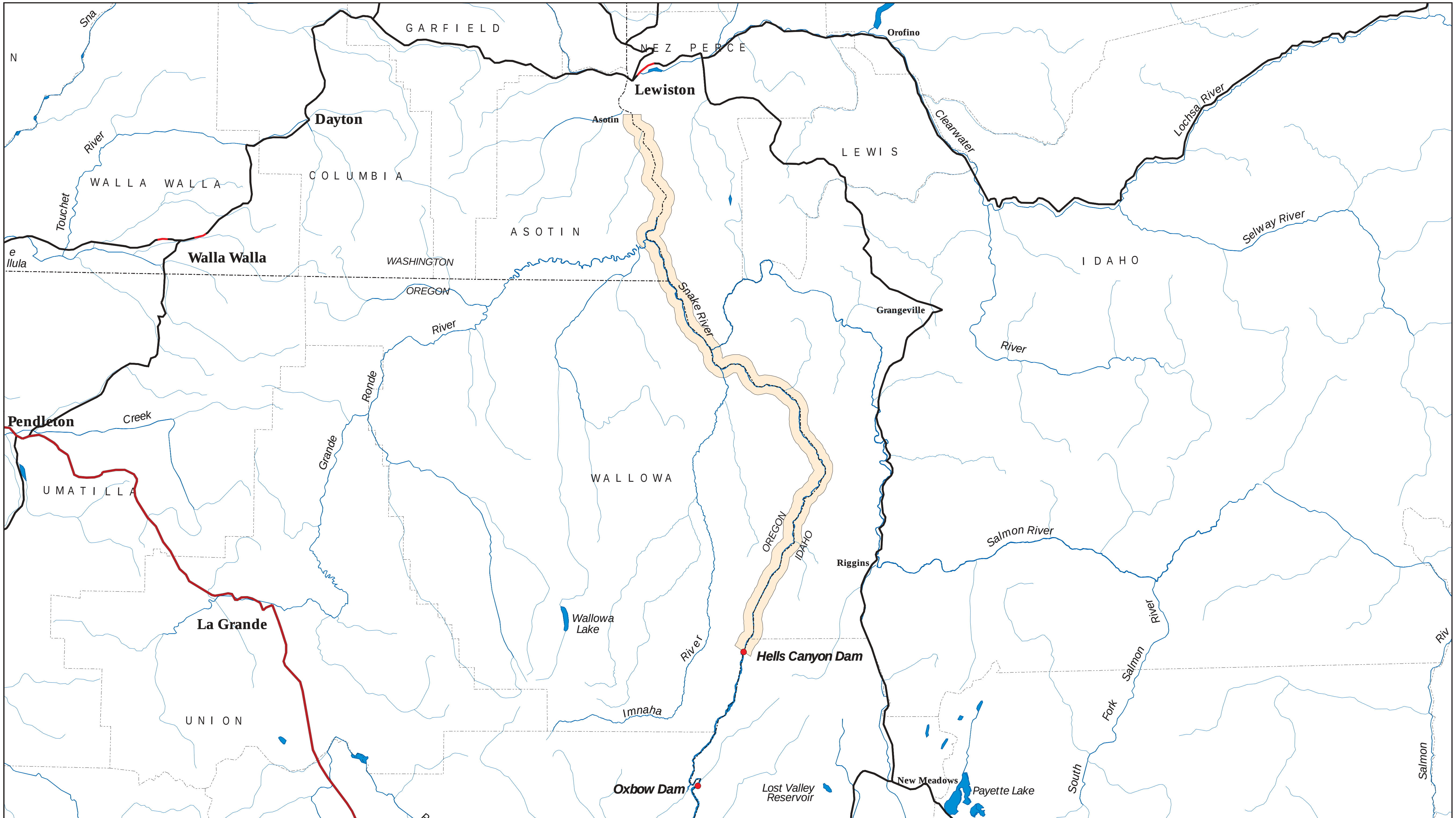
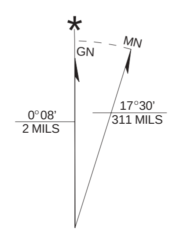


Vicinity Map

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Lakes or Reservoirs
- Fall Chinook spawning and incubation protection, redd and temperature monitoring
- Hells Canyon Complex Dams



UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002
Figure E.3.1- 4
Fall Chinook Recovery Plan

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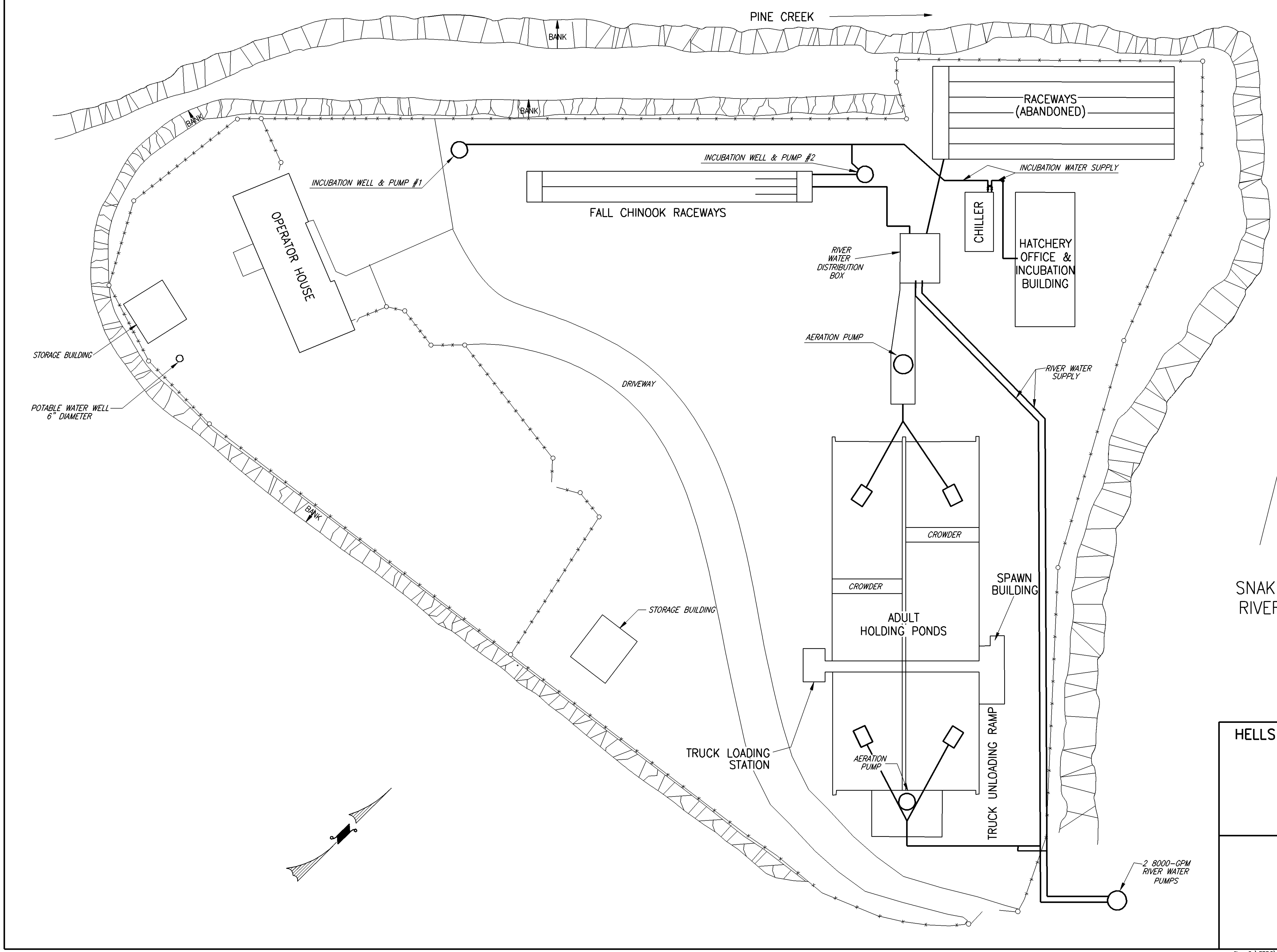

HELLS CANYON PROJECT-FERC No. 1971
Idaho Power Company, Boise, Idaho
Figure E.3.1-5
Oxbow Fish Hatchery
General Site Plan

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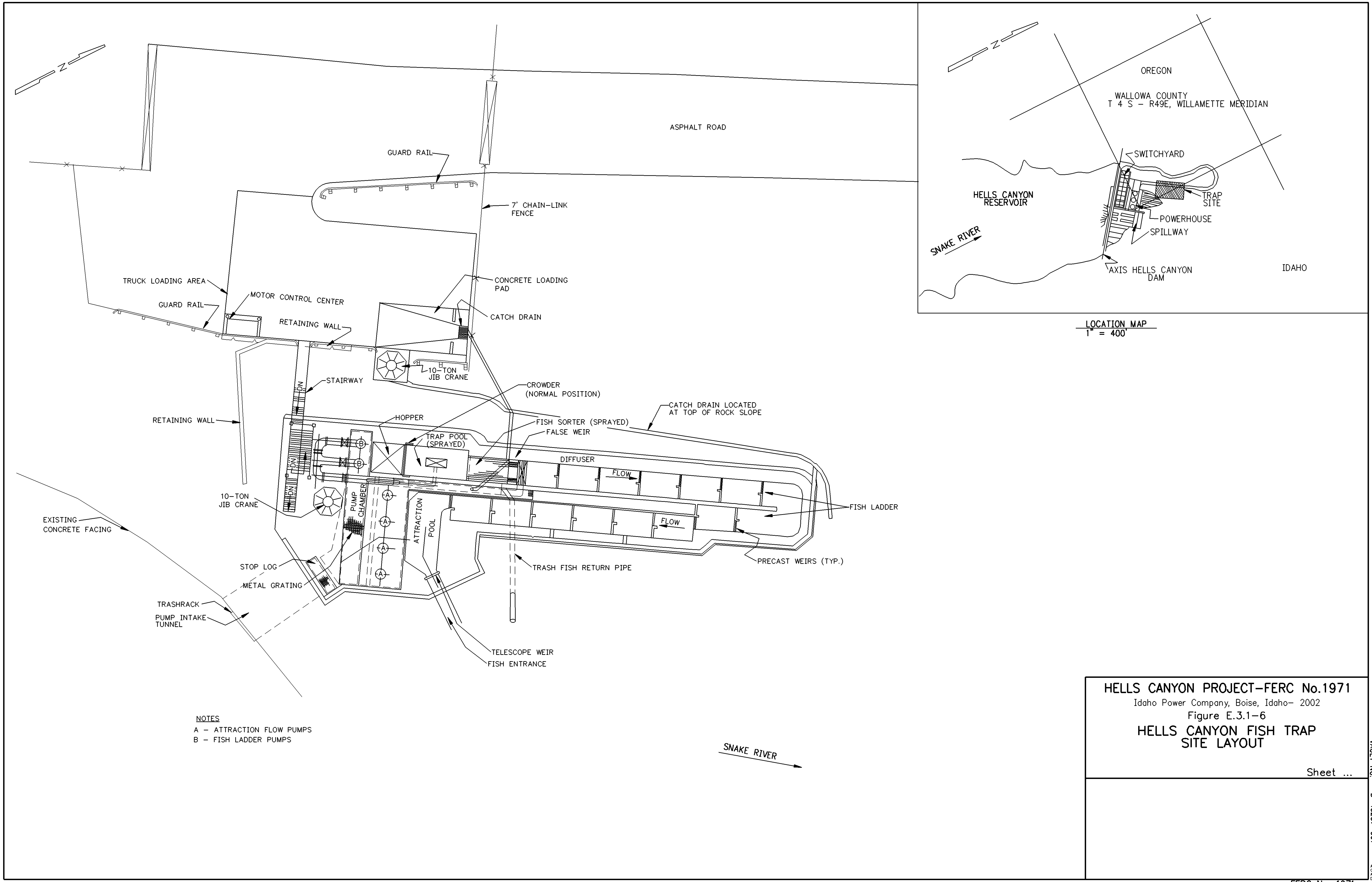

HELLS CANYON PROJECT-FERC No.1971

Idaho Power Company, Boise, Idaho- 2002

Figure E.3.1-6

HELLS CANYON FISH TRAP SITE LAYOUT

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FERC No. 1971

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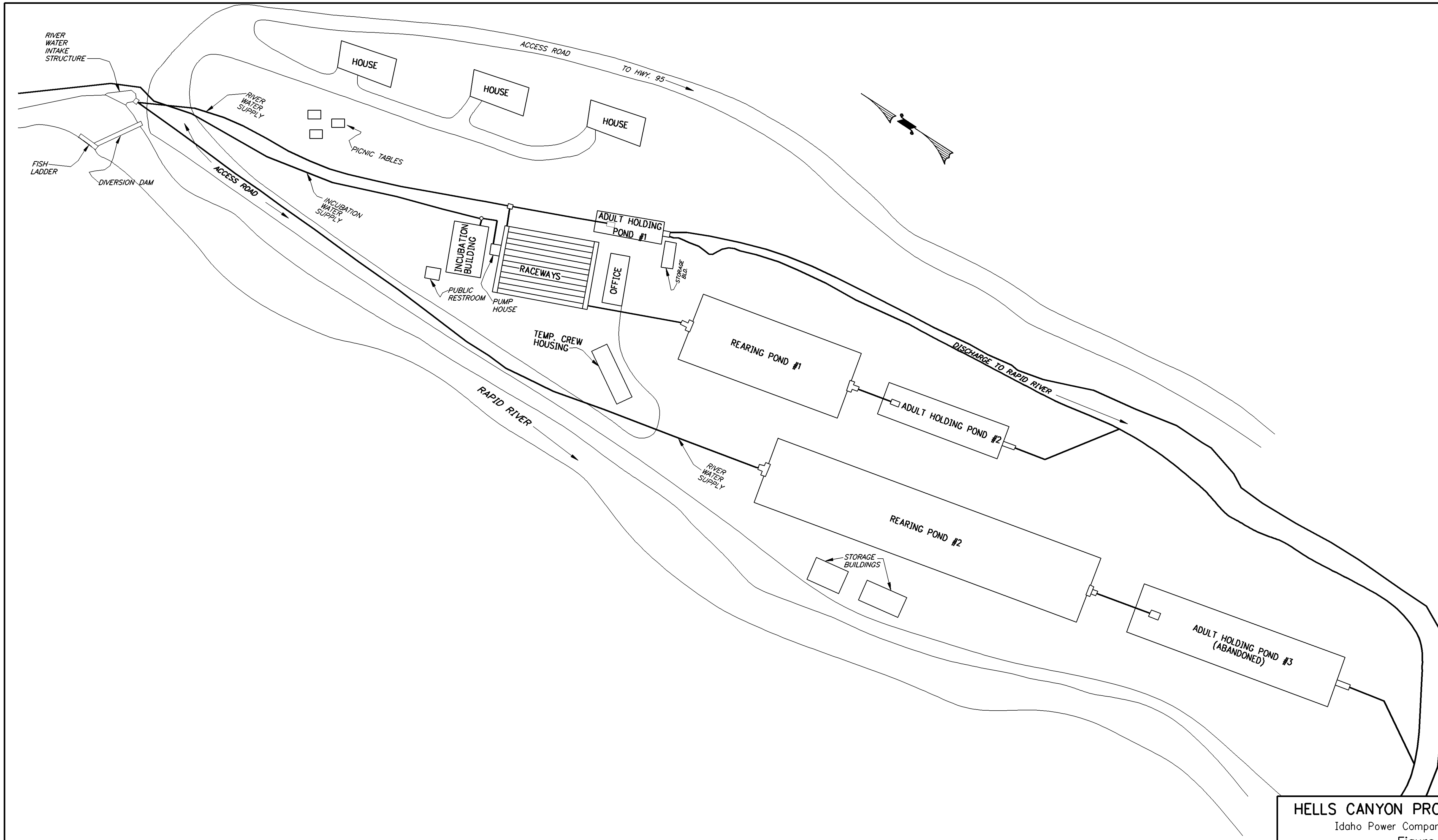

HELLS CANYON PROJECT-FERC No. 1971

Idaho Power Company, Boise, Idaho- 1998

Figure E.3.1-7

Rapid River Fish Hatchery
General Site Plan

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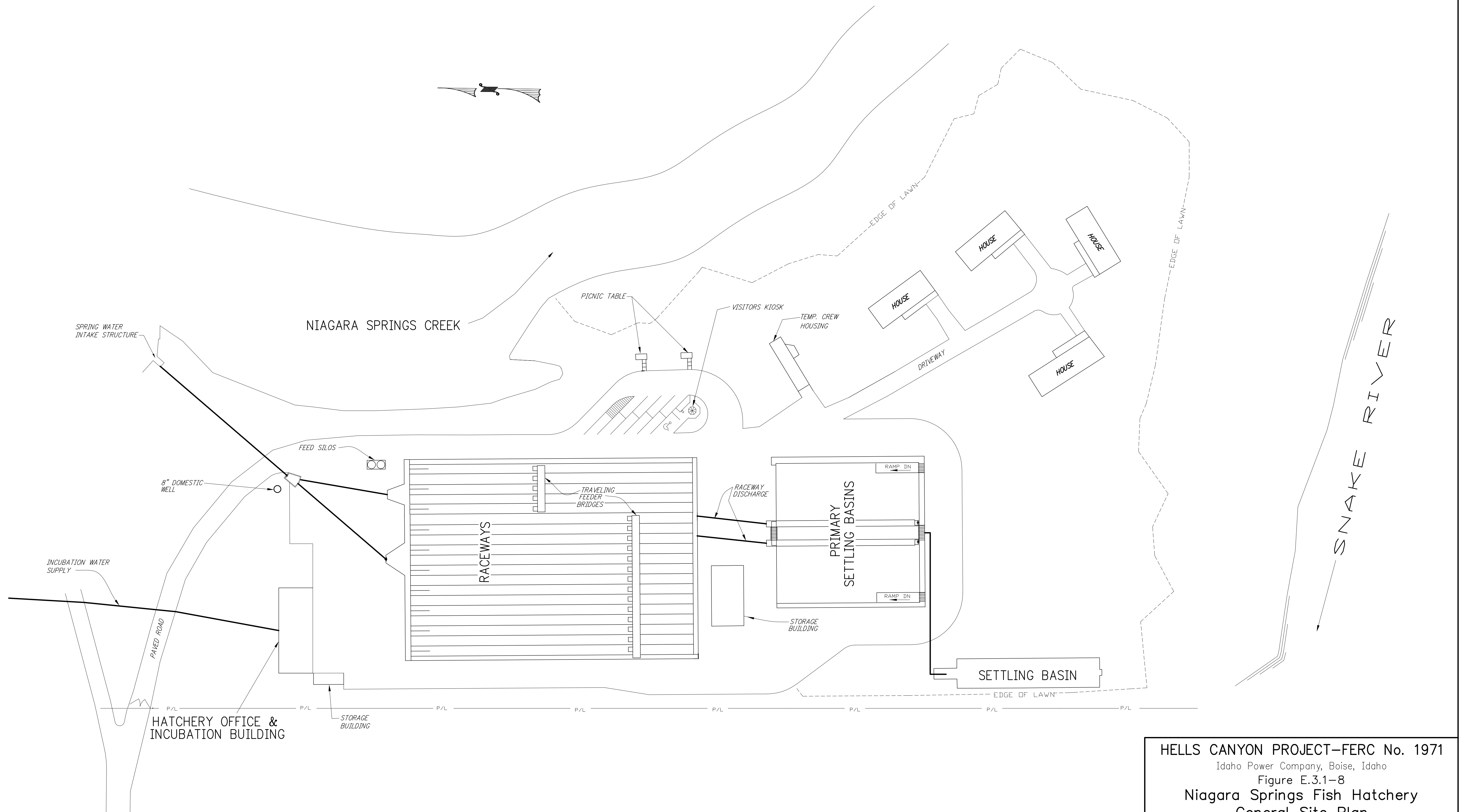

HELLS CANYON PROJECT–FERC No. 1971

Idaho Power Company, Boise, Idaho

Figure E.3.1–8

Niagara Springs Fish Hatchery

General Site Plan

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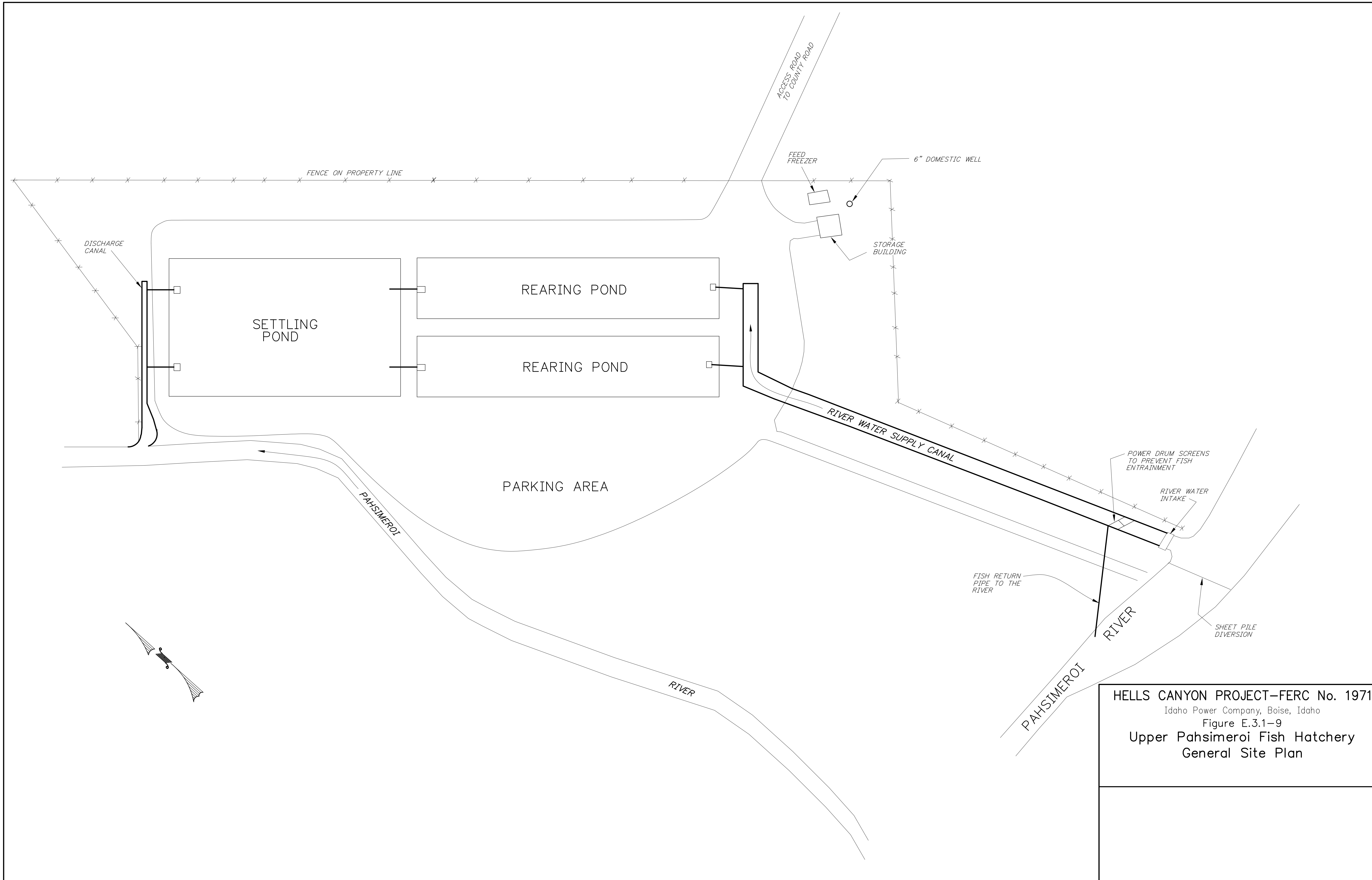

HELLS CANYON PROJECT–FERC No. 1971

Idaho Power Company, Boise, Idaho

Figure E.3.1–9

Upper Pahsimeroi Fish Hatchery
General Site Plan

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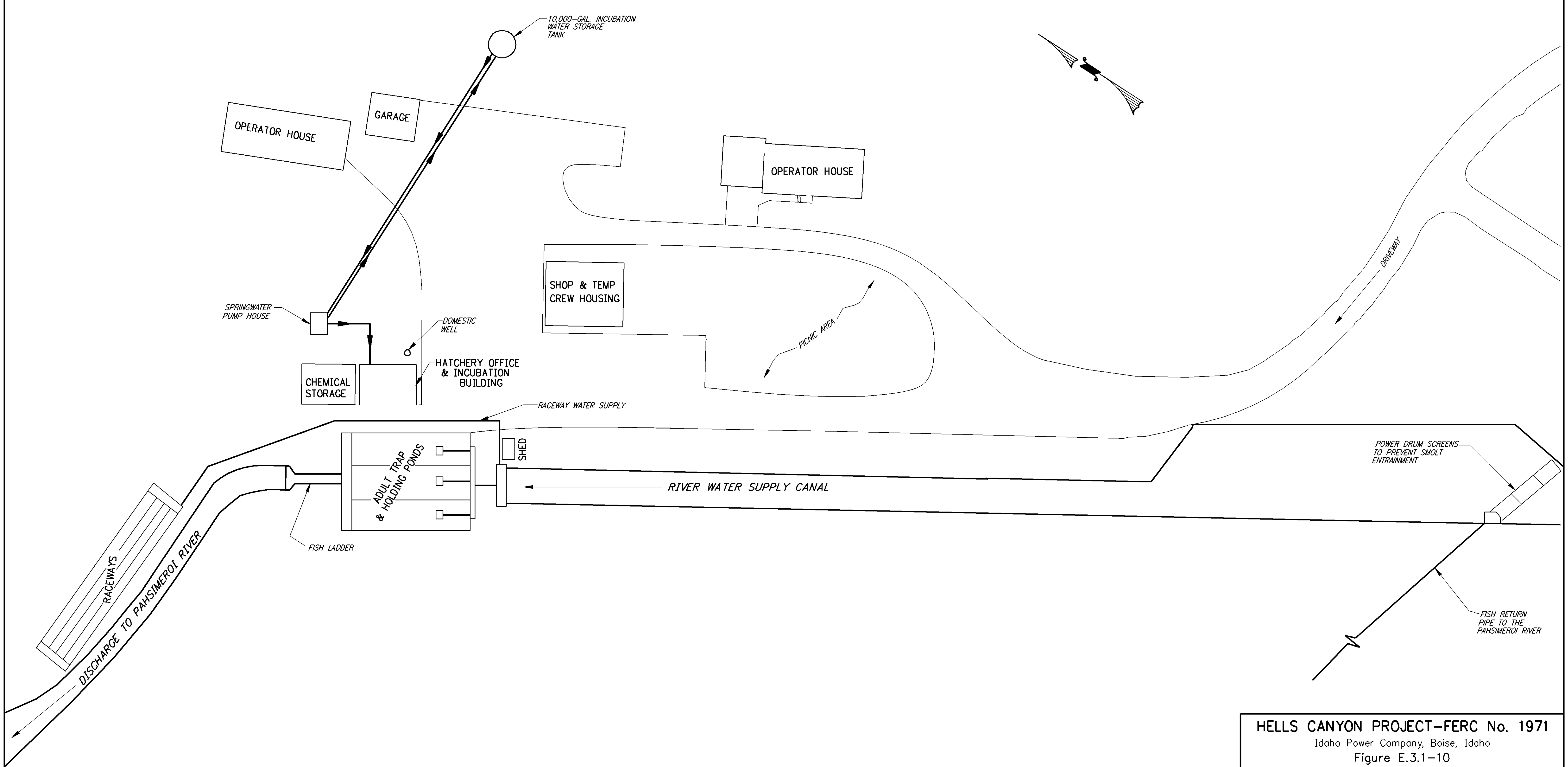

HELLS CANYON PROJECT–FERC No. 1971
Idaho Power Company, Boise, Idaho
Figure E.3.1–10
Lower Pahsimeroi Fish Hatchery
General Site Plan

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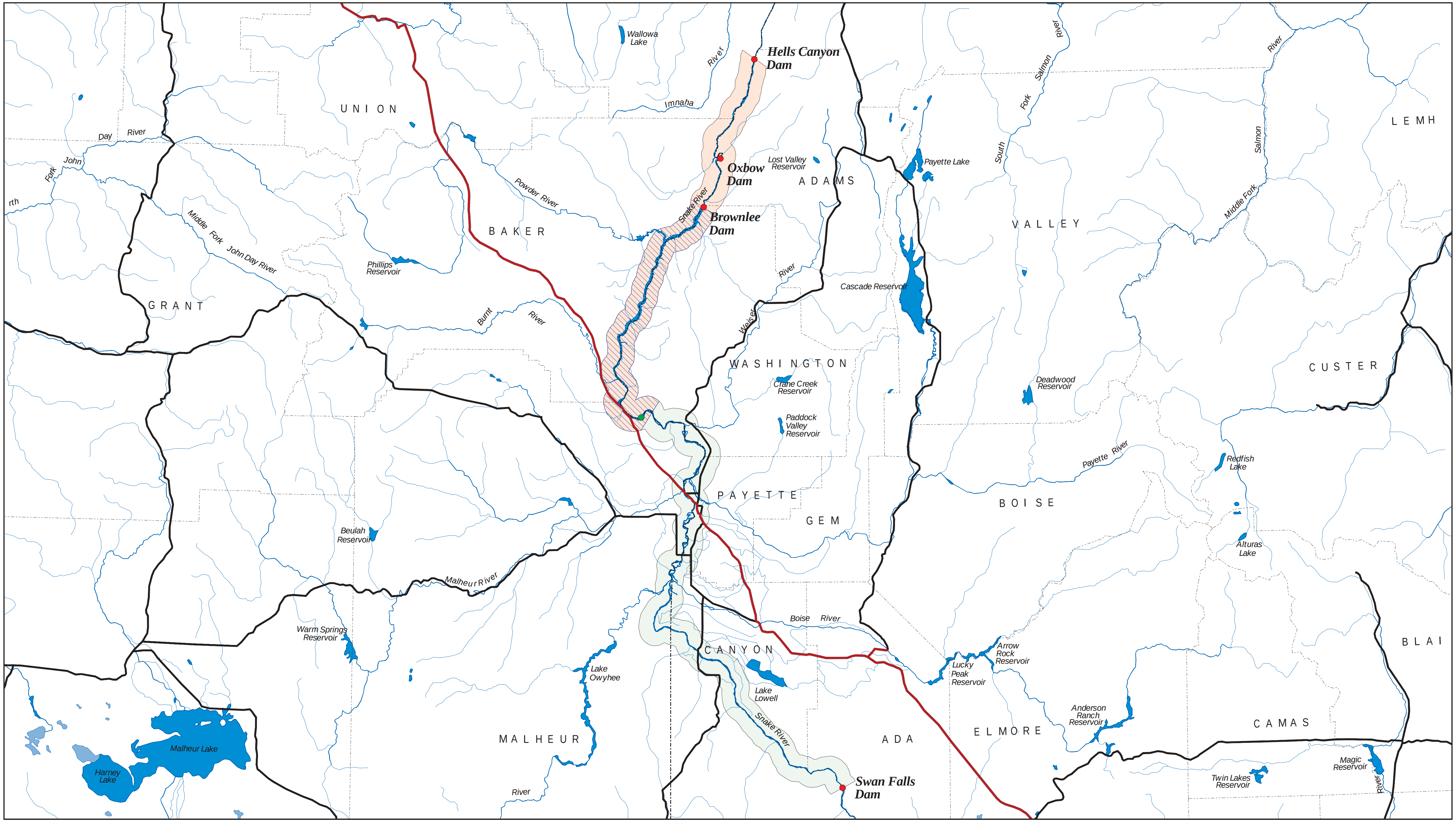

Vicinity Map

IDAHO POWER

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Lakes or Reservoirs
- Dry Lake
- Population Monitoring (annual increment)
- Population Monitoring (5- yr increment)
- Protect Resident Centrarchid Spawning Period
- Mainstem Snake River Dams
- Cobb Rapids

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.1- 11

Warmwater Fish Monitoring Plan

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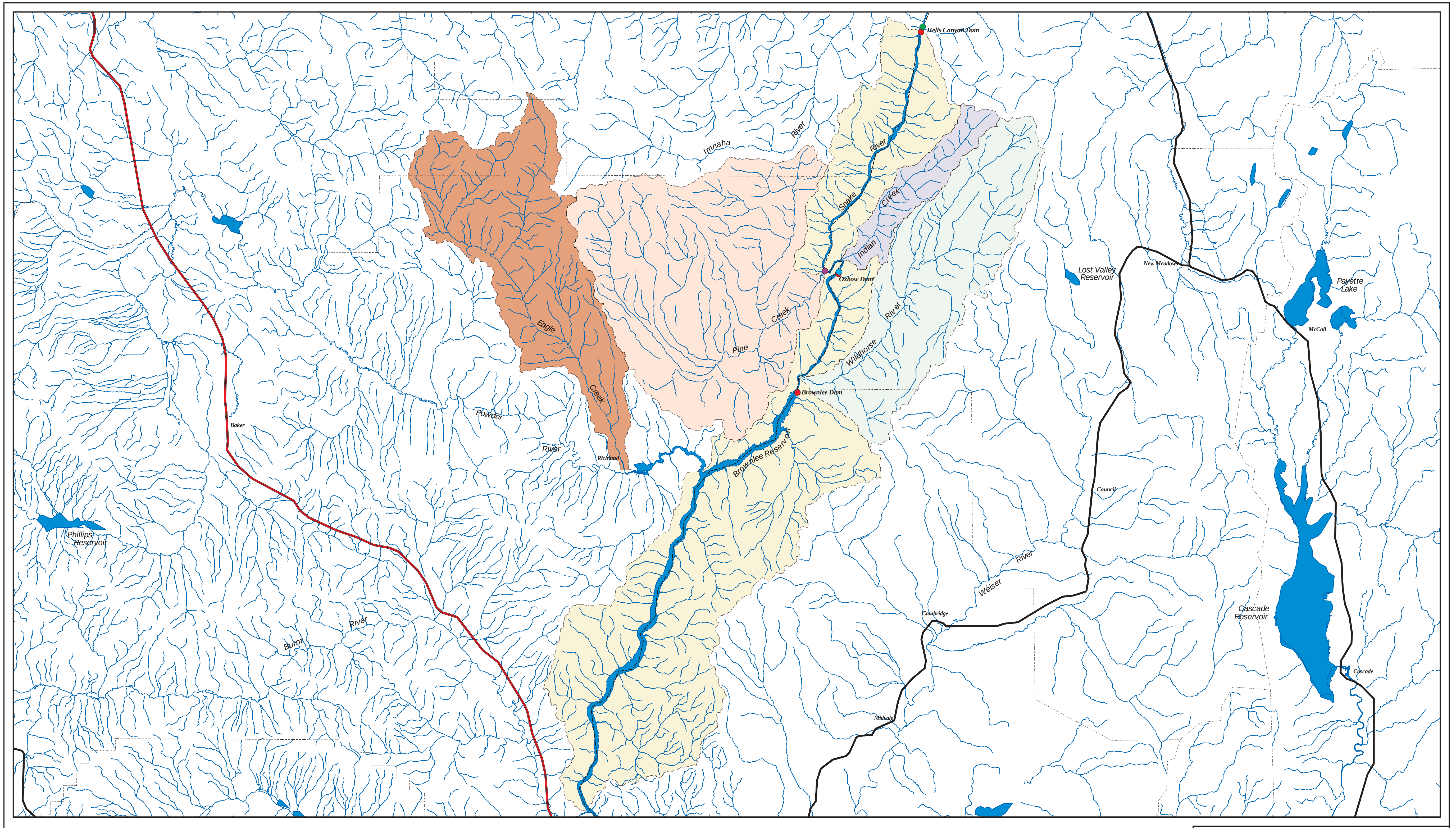

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Lakes or Reservoirs
- Hells Canyon Complex Dams
- Hells Canyon Fish Trap (Existing)
- Oxbow Fish Trap (Proposed)
- Pine Creek Permanent Monitoring Weir (Proposed)

PM&E Measures and Target Watersheds

- Pathogen Survey
- Tributary Habitat Enhancements
- Marine Derived Nutrient Supplementation
- Brook Trout Suppression
- Eagle Creek Presence/Absence Survey

GN
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0°08'
2 MILS
17°30'
311 MILS

UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.1- 12

Native Salmonid Plan

SCALE 1 : 108,000

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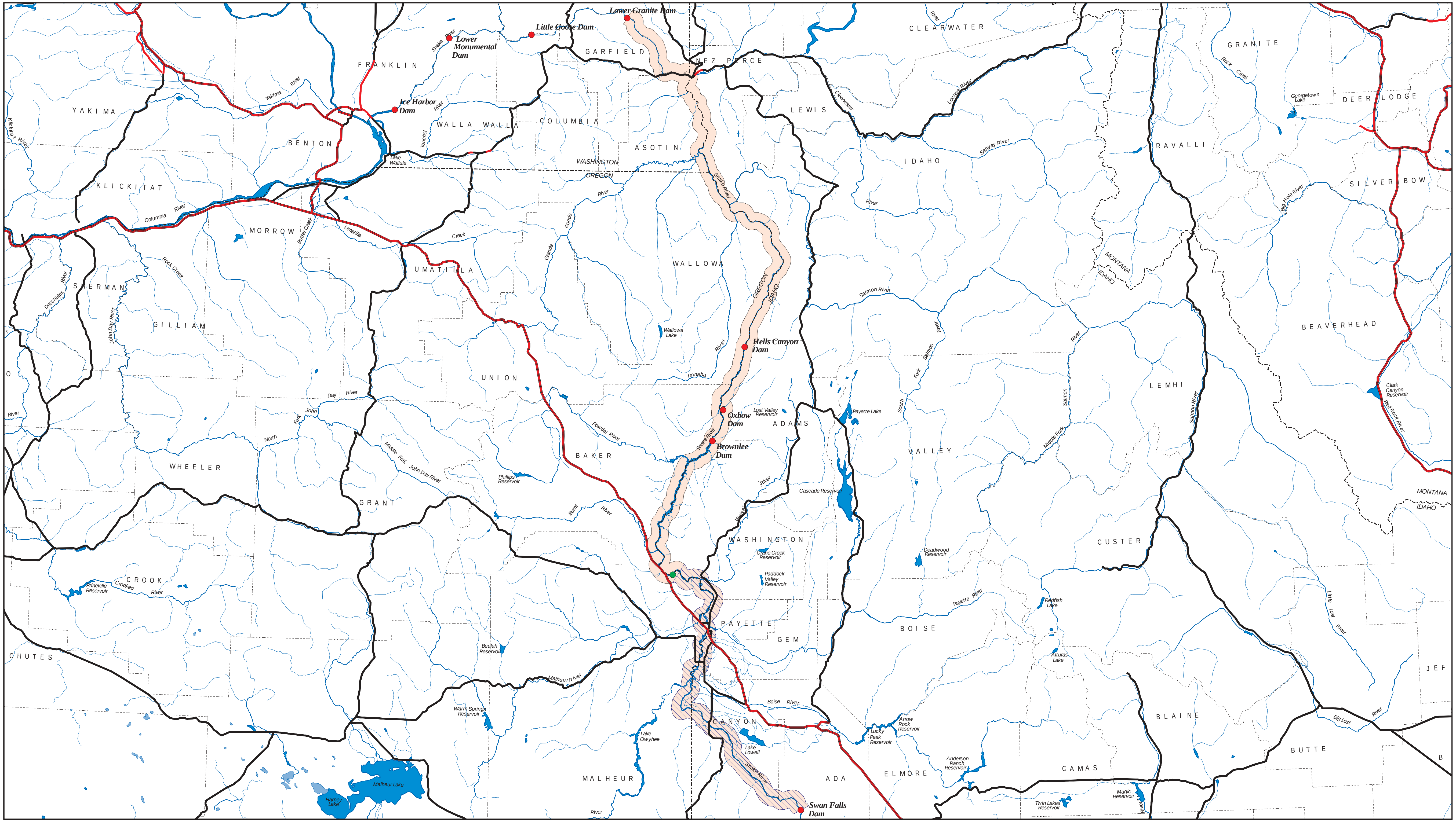
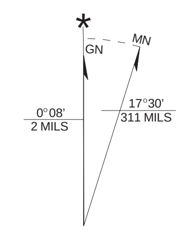


Features Legend

- Primary Route
- Secondary Route
- Major Road
- Perennial River
- County Boundary
- State Boundary
- Lakes or Reservoirs
- Dry Lake
- Periodic Population Assessments and Genetic Evaluations (10-year increment)
- Assess Water Quality Impacts on Early Life Stages and Recipient Reach of Translocation or Conservation Aquaculture Measures
- Mainstem Snake River Dams
- Cobb Rapids

Vicinity Map



UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.1-13

Snake River White Sturgeon Conservation Plan

SCALE 1: 445,000
10 5 0 10 20 30 MILES

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E.3.2. Wildlife Resources

E.3.2.1. Description of Wildlife Resources

The Applicant conducted studies of resources considered to be of greatest concern to natural resource management agencies and to the public because of their ecological, recreational, and economic value (IPC 1997, 2000). These studies were based on discussions in the Terrestrial Resources Work Group (TRWG) that started in 1996 and continued through 1999. Discussions resulted in a set of final study plans presented to the TRWG in February 2000 (IPC 2000). Studies are categorized into two groups: descriptive studies providing information on the current condition of wildlife resources and impact studies addressing effects of the operation and maintenance of the Hells Canyon Complex (HCC),[1] including the associated transmission system, on terrestrial resources.

Wildlife is defined as all nondomesticated terrestrial animals, including those that spend much of their lives associated with water. The Applicant described wildlife communities in Hells Canyon from a regional perspective. Studies were designed to evaluate the status, distribution, and abundance of a broad range of wildlife species. Wildlife studies were conducted in close association with habitat characterization to develop wildlife–habitat relationships, gain insight into the structure of wildlife communities, and enhance the application of study results.

E.3.2.1.1. Prehistoric and Historic Conditions in Hells Canyon

Humans have inhabited Hells Canyon for at least 12,000 years (Daubenmire 1970). Prehistoric peoples successfully hunted big game species, evidenced by large ungulate remains commonly found at archaeological campfire sites. For example, the Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) was the most common large mammal recovered at the Hells Canyon Creek Rockshelter (Pavesic 1971). Large mammals associated with the Ice Age became extinct as the North American climate warmed. Extinct species were replaced by modern forms (Van Vuren 1987).

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

Little is known about the status of wildlife species and their habitat in Hells Canyon before Euro-Asian settlement. The Lewis and Clark expedition in 1805 was the first time Europeans entered the Hells Canyon area and recorded information on the natural resources associated with the Snake River. Hunt and Crook of the Pacific Fur Company explored Hells Canyon in 1812, and Captain Bonneville led a party into Hells Canyon in 1834. Wildlife was apparently scarce in Hells Canyon, and big game sightings (for example, mule deer [*Odocoileus hemionus*] and elk [*Cervus elaphus*]) were infrequent according to the journals of early explorers of Hells Canyon. The Hunt and Crook party killed only a single bighorn sheep and nearly starved. The Bonneville party suffered a similar fate. Scarcity of game in the Hells Canyon region was mentioned for the years 1804, 1805, and 1841. This scarcity may have been why the Nez Perce stopped their periodic use of Hells Canyon in the early 1800s (Pavesic 1971).

Most of the Inland Northwest was settled by European and other immigrants by the mid- to late 1800s. Hells Canyon and vicinity were quickly homesteaded after the Nez Perce War in 1877. The discovery of gold in the Hells Canyon area was the principal reason for the influx of Euro-Asian settlers. Mining played a central role in the development of the Hells Canyon area from Farewell Bend, Oregon, to the confluence of the Snake and Salmon rivers. During the 1880s and 1890s, the Seven Devils district was an active mining center in Idaho. Many mines were opened (for example, the Blue Jacket, the Queen, and the Alaska), a railroad was partially built, a smelter was operational, and three towns—Cuprum, Helena, and Leadore—were established. Mining also occurred in Oregon opposite the Seven Devils mining region in Idaho. In 1899, gold was discovered near the confluence of the Imnaha and Snake rivers, and more than 50 claims were made on Squaw Creek. The town of Eureka was built in Hells Canyon but was abandoned by 1906 because of poor transportation and no major gold strikes. Two more towns, Homestead and Copperfield, were founded and experienced a brief boom until the onset of World War I forced many mines to close. General Land Office (GLO) records noted three separate mines about 3 miles (mi) below the Oxbow Dam site along the Hells Canyon Reservoir and "considerable mining development" along the Deep Creek drainage, entering the Snake River right below Hells Canyon Dam. Few GLO records exist for the river below Hells Canyon Dam. However, mining in this reach was noted at Bernard Creek, Eureka Bar, Dug Bar, Salt Creek, Somers Creek, Temperance Creek, and Big Bar. The U.S. Forest Service (USFS) indicated that 100 mining sites were located along the Snake River within the then-proposed Hells Canyon

National Recreation Area (HCNRA) (USFS 1980). The Winchester Mine near Battle Creek was one of the more prominent mine sites.

Ranching and farming quickly followed mining ventures into Hells Canyon. Agricultural activities in the Weiser reach (between Weiser and Cobb Rapid) were relatively well established by the 1870s to 1880s (Arrowrock Group 1995). By the early 1900s, most of the vegetation on flat bottomland and islands on the Snake River floodplain in the Weiser reach had been converted from native wetland, riparian, and shrub-steppe communities to irrigated crops and orchards; virtually all arable land was farmed by the 1950s (Series 1 and 2 in Technical Report E.3.2-44). Water supplies for irrigating farms along the Weiser River have been over-allocated since at least 1909.

In the Brownlee Reservoir reach (between Cobb Rapid and Brownlee Dam), the floodplain narrows substantially. In 1905, homesteaders arrived to the canyon and established farms and orchards. Flatter alluvial fans along the river and river bars were farmed or used as winter feedlots for livestock (Series 5, 6, and 7 in Technical Report E.3.2-44). The U.S. Census Office (1896) described extensive agricultural development and irrigation diversions along the Powder River drainage as early as 1889. By the 1940s and 1950s, many tributaries of the Powder River had been diverted substantially. Irrigation of alluvial fans and terraces along the river was primarily limited to the individual efforts of farmers, who diverted water from nearby tributaries to irrigate their crops.

In the Oxbow Reservoir and Hells Canyon Reservoir reaches (between Brownlee and Hells Canyon dams), agricultural development was probably similar to that of the Brownlee Reservoir reach. Settlers generally occupied river bars and benches and raised crops and livestock. Irrigation diversions and farming, documented for the Wild Horse River and its tributaries (Arrowrock Group 1995), probably occurred at the mouths of other drainages that had flat lands suitable for supporting a house and garden or orchard. Irrigation was limited below Hells Canyon Dam but is poorly documented (Arrowrock Group 1995).

Difficult access, limited tillable bottomland, poor irrigation, and an extreme summer climate made farming exceptionally difficult in Hells Canyon. Livestock ranching was more feasible. Downstream of Farewell Bend, cattle and sheep ranching dominated the area in the 1880s. From 1860 through 1870 and from 1892 to 1893, cattle and sheep populations rapidly expanded (Galbraith and Anderson 1971). During the 1920s, sheep grazing replaced cattle grazing (Tisdale 1986a). By the 1940s, however, ranchers had replaced sheep with cattle, and numerous feedlots were developed along the Snake River (Asherin and Claar 1976).

Before the eighteenth century, ungulate grazing pressure on native vegetation was probably minor. Grazing pressure changed with the arrival of the horse. Haines (1938) traced the spread of horses from the Spanish colonies in what is now New Mexico. The Navajo and Apaches, among others, acquired these horses and traded them northwards. Haines (1938) calculated that the Cayuse, Nez Perce, and Flathead groups first acquired their horses by 1720 from Northern Shoshones on the upper Snake River. Horses spread throughout the Columbia River Plateau by the end of the 1800s. Most Plateau bands, including the Nez Perce, were quick to recognize the horse’s usefulness (Walker and Sprague 1998). The region contained some of the best horse country in the world, producing large horse herds. Around 1855, an estimated 20,000 horses were owned by the Umatilla, Cayuse, and Walla Walla tribes (Walker and Sprague 1998). Influential families owned herds of more than 1,000 selectively bred horses (Osborne 1955). Intensive grazing probably took place adjacent to Native American villages along the Snake River (Daubenmire 1970). However, widespread impacts from horses to steppe vegetation were probably localized. Fire and grazing were apparently of limited importance in shrub-steppe vegetation before Euro-Asian settlement and grazing by their livestock (Heady 1968, Daubenmire 1970).

The introduction of livestock profoundly affected the native steppe and shrub-steppe vegetation in the Inland Northwest (Daubenmire 1970). Large herds of ungulates had never been an integral part of the steppe communities in the Northwest, as they had been in the Great Plains. The inability of native plant species to endure heavy grazing pressure, or rebound after heavy grazing pressure, probably reflects their evolutionary development free of significant ungulate grazing. Rabbits, rodents, and one bird species—the greater sage grouse (*Centrocercus urophasianus*)—were probably important grazers of shrub-steppe vegetation (Yensen 1982). Insects and arthropods, however, are the dominant consumers of vegetation and may eat as much as 70% of shrub-steppe and steppe plant matter (Rogers et al. 1988).

After Euro-Asian settlement, lands in Hells Canyon not used for crop production were generally impacted to various degrees by livestock grazing (Tisdale 1986b). Although overgrazing was identified as a problem by the early 1900s, unrestricted grazing continued well into the 1940s. Consequently, range conditions were poor in Hells Canyon prior to the 1950s (J. Morrison, Idaho Department of Fish and Game retired, personal communication; P. Grindy, Payette National Forest, personal communication). Agency personnel generally reported that range conditions on USFS lands have improved since the 1950s (section 4.2.5. in Technical Report E.3.2-44). However, monitoring data are not available to support this premise. Plant species diversity has increased, but noxious weeds are currently more problematic (P. Grindy, Payette National Forest, personal communication). Impacts of livestock grazing on wildlife habitat are probably greatest in the Weiser and Brownlee reaches of Hells Canyon, where relatively high livestock grazing densities and low precipitation rates coincide. Along the Snake River corridor to the north, annual precipitation increases, providing more opportunity for vegetation to recover from past livestock grazing impacts.

Exotic plants, which include invasive and noxious weeds, are the greatest threat to the composition and structure of native plant communities in the Interior Columbia River Basin (Croft et al. 1997). Introduced exotics, notably cheatgrass (*Bromus tectorum*), have impaired, impeded, and possibly even arrested recolonization of the range by native shrubs and grasses. Most weed species identified in Hells Canyon (Table 13 in Technical Report E.3.2-44) were apparently present before the HCC was constructed and river flows managed (Rice 2002). The continual spread of exotic plants has steadily degraded the value of wildlife habitat.

GLO records from 1870 through 1920 indicate that “no timber” grew along the Weiser or Brownlee reaches (Appendix 1 to Technical Report E.3.2-44). GLO records from 1902 to 1910 for the Oxbow reach indicate that scattered pines (*Pinus* species) and cottonwoods (*Populus* species) were present at some sites (Series 10, 11, and 13 in Technical Report E.3.2-44). Historically, few ponderosa pines (*Pinus ponderosa*) were found along the Oxbow reach. The only deciduous trees visible in the photo series presented in Technical Report E.3.2-44 appear to be netleaf hackberry (*Celtis reticulata*). GLO records for the Hells Canyon Reservoir reach indicate no timber at some sites and scattered pine and fir at other locations. Cottonwood was mentioned in one record. Several of the photos of this reach from the 1950s show that conifers were present (Series 16–23 in Technical Report E.3.2-44). Morrison (IDFG retired, personal communication) noted that few, if any, trees grew in riparian zones during the 1950s and that livestock use of these areas was heavy. Riparian vegetation probably consisted primarily of shrubby species, with very tall sagebrush (*Artemisia* species) and mountain mahogany (*Cercocarpus* species) common (D. Nadeau, Idaho Department of Fish and Game retired, personal communication). An assessment by the U.S. Fish and Wildlife Service (USFWS) of potential impacts of proposed dams in the Columbia River basin characterized wildlife habitat quality in Hells Canyon as poor to fair (1948).

E.3.2.1.2. Habitats in Hells Canyon

Wildlife habitat on public lands in Hells Canyon is administered principally by the Bureau of Land Management (BLM) and the USFS (Figure E.1-1). The Lower Snake River and Vale Districts of the BLM are responsible for managing much of the public lands in the southern portions of Hells Canyon. BLM's Four Rivers Field Office, located in the Lower Snake River District, manages public lands in Ada, Adams, Boise, Canyon, Gem, Payette, Valley, and Washington counties of Idaho. The Malheur and Baker Field Offices are within the Vale District, which manages public lands in Malheur, Baker, Union, and Wallowa counties of Oregon.

The Four Rivers Field Office manages 0.48 million acres on the east side of the Snake River. These public land holdings contain both scattered tracts and large blocks of land. Sagebrush/grass communities cover about 75% of the resource area's managed lands. Ninety percent of these lands were rated in fair (47%) to poor (43%) condition (BLM 1987). Wildfires in 1986 changed vegetation on 95,516 acres. The major change was loss of the sagebrush/antelope bitterbrush (*Purshia tridentata*) component. Along approximately 198 kilometers (km) (123 mi) of linear riparian areas, woody riparian vegetation was rated in good condition along 63% of the drainages and rated in fair condition along 28%.

The Malheur Field Office encompasses 1.9 million acres; the Baker Field Office, 0.43 million acres. The vegetation in the two resource areas is the product of widely varying elevations, topography, climate, soils, and land-use patterns. The existing plant communities in Hells Canyon vary from low-elevation shrub-steppe and grasslands to high-elevation coniferous forest and subalpine communities. On mid- and lower-elevation rangelands, vegetation types consist of perennial grasses, big sagebrush (*Artemisia tridentata*), bunchgrass (*Stipa* species), big sagebrush/annual grass, and mixed shrub/plant communities (BLM 1986). Ecological condition has been evaluated on 85% of lands administered for grazing. Fifty percent of the range was considered to be in static condition; 39%, improving; and 11%, deteriorating (BLM 1986). About 80% of riparian zones have been inventoried, and most of the habitat is in good or fair condition. The apparent trend in condition is static (USFS 1990a).

USFS lands, comprising most public lands in the northern reaches of Hells Canyon, are managed as part of the Payette National Forest (PNF) and Nez Perce National Forest in Idaho and the Wallowa–Whitman National Forest (WWNF) in Oregon. Wide ranges in elevation and precipitation provide many distinct and readily identified vegetation zones across the WWNF. Of the approximately 2.3 million acres of the WWNF, approximately 1.3 million acres are classified as suitable for livestock grazing under controlled management conditions designed to maintain or improve the range resources (USFS 1990a). The rugged HCNRA is suited primarily for sheep grazing. However, sheep grazing has proven to be unprofitable for several operators in recent years. Therefore, large allotments have not been fully grazed (USFS 1990a).

The WWNF has an estimated 15,360 km (9,523 mi) of streams and associated riparian areas (USFS 1990a). About 50% of the streams showed streambank stability of fair or better, but shade-producing vegetation needs to be increased considerably. Sedimentation does not appear to be a significant problem, but there appears to be room for improvement. Riparian vegetation is impacted by livestock, big game, recreation, and roads (USFS 1990a). All of these factors have degraded riparian areas to a condition below their natural potential. In many cases, the impacts are permanent, and the natural potential cannot be restored. Consequently, these areas are managed for an altered potential.

The Nez Perce National Forest is located entirely within Idaho County in north-central Idaho. Within the Nez Perce Forest are portions of the HCNRA and the Hells Canyon Wilderness (57,113 and 59,900 acres, respectively). From 1975 to 1979, the Nez Perce, Payette, and Wallowa–Whitman National Forests jointly administered the HCNRA and the Hells Canyon Wilderness. Since 1979, the WWNF has solely administered the two areas (USFS 1987). Therefore, this exhibit cites the WWNF land and resource management plan regarding the management of the HCNRA and Hells Canyon Wilderness (USFS 1990a), rather than the Nez Perce National Forest's final environmental impact statement (USFS 1987). The PNF stretches nearly the full width of central Idaho and is situated in Adams, Idaho, Valley, and Washington counties. The PNF also contains a portion of the HCNRA, which is administered by the WWNF. Four management areas in the southwestern corner of the PNF are located in the immediate vicinity of Hells Canyon: Seven Devils, Hornet, Cuddy Mountain, and Brownlee. Riparian areas on the PNF are heavily influenced by past management activities. Historic activities affecting riparian and stream channel conditions include road construction, timber harvest, grazing, fire, mining, and recreation. These activities resulted in loss of riparian areas, decline of desirable shrubby vegetation, invasion of undesirable forbs, and loss of wildlife habitat (USFS 1990b). Detailed descriptions of the vegetation in the Applicant's Hells Canyon Study Area and vicinity are found in section E.1.6. and section E.3.3.1.

E.3.2.1.3. Wildlife Resources of the Hells Canyon Complex and Vicinity

Major categories of wildlife described are 1) birds, 2) mammals, and 3) reptiles and amphibians. Nomenclature of vertebrates follows Banks et al. (1987) and Jones et al. (1992). The following description focuses on the species of greatest concern to resource managers and the public because of their ecological, recreational, or economic value. Threatened, endangered, candidate, and special status wildlife species (see section E.3.2.1.3.13. for definitions) associated with the HCC are described in section E.3.2.1.3.13.

E.3.2.1.3.1. Nongame Birds

The quality of information on abundance, distribution, ecology, and management for most nongame bird species in Idaho and eastern Oregon varies (Idaho: Burleigh 1972, Taylor and Trost 1987, IDFG 1991, Groves et al. 1997, Stephens and Sturts 1998; Oregon: Gilligan et al. 1994, Csuti et al. 1997). Such information, however, is important for gaining reliable knowledge of species status and distribution and has important management implications (for example, Sutherland 1996). Although considerable general information is available on bird communities in shrub-steppe (for example, Wiens and Rotenberry 1981, Wiens 1986) and riparian vegetation (Jensen 1979; BLM 1979; Brown 1990; Holthuijzen 1995a, 1997, 1998; Saab 1999; Rocklage and Ratti 2000), quantitative studies on bird communities along the Snake River of Hells Canyon are generally lacking. The Applicant conducted a study of the nongame bird community in Hells Canyon from 1995 through 1999 (Technical Report E.3.2-1). Objectives were to determine 1) abundance and relative densities; 2) community composition during spring, summer, fall, and winter; 3) relative annual population numbers; and 4) habitat relationships of bird communities during the nesting season.

The Applicant applied a stratified-random sampling design with circular survey plots established at 442 locations within homogeneous patches of upland or riparian vegetation (288 riparian, 154 upland) (Table 2 and Figure 1 in Technical Report E.3.2-1). Surveys were conducted during four seasonal periods: spring (May), summer (June), fall (late September through early October), and winter (late January). Habitat measurements taken at each survey point were used to classify points into vegetation cover type and association and to investigate habitat relationships of individual bird species (Appendix 1 to Technical Report E.3.2-1). The Applicant also recorded all incidental observations of rare or special status species during other field activities in Hells Canyon.

From 1995 through 1999, the Applicant observed 223 bird species (Appendix 3 to Technical Report E.3.2-1). During spring and summer, the lazuli bunting (*Passerina amoena*), spotted towhee (*Pipilo maculatus*), and western meadowlark (*Sturnella neglecta*) were most commonly observed. In fall, the black-capped chickadee (*Poecile atricapilla)*, spotted towhee, and western meadowlark were most common. In winter, commonly observed species were the dark-eyed junco (*Junco hyemalis*), black-capped chickadee, and horned lark (*Eremophila alpestris*) (Table 3 in Technical Report E.3.2-1). Neotropical migrant land birds made up approximately half of the total bird density at each of the cover types during spring and summer, but were nearly absent during fall and winter (Figure 11 in Technical Report E.3.2-1).

Highest bird densities occurred in spring (17.1 birds/hectare [ha]) and summer (17.0 birds/ha), with the lowest densities in fall (11.4 birds/ha) and winter (9.9 birds/ha). Bird densities in riparian cover types were higher than in shrub-steppe cover types, but were similar to structurally complex upland cover types (that is, *Forested Upland*, *Tree Savanna*, and *Mountain Shrub*) (Table 9 in Technical Report E.3.2-1).

Shrub density and tree cover were the most important structural variables influencing bird communities (Table 11 and Figures 16, 17, and 21A in Technical Report E.3.2-1). Spotted towhee, lazuli bunting, yellow-breasted chat (*Icteria virens*), black-capped chickadee, and Bullock's oriole (*Icterus bullockii*) were all positively associated with increasing shrub density, whereas the red-eyed vireo (*Vireo olivaceus*) was positively associated with increasing tree cover (Figure 21 in Technical Report E.3.2-1). Cottonwood, Wood's rose (*Rosa woodsii*), black hawthorn (*Crataegus douglasii*), and upland plants that included Douglas-fir (*Pseudotsuga menziesii*), snowberry (*Symphoricarpos alba*), and serviceberry (*Amelanchier alnifolia*) were commonly identified as positive variables predicting bird abundance or presence (Table 13 and Figure 22 in Technical Report E.3.2-1). Song sparrows (*Melospiza melodia*) were positively associated with hackberry; red-eyed vireos, with white alder (*Alnus rhombifolia*) (Table 13 and Figure 22C in Technical Report E.3.2-1). However, many birds avoided areas of hackberry and alder (Figure 22 in Technical Report E.3.2-1), resulting in lower bird densities in those areas (Figures 12 and 13 in Technical Report E.3.2-1).

Much of Hells Canyon consists of a mosaic of habitats, including riparian habitat in a narrow band along tributaries and upland habitat that is patchily interspersed with seeps, grassland, and shrubland. The interspersion of cover types probably favors species adapted to edge environments rather than species that require a large, contiguous forest or shrub-steppe habitat. Many bird species (such as lazuli bunting and western meadowlark) are generalists and were found throughout the study area. However, some species (such as the house wren [*Troglodytes aedon*] and plumbeus vireo [*Vireo plumbeus*]) appeared to display affinities toward vegetation associations dominated by certain tree and shrub species and had a more limited distribution in the study area. The presence of trees or shrubs in a grassland habitat and the interspersion of cover types could also explain the similarity in bird densities and communities that were found when steppe and upland cover types were compared.

E.3.2.1.3.2. Migrant Shorebirds

Knowledge about shorebird distribution and abundance during migration in the Intermountain West is based on sites with large concentrations of migrating shorebirds—such as the Great Salt Lake or even coastal areas (Warnock et al. 1998). However, shorebird use of the interior regions of North America is much less known (Reed et al. 1997). In Idaho, early studies consisted of only anecdotal observations and checklists (Larrison et al. 1967, Burleigh 1972). Drawdowns of Brownlee Reservoir for hydroelectric production, flood control, and anadromous fish augmentation expose large areas of mostly barren, sediment-rich shore and bottomland (IPC 1997). Several areas of the reservoir with flat topography or delta formations have mudflats that provide potential foraging habitat for migrating shorebirds. Therefore, the Applicant surveyed shorebirds on exposed mudflats of Brownlee Reservoir between 1996 and 1999 (Technical Report E.3.2-2) to assess shorebird resources in the fluctuation zone of the reservoir.

Applicant biologists surveyed four mudflat sites (Powder River, Burnt River, Farewell Bend, and Darrows Island) (Figure 1 in Technical Report E.3.2-2) twice monthly during August and September 1996 through 1998. Three surveys were conducted in 1999 during late July and early August to determine when shorebird use peaked. Twenty shorebird species were observed along Brownlee Reservoir (Appendix 1 to Technical Report E.3.2-2). Seventeen species of shorebirds, and the highest numbers of individuals, were reported at the Powder River. Ten species were observed at the Farewell Bend site; five species, at the Darrows Island site; and five species, at the Burnt River site. The killdeer (*Charadrius vociferus*) was the most commonly observed species, found at all sites and often observed in relatively high numbers (Table 1 in Technical Report E.3.2-2). The western sandpiper (*Calidris mauri*) was the second most common species, followed by the Baird's sandpiper (*Calidris bairdii*), semipalmated sandpiper (*Calidris pusilla*), and spotted sandpiper (*Actitis macularia*). Shorebird use of the study sites declined from August to September (Figure 3 in Technical Report E.3.2-2).

Shorebird use of Brownlee Reservoir mudflats is influenced by migration timing and the extent of mudflats available as the summer season progresses (Table 4 in Technical Report E.3.2-2). Peak shorebird abundances have been observed in Idaho at Lake Lowell and American Falls Reservoir between mid-July and mid-August (Trost et al. 1989, Taylor et al. 1992). At Brownlee Reservoir, the highest annual numbers of shorebirds were observed during the first two weeks in August

(Figure 3 in Technical Report E.3.2-2). The number of shorebirds (range = 500 to 3,000 birds annually) recorded at Brownlee Reservoir was much lower than at areas considered to be of regional importance (20,000 shorebirds annually, or 5% of a species' flyway population) (Harrington and Perry 1995). Brownlee Reservoir may not be situated along a major flyway for most shorebirds. Alternatively, suitable mudflats may not be exposed during periods of peak migration. Timing of drawdown, the type of substrate, and presence or absence of acceptable food items may also influence suitability. In addition, mudflats exposed along Brownlee Reservoir are smaller than mudflats at some other reservoirs (such as American Falls Reservoir) and may not be able to support large numbers of shorebirds.

E.3.2.1.3.3. Upland Game Birds

Hells Canyon provides habitat for a diverse upland game bird community that includes both native and introduced species (Table 1 in Technical Report E.3.2-3). Native upland game birds potentially occurring in Hells Canyon are predominately five grouse species: the blue grouse (*Dendragapus obscurus*), ruffed grouse (*Bonasa umbellus*), greater sage grouse, Columbian sharp-tailed grouse (*Tympanuchus phasianellus*), and spruce grouse (*Dendragapus canadensis*). The most common native migratory upland game bird occurring in the study area is the mourning dove (*Zenaida macroura*). The mountain quail (*Oreortyx pictus*), a special status species, also occurs in restricted areas of Hells Canyon. Other upland game birds are currently in Hells Canyon as a result of translocations to establish huntable populations. Introduced species include the California quail (*Callipepla californica*), chukar (*Alectoris chukar*), gray partridge (*Perdix perdix*), wild turkey (*Meleagris gallopavo*), and ring-necked pheasant (*Phasianus colchicus*). The chukar is probably the most important game bird in Hells Canyon in terms of recreational and economic value. The species' importance may increase as nearby urban centers grow and access to private lands becomes more difficult and restricted. In Idaho, the estimated statewide harvest of chukars from 1991 through 1996 was 103,780 birds per year (range = 54,600 in 1992 to 208,600 in 1996) (IDFG 2000). In Oregon, 9,578 hunters spent 57,119 days afield and harvested 82,386 chukars in 1999–2000 (ODFW 2000). In Idaho, the estimated statewide harvest of gray partridge from 1991 through 1996 was 47,633 birds per year (range = 27,800 in 1992 to 109,300 in 1996) (IDFG 2000). In Oregon, 3,386 hunters spent 16,660 days afield and harvested 19,061 gray partridge in 1999–2000 (ODFW 2000).

Because no recent broad-scale surveys of upland game birds had been conducted in the Hells Canyon, Applicant biologists used line-transect sampling to describe relative spring distributions and abundances of upland game bird populations (Davis 1982, Technical Report E.3.2-3). Applicant biologists surveyed 18 transects, averaging 2,819 meters (m) in length (range = 1,108 to 4,683 m) (Table 2 and Figure 1 in Technical Report E.3.2-3) (Caughley 1977, Davis and Winstead 1980, Rotella and Ratti 1986). Upland game birds observed during spring nongame bird surveys and sightings of uncommon species were included in the study as incidental observations (Technical Report E.3.2-1). Seven species were detected, and an average of 1.93 birds were observed per kilometer (Table 3 in Technical Report E.3.2-3). The most common species were the chukar (0.76 birds/km) and mourning dove (0.75 birds/km). Other species observed were the California quail (0.25 birds/km), gray partridge (0.07 birds/km), ruffed grouse (0.06 birds/km), ring-necked pheasant (0.01 birds/km), and blue grouse (0.01 birds/km). Four other species—the wild turkey, mountain quail, greater sage grouse, and Columbian sharp-tailed grouse—were observed incidentally during other field work. The sage and sharp-tailed grouse are discussed as special status species in section E.3.2.1.3.13.2. Predicted distributions were developed for each of the upland game bird species (Figures 3–13 in Technical Report E.3.2-3). The mourning dove, California quail, ruffed grouse, and blue grouse were also observed throughout the canyon. The sage grouse, ring-necked pheasant, and sharp-tailed grouse were restricted to the southern part of the study area.

Compared with other upland game birds in North America, the chukar has received little research attention (for example, Walter [2000]). Most gray partridge research has been conducted in midwestern states in agricultural environments, and only a few chukar studies have been completed in western states. Assessing population and habitat status of these upland game species is necessary for understanding the influences of the HCC on important wildlife resources. Therefore, Dr. John Ratti (Department of Fish and Wildlife Resources, University of Idaho), under contract with the Applicant, assessed chukar and gray partridge populations and habitat in the Hells Canyon Study Area during 1999–2000 (Technical Report E.3.2-7). The assessment included a field survey and an extensive literature review from published data and agency reports (Appendix F to Technical Report E.3.2-7).

The literature review suggested that the ecological significance of the chukar and gray partridge in Hells Canyon may include their 1) relative importance as prey, especially for raptors; 2) interspecific interactions with other game birds, especially native species; and 3) potential role as a disease vector. Major predators of adults and chicks in Hells Canyon are the golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), and coyote (*Canis latrans*) (Lindbloom 1998, Walter 2000). Chukar population size and density can vary dramatically from year to year (Moreland and Lauckhart 1960, Christensen 1970, Molini 1976, Rippe 1998, WDFW 1999). The chukar was the most common upland game bird and occurred throughout Hells Canyon (Appendix 1 to Technical Report E.3.2-3). Aerial survey results from 2000 indicated that chukar numbers along the Snake River were down 50% from the 1999 count and were 43% below the 1995–1999 average (C. Johnson, BLM, and J. Crenshaw, Idaho Department of Fish and Game, unpublished data). Currently, chukar numbers are below historic highs, but good populations exist in southwestern Idaho (IDFG 2001). Reliable data on population dynamics of the gray partridge in Hells Canyon are lacking.

Twenty-six five-hour surveys, conducted during fall and winter 1999–2000 in the study area, indicated that chukar and gray partridge populations were relatively abundant and that they were probably near or above the long-term average. Although some specific sites were classified as poor habitat, most areas surveyed were classified as having good or excellent habitat for the chukar and gray partridge. At that time, the long-term prediction (for 2000–2005) for both species was positive. Primary ecological and anthropogenic concerns about habitat in Hells Canyon were invasions by exotic plants and overgrazing by livestock.

E.3.2.1.3.4. Waterfowl

Nesting Waterfowl—Reservoir operations associated with hydroelectric generation may negatively affect riparian vegetation and thereby impact habitat for waterfowl nesting and brooding (Lewke and Buss 1977, Tabor et al. 1980, Books 1985, Monda and Reichel 1989). In 1974 and 1975, Asherin and Claar (1976) reported six species of waterfowl that were known or suspected to nest in the area: the Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), American wigeon (*Anas americana*), green-winged teal (*Anas crecca*), and common merganser (*Mergus merganser*). The Canada goose was by far the most common nesting species, with most individuals nesting on islands between Weiser, Idaho, and Farewell Bend, Oregon (river mile [RM] 351–RM 339). Asherin and Claar (1976) found evidence of breeding mallards, green-winged teal, and common mergansers. They found several mallard nests on islands in the Weiser reach and observed mallard and green-winged teal broods in the area. They occasionally observed common merganser broods from Farewell Bend to the Salmon River.

The general lack of recent information on nesting waterfowl prompted the Applicant to conduct nesting waterfowl surveys between Weiser and Hells Canyon Dam (Technical Report E.3.2-11). The main objective of this study was to provide baseline information on waterfowl production in Hells Canyon above Hells Canyon Dam. Using a proportional sampling design, Applicant biologists surveyed approximately 25% of the available shoreline in each of 7 river/reservoir sections. Fifty-five transects covered 53.5 mi of shoreline: 6 transects in upper Brownlee Reservoir, 10 in lower Brownlee Reservoir, 7 in Oxbow Reservoir, 11 in Hells Canyon Reservoir, 9 on islands in the Weiser reach, 5 in the mainland Weiser reach, and 7 in the Powder River arm (section 3.1. in Technical Report E.3.2-11).

One goose, 11 duck, 1 coot, and 2 grebe species were observed. Broods of the American coot (*Fulica americana*), Canada goose, mallard, common merganser, and wood duck (*Aix sponsa*) were found. The Canada goose was the most abundant breeder, with 338 adults and 517 goslings observed in three years (Tables 1–3 in Technical Report E.3.2-11). One hundred ninety-five adult mallards and 129 ducklings from 27 broods were reported. Numbers and the ratio of young to adults (young:adult ratios) for both species fluctuated among years, but overall, the Canada goose population showed a strong population increase. One brood each was recorded for American coot and common merganser and 3 broods for wood duck.

Numbers of adult and hatch-year Canada geese and mallards fluctuated between 1996 and 1997 (Figures 3 and 4 in Technical Report E.3.2-11). For the Canada goose, the highest production year was 1997, which also corresponded to the largest numbers of geese observed (Figures 3 and 5 in Technical Report E.3.2-11). These numbers indicated an increasing population trend for the Canada goose. Mallard production was highest in 1995. Both species had low productivity in 1996.

Important waterfowl-production areas were located at the western end of the Powder River arm and from Weiser to Farewell Bend (Figure 1 in Technical Report E.3.2-11), areas with shoreline sediments and low river gradient. In contrast, lower Brownlee, Oxbow, and Hells Canyon reservoirs have steep slopes, rocky shorelines, and swift water—habitats that do not contain parameters necessary for breeding waterfowl. An analysis of historic records and photographs indicated that, even prior to dam construction, the present-day reservoir areas might not have supported significant wetland and riparian vegetation (Series 5–23 in Technical Report E.3.2-44). No broods of any species were seen in Oxbow Reservoir, and only geese were seen in Hells Canyon Reservoir.

Wintering Waterfowl—Waterfowl habitats in southwestern Idaho, eastern Oregon, and Washington consist primarily of the Snake and Columbia rivers, their associated impoundments, and surrounding agricultural lands (Ball et al. 1989, Bildstein et al. 1991). Development of impoundments influences the presence, characteristics, and habitat values of water bodies important to wintering waterfowl. A dominant wintering strategy for waterfowl today includes rafting on the open water provided by the reservoirs and feeding in adjacent agricultural fields.

Ducks and geese passing through the Pacific Northwest are part of the Pacific Flyway. Generally, Pacific Flyway numbers were relatively high in the 1950s, declined in the 1960s, recovered in the 1970s, steeply declined in the 1980s, and rebounded once again in the late 1990s (Figure 1 in Technical Report E.3.2-12). Since 1972, an Annual Midwinter Waterfowl Count has been conducted by the Oregon Department of Fish and Wildlife (ODFW) from Farewell Bend, Oregon, downstream to the confluence of the Snake and Salmon rivers (G. Keister, ODFW, personal communication). Otherwise, information on wintering waterfowl in the Hells Canyon reach of the Snake River is sparse, particularly for the unimpounded reach below Hells Canyon Dam. Therefore, the Applicant conducted an annual helicopter survey of wintering waterfowl in Hells Canyon during the winters of 1994 through 1999 to coincide with the Annual Midwinter Waterfowl Count (Technical Report E.3.2-12). Surveys began at Weiser, Idaho, and extended to the confluence of the Snake and Salmon rivers.

Winter waterfowl counts from 1994 through 1999 averaged 7,905 (± 3,295 standard deviation [STD]) birds over the entire survey area (RM 351.2–RM 188.2 and 10 river miles along the

Powder River). The highest numbers of waterfowl were reported in the unimpounded reach above Farewell Bend (169.3 ± 68.5 STD birds/river mile) and in the Powder River arm of Brownlee Reservoir (120.3 ± 68.5 STD birds/river mile). Numbers rapidly declined through Brownlee Reservoir (61.6 ± 35.9 STD birds/river mile), Oxbow Reservoir (53.2 ± 28.5 STD birds/river mile), and Hells Canyon Reservoir (17.2 ± 11.3 STD birds/river mile). These trends were consistent among years (Figure 9 in Technical Report E.3.2-12).

Seventeen species of waterfowl were observed, species that were classified into three groups: dabbling ducks (55.2%), diving ducks (44.6%), and surface dippers (0.2%). Common species were the mallard (46.7% of all waterfowl counted), followed by the goldeneye (both common [*Bucephala clangula*] and Barrow's goldeneye [*B. islandica*] combined; 20.5%), common merganser (19.4%), Canada goose (6.1%), and bufflehead (*B. albeola*) (1.4%). Other species were observed in small numbers (< 1% of all observations). Species richness was highest in the unimpounded reach above Farewell Bend (13 species), decreased in Brownlee Reservoir and the Powder River arm (10 species each), increased in Oxbow Reservoir (12 species), and continued to decline through Hells Canyon Reservoir and the unimpounded reach below Hells Canyon Dam (8 and 6 species, respectively) (Technical Report E.3.2-12). Proportions of dabbling ducks declined from the unimpounded reach above Farewell Bend through Hells Canyon Reservoir. Proportions of diving ducks had an opposite trend (Figure 8 in Technical Report E.3.2-12).

Waterfowl numbers in the Hells Canyon Study Area make up only a small fraction of the total numbers of waterfowl counted in the Riverine and Pacific Coast Region (< 0.5%) and along the Idaho–Oregon border (1.5%). Therefore, Hells Canyon is of relatively low importance in terms of numbers of wintering waterfowl to both the Pacific Flyway and the Northwest Riverine and Pacific Coast Region.

E.3.2.1.3.5. Nesting Colonial Waterbirds

Colonial waterbirds feed predominantly in aquatic systems and often nest close together in rookeries (Speich 1986). Surveys of colonial waterbirds are important to state and federal agencies because these species are at the top of the food chain and therefore sensitive to aquatic ecosystem health. Numbers and reproduction of colonial nesting waterbirds can serve as indicators of the presence of contaminants in the environment (Trost 1985, Speich 1986).

The Snake River and its impoundments support a variety of nesting colonial waterbirds. More than 100 islands, most within the Deer Flat National Wildlife Refuge, occur in the Snake River between Swan Falls Dam and Brownlee Reservoir. The double-crested cormorant (*Phalocrocorax auritus*), great blue heron (*Ardea herodias*), black-crowned night-heron (*Nycticorax nycticorax*), and California gull (*Larus californicus*) nest on islands in the Snake River (Trost and Gerstell 1994).

The lack of information on these birds in Hells Canyon prompted the Applicant to conduct surveys of nesting colonial waterbirds (Technical Report E.3.2-13). Survey objectives were to 1) locate existing colonies and 2) estimate the maximum number of adults and occupied nests. Forested wetlands that could support colonial waterbirds are exclusive to the Powder River arm of Brownlee Reservoir and the unimpounded portion of the Snake River above Brownlee Reservoir. Rookeries are generally conspicuous and were readily detected from the ground, boat, and helicopter.

Between 1996 and 1998, three nesting species were documented at two colonial waterbird colonies and nesting rookeries (Figures 3 and 4 in Technical Report E.3.2-13): the great blue heron, black-crowned night-heron, and double-crested cormorant (Table 1 in Technical Report E.3.2-13). At one rookery (the Powder River), only great blue herons nested. A maximum of 16 occupied great blue heron nests was documented here in 1998. At the other rookery (Peep Island), all three species were observed. In 1998, 43 occupied double-crested cormorant nests were recorded at Peep Island, while the black-crowned night-heron and great blue heron occupied a maximum of 5 and 4 nests, respectively (Table 2 in Technical Report E.3.2-13).

E.3.2.1.3.6. Nesting Diurnal Raptors

Throughout southern Idaho, many areas along the Snake River support a dense and diverse community of nesting raptors (Howard et al. 1976, Thurow et al. 1980, BLM 1996). In 1974 and 1975, Asherin and Claar (1976) conducted the only comprehensive surveys for nesting raptors in Hells Canyon. Other smaller surveys were conducted for threatened and endangered species such as the bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*) (Levine and Erickson 1990). Brownlee and Oxbow reservoirs were identified as key raptor areas (Olendorff et al. 1989, BLM 1992), and the area around Hells Canyon Dam supported several hack sites for peregrine falcon reintroduction (Bechard and Levine 1988). Nonetheless, recent information on raptor populations in Hells Canyon is sparse.

To determine the importance of the HCC reservoirs to cliff-nesting raptors, the Applicant conducted two studies: a pilot study to evaluate survey techniques (Technical Report E.3.2-14) and an inventory of nesting raptor species (Technical Report E.3.2-15). Limited access prevented surveys below Hells Canyon Dam. Similarities between plants, animals, and topography above and below Hells Canyon Dam suggest that the raptor communities are also similar throughout Hells Canyon.

Survey Techniques—In spring and summer 1995, Dr. J. Marzluff (Boise State University, Department of Biology, under contract to the Applicant) surveyed cliff-nesting raptors along lower Hells Canyon Reservoir (RM 256–RM 247) and made recommendations—based on 300 hours of observation—for an optimal sampling protocol (Tables 2 and 3 in Technical Report E.3.2-14). Observation points at or near river level were used to accurately survey cliff-resting raptors in Hells Canyon. Observations over a period of four hours per day for three to four days at each site were considered optimal to document resident raptors. Placing observation sites at 1-km intervals maximized coverage of potential nesting habitat. Surveys conducted during the spring and summer documented all resident species and confirmed nest occupancy. Aerial surveys (by helicopter) were useful to clarify questionable residency and to document productivity.

Eleven raptor species were observed, but four resident species comprised most observations: the golden eagle, prairie falcon (*Falco mexicanus*), peregrine falcon, and American kestrel (*Falco sparverius*). Five species observed were primarily winter residents (the bald eagle) or spring migrants (the osprey [*Pandion haliaetus*], Cooper's hawk [*Accipiter cooperii*], and merlin [*Falco columbarius*]). The golden eagle was the most commonly observed species in spring and summer. Five pairs of golden eagles, five pairs of American kestrels, one pair of prairie falcons, and one pair of peregrine falcons occupied territories along 14 km of the Snake River. Two pairs of golden eagles each produced one nestling, the prairie falcons produced five nestlings, and the peregrine falcons did not appear to breed successfully. American kestrel nests were difficult to locate and were not monitored. Red-tailed hawks [*Buteo jamaicensis*], northern goshawks [*Accipiter* *gentilis*], and northern harriers [*Circus cyaneus*] probably breed in Hells Canyon, but did not appear to be residents in the area surveyed.

Raptor Surveys—In spring 1995 and 1996, the Applicant surveyed the cliff-nesting raptor community along all three Hells Canyon reservoirs (Technical Report E.3.2-15). A slope model predicted that 1.6% of the area adjacent to Brownlee and Oxbow reservoirs was characterized as cliff; 20% of this cliff area was surveyed (Figure 4 in Technical Report E.3.2-15). In contrast, 19.4% of Hells Canyon Reservoir was predicted to be cliff, and 60% of this cliff area was surveyed.

Five raptor species and the common raven (*Corvus corax*) occupied 31 nesting territories (Table 1 in Technical Report E.3.2-15). The golden eagle was the most abundant nesting raptor (11 territories), followed by the red-tailed hawk (5 territories), prairie falcon (5 territories), common raven (5 territories), American kestrel (4 territories), and peregrine falcon (1 territory). Incidentally observed raptors included five owl species, the bald eagle, and the Cooper's hawk. Owl species were the great horned owl, common barn owl (*Tyto alba*), western screech-owl (*Otus kennicottii*), long-eared owl (*Asio otus*), and burrowing owl (*Athene cunicularia*) (Table 4 in Technical Report E.3.2-15). Species composition reported here is similar to that in other published reports for the area (Table 6 in Technical Report E.3.2-15). However, Asherin and Claar (1976) and Levine and Erickson (1990) noted that the Swainson's hawk (*Buteo swainsoni*), turkey vulture (*Cathartes aura*), northern goshawk, northern harrier, and short-eared owl (*Asio flammeus*) also nested in the study area.

Hells Canyon Reservoir had the highest species richness (6 species) and concentration (0.54 territories/river mile) of cliff-nesting raptors (Table 2 in Technical Report E.3.2-15). Oxbow and Hells Canyon reservoir reaches had higher golden eagle densities than the Brownlee Reservoir reach (4.62 and 1.48 territories/100 square kilometers [km^2], respectively) did, while the Brownlee Reservoir reach had higher red-tailed hawk densities than the Oxbow and Hells Canyon reservoir reaches combined (3.25 and 1.02 territories/100 km^2, respectively) (Technical Report E.3.2-15). An estimated 13.6 nesting territories/100 km^2 was calculated for all species combined. This estimate is higher than other estimates from southern Idaho (Howard et al. 1976) but is substantially lower than densities reported in the Snake River Birds of Prey National Conservation Area (SRBPNCA) (139.3–217.8 nests/100 km^2) (Howard et al. 1976).

E.3.2.1.3.7. Small Mammals

Remoteness and ruggedness have discouraged researchers from studying and collecting small mammals in Hells Canyon. Consequently, few small mammal studies have been conducted (Davis 1939, Asherin and Claar 1976). Nonetheless, 17 species have been reported within Hells Canyon, and another 6 species are likely to occur (Davis 1939, Hall 1981, Groves and Marks 1985, Marshall 1986, Csuti et al. 1997, Verts and Carraway 1998, Table 1 in Technical Report E.3.2-23). Some species (Table 1 in Technical Report E.3.2-23), such as the American pika (*Ochotona princeps*), are found only at high elevations in Hells Canyon.

In April 1997 and 1998, the Applicant trapped small mammals at nine sites in Hells Canyon (Figure 1 in Technical Report E.3.2-23). Trap lines were placed in all available cover types at each site. Trapping continued for three consecutive nights following the prebaiting period, for a total of 4,205 trap nights. Shrews were selectively trapped using pit-falls at Dukes Creek, Cottonwood Creek, and the mouth of the Powder River (Figure 1 in Technical Report E.3.2-23). Shrew trap sites were operated for 18 days between April 1 and May 8, 1997 (Table 4 in Technical Report E.3.2-23). Eight species of small mammals were captured (Table 5 in Technical Report E.3.2-23). Four species were relatively common: the deer mouse (*Peromyscus maniculatus*), montane vole (*Microtus montanus*), western harvest mouse (*Reithrodontomys megalotis*), and vagrant shrew (*Sorex vagrans*). The four remaining species, the Great Basin pocket mouse (*Perognathus parvus*), western jumping mouse (*Zapus princeps*), long-tailed vole (*Microtus longicaudus*), and bushy-tailed woodrat (*Neotoma cinerea*), were caught in small numbers. One additional species, the northern pocket gopher (*Thomomys talpoides*), was caught at one of the pit-fall sites. Other species that were observed or collected incidentally were the coast mole (*Scapanus orarius*), least chipmunk (*Tamias minimus*), yellow-pine chipmunk (*Tamias amoenus*), white-tailed antelope ground squirrel (*Ammospermophilus leucurus*), Townsend's ground squirrel (*Spermophilus townsendii*), Belding's ground squirrel (*S. beldingi*), golden-mantled ground squirrel (*S. lateralis*), Columbian ground squirrel (*S. columbianus*), and southern Idaho ground squirrel (*S. brunneus endemicus*).

Small mammal abundance ranged between 14.2 and 41.6 small mammals captured per 100 trap nights and averaged 21.8 ± 10.5 small mammals per 100 trap nights (Table 6 in Technical Report E.3.2-23). Small mammal abundance did not differ among study reaches or cover types and is similar to abundance reported for southern Idaho (Tables 8 and 9 in Technical Report E.3.2-23). Overall, small mammal abundance tended to increase from Brownlee Reservoir (18.8 ± 9.8 mammals/100 trap nights) downriver below Hells Canyon Dam (31.3 ± 7.2 mammals/100 trap nights) (Table 6 in Technical Report E.3.2-23). Species diversity differed considerably among cover types. The highest species diversity was found for the *Mountain Shrubland* cover type (*H*' = 1.03); the lowest, for *Shore & Bottomland Wetland* (*H*' ≤ 0.01) (Table 7 in Technical Report E.3.2-23). Small mammal species were not associated with specific cover types (Figure 3 in Technical Report E.3.2-23). Small mammal communities in upland and riparian habitats of the Hells Canyon Study Area were similar in both relative abundance and composition.

E.3.2.1.3.8. Medium-Sized Mammals

A diverse group of animals—including lagomorphs, rodents, and carnivores with varied functional roles in ecosystems—are classified as medium-sized mammals. Twenty-seven medium-sized mammal species may occur in the Hells Canyon Study Area (Table 1 in Technical Report E.3.2-25). Information was collected on medium-sized mammals of the orders Lagomorpha and Rodentia. See section E.3.2.1.3.10. for more information on the furbearer and carnivore community. From 1995 to 1999, the Applicant surveyed medium-sized mammal resources in Hells Canyon (Technical Reports E.3.2-24 and E.3.2-25).

Five species were observed during surveys (Table 2 in Technical Report E.3.2-24 and Table 4 in Technical Report E.3.2-25). The red squirrel (*Tamiasciurus hudsonicus*) was the most common species, followed by the coyote, mountain cottontail (*Sylvilagus nuttallii*), American badger (*Taxidea taxus*), and American beaver (*Castor canadensis*). Thirteen other medium-sized mammal species were observed incidentally to other studies conducted by the Applicant (Table 1 in Technical Report E.3.2-25). The density of medium-sized mammals, species that serve as prey for mammalian carnivores and raptors, was very low for upland and riparian habitats, except for the red squirrel in riparian habitats. This squirrel was reported in moderately high densities in riparian and wooded upland cover types. Even though the mountain cottontail was observed throughout the study area, densities were low (< 0.01/hectare [ha] in upland and riparian habitats) compared with the species' density in other areas along the Snake River (C.J. Strike: 0.02–0.34/ha, Sunderman et al. 1998; Hagerman Valley: 0.05–0.18/ha, Holthuijzen 1995b).

E.3.2.1.3.9. Bats

Bat communities are integral to the ecology of the HCNRA, the Snake River canyon, and the Snake River corridor (Perkins and Peterson 1996). Hells Canyon may be among the most pristine, year-round bat habitats available in the Columbia River basin. Abundant and secure habitat with lithic complexity, water, and macroinvertebrates that support a bat community are near historic or prehistoric levels. Bat communities are intrinsic to riverine, riparian, forest, and regional ecosystems (Marcot 1996). In Hells Canyon, the community is composed of 13 to 15 species (Table 1 in Technical Report E.3.2-27). Bats are relatively long-lived, slow-to-reproduce, highly mobile animals adapted to relatively stable environments (Findley 1993).

Bat ecology even in remote areas of Hells Canyon has been influenced by the presence and activities of humans (Reid and Chatters 1997). In 1981, bats were assessed relative to forest spray application of DDT[2] for Douglas-fir tussock moth (*Orgyia pseudotsugata*) (Maser and Cross 1981, Perkins 1984a). Since that time, few bat surveys have been conducted in Hells Canyon (Appendix 2 to Technical Report E.3.2-27). Bats use mines and caves as hibernacula, and many mines exist throughout the Hells Canyon Study Area. Mineshafts and caves are of particular importance to the Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*) and Yuma myotis (*Myotis yumanensis*).

The Applicant participated with the USFS in surveying bats along the Snake River between the Washington state line and Hells Canyon Dam (RM 174–RM 264) (Technical Report E.3.2-27). Between 1995 and 1997, USFS personnel from the Wallowa Valley Ranger District at the HCNRA spent approximately 200 hours surveying for bats. Ten species of bats were recorded at 46 sites along 111.6 mi of Snake River corridor (Table 3 in Technical Report E.3.2-27). Three additional species, the spotted bat (*Euderma maculatum*), hoary bat (*Lasiurus cinereus*), and

2. DDT is an organochlorine insecticide that has been banned from use in the United States because of its environmental persistence and tendency to accumulate in animal body fats.

fringed myotis (*Myotis thysanodes*), were recorded in the uplands of Hells Canyon. Two more species may occur based on nearby distribution and on dispersal characteristics: the pallid bat (*Antrozous pallidus*) and red bat (*Lasiurus borealis*); the red bat may be a rare species or an accidental vagrant. The Townsend's western big-eared bat, spotted bat, western pipistrelle (*Pipistrellus hesperus*), and Yuma myotis appear to be limited to canyons of the Snake, Imnaha, and Grande Ronde rivers. Yuma myotis colonies were found in most buildings and mine shafts. Surveys did not specifically target project facilities or structures, but since bats were frequently found in manmade structures (Appendix 1 to Technical Report E.3.2-24), they may be present at project facilities or structures.

E.3.2.1.3.10. Carnivores and Furbearers

Mammalian carnivores and furbearers (orders Carnivora and Rodentia) are important components of biological diversity in terrestrial ecosystems. Species within these diverse groups (including specialists such as the northern river otter [*Lutra canadensis*] and generalists like the coyote) occupy almost every habitat in North America (Spowart and Samson 1986).

Nineteen species of the order Carnivora and two species of the order Rodentia may be present in the study area (Csuti et al. 1997, Groves et al. 1997, Table 1 in Technical Report E.3.2-28). In Idaho and Oregon, the American marten (*Martes americana*), fisher (*Martes pennanti*), mink (*Mustela vison*), northern river otter, American beaver, muskrat (*Ondatra zibethicus*), bobcat (*Felis rufus*), red fox (*Vulpes vulpes*), and common raccoon (*Procyon lotor*) are considered furbearers. In both states, these species have regulated seasons, with one exception: the fisher may not be harvested in Oregon. Idaho also considers the American badger a furbearer, whereas Oregon considers it an unprotected species. The western spotted skunk (*Spilogale gracilis*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), ermine (*Mustela erminea*), and coyote are classified as unprotected in Oregon or predatory in Idaho and may be harvested throughout the year. In both Idaho and Oregon, the black bear (*Ursus americanus*) and mountain lion (or cougar, *Felis concolor*) are classified as big game animals (Harris 1991; Beecham and Zager 1992; ODFW 1993a,b). The wolverine (*Gulo gulo*) and kit fox (*Vulpes macrotis*) are protected species in both states and may not be harvested. The Canada lynx (*Lynx canadensis*) and gray wolf (*Canis lupus*) are currently classified as threatened or endangered and are also protected from harvest (see section E.3.2.1.3.13.1.).

Few formal, broad-scale surveys have been conducted to evaluate the distribution of carnivores and furbearers in Hells Canyon. Currently, the only monitoring of carnivores and furbearers in Hells Canyon is through harvest (IDFG 1994, 1995; ODFW 1995). Surveying these species is difficult, and methods typically employed attempt to index only population attributes—for example, presence, relative abundance, and population change over time (Spowart and Samson 1986). As a result, the information necessary for baseline descriptions and informed management decisions concerning these species is largely absent. To provide additional baseline information, the Applicant surveyed the carnivore and furbearer community in Hells Canyon (Technical Report E.3.2-28).

The Applicant surveyed carnivores and furbearers along Brownlee, Oxbow, and Hells Canyon reservoirs (93 river miles) at 390 scent stations baited with fatty acid scent tablets (Table 2 and Figure 3 in Technical Report E.3.2-28). Species visiting the scent stations were identified by tracks left in prepared soil at the station. From 769 (71%) operational scent stations, only 92 visits from 8 species were recorded (Tables 4 and 5 in Technical Report E.3.2-28). These numbers resulted in 0.12 visits per scent-station day. The coyote (35 detections) was the most common visitor; the red fox, the least (3 detections). Other animals detected were the black bear (6 detections), common raccoon (6 detections), bobcat (9 detections), weasel (13 detections), skunk (16 detections), and unknown mustelid (4 detections) (Table 5 in Technical Report E.3.2-28). The coyote, bobcat, and raccoon were observed throughout the study area.

Additional species were reported as incidental observations: the mountain lion, northern river otter, American badger, American beaver, and mink. Unconfirmed observations of the wolverine and gray wolf were recorded for the Idaho shoreline of Hells Canyon Reservoir (Table 6 in Technical Report E.3.2-28).

E.3.2.1.3.11. Big Game

Hells Canyon contains some of the most regionally important big game winter habitat and supports populations of the mountain goat (*Oreamnos americanus*), Rocky Mountain bighorn sheep, black bear, mountain lion, mule deer, and elk (Technical Reports E.3.2-31 and E.3.2-34). Pronghorn (*Antilocapra americana*) and white-tailed deer (*Odocoileus virginianus*) also occur in Hells Canyon but as small and isolated populations. Idaho and Oregon state wildlife management agencies manage big game in Hells Canyon for consumptive and nonconsumptive recreational values (USFWS and Bureau of Census 1998). Therefore, the TRWG recommended that winter range for big game (emphasizing mule deer) be delineated and evaluated (Table 1 in Technical Report E.3.2-31).

The Applicant conducted six studies describing big game resources in Hells Canyon and evaluating impacts from the HCC (see Technical Reports E.3.2-30, E.3.2-31, E.3.2-32, E.3.2-33, E.3.2-34, and E.3.2-35). The Applicant contracted Dr. J. Ratti (University of Idaho) to review literature associated with big game biology, ecology, and management and to review the status of big game species in Hells Canyon (Technical Report E.3.2-34). The Rocky Mountain Elk Foundation contracted with the Applicant to work with state and federal wildlife resource specialists while evaluating big game winter range within 48 km of the HCC (Technical Report E.3.2-31). The Applicant contracted Dr. R. Ryle to assess potential impacts to big game from ice formation on Brownlee Reservoir (Technical Report E.3.2-35). Applicant biologists directly documented the relative distribution and abundances of mountain goat (Technical Report E.3.2-33) and mule deer (Technical Report E.3.2-30) populations and investigated the winter ecology of mule deer adjacent to the HCC reservoirs (Technical Report E.3.2-32). Information collected during big game studies is compiled as species accounts for Hells Canyon.

E.3.2.1.3.11.1. Mountain Goat

Mountain goats are native to Hells Canyon (Grant 1905, Rideout 1978). Randolph and Dahlstrom (1977), Reagan and Womack (1981), and Draper and Reid (1986) reported that mountain goats were among food items used by prehistoric people living in Hells Canyon. Apparently absent from this area by 1936 (Bailey 1936), mountain goats were reintroduced to the Seven Devils Mountains in 1962 and 1964 (Oldenburg 1994). According to recent surveys, this population appears to be increasing, and it has been used as a source for translocations into other areas (Hayden 1990, Oldenburg 1994, Toweill 2001). The population's movements appear to be confined mostly to the Seven Devils Mountains (IDFG 1981, Kuck 1986). However, mountain goats are observed near the Hells Canyon Reservoir and Snake River during winter and spring (M. Schlegel, Idaho Department of Fish and Game, 1995, personal communication). An experimental population was translocated to the Oregon portion of Hells Canyon in 2000:

16 mountain goats were released into Sluice Creek (P. Mathews, ODFW, 2000, personal communication).

The lack of current information on the mountain goat in Hells Canyon prompted the Applicant to delineate occupied and potential habitat (Technical Report E.3.2-31), review population status (Technical Report E.3.2-34), and census the population (Technical Report E.3.2-33) in Hells Canyon. Habitats are usually described as subalpine or alpine zones and are characteristically rocky cliffs, ledges, and steep talus slopes. Mountain goats commonly use high elevations in winter, but deep winter snows often force animals to lower elevations and use of canyons and forests (Anderson 1940, Arnett and Irwin 1989). A total of 53,296 ha of currently occupied mountain goat habitat was delineated in Hells Canyon. Another 193,873 ha were delineated as potential mountain goat winter habitat (Table 8 in Technical Report E.3.2-31). Nearly 100% of currently occupied and potential mountain goat habitat is located on USFS-managed lands. Warnick and Clapp (1978) noted concern for big game animals in Hells Canyon that use riparian zones subject to water fluctuations. However, no literature that noted riparian areas as important goat habitat was located. Also, some concern has been expressed about reservoirs restricting big game movement. However, no information is available regarding daily, seasonal, or traditional (or historical) movement patterns of goats in Hells Canyon. Goats moving between Idaho Department of Fish and Game (IDFG) Big Game Management Units 18 and 22 within Hells Canyon has been documented (IDFG 1996). Based on the existing literature, it appears that existing hydroelectric operations and associated operation and maintenance activities in Hells Canyon have minimal or no impact on current mountain goat populations (Technical Reports E.3.2-31 and E.3.2-34).

Vogel et al. (1996) summarized Idaho mountain goat census data for Hells Canyon, and the Applicant and the IDFG cooperated in a helicopter census of mountain goats during April 1996, when goats were near the HCC. The survey extended laterally from the Snake River (1,200–1,700 feet [ft] elevation) to approximately 7,000 ft in the Seven Devils Mountains and followed IDFG methodologies (Unsworth et al. 1994). Population estimates were 71 in 1981, 82 in 1987, and 137 in 1993 (IDFG 1996). The Applicant counted 117 goats with a kid to adult (kid:adult) ratio of 11.4% (Tables 1 and 2 in and Appendix 1 to Technical Report E.3.2-33). Sixty-eight goats were observed in Unit 18 and 49 goats in Unit 22. Nine goats were observed upstream of

Hells Canyon Dam and, on average, were 1,760 ft above the reservoir. In addition, the kid:adult ratio above the dam was 29%. The remaining goats were observed downstream of Hells Canyon Dam, with a kid:adult ratio of 10.2%. The goats below the dam averaged 1,410 ft above the Snake River. The average elevation of goats observed was 4,474 ft mean sea level (msl), while the snow line was approximately 6,000 ft (Figures 4 and 5 in Technical Report E.3.2-33).

Population trends were difficult to assess because previous surveys were not conducted within the same years in Units 18 and 22 (except 1993; surveys in 1993, however, were separated by 2 months). Regardless of these limitations, goat numbers declined from 137 goats in 1993 to 117 in 1996 (Figure 6 in Technical Report E.3.2-33). In addition, kid:adult ratios declined, a change that may also indicate a declining population. Approximately 3 to 15% of the population is consistently observed above Hells Canyon Dam, and this percentage increased in 1996. However, no trends in distributional shifts were detected. Mountain goats have low rates of increase (Brandborg 1955, Fitzgerald et al. 1994), and the Hells Canyon population probably does not exceed carrying capacity.

E.3.2.1.3.11.2. Rocky Mountain Bighorn Sheep

Many archaeological and historical reports verify that bighorn sheep prehistorically occupied and were historically abundant in Hells Canyon (Buechner 1960, Gustafson 1990, Meatte 1990, Reid et al. 1991, Chatters et al. 1995, Hackenberger et al. 1995). However, bighorn populations were extinct in Hells Canyon by 1945 (Smith 1954, Johnson 1980, Parker 1985, ODFW 1992). Between 1971 and 1995, 33 sheep transplants to Hells Canyon and the Wallowa Mountains were completed (20 in Oregon, 5 in Idaho, and 8 in Washington). A total of 451 animals was transplanted: 53% were ewes; 22%, rams; and 25%, lambs (Errata Table 2 in HCBSRC 1997). Sheep were transplanted from source populations in Canada, Montana, Wyoming, Idaho, and Colorado (HCBSRC 1997).

Distribution of current bighorn sheep populations in Hells Canyon has been described in detail in a report by the Hells Canyon Bighorn Sheep Restoration Committee (HCBSRC 1997).
Hells Canyon has 14 bighorn sheep herds: 10 from reintroductions and 4 from dispersal (from the reintroduced herds). Three of the current Hells Canyon herds are in Idaho, 7 are in Oregon, 2 are in Washington, and 2 have home ranges that extend into both Oregon and Washington. The

average herd size is 50 (range = 5–130), and the total Hells Canyon population is 697 (HCBSRC 1997). Population estimates are usually determined by counts from the ground, helicopter, and fixed-wing aircraft (ODFW no date). The HCBSRC (1997) estimated that average population growth for all 14 of the Hells Canyon sheep herds was 7% ([production + immigration] – mortality). The average lamb:ewe ratio between 1971 and 1996 was 41:100 (range = 14–76:100) (Table 5 in HCBSRC 1997). The average ram:ewe ratio was estimated at 52:100 (range = 32–76:100). Additional translocations of sheep would probably increase potential for population expansions beyond current estimates. Movements among Hells Canyon sheep herds have been documented, especially during rut (HCBSRC 1997).

Bighorn sheep habitat has been described as “semiopen, precipitous terrain with rocky slopes, ridges, and cliffs or rugged canyons” (Todd 1972, cited by Lawson and Johnson 1982:1040). Smith (1954) described bighorn sheep habitat on the Middle Fork Salmon and main Salmon river drainages of Idaho as areas with little human disturbance and with steep, rocky topography; open bunchgrass slopes; and sedges, grasses, rushes, and forbs. Smith (1954) noted that bighorn sheep seek cliffs and scattered stands of timber during periods of inclement weather. Few studies provided information on habitat use by bighorn sheep in Hells Canyon. Bighorn sheep habitat occupies an estimated 104,543 ha in Hells Canyon (Technical Report E.3.2-31). A total of 389,603 ha was modeled as potential bighorn habitat. Suitable bighorn sheep habitats were described as having steep slopes (31–85°), high visibility, proximity to free water (< 3.2 km), and winter range relatively free of snow. Slope was the primary habitat component that limited bighorn sheep distribution. Approximately 57 to 68% of bighorn sheep habitat in Hells Canyon is managed by the USFS (HCBSRC 1997, Technical Report E.3.2-31).

Geist (1971), Blunt et al. (1977), Eccles and Shackelton (1979), Lawson and Johnson (1982), and Thompson and Turner (1982) described the ecology of bighorn sheep. Predation on bighorn sheep is mostly limited to lambs and can limit populations (Hornocker 1969). Hass (1989) estimated that lamb survival was less than 25% and that coyotes were the primary predator (most losses were during the first three days after birth). Hunting has been an important mortality source for bighorn sheep, and overharvest has been reported as the cause of population declines (for example, Buechner 1960, Hansen 1967, Kurten 1980). Festa-Bianchet (1989) estimated that hunting accounted for 68% of the mortality on males about five years old. However, if hunting is properly regulated and populations are monitored annually, hunted populations can be maintained at a relatively high level (Jorgenson et al. 1993). Hunting for bighorn sheep in the Hells Canyon region began in 1976, and hunters harvested 184 sheep from 1976 to 1996 (Table 4 in HCBSRC 1997:26). The most heavily hunted herds have been the Imnaha and Lostine herds in Oregon.

Two important habitat issues are invasion of exotic weeds and competition from livestock. The yellow star-thistle (*Centaurea solstitialis*) has been rapidly invading grassland/canyon habitats in Hells Canyon, and the impact on bighorn sheep (and other wildlife) is unknown. Competition for forage between domestic livestock and bighorn sheep has been reported (Smith 1954, Buechner 1960, Stevens 1966, Morgan 1970, Trefethen 1975, Jones 1980, and others), and this issue remains a concern for some Hells Canyon habitats (for a description of specific grazing allotments, see HCBSRC 1997:6).

Current hydroelectric operations and fluctuating river flows mostly affect riparian habitats and should, therefore, have minimal impact on bighorns (Technical Report E.3.2-34). However, there is some concern that reservoirs may impede migration and seasonal movements. Sheep have been observed crossing bridges and HCC dams and swimming the Snake River and HCC reservoirs (F. Cassirer, IDFG, Lewiston, personal communication; V. Coggins, ODFW, Enterprise, personal communication). In some cases, restrictions to movements may help isolate diseased herds. On the other hand, movement restrictions may limit dispersal and lead to overpopulation on range with limited forage, a situation that could make animals more susceptible to disease.

Disease has been a major factor in the decline of many wild sheep herds in North America (for example, Smith 1954, Buechner 1960, Morgan 1970, Trefethen 1975). Lawson and Johnson (1982:1046–1048) present a good review of sheep diseases. Disease from contact with domestic sheep is the primary ecological concern for bighorn sheep populations in Hells Canyon (USFS 1994, HCBSRC 1997).

Hells Canyon populations have not been an exception to the disease problems in North America. Seven disease “die-offs” have been documented in the Hells Canyon region: five linked to contact with domestic sheep, and one to contact with a feral goat. Most mortality in these cases was from bacterial pneumonia diseases (HCBSRC 1997:3). Because livestock compete with wild sheep for available forage and are a source of disease, ideal bighorn sheep range would be free of contact with domestic livestock (USFS 1994).

E.3.2.1.3.11.3. Black Bear

Black bear are among faunal remains identified at a number of archaeological sites in Hells Canyon (Spinden 1964, Pavesic 1971, Randolph and Dahlstrom 1977, Meatte 1990, Reid et al. 1991, Hackenberger et al. 1995). Idaho black bears are most commonly found in mountainous conifer forests (Larrison and Johnson 1981, Beecham and Rohlman 1994) and are year-round residents of Hells Canyon (Wilson 1975, 1993). Although black bears have a specific home range (Hamilton 1978), they often move large distances (Rogers 1977). Movement patterns vary in relationship to animal sex and age, season, bear density, and habitat quality (Pelton 1982). In Idaho, Amstrup and Beecham (1976:345) estimated average home range for adult males at 112 km^2 and 49 km^2 for females. Mean daily movements (linear distance) were 3.0 and 2.1 km for males and females, respectively.

Black bears may be observed in most habitats within Hells Canyon, especially in regions with timber (John Beecham, IDFG, Boise, personal communication). Bear habitat use is directly related to food availability (Amstrup and Beecham 1976, Reynolds 1977). During early summer, bears used lower to middle elevations and moved to higher elevations as snow melted and food items became more abundant. Bears were frequently associated with grass and forb use at lower elevations in May and June. During midsummer, they frequented middle-elevation regions abundant with huckleberries (*Vaccinium globulare*). In August, bears moved to higher elevations to feed on wild cherries (*Prunus* species) and mountain ash (*Sorbus scopulina*) fruit. Insects are dominant animal food in the black bear diet, and larger animals are consumed rarely (Pelton 1982, Beecham and Rohlman 1994). Unsworth et al. (Table 1 in Unsworth et al. 1989:670) concluded that timber, open timber, shrubfields, and riparian areas were all important habitats for bears.

Beecham and Rohlman (1994) classified black bears as a long-lived species that matures late and has low reproductive rates. Idaho may support 20,000 to 25,000 black bears within an estimated 30,000 square miles (mi^2) of bear habitat (Beecham and Rohlman 1994). Oregon populations were estimated at 25,000 bears throughout their historical range in the state (ODFW 1993b).

Specific density data are not available for the Hells Canyon Study Area; however, Beecham (1983) reported 1 bear per 1.3 km^2 for the study area southeast of Council, Idaho, and these data are probably comparable to timbered portions of Hells Canyon with quality bear habitat (John Beecham, IDFG, Boise, personal communication). Most litters are 2 cubs, and reported mean litter size ranges from 1.7 to 2.6 (Eiler et al. 1989, Beecham and Rohlman 1994). Overall cub mortality was reported at 41% by 1 year and 61% by 2.5 years (Elowe and Dodge 1989).

Black bear mortality from predators has been limited in most cases to attacks from other black bears. Pelton (Table 24.2 in Pelton 1982:511) lists a number of diseases that have been reported for black bears, but noted that none is considered to be a significant regulatory factor on populations. Hunting is a major cause of death in most black bear populations (Barber and Lidzey 1986, Hellgren and Vaughan 1989, Gill and Beck 1990). Black bear hunting in Idaho is an important form of recreation, and bear densities may reach 2 per mi^2 in high-quality habitats (Beecham 1986). Harvest rates are influenced by vegetation density (visibility), road access, difficulty of terrain, and number of hunters.

The IDFG monitors bear populations in the Hells Canyon region for indicators of overharvest or population declines (IDFG 1993). More restrictive harvest regulations were enacted in 1986, and further seasonal restrictions were incorporated into the 1992–2000 black bear management plan (IDFG 1993). Black bear may be harvested in game management units adjacent to Hells Canyon in both spring and fall hunting seasons on the Idaho and Oregon sides of the canyon (IDFG 1997, ODFW 1997).

The primary impact on habitat from hydroelectric operations that might affect black bear populations in Hells Canyon is degradation to riparian habitats (Warnick and Clapp 1978). Quality bear habitats are limited in Hells Canyon, and important habitats include timber (for bedding) and riparian (for feeding and travel corridors) areas (Unsworth et al. 1989). Riparian habitats are impacted primarily by fluctuating water levels, wind erosion, and erosion from boat wakes; each of these factors may cause habitat loss and inhibit reestablishment of riparian vegetation (McKern 1976, U.S. Department of Energy 1984).

E.3.2.1.3.11.4. Mountain Lion

The status of mountain lion in Hells Canyon is unknown (Technical Report E.3.2-34). Because male mountain lions defend large, nonoverlapping home ranges, the availability of minimum-sized territories within suitable habitat determines population densities (Seidensticker et al. 1973). Currier (1983) noted that although numerous estimates of lion abundance have been attempted, accurate estimation is difficult. Ross and Jalkotzy (Table 2 in Ross and Jalkotzy 1992:420) estimated mountain lion density in Alberta to vary between 2.7 and 4.7 lions per 100 km^2. Currier (1976) estimated lion abundance on a Colorado study area to be 1 lion per 30 to 60 km^2, and densities were reported to vary directly with prey density and stalking cover. In Utah, Lindzey et al. (1994) estimated lion density to be 0.37 per 100 km^2, and Logan et al. (1986) estimated density at 1 lion per 22 to 29 km^2 in Wyoming. No estimates of mountain lion numbers are available for Hells Canyon (Technical Report E.3.2-32).

The mountain lion is essentially a solitary animal (Seidensticker et al. 1973) that uses numerous habitats within large home-range areas. Most populations today are restricted to mountainous and desert environments (Whitaker 1996). Seidensticker et al. (1973:715) noted that lion movements in Idaho often seem “random” within habitats that include dense Douglas-fir timber, open ponderosa pine, sagebrush-grass openings, and talus slopes. Lions also use riparian habitats (Logan and Irwin 1985), which are important for prey species such as deer (Carson and Peek 1987, Loft et al. 1991). Although a wide range of habitat use was documented, escape and stalking cover were key components (over 95% of lion locations were in timber or rocky, broken areas).

Deer and elk numbers and topography providing stalking opportunities heavily influenced the amount of time a lion spent within specific portions of its home range (Seidensticker et al. 1973:58). Annual home range size for male mountain lions ranged from 194 to 575 km^2; home range for females is smaller and ranged between 104 and 203 km^2 (see summary data from four studies in three states: Table 38.2 in Dixon 1982:715).

For northeastern Oregon, lion habitat was closely associated with deer and elk habitats, primarily in open mixed conifers (including pine/bunchgrass) and canyons (ODFW 1993a). The most common prey of the mountain lion is deer (Hall and Kelson 1959, Dixon 1982, Whitaker 1996);

however, some studies have also documented significant predation on elk (Hornocker 1970). Ackerman et al. (1984) reported that mule deer represented 81% of forage biomass consumed by lions in Utah (data from 239 mountain lion scats). Hornocker (1970) reported that 50% of deer and elk killed by mountain lions were in poor condition. However, O'Gara and Harris (1988) found that lions killed prime-age deer and that only 7% were in poor condition. Mountain lions also prey on bighorn sheep (Hornocker 1970, Krausman et al. 1989). Other lion prey include porcupine (*Erethizon dorsatum*), lagomorphs, rodents, and vegetation (for tabular reviews with seasonal and geographic comparisons, see Table 2 in Spalding and Lesowski 1971:379, Table 38.3 in Dixon 1982:717, and Table 3 in Leopold and Krausman 1986:293). Beier (1995) estimated that a mountain lion killed and consumed an average of 48 large mammals and 58 small mammals each year. The mountain lion is a major predator of deer wintering adjacent to the HCC reservoirs (Technical Report E.3.2-32).

Hunting, predation, and accidents account for most sources of lion mortality. Most accidental lion deaths are from collisions with automobiles while crossing major highways (Currier 1976, Dixon 1982). Gashwiler and Robinette (1957) reported that death can also occur from accidental collision with hard objects while rapidly charging and springing on prey. Macgregor (1976) reported cougars in California drowning in drainage canals (which are used as daytime refuge by lions that frequent urban areas to hunt domestic cats and dogs). Predators such as wolves, coyotes, and bears (especially grizzly bears [*Ursus arctos*]) may occasionally kill young, old, or sick lions. Hunting by humans has been a major source of mortality for most mountain lion populations (Currier 1976, Dixon 1982). Ashman (1975) estimated that hunting reduced one Nevada population to 50% below normal carrying capacity. However, other populations have been reported to sustain regulated hunting without serious reductions to populations (Currier et al. 1977). Lion hunting occurs in both Idaho and Oregon portions of Hells Canyon (ODFW 1996, IDFG 1997). For eastern Oregon, annual lion harvest averaged 87 for the past 3 years, and 73 for the past 10 years. In big game management units associated with the Idaho and Oregon portions of Hells Canyon, annual harvest averaged 27 and 87 lions during 1995–1998 and 19 and 73 during 1988–1998, respectively. Aside from human disturbance and hunting, the combined distribution of big game and stalking cover probably limits the distribution of mountain lions (Currier 1976).

E.3.2.1.3.11.5. Mule Deer

Mule deer were an important resource to native people of Hells Canyon and are commonly reported among anthropological studies of the Hells Canyon region (Randolph 1976, Draper and Reid 1986, Pavesic et al. 1986, Reid et al. 1991). Reid et al. (1991:318) noted "the artifact and faunal assemblages are heavily oriented toward hunting with a strong emphasis on deer." Currently, big game hunting is popular in the West (USFWS 1964), and the relationship between mule deer population status and hunting is a primary public and political issue in Hells Canyon (Technical Report E.3.2-34).

Mule deer populations and harvest in western states have fluctuated during past decades. Flather and Hoekstra (1988) noted population increases in the 1980s, but decline has been the general mule deer trend during the 1990s (mule deer workshop, 1997, Rio Rico, Arizona, unpublished data; G. C. White, Colorado State University, Fort Collins, personal communication). Connolly (1981:237) noted that no single factor (including hunting) has been identified that explains population declines. Nonetheless, the mule deer is one of the most popular of all hunted species in the western United States (Mackie et al. 1982). Mule deer are currently found throughout Hells Canyon (Technical Reports E.3.2-30 and E.3.2-34), and they interact closely with the HCC during winter (Technical Report E.3.2-32).

Within Hells Canyon, reservoirs of the HCC bisect one of the more important winter ranges (the HCC winter range) for mule deer in eastern Oregon and western Idaho (Technical Report E.3.2-31). Winter habitat is an important component of the mule deer's annual habitat needs (Wallmo 1981). Upland areas adjacent to Brownlee and Oxbow reservoirs provide the majority of habitat used by mule deer on this winter range (Technical Report E.3.2-30). Because the mule deer is a native game species that is highly valued by the public, natural resource agencies strive to optimize mule deer habitats and populations (ODFW 1990, Scott 1991). However, no previous studies investigated the ecology of mule deer on this winter range or their interactions with the HCC. Elsewhere, the USFWS (1964), the Pacific Northwest Power Company and Washington Public Power Supply Systems (1971), Warnick and Clapp (1978), Bissell and Yde (1985), Fraley (1986), Yde and Olsen (1986), and O'Neil and Witmer (1991) have reported potential impacts to mule deer from hydroelectric development. Potential impacts included both direct loss of habitat, indirect changes in habitat availability or quality, and interference with migration routes.

While considering potential environmental impacts of hydroelectric developments, natural resource agencies that manage wildlife populations and habitat in Idaho and Oregon have expressed concerns to the Federal Energy Regulatory Commission (FERC) that the Applicant's operation and maintenance of the HCC may 1) inhibit mule deer movements, 2) influence habitat availability and quality, and 3) increase mortality for mule deer wintering in Hells Canyon. These concerns are summarized in Technical Report E.3.2-31. The Applicant conducted a series of studies describing the mule deer population that occupies the HCC winter range and evaluating potential impacts to mule deer from the HCC. Specifically, the Applicant 1) evaluated mule deer status (Technical Report E.3.2-34), 2) estimated late-winter distribution and abundance (Technical Report E.3.2-30), 3) mapped winter range (Technical Report E.3.2-31), 4) investigated winter ecology (movements, habitat selection, and mortality) (Technical Report E.3.2-32), and 5) evaluated the potential of deer mortality from reservoir icing (Technical Report E.3.2-35). The following information is synthesized from the Applicant's studies in Hells Canyon and other published information about mule deer.

Population Status and Abundance—The IDFG and ODFW regularly survey wintering mule deer in Hells Canyon. In Idaho, Big Game Management Units 22 and 31 intersect the Hells Canyon Study Area. IDFG personnel counted mule deer in these units during late winter or early spring from 1962 to 1990 at an average interval of 2.4 years (Scott 1991). In 1991, the IDFG began annual surveys in response to mule deer declines in the winter of 1988–1989. In Oregon, the ODFW has conducted annual surveys since 1965 in the Snake River, Pine Creek, and Lookout Mountain Big Game Management Units (G. Kiester, ODFW, personal communication). Survey routes were traveled on horseback until 1995, when helicopters were used. Since 1998, the Applicant has also surveyed mule deer adjacent to the HCC reservoirs (Technical Report E.3.2-30).

The Applicant surveyed deer with a helicopter during fall 1999 and 2000 and during late winter/early spring 1998, 2000, and 2001 (referred to as fall and spring surveys, respectively). During spring surveys, 10,864 deer were counted in 1998, 13,979 in 2000, and 14,496 in 2001 (Table 1 in and Appendix 1 to Technical Report E.3.2-30). Deer densities also increased each year: 7.10 deer per km^2 were observed in 1998, 9.33 deer per km^2 in 2000, and 9.38 deer per km^2 in 2001 (Table 2 in Technical Report E.3.2-30). The maximum recorded elevation of deer groups was 1,433 m (4,700 ft). Densities of deer observed at 1,433 m or lower in elevation were 8.25 deer per km^2 for 1998, 10.84 deer per km^2 for 2000, and 10.89 deer per km^2 for 2001 (Table 2 in Technical Report E.3.2-30). In the area around Brownlee Reservoir, 95% of the mule deer population was found at or below 1,128 m (3,700 ft); in the area around Oxbow and Hells Canyon reservoirs, 95% of the population was found at or below 1,097 m (3,600 ft) (Figures 3–5 in Technical Report E.3.2-30).

Average water surface elevation of Brownlee Reservoir is 633 m (2,077 ft); Oxbow Reservoir, 550 m (1,805 ft); and Hells Canyon Reservoir, 515 m (1,819 ft). High concentrations of deer were consistently observed in Idaho from Oxbow Dam to just south of Brownlee Creek and along the Powder River in Oregon (Figures 9–14 in Technical Report E.3.2-30). New areas with deer concentrations appeared as the population increased.

During fall surveys, the Applicant counted 6,795 deer in 1999 and 5,375 in fall 2000 (Table 4 in Technical Report E.3.2-30). Deer numbers and densities were comparable between years. Fawn ratios (fawns/100 does) were higher in 2000, possibly indicating higher fawn production in the previous summer (Table 6 and Figures 17 and 18 in Technical Report E.3.2-30). As observed during spring surveys, fawn ratios were slightly higher in Idaho than in Oregon. However, buck ratios (bucks/100 does) were consistently higher in Oregon (Table 7 and Figures 19 and 20 in Technical Report E.3.2-30).

The mule deer population increase between 1998 and 2001 was largely attributed to mild winters during this period. Higher-than-average temperatures and lower-than-average precipitation and snowfall probably contributed to higher overwinter survival, particularly for fawns (White et al. 1987, Bishop 1998, Unsworth et al. 1999). The annual variation in population size is largely attributed to fawns because overwinter survival of fawns was more variable than annual survival of adults (Unsworth et al. 1999). Not only were deer less exposed to weather extremes between 1998 and 2001, deer were also able to access new growth of grasses throughout winter. Deer population decreases in the winters of 1983–1985, 1988–1989, and 1992–1993 corresponded with extreme low temperatures and high snowfall. These data emphasize that mule deer populations respond to extremes of winter weather (Technical Report E.3.2-30).

Movements—Movement corridors that connect seasonal ranges are important components of the winter ecology of mule deer (Wallmo and Reglin 1981, Thomas and Irby 1990). Reservoirs from hydroelectric projects are common features of big game winter ranges, and some researchers have hypothesized that these reservoirs affect deer migration chronology and routes (Robinette 1966, Loft et al. 1984, GANDA 1996, Boroski 1998).

The Applicant determined that most deer (74%) seasonally occupying the HCC winter range migrate to higher-elevation summer ranges primarily in and around the Wallowa Mountains of Oregon and the Cuddy and Sturgill mountains in Idaho (Figure 3-2 in Technical Report E.3.2-32). Migrating deer tend to exhibit strong winter and summer range fidelity and often travel relatively long distances during annual migrations. Only about one-quarter of deer are year-round inhabitants of the HCC winter range, and very few deer move to other winter ranges outside of Hells Canyon. Migratory deer are distributed throughout the winter range, but resident deer were concentrated in the southern portions of Hells Canyon (Table 3-3 in Technical Report E.3.2-32). Similar proportions of resident and migrant mule deer were reported by Gruell and Papaz (1963) in northeastern Nevada, by Brown (1992) in southeastern Idaho (26%), and by Matthews and Coggins (1997) in eastern Oregon (25%).

The majority (92%) of migrant deer in Hells Canyon move long distances (mean = 30.3 km, maximum = 69 km) between summer and winter range, and very few (8%) migrants moved less than 10 km (Table 3-5 in Technical Report E.3.2-32). Zalunardo (1965) reported a 29.8-km average migration distance for deer in south-central Oregon, and Matthews and Coggins (1997) reported 25.3 km for northeastern Oregon, a distance similar to that of deer from the HCC winter range. Thomas and Irby (1990) reported longer migration distances of 54 km for mule deer in southeastern Idaho. For northwestern Colorado, Garrott et al. (1987) reported an average of 27 km and 43 km for female migrants from two mule deer populations. Zalunardo (1965) documented that summer range surrounded winter range in south-central Oregon and that summer range was usually within 30 mi of winter range. In southeastern Idaho, Brown (1992) reported that average movements between summer and winter habitats was 19.7 km and that movement ranged from 7 to 28 km.

Migrant deer typically depart the HCC winter range in mid-April to early May (Table 3-2 in Technical Report E.3.2-32). Matthews and Coggins (1997) observed similar migration timing on the Minam winter range located northwest of Hells Canyon. Weather conditions are often associated with the timing of spring migration (Garrott et al. 1987, White and Garrott 1990). Colder-than-usual spring temperatures can delay snowmelt along migration routes and can force deer to remain at lower elevations into late spring (Technical Report E.3.2-32).

The Applicant identified one migration corridor linking the HCC winter range to summer range (Technical Report E.3.2-32). Migrant deer that winter in Oregon adjacent to Brownlee Reservoir seasonally followed the Powder River arm–Summit Ridge migration corridor while moving to summer range in the Wallowa Mountains. Summit Ridge is a relatively narrow ridge of rangeland between Richland and Halfway, Oregon, extending from the Powder River near Hewitt Park to the Wallowa Mountains. Valleys on either side of Summit Ridge are developed for agriculture and grazing. Many deer that winter in Idaho adjacent to Brownlee Reservoir migrate northeast to Cuddy Mountain for summer. However, migrating deer in Idaho do not follow an obvious migration corridor as they do in Oregon. Migrating deer in Idaho use many routes without distinct topographical characteristics (Figure 3-2 in Technical Report E.3.2-32).

The HCC reservoirs separate Idaho and Oregon and corresponding subpopulations of mule deer within Hells Canyon. In addition, the Powder River arm of Brownlee Reservoir separates northern and southern portions of the HCC winter range within Oregon. Applicant biologists frequently observed mule deer crossing HCC reservoirs, especially the Powder River arm (Technical Report E.3.2-32). Most reservoir crossings (71%) are associated with spring and fall migration, when many deer (47%) that winter in Oregon adjacent to Brownlee Reservoir swim the Powder River arm en route to seasonal ranges. Crossings appear to occur independently of HCC reservoir operations (Figure 3-8 in Technical Report E.3.2-32). During other studies, researchers have similarly observed deer swimming reservoirs during migration (Robinette 1966, Boroski 1998).

The Applicant determined that subpopulations from Idaho and Oregon portions of the winter range were mostly distinct because most deer moving between Idaho and Oregon typically return to their state of origin after a short period of time (Technical Report E.3.2-32). That is, most interchanges between states are of short duration, with many deer (21%) swimming between Idaho and Oregon and then returning within the same season. In addition, few deer migrate seasonally between states. The nature of short-duration crossings is not understood, but reasons associated with habitat exploration or predator escape have been hypothesized (Technical Reports E.3.2-32 and E.3.2-34).

Winter Habitat—Winter habitat is a critical component of the annual habitat requirements of mule deer. Numerous studies about mule deer habitat have been published, and most reflect differences in habitat selection relative to the geographic region of the study population (for example, Martinka 1968, Anthony and Smith 1977, Collins and Urness 1983, Ordway and Krausman 1986, Wood 1989, Armleder et al. 1994). Mule deer typically winter in semiarid, shrub-steppe habitats in rough terrain that supports nutritious browse plants that are accessible above snow (Carpenter and Wallmo 1981, Mackie et al. 1982). While specific characteristics of winter range may vary, the basic determinants of habitat quality are the quantity and quality of available forage; habitat use is often assumed to reflect foods consumed.

Having unique vegetation, elevation, and climate, Hells Canyon provides much of the crucial[3] winter range (HCC winter range) within the region. In Hells Canyon, 250,911 ha of mule deer winter range were delineated by agency biologists (Table 5 in Technical Report E.3.2-31). Crucial winter range accounted for 135,282 ha (54%), and regular winter range for 115,629 ha (46%). The USFS (99,224 ha), private landowners (78,908 ha), and the BLM (49,996 ha) primarily manage winter range in Hells Canyon. In addition to the HCC, numerous issues potentially impact mule deer habitat on the HCC winter range: noxious weeds, human disturbance, and forage competition from domestic livestock (Technical Report E.3.2-31).

3. "Crucial" is a biological designation of habitat. "Crucial winter range" habitat is that part of the winter range where 90% of the individuals of a population are located when the annual snow pack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten. Crucial winter range as used in this application and in technical reports is synonymous with "critical winter range." Because the term "critical" has specific meaning under the Endangered Species Act, it is not used here so as to minimize confusion about meaning among biologists.

The Applicant investigated winter habitat selection at multiple scales on the HCC winter range (Technical Report E.3.2-32). At the largest scale, deer selected the HCC winter range from among other winter ranges available in the region (Technical Report E.3.2-31). Two main factors probably contribute to selection of the HCC winter range. First, habitat features needed to support deer are available throughout the winter because low elevations in Hells Canyon remain relatively free of snow in most years. Second, deer in the region have learned to winter in Hells Canyon. Once the deer are on the HCC winter range, mid-scale habitat selection is driven largely by physiographic and weather-related variables (Technical Report E.3.2-32). Deer select south and southwest aspects in low-elevation habitats—and therefore closer to the HCC reservoirs—more often than they select other available areas. Within low-elevation habitats on southerly aspects, deer select fine-scale sites with abundant grasses and forbs and with relatively less snow, areas where forage is more readily available (Technical Report E.3.2-32).

Southerly aspects on the HCC winter range provide an abundance and diversity of quality winter forage, a condition that suggests a link between habitat selection and nutrition. Cover types (that is, annual grasslands and bitterbrush shrublands) that provide important deer forage are abundant on south and southwest aspects. Young, green growth of low-stature annual and perennial grasses (for example, cheatgrass, medusahead [*Taeniatherum caput-medusae*], bulbous bluegrass [*Poa bulbosa*], and Sandberg bluegrass [*Poa secunda*]) is highly digestible and nutritious (Austin et al. 1994, Bishop et al. 2001). During early spring, when grass dominates the diet, deer are attracted to gentle slopes where annual grasslands are common and early spring growth of herbaceous vegetation (or green-up) is abundant. In addition, annual grasslands provide an abundance and diversity of forbs, which are also important in winter diets (Table 5-1 and Figure 5-2 in Technical Report E.3.2-32).

Many researchers have consistently identified bitterbrush as an important winter food for mule deer (Trout and Thiessen 1973, Carson and Peek 1987, Griffith and Peek 1989). Wallmo and Regelin (Table 60 in Wallmo and Regelin 1981:391) listed the most commonly reported forage species for mule deer; this list included 17 browse species, 6 grass and sedge species, and 17 forb species (data from over 69 food-habits studies). Bitterbrush habitats in Hells Canyon also offer the benefits of favorable southerly aspects in addition to quality forage. Specifically in areas adjacent to Oxbow Reservoir, bitterbrush composes up to 55% of mule deer diets. Sagebrush is also important in the winter diet, particularly in January and February. Sagebrush cover types occurred on all aspects and were common along Brownlee Reservoir (Figure 4-3 in Technical Reports E.3.2-32 and E.3.3-1).

The Applicant identified an abundance of bitterbrush along Oxbow Reservoir and its rarity along Brownlee Reservoir (Technical Report E.3.3-1). Conversely, sagebrush is more common in southern portions of Hells Canyon and mostly absent north of Brownlee Dam (Technical Report E.3.3-1). Both sagebrush and bitterbrush shrublands and shrub savannas contain a moderate cover (16.7%) of forbs. During harsh winters with deep snow, deer probably rely on bitterbrush, sagebrush, and taller perennial grasses such as bluebunch wheatgrass (*Pseudoroegnaria spicata*) (Table 5-4 in Technical Report E.3.2-32). Riparian habitat (2.65% of the HCC winter range) may also become more important for deer in harsh winters (Carson and Peek 1987).

The Applicant found that, while on the HCC winter range, mule deer use a diversity of habitats and forages. Therefore, habitat selection is probably driven by changes in conditions that influence the growth and availability of forage (Technical Report E.3.2-32). The short-term availability of high-quality (that is, with new growth) herbaceous foods is affected by three components: 1) fall and winter weather, which determines the amount and persistence of actively growing (green-up) grasses and forbs; 2) snow cover, which affects a deer's access to green-up; and 3) physiographic characteristics (for example, elevation, slope, and aspect), which interact to influence the distribution of snow cover and green-up. Long-term availability of foods, especially shrubs, is significantly determined by land uses and environmental perturbations (for example, wildfire and drought) that influence the composition of upland and riparian vegetation communities (Technical Report E.3.2-32).

Mortality—Survival is an important parameter determining the population status of mule deer (White et al. 1987). Numerous limiting factors, operating at many scales, influence survival. These factors include competition, habitat condition, hunting, predation, and weather (Connolly 1981). A large component of the annual mortality for migratory mule deer populations in the Intermountain West often occurs while deer are concentrated on winter range (Bartmann and Bowden 1984, White et al. 1996). Understanding survival patterns and proximal causes of mortality on the winter range is important for identifying factors that influence deer population dynamics. While investigating mortality of mule deer subpopulations (Idaho and Oregon) on the HCC winter range, the Applicant described 1) temporal and spatial patterns of survival, 2) proximal causes of mortality, and 3) predisposing causes of mortality (Technical Report E.3.2-32).

The Applicant determined that general patterns of mule deer survival were similar between Idaho and Oregon, with a large proportion of the annual mortality occurring while subpopulations were concentrated on the winter range or transitioning between winter and summer ranges (Figure 6-1 in Technical Report E.3.2-32). While concentrated on the HCC winter range (that is, in winter and through spring migration periods), fawns in both states typically had the lowest survival ($\bar{x}$ = 0.467 in Idaho, $\bar{x}$ = 0.449 in Oregon); does, the highest survival ($\bar{x}$ = 0.883 in Idaho, $\bar{x}$ = 0.863 in Oregon); and bucks, intermediate survival ($\bar{x}$ = 0.619 in Idaho, $\bar{x}$ = 0.722 in Oregon). Also, average annual survival was very similar between subpopulations for does ($\bar{x}$ = 0.753 in Idaho and $\bar{x}$ = 0.761 in Oregon) and bucks ($\bar{x}$ = 0.486 in Idaho and $\bar{x}$ = 0.484 in Oregon). Average doe mortality in both states typically decreased from winter through spring migration and increased again from summer through fall migration. Although average annual estimates for bucks were similar for Idaho and Oregon, patterns were extremely variable seasonally. Nonetheless, most buck mortality occurred while deer were concentrated on the winter range (Tables 6-1 and 6-2 in Technical Report E.3.2-32).

Predation is a common cause of mortality for mule deer associated with the HCC (37–69% of mortalities for does; 0–67%, for bucks; and 61–64%, for fawns between 1999 and 2001) (Tables 6-5 and 6-6 in Technical Report E.3.2-32). Harvest (17–67% of mortality) can also be an important cause of buck mortality in both states. Predation patterns are similar between states. The Applicant determined that mountain lions are a primary predator of does and bucks, whereas both coyotes and mountain lions are primary predators of fawns (Tables 6-8 and 6-9 in Technical Report E.3.2-32). Physical condition can also determine the vulnerability of deer to predators. The Applicant determined that poor condition was implicated in 40% of predations on does, in 14% of predations on bucks, and in 64% of predations on fawns.

The most commonly studied predators of mule deer are coyotes and mountain lions (Technical Report E.3.2-34). Studies by Murie (1940) and Leopold et al. (1951) documented that coyotes consumed deer primarily during mid to late winter and during spring. Mackie et al. (1982) noted that 25 to 30% of fawns die by fall; 50%, by winter; and 75%, by early spring. Fawn weight is the biggest predictor of overwinter survival (White et al. 1987). Murie (1940) concluded that deer dying during winter was a function of winter habitat quality. However, coyote predation on fawns probably has a more direct impact on populations, and some studies have noted fairly dramatic impacts on deer populations from coyote predation. Studies have typically failed to demonstrate that predator reductions increase fawn survival or that coyote populations can be consistently and efficiently controlled (Technical Report E.3.2-34).

Richens (1967), Hornocker (1970), Nellis (1977), Robinette et al. (1977), and Shaw (1977) have studied mountain lion predation on mule deer. Richens (1967) estimated that 54% of 89 mule deer killed in Utah were killed by predators and that over half of the predation was from mountain lions. Hornocker (1970) reported that 70% of lion scats contained mule deer or elk. Shaw (1977) documented 62 lion kills and found that 60% of these were mule deer. Nellis (1977) estimated that hunter harvest was approximately equal to the number of deer killed by mountain lions. Therefore, deer populations are extremely important to population viability of mountain lions.

Other sources of deer mortality identified by the Applicant included 1) malnutrition, 2) collisions with vehicles, 3) drowning while swimming a reservoir, 4) accidental falls from cliffs, and 5) unknown causes (Tables 6-5 and 6-6 in Technical Report E.3.2-32). Accidental mule deer mortality has been reported by a number of authors (Caswell 1953, Williams 1964, Richens 1967, Reed 1981:524), and the most common is from automobile collisions (Reed 1981). In the West, annual mortality from automobiles ranges from 20,000 in California to 1,600 in Montana. Many cases of accidental deer mortality are from entanglement in fences, but these are not well documented in professional literature (Technical Report E.3.2-34).

While deer are relatively strong swimmers (Robinette 1966, Loft et al.1984, Boroski 1998), they do occasionally drown (Boroski 1998), especially when thin ice is present (Loft et al. 1984). Deer mortality during significant reservoir icing events has not been quantified for the HCC (Technical Reports E.3.2-32, E.3.2-34, and E.3.2-35). The Applicant determined that reservoirs are directly responsible for little deer mortality (such as from drowning) (Table 6-10 in Technical Report E.3.2-32). Drowning is rare considering that numerous deer successfully swim the HCC reservoirs.

Nevertheless, the Applicant determined that reservoirs indirectly contribute to deer mortality by influencing predator success (Technical Report E.3.2-32). The swimming and exposure to cold water required to navigate the HCC reservoirs can at least temporarily weaken deer and increase their vulnerability to predation (Boroski 1998). Also, Brownlee Reservoir is steep-sided, and erosion from annual drafting has created steep and rocky shorelines above and below the full-pool reservoir elevation (Technical Report E.3.2-42). Evidence suggests that the water and eroded shoreline terrain of Brownlee Reservoir can hinder a deer's escape from predators (primarily coyote predation on fawns).

Severe winter weather has determined historic minimum numbers of mule deer occupying the HCC winter range (Technical Report E.3.2-30). Conversely, populations tend to grow during years of relatively mild to moderate winter weather. Severe winters are relatively uncommon because the HCC winter range offers the lowest elevations and correspondingly the mildest winter weather in the region (Technical Report E.3.2-32). Harsh winter conditions that could have prompted a large population decline did not occur while Applicant biologists directly studied mule deer in Hells Canyon (Technical Reports E.3.2-30 and E.3.2-32). The winter of 1992–1993 was the latest with severe weather and a corresponding large population decline (Table 10 in Technical Report E.3.2-30). Nonetheless, factors determining deer numbers above minimum levels remain poorly understood in Hells Canyon.

E.3.2.1.3.11.6. Elk

The elk was important to aboriginal people of Hells Canyon. Numerous archaeological sites have documented elk presence: Hells Canyon Creek (Pavesic 1971); Tyron Creek, Knight Creek, and Bernard Creek (Hackenberger et al. 1995, Hackenberger 1993, and Randolph and Dahlstrom 1977, respectively); and Pittsburg Landing (Reid et al. 1991). Elk are also important to modern humans as one of the most popular big game species in the West and are commonly reported in Hells Canyon (for example, USFWS 1964, Wilson 1975, Asherin and Claar 1976, McKern 1976, U.S. Department of Energy 1984, Meatte 1990, and ODFW 1997, Technical Report E.3.2.34).

The HCC bisects elk winter range within Hells Canyon. Some concerns exist regarding barriers to elk movement and migration (Technical Report E.3.2-34).

Hunting exterminated elk from much of the original range across North America, but western populations have thrived for decades in rugged habitats and with the aid of modern wildlife management (Potter 1982). However, in more recent decades, there has been increased concern about disturbance to elk habitat in combination with heavy hunting pressure. During the 15-year period from 1950 to 1965, the number of elk hunter visits on national forest lands increased from 1.5 million to 25 million, and harvest success rates during the same period declined from approximately 23 to 5% (Figure 101 in Potter 1982:516). Unsworth et al. (1993:495) estimated that "86% of all elk deaths [in Idaho] occurred during September and October and were associated with hunting" (Technical Report E.3.2-34).

Estimates of the total population of elk in Hells Canyon (on the Oregon and Idaho sides) are not available. Data from Oregon and Idaho are not directly comparable because of the different configurations and establishment of management units. Nonetheless, elk survey data for recent years in Oregon reflect relatively stable populations for the survey units (that is, Pine Creek and Lookout Mountain) that are partially included in Hells Canyon (Table 3 in Technical Report E.3.2-34). An exception is the Snake River unit downstream of Hells Canyon Dam. For Idaho, counts of elk in Unit 22 have varied in recent years from 1,400 to 2,329 (Table 4 in Technical Report E.3.2-34). In 1993, 1,329 elk were counted in the Hillman Ranch portion of Unit 31. As with the mule deer survey data, historical elk survey methods were not consistent among years or survey units and were not specific to Hells Canyon. Therefore, it is difficult to reach firm conclusions regarding the current status of elk specifically in Hells Canyon (Technical Report E.3.2-34).

Elk habitat varies from open plains to forested mountains (Peek et al.1982, Skovlin 1982), and elk distribution extends from northern British Columbia to New Mexico and from California to North Dakota. Therefore, specific habitat use varies considerably among populations, and much of the review below is restricted to literature from Idaho, Oregon, and neighboring regions. Skovlin (Table 60 in Skovlin 1982:376) summarized key habitat factors as topography (elevation, slope, and land features), climate (precipitation, temperature, and wind), food (availability and quality), cover (type, density, composition, structure, and successional stage), and specialized habitats (salt, calving, wallows, and trails).

For Oregon and Washington, Thomas et al. (1979:109) concluded that optimal elk habitat consisted of a "ratio of 40% of a land type in cover to 60% in forage areas of proper size and arrangement." Hiding cover is required for escape from human disturbance and predators; thermal cover is important for energy conservation (especially during winter). Thomas et al. (1979) noted that optimal calving habitat contains forage areas, hiding cover, and thermal cover. Hall and Thomas (1979) described many silvicultural options to increase compatibility between timber harvest and habitat requirements of elk. Elk habitat use is closely associated with food habits, and food habits are "highly variable and depend upon the local availability of forage" (Peek et al. 1982).

Hells Canyon has been identified as having the most important big game winter habitat in the region (Technical Report E.3.2-31). In Hells Canyon, 260,227 ha of elk habitat were delineated, of which 168,194 ha (66%) were defined as crucial winter range, 79,732 ha (31%) as regular winter range, and 12,301 ha (4.7%) as important movement areas (Table 2 in Technical Report E.3.2-31). The USFS manages 117,122 ha (45%) of the delineated elk habitat, 76,547 ha (29%) are on private land, and 43,256 ha (17%) are on BLM-managed lands (Table 3 in Technical Report E.3.2-31). Aspects of the HCC have been identified as potentially affecting elk winter range (for example, noxious weeds, human disturbance of winter range, migration barriers, and direct mortality from reservoir swimming) (Technical Report E.3.2-34).

Primary predators of elk are wolves and mountain lions (Taber et al. 1982:291). In Idaho, the primary reports of predation on elk are from mountain lions (Hornocker 1970, Seidensticker et al. 1973). These studies documented that elk were dominant among lion big game kills over a four-year period, that elk prey were predominantly young or old individuals, and that lions constantly altered their home range in response to the location of elk or deer herds. Toweill and Meslow (1977) also reported elk as prey of mountain lions in Oregon.

E.3.2.1.3.12. Reptiles and Amphibians

Until recently, reptiles and amphibians were overlooked as important functional components of the ecosystem, often because of their relative size, secretive nature, appearance, and nongame status. Amphibians and reptiles are important functional components in many ecosystems as predators, prey, and transporters of nutrients (Grothe 1991). The apparent widespread decline of amphibian (Blaustein and Wake 1990, Heyer et al. 1994) and reptile populations (Beck 1997, Gibbons et al. 2000) has elevated concern for reptile and amphibian populations. Eleven amphibian and reptile species with federal status (listed threatened, endangered, or candidate species), federal agency status (sensitive species), or state status (sensitive species or species of special concern) potentially occur in Hells Canyon (see section E.3.2.1.3.13.2.). Consequently, proper management of wildlife habitat requires a basic understanding of amphibian and reptile communities.

Relatively little information is available on the distribution and abundance of reptiles and amphibian in the Intermountain West (for example, Northern Intermountain Herpetological Database) (Munger et al. 1994). Three studies of amphibians and reptiles have been conducted in the vicinity of Hells Canyon: the Hells Canyon reach (Farewell Bend, Oregon, to near Asotin, Washington) of the Snake River in Idaho and Oregon (Asherin and Claar 1976), the Craig Mountain Wildlife Area north of Hells Canyon in Idaho (Llewellyn and Peterson 1995), and the lower Snake River in eastern Washington (Metter 1960). Historical records and predicted distributions suggest that 29 amphibian and reptile species potentially occur in Hells Canyon (Table 1 in Technical Report E.3.2-36). The sparseness of data available for Hells Canyon prompted the Applicant to contract the Herpetology Laboratory (Idaho State University, Pocatello, ID) to inventory amphibians and reptiles (Technical Report E.3.2-36). Objectives were to determine 1) habitat associations, 2) relative abundances, and 3) distributions for amphibians and reptiles.

During 1996–1999, amphibian and reptile populations were sampled with standard techniques: 1) drift fences with funnel traps ($n = 72$), 2) USFWS protocols (Heyer et al. 1994) for timed visual searches ($n = 52$), 3) nighttime driving, and 4) incidental observations (Technical Report E.3.2-36). Ten reptile and 3 amphibian species were captured using drift fences with funnel traps ($n = 1,403$ individuals) (Table 5 in Technical Report E.3.2-36). The racer (*Coluber* *constrictor*) (15.6 captures/100 trap nights), gopher snake (*Pituophis catenifer*) (5.3 captures/100 trap nights), western whiptail (*Cnemidophorus tigris*) (2.0 captures/100 trap nights), western rattlesnake (*Crotalus viridis*) (2.2 captures/100 trap nights), and night snake (*Hypsiglena torquata*) (0.8 captures/trap nights) were the most abundant reptile species captured. Amphibians were documented with timed searches of wetlands in Hells Canyon (Table 9 in and Appendix 3 to Technical Report E.3.2-36). The western toad (*Bufo boreas*) was found at 24 sites, long-toed salamander (*Ambystoma macrodactylum*) at 22 sites, Pacific chorus frog (*Pseudacris regilla*) at 21 sites, bullfrog (*Rana catesbeiana*) at 6 sites, spadefoot toad (*Scaphiopus intermontanus*) at 2 sites (ponds < 100 m apart), and Columbia spotted frog (*Rana luteiventris*) at 1 site.

The distribution of the vegetation types changes significantly with topography, soil, and precipitation gradients from Weiser, Idaho, north to the confluence with the Salmon River. Reptiles common to sagebrush habitats of southern Idaho and southeast Oregon (the side-blotched lizard [*Uta stansburiana*], western whiptail, longnose leopard lizard [*Gambelia wislizenii*], and striped whipsnake [*Masticophis taeniatus*]) were observed in suitable habitat in the southern portion of Hells Canyon. The western fence lizard (*Sceloporus occidentalis*) was found to the north from approximately Brownlee Dam, corresponding with an increase of rocky outcrops, cliffs, and talus slopes. The common garter snake (*Thamnophis sirtalis*), racer, western terrestrial garter snake (*Thamnophis elegans*), western rattlesnake, western skink (*Eumeces skiltonianus*), gopher snake, rubber boa (*Charina bottae*), and night snake were distributed throughout Hells Canyon (Figures 6–8 in Technical Report E.3.2-36). The western whiptail was captured only along Brownlee Reservoir, but the racer, gopher snake, and western rattlesnake did not discriminate among habitat types.

As with the reptiles, there appear to be distinct changes in amphibian species composition along a north/south gradient within Hells Canyon. The bullfrog and Great Basin spadefoot toad were only captured or observed in the southern portion of Brownlee Reservoir (Figures 13a and c in Technical Report E.3.2-36). The long-toed salamander, western toad, and Pacific chorus frog occurred throughout the study area (Figure 14 in Technical Report E.3.2-36). The Columbia spotted frog was found only at the confluence of Eagle Creek and the Powder River adjacent to Brownlee Reservoir (Figure 13b in Technical Report E.3.2-36).

Hells Canyon contains large areas of high-quality reptile habitat. Fourteen reptile species were recorded in the study area. All reptile species expected to occur in the study area were found, except for the ringneck snake (*Diadophis punctatus*) and desert horned lizard (*Phrynosoma platyrhinos*) (Table 2 in Technical Report E.3.2-36). Wetland habitat for breeding amphibians is limited due to the semiarid climate and steep topography. However, eight amphibian species were recorded in Hells Canyon.

E.3.2.1.3.13. Threatened, Endangered, Candidate, and Special Status Species

One hundred five species with a federal designation of threatened, endangered, or candidate or with other special status designations from state or federal agencies are potentially associated with the HCC reservoirs (Table E.3.2-1). The Applicant provides brief descriptions of each of the 105 threatened, endangered, candidate, and special status species. USFWS candidate species are discussed with threatened and endangered species in this exhibit. Of the 105 species considered in this section, the species not classified as threatened, endangered, or candidate species were characterized as "special status species." State and federal agencies use several designations for species that are rare, have questionable status, or have special conservation needs, but that are not listed by the USFWS under the Endangered Species Act (ESA) as threatened, endangered, or candidates. Designations for special status species are listed in Table E.3.2-1. From the extensive set of 105 species, the TRWG identified 37 species to be evaluated for potential impacts from HCC operations: 18 bird species, 11 mammals, 4 amphibians, and 4 insects (Table E.3.2-1) (see section E.3.2.4. for impact evaluations). The Canada lynx and yellow-billed cuckoo (*Coccyzus americanus*) were were not considered when the TRWG compiled the evaluation list because they were not listed as threatened or endangered at that time; they were later added to the list, raising the number of bird species to 19 and mammal species to 12.

Under the ESA, an endangered species is one in danger of extinction throughout all, or a significant portion, of its range. A threatened species is one that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Candidate species are those for which the USFWS has sufficient information on biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher-priority listing activities. Candidate species receive no statutory protection under the ESA. A wildlife species designated as threatened, endangered, or candidate is managed by the USFWS (ORNHP 1995, IDCDC 2001). The USFWS Snake River Basin Field Office also maintains a list of species of concern for species for which information supports tracking status and threats.

Definitions of sensitive species vary among resource agencies. The ODFW defines sensitive species as naturally reproducing native animals that are likely to become threatened or endangered throughout all or a significant portion of their range in Oregon (Marshall et al. 1996). Sensitive species are divided into four subcategories: critical, vulnerable, peripheral, and undetermined status (Marshall et al. 1996). Critical species are those for which listing as threatened or endangered is pending or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Vulnerable species are those for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued and expanded use of adequate protective measures and monitoring. Peripheral species are those whose Oregon populations are on the edge of their range. Included are species that had low population numbers historically in Oregon because of naturally limiting factors. Also considered critical are some peripheral species that are at risk throughout their range, as well as some disjunct populations. Species have an undetermined status when their status is unclear (ORNHP 1995).

The IDFG uses similar terminology for Idaho special status species (IDCDC 2001), called species of special concern. These species are defined as native species that are either low in numbers or limited in distribution or that have suffered significant habitat losses. Three subcategories of sensitive species are identified: priority, peripheral, and undetermined status. Priority species meet one or more of the criteria set forth under the ESA, and Idaho currently contains, or formerly constituted, a significant portion of those species' range. Peripheral species meet one or more of the criteria above, but their populations in Idaho are on the edge of the species' breeding range. Finally, undetermined status species are those that may be rare in the state, but for which there is little information on population status, distribution, and/or habitat requirements. The IDFG defines a threatened species as likely to be classified as endangered in the foreseeable future throughout all or a significant portion of its Idaho range. Endangered species are in danger of extinction throughout all or a significant portion of their Idaho range.

In addition, the BLM and USFS have definitions for sensitive species occurring or potentially occurring on federal lands under their respective jurisdictions (ORNHP 1995, IDCDC 2001). The BLM considers those species sensitive that 1) are under status review by the USFWS, 2) have numbers that are declining so rapidly that federal listing may become necessary, 3) have typically small and widely dispersed populations, and 4) inhabit ecological refuges or other specialized or unique habitats.

The USFS considers species sensitive when population viability is questionable. Questions of viability can be evidenced by significant current or predicted downward trends in population numbers or density or by significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

E.3.2.1.3.13.1. Threatened, Endangered, and Candidate Species

Bald Eagle

Status—The bald eagle breeds from Alaska and Canada south to California and Florida. Bald eagles are found along coasts, rivers, lakes, and marshes where nearby tall trees or cliffs can be used for nesting. About 340 bald eagles nested in Oregon in 1995 (Isaacs and Anthony 1999). In Idaho, 113 occupied territories were found in 2000 (IDFG 2001). Numbers of eagles in the continental United States decreased dramatically in the last 200 years. In response to this decline, the USFWS in 1973 declared the bald eagle to be endangered in 43 of the 48 contiguous states and threatened in the remaining states. In 1999, the USFWS proposed to remove the bald eagle from the federal list of endangered and threatened species. A final decision is expected in the near future.

Wintering—Bald eagles winter in substantial numbers along the Hells Canyon reach (Weiser to the Salmon River) of the Snake River and its associated reservoirs and occupy several large communal roosts (Technical Report E.3.2-17). Concern about potential impacts of habitat alteration and other human activities, however, resulted in a study on wintering bald eagles in northeastern Oregon from 1988 to 1991; the Applicant cooperated in this study (Technical Report E.3.2-17). Objectives were to 1) document eagle abundance, 2) foraging areas, 3) food habits, and 4) night roosts. During the winters of 1993 through 1998, the Applicant also estimated with annual aerial surveys the number (subadult and adult birds) and distribution of bald eagles wintering specifically in Hells Canyon (Technical Report E.3.2-16).

A substantial increase of wintering bald eagles has occurred in the vicinity of Hells Canyon in recent years (Figure 4 in Technical Report E.3.2-17). Between 1988 and 1991, bald eagle numbers peaked at 218 during early January 1989, 283 during mid-February 1990, and 291 during early February 1991 (Figure 4 in Technical Report E.3.2-17). From 1993 through 1998, total bald eagle numbers averaged 102.5 (± 31.2 STD; range = 152 eagles in 1994 to 68 eagles in 1998). On average, subadults composed 19.9% of the annual wintering population. No significant population trend was detected.

Hells Canyon provides key parameters of bald eagle winter habitat: 1) abundant and available food supply, 2) suitable night roosts, 3) perching substrate, and 4) little human disturbance. Bald eagles concentrated along Oxbow Reservoir and the Powder River arm of Brownlee Reservoir rather than along the unimpounded reaches above Brownlee Reservoir and below Hells Canyon Dam (Technical Report E.3.2-16). Concentration areas appeared to have reliable food sources, such as fish, waterfowl, and dead mule deer. Primary foraging areas were Brownlee (27%) and Oxbow (16%) reservoirs, the lower Wallowa and Grande Ronde rivers (23%), and the Wallowa Valley (15%) (Table 1e in Technical Report E.3.2-17). Fish and large mammal carrion were the most obvious foods sources, and ground squirrels and waterfowl were also important (Table 4 in Technical Report E.3.2-17). The food supply associated with the HCC reservoirs can be considered stable and probably plentiful (Technical Report E.3.2-16).

Perch sites are not considered to be limiting, and many winter roosts occur near the Snake River and reservoirs (Technical Report E.3.2-17). Forty-six night roosts were located in northeastern Oregon, 12 more were suspected, and many more probably existed in inaccessible areas (Tables 2a–d in Technical Report E.3.2-17). Many forested areas with difficult access for humans occur at higher elevations in Hells Canyon and are apparently suitable for roosting. Exceptionally large night roosts occur in Hells Canyon: 55 eagles were recorded at Eagle Island Creek (Oxbow Reservoir) and 100 at Soda Creek (Brownlee Reservoir) (Technical Report E.3.2-17). Because many roost trees and stands are commercially valuable, human activities (for example, timber harvest) in areas with night roosts could substantially impact wintering bald eagles. Management of winter bald eagle habitat should focus on enhancing the prey base, providing foraging perches where needed, protecting night roosts, and controlling human activities in areas where they conflict with bald eagles (Technical Report E.3.2-17).

Nesting—Bald eagles historically nested along the Snake River in Hells Canyon. One pair reportedly nested at the mouth of Two Creeks in the early 1900s (Taylor 1989). At least five other historic nest sites have been reported (Isaacs et al. 1989). Currently, seven existing and suspected bald eagle nest sites occur within approximately 60 mi of Hells Canyon (Isaacs et al. 1989). Existing nests in Oregon occur at Unity Reservoir, Phillips Reservoir, and Wallowa Lake. Nests suspected to be built by bald eagles were reported at the Grande Ronde, Wallowa, and Lostine rivers and at Eagle Island Creek. The Unity Reservoir bald eagle pair has produced young for several years prior to 1989 (Isaacs et al. 1989). Information from the Idaho Conservation Data Center (IDCDC) indicates that, along Brownlee Reservoir, two historic bald eagle nest sites were surveyed from 1995 through 1999; the nests had blown out of the nest trees in the late 1980s and were not rebuilt (Technical Report E.3.2-15).

In 1998, a bald eagle nest was discovered along Hells Canyon Reservoir (Table 4 in Technical Report E.3.2-15). The pair successfully fledged one young in both 1998 and 1999. In 1999, another bald eagle nest site was discovered on the Oregon side of Oxbow Reservoir (Table 4 in Technical Report E.3.2-15); one young was successfully fledged. In 2000 and 2001, the bald eagle pairs on Oxbow and Hells Canyon reservoirs each fledged two young. A third bald eagle territory was discovered in 1999. At this site, an immature bald eagle was observed bringing nesting material to a large nest in a tree. This site was considered to be a one-bird site as no evidence of breeding was found on subsequent visits. All three nests were built in ponderosa pines and are considered to be new nest sites.

Peregrine Falcon

Status—The peregrine falcon breeds on every continent except Antarctica. In North America, the peregrine falcon breeds in Alaska and the western United States, but is absent from much of the middle and eastern United States. Critical habitat components for this species are suitable nest sites, usually cliffs, overlooking open areas with an adequate food supply (Csuti et al. 1997). The peregrine falcon was listed as endangered in 1970. Since then, restrictions on the use of organochlorine pesticides in the United States and Canada improved reproductive rates of most surviving peregrine falcon populations in North America. Wild populations were augmented with the release of captive-bred peregrine falcons at hacking sites throughout much of the United States. Peregrine falcons have recovered throughout most of their range. On August 25, 1999, the peregrine falcon was removed from the federal list of endangered and threatened species. Recovery plan objectives in each of the four recovery regions of the United States were either met or exceeded.

Nesting—Peregrine falcons historically nested at two locations in Hells Canyon (Bechard et al. 1987). One historical site was in Oregon near Hells Canyon Dam. The other site was near the confluence of the Grand Ronde and Snake rivers. At least until 1967, peregrines at this second site produced wild young. Peregrines were reintroduced at this site in 1987 (Bechard et al. 1987). Since 1987, the Wallowa–Whitman National Forest (WWNF) has cooperated with the ODFW and the Peregrine Fund in annually releasing peregrines at P.O. Saddle in Hells Canyon. In 1990, peregrine falcons were also released from High Dive, located on the Payette National Forest (PNF), 8 mi east of Hells Canyon Dam (Levine and Erickson 1990). In 1990, a peregrine survey of the HCNRA was conducted, but peregrines were not observed (Levine and Erickson 1990).

Nesting Survey—During spring and summer 1996, the USFS and the Applicant cooperatively surveyed nesting peregrine falcons using the protocol developed by Pagel (1992) (Technical Report E.3.2-18). The survey area was a 10- by 3-mi section of Hells Canyon along the Oregon side of the Snake River near Hells Canyon Dam, from Steamboat Creek to Black Mountain. The Peregrine Fund reintroduced peregrine falcons to the survey area in the early 1990s, and peregrine falcons were observed there for several years. One active peregrine falcon nest (eyrie) was found, which fledged one female falcon. The nest site is located near a historical site. During nest site monitoring in 1997–2000, peregrine falcon pairs were observed at the eyrie exhibiting behaviors indicative of occupancy (such as prey delivery, copulation, and patrolling the territory). In 2001, only a single bird was observed.

Canada Lynx

The Canada lynx has a holarctic distribution, ranging across the boreal region of Canada and Alaska, down to the northern United States (McCord and Cardoza 1982). In the western United

States, Canada lynx are found as isolated populations in Douglas-fir, spruce (*Picea* species), fir, and lodgepole pine (*Pinus contorta*) forests of Washington, Idaho, Montana, Wyoming, Colorado, and Utah. Peripheral records also exist for the Wallowa Mountains of northeastern Oregon (Coggins 1969, ORNHP 2001). Canada lynx are at the southern extent of their range in Idaho and Oregon and probably occur at low densities in these states (McCord and Cardoza 1982). The species is generally abundant and widespread in northern portions of its range. However, Canada lynx have declined in much of their former range in the United States, excluding Alaska (McCord and Cardoza 1982). On March 24, 2000, the USFWS listed the Canada lynx as threatened, citing the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of Canada lynx in federal land management plans (*Federal Register* 65[58]:16052–16086).

According to Rust (1946), Canada lynx were distributed throughout northern Idaho in the early 1940s, occurring in 8 of the 10 northern and north-central counties. Twelve Canada lynx were reported harvested between 1978 and 1991. Recent confirmed Canada lynx reports are scarce. Prior to 1977, the species was considered a predator in Idaho, subject to unrestricted harvest with no closed season and no bag limit. In 1995, a multiple-agency conservation strategy was initiated to assess the conservation of the Canada lynx and other forest carnivores (Roloff 1995). The USFWS concluded that a self-sustaining resident population does not exist in Idaho, but that individual animals are present. Resident Canada lynx populations were historically low in Oregon (Koehler and Aubry 1994). Historic records exist from nine counties in Oregon (Bailey 1936; Nellis 1971, cited in the *Federal Register* [March 24, 2000] 65[58]:16052–16086). The USFWS could not substantiate the historic or current presence of a resident Canada lynx population in Oregon. Canada lynx sightings have not been reported in the vicinity of the HCC reservoirs.

Gray Wolf

The gray wolf is native to most of North America, except for the southeastern United States, where the red wolf (*Canis rufus*) is found (Paradiso and Nowak 1982). The gray wolf occupied nearly every area in North America that supported populations of ungulates, the wolf’s major food source. The gray wolf occurred historically in the northern Rocky Mountains, including mountainous portions of Wyoming, Montana, and Idaho. The drastic reduction in the distribution and abundance of this species in North America was directly related to human activities, such as the elimination of native ungulates, conversion of wildland into agricultural lands, and extensive predator control efforts. By the middle of the twentieth century, few wolves existed in the lower 48 states: several hundred gray wolves in Minnesota, a few red wolves in the southeast, and an occasional Mexican gray wolf. Gray wolves in the lower 48 states now number about 2,600, with more than 2,000 of those in Minnesota. The current gray wolf distribution in Idaho includes the northern border adjacent to Canada and Montana and the central Idaho wilderness and adjacent national forests (Spahr et al. 1991).

The northern Rocky Mountain gray wolf was listed as endangered on June 4, 1973, and a recovery plan was released in 1987 (USFWS 1987). Idaho gave the species a similar classification and protection in 1977. Likewise, the wolf is listed as endangered by the ODFW. Wolves were reintroduced to Yellowstone National Park and central Idaho in 1995 and 1996 to accelerate wolf recovery in the Rocky Mountains, where wolves were eliminated in the late 1920s. Wolves in the reintroduction areas of Yellowstone National Park and central Idaho are designated as nonessential, experimental populations. On July 11, 2000, the USFWS published a *Federal Register* notice that proposed to change the status of the gray wolf under the ESA. In the northwestern United States, the gray wolf received a recommendation to be reclassified from endangered to threatened status because populations in Montana, Idaho, and Wyoming had exceeded 20 breeding pairs for more than three successive years. No changes were recommended for the Yellowstone National Park and central-Idaho experimental populations. In fall 2000, the minimum population was 177 wolves in the greater Yellowstone National Park area and 192 wolves in central Idaho.

On January 30, 2001, a single gray wolf was observed upriver of Allison Creek, on the Idaho side of Hells Canyon Reservoir. In addition, three wolves are known to have crossed the Snake River, most likely passing through Hells Canyon, into Oregon. In February 1999, a young radio-collared female wolf (B-45) from Idaho crossed the Snake River into Oregon. This wolf traveled as far as the headwaters of the John Day River. She was recaptured and returned to Idaho and established a territory north of McCall, Idaho. Another radio-collared wolf strayed into Oregon where it was fatally hit by a car while trying to cross Interstate 84 in Baker County. A third wolf, without a collar, was shot near Ukiah, Oregon. Several wolf sightings are in ODFW files for Wallowa County (ODFW unpublished data). One track of a gray wolf was incidentally reported during wolverine and Canada lynx surveys in the WWNF (Schommer 1994). In 2002, an Applicant biologist observed a radio-collared wolf within the canyon rim near the headwaters of the Wildhorse River, a tributary to Oxbow Reservoir. The Nez Perce Tribe is the principal entity leading gray wolf recovery in Idaho.

Idaho Ground Squirrel

The Idaho ground squirrel has the most restricted geographical range of any *Spermophilus* taxa and one of the smallest ranges of North American mainland mammals (Gill and Yensen 1992). The Idaho ground squirrel consists of two well-defined allopatric (occurring in separate, nonoverlapping geographical areas) taxons that are currently classified as subspecies: the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) and southern Idaho ground squirrel (*S. b. endemicus*) (Yensen 1991). Subsequent work has indicated that the two subspecies can be distinguished by differences in fur length and texture, cranial skull and external morphology, bacula size, allelic frequencies, DNA sequences, timing of the life history cycle, and behavior (Gill and Yensen 1992, Gavin et al. 1999).

Northern Idaho Ground Squirrel—The northern Idaho ground squirrel is endemic to west-central Idaho. In 1998, 36 historic and extant populations were known in Adams and Valley counties (*Federal Register* [April 5, 2000] 65[66]:17779–17786). Populations primarily occur between the Cuddy and Seven Devils mountains, east to New Meadows in Adams County and south through Long Valley to Round Valley in Valley County, an area that includes portions of Hells Canyon east of Oxbow and Hells Canyon reservoirs (Figure 1 in Technical Report E.3.2-26). The subspecies range appears to be about 300,000 ha, but the area occupied by the species is less than 500 ha (E. Yensen, Albertson College, personal communication). Suitable habitat occurs in xeric montane meadows surrounded by coniferous forests of ponderosa pine and Douglas-fir at elevations between 1,155 to 1,580 m (Yensen and Sherman 1997).

Populations have greatly declined in recent decades: 5,000 individuals in 1985 (Yensen 1985), 1,000 to 1,200 in 1993, 600 to 800 in 1994 (Yensen and Sherman 1997), and less than 350 in 2000 (Haak 2000). Population declines caused the USFWS to list the northern Idaho ground squirrel as threatened on April 5, 2000. The primary threat to the species is habitat loss from forest encroachment into suitable meadow habitat.

Population declines and the proximity of extant populations to the HCC prompted the Applicant to survey for northern Idaho ground squirrels in areas of Hells Canyon where reconnaissance surveys identified potentially suitable habitat (Figure 3 in Technical Report E.3.2-26). Two areas were surveyed for northern Idaho ground squirrels: Barber Flats (elevation 4,400 ft) and Indian Creek (3,800 ft). These sites contained habitats and soils similar to sites having existing populations and also had possible habitat corridors linking the historically and currently occupied sites. In 1998, one active northern Idaho ground squirrel burrow was found, and a whistle was heard on a bunchgrass-dominated ridge above Barber Flat (Figure 3 in Technical Report E.3.2-26). The Barber Flat population is isolated, and dispersal is unlikely. No evidence of ground squirrels was detected at Indian Creek.

Southern Idaho Ground Squirrel—The southern Idaho ground squirrel occurs in Gem, Payette, and Washington counties in west-central Idaho (Figure 1 in Technical Report E.3.2-26). The species was originally widespread over the entire area but is now restricted to small discrete sites (Yensen 1991). Yensen (1991) initially identified 24 sites potentially supporting southern Idaho ground squirrels and subsequent field work identified another 175 sites as of 1999. However, many of these sites are not currently occupied (Appendix 1 to Technical Report E.3.2-26). Extant populations occur between 670 and 975 m in elevation on rolling hills composed of lacustrine and fluvial sediments (Yensen and Sherman 1997). Much of the vegetation within the southern Idaho ground squirrel's range has been converted from native sagebrush-bunchgrass steppe to exotic cheatgrass and medusahead grasslands, a conversion that has probably caused population declines (Vander Haegen et al. 2001; Appendix 1 to Technical Report E.3.2-26). Because of declines, however, the USFWS was petitioned on January 26, 2001, to protect the subspecies under the ESA. The USFWS listed the southern Idaho ground squirrel as a candidate species on October 30, 2001 (*Federal Register* 66[210]:54808–54832).

Because of the precarious status and the proximity of extant populations to the HCC, the Applicant surveyed for southern Idaho ground squirrels in potentially suitable habitat within Hells Canyon (Technical Report E.3.2-26). Suitable habitat was defined as having deep soils, low topographic relief, little rock substrate, and possible corridors to extant populations. Expert opinion reconnaissance surveys identified potential habitat adjacent to upstream portions of Brownlee Reservoir, that is, near three historically occupied sites (Figure 4 in Technical

Report E.3.2-26). Systematic ground surveys detected southern Idaho ground squirrels and burrows at two sites: Cobb Rapids and Corral sites (Figure 4 in Technical Report E.3.2-26). Rubber rabbitbrush (*Ericameria nauseosa*), big sagebrush, and bulbous bluegrass dominate both sites. The sites are within several kilometers of each other, and dispersal between the two and among historically occupied sites is probable (Technical Report E.3.2-26).

Yellow-Billed Cuckoo

The yellow-billed cuckoo breeds over much of the United States and northern Mexico. However, the species has declined in the western United States since the 1930s. The species was formerly a common breeder along the Columbia River west of the Cascade Range. The yellow-billed cuckoo was listed as a candidate species by the USFWS on October 30, 2001 (*Federal Register* 66[210]:54808–54832). The species prefers large riparian forests, especially those with cottonwood overstories and willow (*Salix* species) understories. The yellow-billed cuckoo breeds in southern Idaho, at least in historical times (Stephens and Sturts 1998). No current nest sites are known in Oregon (Marshall et al. 1996). Information is not available for Idaho. The species was not observed in the Hells Canyon Study Area (Appendix 3 to Technical Report E.3.2-1).

Columbia Spotted Frog

The Columbia spotted frog ranges from extreme southeastern Alaska through western Alberta, western Montana, and northwestern Wyoming to northern Utah and central Nevada and west to northeastern Oregon and eastern Washington. Disjunct populations include the Great Basin population (Nevada, southwestern Idaho, and southeastern Oregon), the West Desert and Wasatch Front populations (Utah), and the Big Horn Mountain population of Wyoming. Populations of Columbia spotted frogs have greatly decreased from interspecific competition with northern leopard frogs and introduced bullfrogs and from loss of riparian habitat (Spahr et al. 1991, Marshall et al. 1996). The Columbia spotted frog was listed as a candidate species by the USFWS in some portions of its range, including the Great Basin on May 7, 1993 (*Federal Register* 58[87]:27260–27263). Within the area covered by this listing, this species is known to occur in Idaho, Nevada, and Oregon. The predicted distribution of the Columbia spotted frog includes higher elevations adjacent to Hells Canyon (Csuti et al. 1997, Groves et al. 1997). The Applicant reported Columbia spotted frogs at only one location within the study area. This site was located near the Powder River arm of Brownlee Reservoir (Figure 13b in Technical Report E.3.2-36).

E.3.2.1.3.13.2. Special Status Species

Birds

The Applicant observed 9 of 13 possible special status waterbirds in Hells Canyon: the common loon (*Gavia immer*), harlequin duck (*Histrionicus histrionicus*), American white pelican, (*Pelecanus erythrorhynchos*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), white-faced ibis (*Plegadis chihi*), greater sandhill crane (*Grus canadensis tabida*), long-billed curlew (*Numenius americanus*), and Franklin's gull (*Larus pipixcan*) (Appendix 3 to Technical Report E.3.2-1). Nesting was not detected for any of these species (Technical Report E.3.2-13). Three of 4 special status upland game bird species were observed in Hells Canyon: the greater sage grouse, Columbian sharp-tailed grouse, and mountain quail (Appendix 3 to Technical Report E.3.2-1 and Technical Report E.3.2-3.). All special status diurnal birds of prey were observed: the northern harrier, northern goshawk, ferruginous hawk (*Buteo regalis*), Swainson's hawk, merlin, and prairie falcon (Appendix 3 to Technical Report E.3.2-1 and Table 1 in Technical Report E.3.2-15). Only the prairie falcon and possibly the goshawk nested in Hells Canyon (Table 1 in Technical Report E.3.2-15). Three of 5 special status owl species were observed: the burrowing owl, flammulated owl (*Otus flammeolus*), and northern pygmy-owl (*Glaucidium gnoma*) (Appendix 3 to Technical Report E.3.2-1 and Technical Report E.3.2-15). Eight of 10 special status nonpasserines were observed: the calliope hummingbird (*Stellula calliope*), rufous hummingbird (*Selasphorus rufus*), pileated woodpecker (*Dryocopus pileatus*), Lewis' woodpecker (*Melanerpes lewis*), white-headed woodpecker (*Picoides albolarvatus*), red-naped sapsucker (*Sphyrapicus nuchalis*), Williamson's sapsucker (*Sphyrapicus thyroideus*), and Vaux's swift (*Chaetura vauxi*) (Appendix 3 to Technical Report E.3.2-1). Nineteen of 23 special status passerine species were observed: the olive-sided (*Contopus cooperi*), dusky (*Empidonax oberholseri*), cordilleran (*E. occidentalis*), Hammond's (*E. hammondii*), and willow flycatchers (*E. traillii*); bank swallow (*Riparia riparia*); Swainson's thrush (*Catharus ustulatus*); loggerhead shrike (*Lanius ludovicianus*); plumbeus vireo; Townsend's (*Dendroica townsendi*), yellow (*D. petechia*), MacGillivray's (*Oporornis tolmiei*), and Wilson's warblers (*Wilsonia pusilla*); green-tailed towhee (*Pipilo chlorurus*); Brewer's, grasshopper (*Spizella breweri*), and black-throated sparrows (*Amphispiza bilineata*); yellow-headed blackbird (*Xanthocephalus xanthocephalus*); and black rosy-finch (*Leucosticte atrata*).

Waterbirds (*Loons, Grebes, Pelicans, Swans, Ducks, Gulls, Terns, and Wading Birds*)—The common loon breeds from Alaska, northern Canada, and Greenland south to northeastern California, Iowa, and New England. The species breeds on northern lakes, ponds, and reservoirs. The species passes through Idaho during migration and is observed along the Snake River and associated reservoirs in small numbers in spring and fall (Stephens and Sturts 1991). The common loon breeds occasionally in southeastern Idaho (Groves et al. 1997). The Applicant regularly observed the species, but it was considered rare during winter, spring, and fall at the HCC reservoirs (Appendix 3 to Technical Report E.3.2-1).

The horned grebe (*Podiceps auritus*) breeds in most of Alaska and Canada south to Idaho, northern South Dakota, northern Iowa, and central Wisconsin. This species favors areas with open water surrounded with emergent vegetation. In Idaho, the horned grebe breeds uncommonly in northern and southeastern Idaho (Groves et al. 1997). In Oregon, the species breeds in south-central portions of the state (Csuti et al. 1997). The Applicant did not report this species in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The trumpeter swan (*Cygnus buccinator*) was formerly abundant and geographically widespread. However, its numbers and distribution were greatly reduced during the early fur trade and Euro-Asian settlement. The trumpeter swan breeds in areas of eastern Idaho and southern Oregon (Csuti et al. 1997, Groves et al. 1997). The Applicant did not observe the species in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The harlequin duck breeds in western North America from western Alaska south to Vancouver Island, eastern Oregon, and western Wyoming. In Idaho, the species has been found along swiftly flowing mountain streams (Cassirer et al. 1991). In eastern Oregon, on the WWNF, harlequin duck habitat exists, and the species has been sighted (USFS 1990a). A 1930s breeding record is available for the Wallowa Mountains (Wallowa River near Frazier Lake and Imnaha River) (Gabrielson and Jewett 1940). Surveys have not been conducted in Oregon (Cassirer and Groves 1991). The Applicant reported the harlequin duck during winter on Brownlee Reservoir (Appendix 3 to Technical Report E.3.2-1).

The American white pelican breeds discontinuously from northern California and southern Oregon to southwestern Montana. Pelicans need shallow water for foraging and also feed in open areas within marshes, along lake or river edges, on or below rapids, and less commonly in deep water of rivers and lakes (Evans and Knopf 1993). The species requires both permanent water and isolation from human disturbance and mammalian predators for successful breeding. Three nesting colonies have been established in southern Idaho since 1985 (Trost and Gerstell 1994). Total number of nesting pairs was estimated to range from 275 to 290 in 1993 (Trost and Gerstell 1994). In Oregon, three breeding colonies exist: Pelican Lake, Upper Klamath Lake, and Malheur Lake (Csuti et al. 1997). The Applicant commonly reported the American white pelican in the Snake River immediately upriver of Brownlee Reservoir and in the upper portions of Brownlee Reservoir, but only rarely in Oxbow and Hells Canyon reservoirs (Appendix 3 to Technical Report E.3.2-1).

The Franklin's gull breeds in north-central Canada south into the Great Plains, Montana, Idaho, Utah, and northern California. Breeding habitat includes sloughs, marshy lakes, and alkaline hardstem bulrush (*Schoenoplectus acutus*) marshes. The species is considered sensitive in Oregon because it breeds only at Malheur National Wildlife Refuge, which has an insecure and erratic water supply (Marshall et al. 1996). The Franklin's gull was considered to be rare in spring and fall on the HCC reservoirs (Appendix 3 to Technical Report E.3.2-1).

The black tern (*Chlidonias niger*) breeds from Canada south to northern Nevada and northern Utah, east of the Cascade Range. In Idaho, breeding terns are found south of the Snake River and in the northern panhandle. In Oregon, black terns breed at Malheur National Wildlife Refuge and other desert marshes (Csuti et al. 1997). The species requires aquatic habitats with extensive stands of emergent vegetation and large areas of shallow open water (DeGraaf and Rappole 1995). Black terns nest in low numbers (68–91 nesting pairs) in marshes of eastern Idaho (Trost and Gerstell 1994). The species migrates along the Snake River during spring and fall (BLM 1995), but the Applicant did not observe black terns in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The great egret breeds locally in various areas of the West, particularly Oregon, Nevada, California, and Idaho. In Idaho, the species nests in low numbers (17–36 pairs) at Mud Lake

Wildlife Management Area in eastern Idaho (Trost and Gerstell 1994). The great egret nests in the south-central portion of Oregon, with the largest colony at Malheur National Wildlife Refuge (Csuti et al. 1997). The species requires open freshwater marshes, wetlands, or ponds for foraging, with nearby woodlands for nesting (Trost and Gerstell 1994, DeGraaf and Rappole 1995). The Applicant reported the great egret during all seasons along the Snake River upriver of Brownlee Reservoir (Appendix 3 to Technical Report E.3.2-1).

The snowy egret breeds from Oregon and southern Idaho southward in the western United States and from Maine south along the Atlantic coast. The species is found on marshes, lakes, ponds, reservoirs, lagoons, and other shallow coastal habitats. Oregon and Idaho are at the northern edge of the breeding range for this species, and the breeding population fluctuates with habitat conditions (Marshall et al. 1996). Small numbers of snowy egrets have been reported in spring and fall along the Snake River immediately upriver of Brownlee Reservoir (Appendix 3 to Technical Report E.3.2-1).

The white-faced ibis breeds locally in northeastern California, southeastern Oregon, northern Nevada and Utah, Wyoming, western Montana, and southern Idaho. The species reaches its northern limit of breeding at the northern boundary of the Snake River Plain (Trost and Gerstell 1994). The white-faced ibis inhabits primarily freshwater wetlands, especially cattail (*Typha* species) and bulrush (*Scirpus* species) marshes, although it feeds in flooded hay meadows and agricultural fields (Ryder and Manry 1994). Idaho's breeding ibis population (3,300 and 4,700 nesting pairs) increased moderately from 1985 through 1997 (Earnst et al. 1998). In Oregon, the number of breeding pairs also increased, with approximately 4,000 breeding pairs in 1990 (Csuti et al. 1997). The white-faced ibis was rarely observed in Hells Canyon and only along Brownlee Reservoir (Appendix 3 to Technical Report E.3.2-1).

The greater sandhill crane breeds from northern Alaska and middle arctic Canada south locally to northeastern California, Nevada, Wyoming, Colorado, South Dakota, and Minnesota. The species nests in marshes and wet meadows or in drier grasslands and pastures. Populations in Oregon have been stable in recent years (Csuti et al. 1997). Sandhill cranes migrate through the Hells Canyon area and have been reported in small numbers (Appendix 3 to Technical Report E.3.2-1).

The long-billed curlew was historically abundant over much of the prairie regions of North America. Extensive market hunting and loss of habitat exterminated the species from eastern North America in the late 1800s. Continental populations continued to decline through the 1930s (Bent 1929). The population of long-billed curlews in the Columbia River basin and northern Great Basin was estimated at 8,000 to 13,000 nesting pairs in 1980 (Pampush 1980), with an estimated 2,500 to 3,500 nesting pairs in the central Snake River basin. In 1987, the former Cascade Resource Area of the BLM's Boise District reported an estimated 1,200 nesting pairs (BLM 1987). Habitat exists on the WWNF, and scattered sightings of the species have been reported (USFS 1990a). The long-billed curlew is considered to be an uncommon breeding bird in the Blue Mountains Province in Oregon (Marshall 1986). The species was considered uncommon in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The upland sandpiper (*Bartramia longicauda*) breeds locally from north-central Alaska southeastward to north-central Texas, across the Great Plains, and eastward across the northern half of the eastern United States to central Maine; it also breeds in northeastern Oregon. The species was abundant in historical times, but greatly reduced in the past because of market hunting and agricultural practices. The species is reported to nest near Hells Canyon (Stephens and Sturts 1998) and in the Blue Mountains Province in Oregon (Marshall 1986). Extensive surveys in 1984 and subsequent observations accounted for fewer than 100 upland sandpipers in Oregon (Herman et al. 1985) and even fewer in Idaho. Habitat is available on the WWNF, where the species has been reported (USFS 1990a). Applicant biologists did not observe the upland sandpiper in Hells Canyon (Appendix 3 to Technical Report E.3.2-1 and Appendix 1 to Technical Report E.3.2-2).

Upland Game Birds—Spruce grouse (*Dendragapus canadensis*) are distributed congruently with boreal coniferous forest and occur sparsely in Idaho and Oregon. Idaho and Oregon are the southernmost extent of the spruce grouse range. Spruce grouse, categorized as sensitive in Oregon, are mostly restricted to the Wallowa Mountains (Marshall et al. 1996), but may move through Hells Canyon when interchanging with populations in the Seven Devils Mountains of Idaho. Information on population sizes is not available for Oregon or Idaho (IDFG 1990). Spruce grouse were not observed in the Hells Canyon Study Area, but are expected at high elevations where the Seven Devils Mountains form the rim of Hells Canyon (Technical Report E.3.2-3).

The greater sage grouse occurs throughout the western United States and is loosely divided into two subspecies (Aldrich 1963). The western subspecies (*Centrocercus urophasianus phaios*) is found in eastern Washington, eastern Oregon, northwest Nevada, and northeast California (Aldrich 1963, Schroeder et al. 1999). The eastern subspecies (*C. u. urophasianus*) occurs in Idaho, Montana, Wyoming, Nevada, Utah, and Colorado. Sage grouse were historically abundant in shrub-steppe habitats of the western United States, although population declines were noted as early as 1903 (Willis et al. 1993). During early spring, sage grouse assemble at traditional lek sites, where males display to attract females (Batterson and Morse 1948, Connelly et al. 1981, Gates 1985, Wakkinen et al. 1992). Sage grouse populations may be resident or migratory. For resident populations, the lek area tends to be the center of activity, whereas migratory populations move among breeding, brood-rearing, fall, and winter habitats (Connelly et al. 2000). Connelly et al. (2000) recommend habitat protection within 3.2 km of lek sites for resident populations and within 18 km for migratory populations.

The greater sage grouse depends on sagebrush-dominated rangelands year-round and was historically widespread in southern Idaho and southeastern Oregon. The status of sage grouse is of concern to wildlife managers because of recent population declines throughout the species' range. Declines are largely attributed to the loss and degradation of sagebrush (*Artemisia* species) habitats (Klebenow 1969, Martin 1970, Wallestad 1975, Braun et al. 1977, Swenson et al. 1987, Drut 1994, Connelly and Braun 1997, Braun 1998). The USFWS listed the Columbia River basin population of the greater sage grouse in Washington as a candidate species on October 30, 2001 (*Federal Register* 66[210]:54808–54832). Although Applicant biologists did not detect sage grouse during formal surveys (Technical Report E.3.2-8), sage grouse were observed at several locations at the southern end of Hells Canyon adjacent to Brownlee Reservoir and near the Powder River arm of Brownlee Reservoir (BLM 1987, Smith 1990, Willis et al. 1993, section 6.2. in Technical Report E.3.2-3).

The sharp-tailed grouse is separated into seven subspecies (Connelly et al. 1998). The Columbian sharp-tailed grouse subspecies (*Tympanuchus phasianellus columbianus*) is native to shrub and grassland habitats of the northwestern United States, including Hells Canyon. It was historically abundant throughout its range, but now occupies less than 10% of its former range (Marks and Marks 1987, BLM 1987). In Oregon, sharptails are currently extinct (excluding an experimentally translocated population in Wallowa County; Crawford and Snyder 1995), and in west-central Idaho, they are known to exist only in isolated populations (Miller and Graul 1980, BLM 1987, Hemker 1994). Because of large-scale population declines, the USFS and BLM classified Columbian sharp-tailed grouse as a sensitive species (Table E.3.2-1) (IDCDC 2001). The USFWS classified the subspecies as a federal candidate species (IDCDC 1994). After a 12-month review of the grouse's status across its range, however, the USFWS determined that the species was not warranted for listing as threatened or endangered (*Federal Register* [October 11, 2000]).

Habitat degradation (Connelly et al. 1998), grazing and haying (Kirsch et al. 1973, 1978; Marks and Marks 1987; Giesen and Connelly 1993), and fire suppression (Kirsch et al. 1973, Meints 1991, Giesen and Connelly 1993) are the main causes of population declines. The status of the Columbian sharp-tailed grouse specifically in Hells Canyon is unknown, with only one lek known to historically occur (BLM 1987). Few systematic surveys for sharptails have been conducted in Hells Canyon; distributional information is restricted to anecdotal sightings (Technical Report E.3.2-8). The Applicant observed sharptails incidentally in Hells Canyon but not during formal surveys (section 6.2. in Technical Report E.3.2-3).

The mountain quail is distributed throughout the mountains of the Pacific coast, western Great Basin, and Intermountain West (AOU 1983, Spahr et al. 1991, Gutiérrez and Delehanty 1999). Idaho and northern Nevada are at the eastern edge of this species' distribution. Although western populations appear stable (Brennan 1990, Gutiérrez and Delehanty 1999), those in the Intermountain West have experienced significant declines over the last several decades (Robertson 1989, Brennan 1990). As a result, the IDFG classified mountain quail as a species of special concern, and the BLM and USFS classified it as a sensitive species (ORNHP 1995, IDCDC 2001). On March 16, 2000, the USFWS was petitioned to provide the mountain quail protection under the ESA.

In Idaho, mountain quail historically occupied narrow, riparian habitats in the lower elevations along the Boise, Snake, Salmon, and Clearwater rivers (Murray 1938; Ormiston 1966; Brennan 1989; Robertson 1989, 1990; Brennan 1990). Now mountain quail are only commonly found in the lower Salmon River drainage (Brennan 1989; Robertson 1989, 1990; Heekin et al. 1995). Little research on the mountain quail has been conducted in Idaho and eastern Oregon because of the bird's secretive behavior, low population densities, and use of dense vegetation in difficult terrain (Techical Report E.3.2-4). Ormiston (1966) investigated mountain quail food habits, habitat use, and movements specifically for Hells Canyon. More recently, Vogel (1994) assessed habitat suitability in selected tributaries of Brownlee Reservoir and determined that, although mountain quail are absent, habitat in the area appeared suitable for reintroduction efforts. Pope (2002) tested reintroduction techniques for mountain quail in the HCNRA.

Because of the quail's uncertain population status and habitat relationships with the HCC, the Applicant participated in three mountain quail studies: 1) developing a survey technique (Technical Report E.3.2-4), 2) inventorying Big Canyon Creek (Technical Report E.3.2-5), and 3) evaluating habitat adjacent to the HCC (Technical Report E.3.2-6). The Applicant cooperated with the University of Idaho, IDFG, and BLM to develop a survey technique for mountain quail (Technical Report E.3.2-4). A call-count survey was determined to be the most efficient method for detecting the presence of this secretive species in areas with dense vegetation (Levy et al. 1966, Stirling and Bendell 1966, Fuller and Mosher 1981).

Under contract with the Applicant in 1996, the University of Idaho assessed the feasibility of conducting a mountain quail ecology study at Big Canyon Creek in Hells Canyon (Technical Report E.3.2-5). Ormiston (1966) studied mountain quail in Big Canyon Creek during 1964 and 1965, when the species was more abundant. The Big Canyon Creek Study Area was approximately 5 km north of Pittsburg Landing on the Snake River and occupied approximately 15 mi^2 (Ormiston 1966) of the HCNRA. In 1996, field work was conducted from March 1 to April 5, for a total of 23 days, or 440 hours of effort. No mountain quail or signs of mountain quail were detected by various field techniques. Reasons for the absence were unclear (Technical Report E.3.2-5).

Isolated populations are, however, believed to exist elsewhere in Hells Canyon (Stephen and Sturts 1998). The IDCDC documented recent mountain quail sightings at Big Bar (1996) and Brownlee Creek (1994).

The Applicant evaluated the existing distribution and quality of mountain quail habitat in the Hells Canyon Study Area (Technical Report E.3.2-6). The analysis of mountain quail habitat was based on a Habitat Suitability Index (HSI) model developed and tested by Brennan (1984, 1991). The model analyzed two spatial (distance to water and to cover) and three vegetation (minimum and maximum shrub heights and percentage cover of shrubs) variables. For a landscape-level assessment, Brennan's model was applied to forest and shrub habitats (Ormiston 1966, Gutiérrez 1980, Brennan 1984, Brennan et al. 1987, Brennan 1990) that were identified on the Applicant's cover type map of Hells Canyon (Technical Report E.3.3-1).

Oxbow Reservoir contained the highest-quality habitat for mountain quail, followed by Brownlee Reservoir (Table 5 in Technical Report E.3.2-6). High-quality habitat was found on only a small portion of the land area and was largely restricted to riparian draws. *Scrub-Shrub Wetlands* had HSI scores greater than 0.80 in all reaches (a score of 1.0 indicates optimal habitat for the species) (Table 6 in Technical Report E.3.2-6); *Forested Wetlands* had HSI scores from 0.70 to 0.80. Approximately 1,012 ha, or 2.88% of the study area, were identified as these two cover types. *Shrubland* and *Shrub Savanna* were largely unsuitable for mountain quail. Therefore, limited high-quality habitat appears to be available to mountain quail in the Hells Canyon Study Area. The decline of mountain quail in the area was not explained by the study results.

Diurnal Birds of Prey—The northern harrier breeds throughout North America and Eurasia. The northern harrier is a long-distance migrant throughout much of its range (MacWhirter and Bildstein 1996). The species winters primarily from southern Canada throughout the conterminous United States, Central America, and Caribbean islands. Studies in the western United States suggest very low (< 0.10/10km^2) nest densities in dry shrub-steppe and cold desert habitats. Populations have been apparently stable since the early 1960s in North America. The Idaho population has shown a steady decline (Dobkin 1994). Asherin and Claar (1976) observed the northern harrier nesting along Brownlee Reservoir. The northern harrier was rarely reported in the Hells Canyon Study Area (Appendix 3 to Technical Report E.3.2-1). The species was never observed during summer and apparently does not nest in Hells Canyon (Technical Reports E.3.2-14 and E.3.2-15).

The northern goshawk is holarctic in distribution. The species occurs throughout the western United States. Northern goshawks are residents in northeastern Oregon and north and north-central Idaho (Reynolds 1987). Northern goshawks nest at elevations of 580 m (1,900 ft) to 1,860 m (6,100 ft) in stands of large coniferous or deciduous trees. During a raptor survey of Hells Canyon, Levine and Erickson (1990) recorded three occupied northern goshawk territories. Applicant biologists rarely encountered the goshawk in Hells Canyon. Nesting activity was suspected at one site (the Applicant's Environmental Affairs Department, unpublished data).

Ferruginous hawks have historically inhabited much of western North America. The species breeds in arid, semiarid, and grassland regions. The species' breeding range is the most restricted of all North American buteos and is declining throughout much of the bird's range (Harlow and Bloom 1987, Marshall et al. 1996). The ferruginous hawk appears to be currently restricted to north-central and southeastern portions of Oregon and southern portions of Idaho (Bechard et al. 1986, Harlow and Bloom 1987). Ferruginous hawks nest in the WWFN, but specific information is not available (USFS 1990a). Applicant biologists observed the ferruginous hawk along Brownlee Reservoir in Hells Canyon (Appendix 3 to Technical Report E.3.2-1), but nesting was not detected (Table 4 in Technical Report E.3.2-15).

The Swainson's hawk has a similar distribution as the ferruginous hawk. In the early 1900s, the species was one of the most common nesting raptor species across eastern and central portions of Oregon (Bechard et al. 1986). Swainson's hawks were formerly considered common in arid and semiarid habitats, but populations have experienced recent and dramatic declines (Harlow and Bloom 1987). Oregon is estimated to support 400 to 800 nesting pairs (Harlow and Bloom 1987, Janes 1987), and status is unknown in Idaho (Bechard et al. 1986). Asherin and Claar (1976) observed the Swainson's hawk nesting adjacent to Brownlee Reservoir. Applicant biologists did not detect nesting Swainson's hawk (Table 4 in Technical Report E.3.2-15), a species considered to be uncommon in the southern portion of Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The merlin has a circumpolar distribution. In North America, the species breeds in Alaska, most of Canada, and parts of the northern and western United States (Sodhi et al. 1993). The species is migratory and winters as far south as northern Peru. Merlins prefer to nest in semi-open areas and to winter in open grassland, semi-open forest, and coastal habitats. Numbers of merlins indicate a significant decline in Idaho (Dobkin 1994). Applicant biologists observed the merlin in Hells Canyon only during winter and considered the species to be rare (Appendix 3 to Technical Report E.3.2-1).

The prairie falcon is largely restricted to western North America (Palmer 1988). The species breeds from southeastern British Columbia to Baja California and northern Texas. Prairie falcons winter south to central Mexico (DeGraaf and Rappole 1995). The species inhabits arid lands typified by open, treeless terrain (Palmer 1988). Prairie falcons are locally common (for example, SRBPNCA), but they have shown a long-term decline in the western part of their range (DeGraaf and Rappole 1995). Population numbers are stable in Idaho (Dobkin 1994). In Hells Canyon, Applicant biologists documented five prairie falcon nesting territories associated with cliff habitats (Table 1 in Technical Report E.3.2-15).

Owls—The great gray owl (*Strix nebulosa*) resides in forested areas across North America. The great gray owl is an uncommon local resident in Idaho and Oregon (Marshall et al. 1996). Great gray owls are found in north, north-central, and southeastern Idaho (Munts and Powers 1991), and they nest in central and northeastern Oregon. The great gray owl nests in mixed-coniferous, ponderosa pine, and lodgepole pine forests and forages over open areas, such as meadows and clear-cuts (Csuti et al. 1997). Quantitative data on population trends are not available (Forsman and Bull 1987). Applicant biologists did not observe the great gray owl in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The burrowing owl occurs throughout the western United States, although very little population data is available. The species breeds and forages in open grasslands, deserts, agricultural lands, and urban areas (Marti and Marks 1987). The status of the species is stable in Idaho (Marti and Marks 1987), but unclear in Oregon (Marshall et al. 1996). The Applicant documented nesting by burrowing owls in upland habitat adjacent to Brownlee Reservoir (Table 4 in Technical Report E.3.2-15).

The boreal owl (*Aegolius funereus*) is circumpolar in distribution and is typically found in coniferous forests. In the lower 48 states, it nests in the mountains of Washington, Idaho, Montana, Wyoming, and Colorado (Reynolds et al. 1989). In Idaho, boreal owls nest in north and north-central parts of the state. In Oregon, the species occurs as geographically isolated metapopulations because of patchily distributed habitat (Hayward 1994). Boreal owl nesting has been found mainly in higher-elevation conifers, primarily spruce and fir, but also in lodgepole pine and Douglas-fir habitat immediately adjacent to the spruce-fir zone. The Applicant did not observe the boreal owl in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The flammulated owl occurs in montane forests in western North America from Central America to British Columbia. It is the only forest owl classified as a neotropical migrant. Flammulated owls nest in northern and west-central portions of Idaho. In Oregon, they are restricted to the Cascade Range and the northeastern portion of the state (Reynolds et al. 1989, Marshall et al. 1996). Flammulated owl nesting habitat consists of mature to old forest stands, with open, multiple canopy layers and low tree densities (Moore and Frederick 1991). The species was once thought to be rare, but is now known to occur at least uncommonly and even commonly in prime habitat (Marshall et al. 1996). Although the flammulated owl is considered rare, Applicant biologists observed the species throughout Hells Canyon during spring and summer and therefore suspected nesting (Appendix 3 to Technical Report E.3.2-1).

The northern pygmy owl resides in woodlands and forests from foothills to high mountains from southeastern Alaska to Mexico and Guatemala. The species nests throughout Idaho, except for the southern and southwestern deserts. In Oregon, the northern pygmy owl nests in the western and northeastern parts of the state (Reynolds et al. 1989). Little is known about population status and nesting habitat because few pygmy owl nests have been found. The Applicant commonly observed the northern pygmy owl during winter. No nests were found, but the Applicant also observed pygmy owls during spring and fall at higher elevations (Appendix 3 to Technical Report E.3.2-1), suggesting that nesting may occur within Hells Canyon.

Nonpasserines (*Hummingbirds, Woodpeckers, and Swifts*)—The rufous hummingbird breeds from southern Alaska and British Columbia to northwestern California, eastern Oregon, and central Idaho (Calder 1993). The species occurs in meadows, forest edges, and riparian thickets of coniferous woodlands and in northwestern parks and gardens (DeGraaf and Rappole 1995). Breeding Bird Survey data indicated that, in Oregon, the species had a significant declining trend, whereas in Idaho, the trend was increasing but nonsignificant (Sauer et al. 2001). Applicant biologists observed the rufous hummingbird during spring and summer in Hells Canyon and considered the species uncommon to common (Appendix 3 to Technical Report E.3.2-1).

The calliope hummingbird breeds in mountains from central British Columbia and southwestern Alberta through Washington, Oregon, Nevada, California, Wyoming, Colorado, and Utah. Habitats include open montane forests and thickets of willow and alder (*Alnus* species). Diet includes insects; spiders; and the nectar of currant (*Ribes* species), paintbrush (*Castilleja* species), columbine (*Aquilegia* species), *Penstemon* species, and *Gilia* species (Csuti et al. 1997, Groves et al. 1997). According to Breeding Bird Survey data, the calliope hummingbird had a significant declining trend in Oregon, whereas the trend was increasing but nonsignificant in Idaho (Sauer et al. 2001). The Applicant considered the calliope hummingbird to be uncommon in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The pileated woodpecker breeds in North America, where it is widely dispersed. The species is generally limited to mature coniferous, deciduous, and mixed forests that have large, dead trees. The species is an important primary excavator of nest cavities that are used by secondary cavity users. The pileated woodpecker is uncommon in coniferous forests of northeastern Oregon (Bull 1987), with an estimated density of one pair per 220 ha in the WWNF (Bull 1987). The species occurs throughout western Idaho in forests containing suitably large trees and snags for nesting and foraging (Csuti et al. 1997, Stephens and Sturts 1998). Specific information on the status of this species on the Idaho side of Hells Canyon is not available, although the species is reported to nest in all counties composing Hells Canyon (Stephens and Sturts 1998). The Applicant considered the pileated woodpecker to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The white-headed woodpecker ranges from southern British Columbia through Washington and Idaho to southern California and Western Nevada (AOU 1983). The species uses open-canopied stands of mature ponderosa pine and mixed ponderosa pine and Douglas-fir (Frederick and Moore 1991). The species is considered rare to uncommon, having a patchy distribution in ponderosa pine zones in Oregon (Marshall et al. 1996). White-headed woodpeckers have been reported in Hells Canyon (Frederick and Moore 1991) and western Idaho (Stephens and Sturts 1998). The species is considered an uncommon breeding bird in the Blue Mountains Province in Oregon (Marshall 1986). Applicant biologists considered the white-headed woodpecker to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The three-toed woodpecker (*Picoides tridactylus*) ranges across North America from northern Canada to southern Oregon, Idaho, Utah, New Mexico, and Arizona. The species is found in northern coniferous and mixed forest types up to elevations of 3,000 m (9,840 ft). Forests containing spruce, grand fir (*Abies grandis*), ponderosa pine, tamarack (*Larix laricina*), and lodgepole pine are used (Spahr et al. 1991, Csuti et al. 1997). Because snags are used for foraging as well as nesting, large burns and beetle-infested forests are strongly favored for breeding (Goggans et al. 1988). Insufficient information is available in the Breeding Bird Survey data to determine trends for the three-toed woodpecker in the Intermountain West (Sauer et al. 2001). Specific information on the status of the three-toed woodpecker is not available for Hells Canyon, and Applicant biologists never observed the species (Appendix 3 to Technical Report E.3.2-1).

The black-backed woodpecker (*Picoides arcticus*) ranges from Alaska and Canada where there are coniferous forests south into Oregon. The species inhabits high-elevation forests dominated by lodgepole and ponderosa pines mixed with other conifers along the Cascade Range and the Blue Mountains in northeast Oregon (Marshall et al. 1996, Csuti et al. 1997). Likewise, in Idaho, the species can be found in coniferous forests throughout the state (Stephens and Sturts 1998). The black-backed woodpecker breeds throughout Idaho in suitable habitat (Stephens and Sturts 1998) and is locally common in Oregon, although with a spotty distribution. Applicant biologists never observed the black-backed woodpecker in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Lewis' woodpecker ranges from British Columbia to southern New Mexico and eastern Colorado. Unlike most woodpecker species, Lewis' woodpecker is an aerial insectivore and requires open country with vegetation openings and scattered trees for foraging maneuvers. The species was originally a summer resident in every part of Oregon (Gabrielson and Jewett 1940), but its numbers have declined and its distribution has decreased since the late 1940s. Breeding

Bird Survey data for Idaho and Oregon indicated a decreasing population trend from 1966 to 2000, but limited numbers of birds were observed and trends were nonsignificant (Sauer et al. 2001). The species breeds throughout Idaho. Applicant biologists considered the Lewis' woodpecker to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The red-naped sapsucker breeds from south-central British Columbia, southwestern Alberta, and western Montana to east-central California, southern Nevada, central Arizona, southern New Mexico, and western Texas. The species is found primarily in coniferous/deciduous woodlands that include aspen and cottonwood. Applicant biologists considered the bird rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Williamson's sapsucker breeds in mountains from southern British Columbia, Idaho, and western Montana to northern and east-central California and northern New Mexico. This species is found in mature, higher-elevation coniferous and aspen forests. The Williamson's sapsucker is considered sensitive in Oregon due to timber management that includes removing older trees with heartrot and snags (Marshall et al. 1996). Applicant biologists considered the species to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Vaux's swift breeds from southeastern Alaska, western Canada, northern Idaho, and western Montana south to central California. This species is found in coniferous forests but forages and migrates over open country, rivers, and lakes. Because large, hollow coniferous trees serve as nesting sites (Csuti et al. 1997), this species is sensitive to timber harvest (Csuti et al. 1997). The Breeding Bird Survey indicated a nonsignificant increasing trend from 1966 to 2000 (Sauer et al. 2001). Applicant biologists considered the Vaux's swift to be uncommon in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

Passerines—The olive-sided flycatcher breeds from portions of Alaska and Canada south to North Carolina in the East and to the mountains of northern Baja California, Arizona, and New Mexico in the West. The olive-sided flycatcher occupies a variety of forest types, from sea level to subalpine environments. The species prefers forests with an uneven canopy and perches in tall trees or snags while overlooking its territory (Csuti et al. 1997). The Breeding Bird Survey (1966–

2000) demonstrated a significant decreasing trend of 3.5% average per year in the western region (Sauer et al. 2001). Applicant biologists considered the olive-sided flycatcher to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The dusky flycatcher winters in southern Arizona and Mexico, but breeds from southwestern Yukon to western South Dakota and to southern California, southern Nevada, central Arizona, and New Mexico (DeGraaf and Rappole 1995). The dusky flycatcher prefers shrubby sites or open forests with substantial shrub understory and occurs in a variety of habitats from montane chaparral to many montane conifer and aspen forests. Although the 30-year (1966–2000) population trend generated from the Breeding Bird Survey showed a nonsignificant decrease (Sauer et al. 2001), other analyses suggest that forest management practices have enhanced historical population levels of the species (Sharp 1996). Applicant biologists considered the dusky flycatcher to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Hammond’s flycatcher nests from central Alaska and western Canada to the southern Sierra Nevada Mountains in California and the Rocky Mountains in New Mexico. This species is found in mid- to high-elevation coniferous forests, particularly old-growth Douglas-fir/ponderosa pine forests (Csuti et al. 1997, Groves et al. 1997). Applicant biologists considered the Hammond’s flycatcher to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The cordilleran flycatcher breeds from southeastern Washington, southwestern Alberta, northern Idaho, western Montana, Wyoming, and western South Dakota to northern California, Nevada, Arizona, and Mexico. This species breeds in cool forests and woodlands near cliffs and in shady canyon bottoms, especially along streams in montane coniferous forests (Groves et al. 1997). Applicant biologists considered the cordilleran flycatcher to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The willow flycatcher breeds from central British Columbia, southern Alberta, southern Wisconsin, southern Quebec, central Maine, and Nova Scotia to southern California, western and central Texas, Arkansas, northern Georgia, and Virginia. The species occurs in a variety of habitats: shrubby fields, riparian willows thickets, and riparian-gallery forests (DeGraaf and

Rappole 1995). In the West, riparian breeding habitat is degraded by livestock grazing and willow control (Taylor and Littlefield 1986, Saab et al. 1995) and is the center of much concern for range management (Saab and Rich 1997). The Breeding Bird Survey (1966–2000) showed a significant decreasing population trend in both Idaho and Oregon (Sauer et al. 2001). The Applicant considered the willow flycatcher to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The bank swallow ranges from western and central Alaska to southern California and southern Texas. In Oregon, mainly east of the Cascade Range, the species occurs as a summer resident (Marshall et al. 1996). The bank swallow breeds throughout Idaho, except at high elevations (Stephens and Sturts 1998). An Idaho/Oregon wildlife survey of the Snake River in 1991 found three colonies totaling 650 burrows along the river east of Nyssa, Oregon, in Malheur County. The status of the bank swallow in Oregon and Idaho is unclear (Marshall et al. 1996, Stephens and Sturts 1998), and Applicant biologists considered the bank swallow to be uncommon in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The pygmy nuthatch (*Sitta pygmaea*) is a resident from southern British Columbia to the mountains of northern Baja California. In the Rocky Mountains, the species occurs in a variety of open coniferous woodlands, especially old-growth ponderosa pine (Csuti et al. 1997, Groves et al. 1997). Pygmy nuthatch populations decline significantly with timber harvest and snag removal (Marshall et al. 1996). Applicant biologists did not observe the species in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Swainson's thrush breeds from western and central Alaska to California, central Utah, north-central New Mexico, northern Nebraska, and the Northeast. In the western parts of its range, the Swainson's thrush prefers old growth of mixed conifers on moist slopes, aspen forests with dense understories, and willow or alder thickets (Groves et al. 1997). Breeding Bird Survey data indicated that, in Idaho and Oregon, populations showed a nonsignificant decline over the period 1966 to 2000 (Sauer et al. 2001). Applicant biologists considered the Swainson's thrush to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The veery (*Catharus fuscescens*) breeds from southern British Columbia east to Newfoundland, from British Columbia southeastward to central Oregon and southern Idaho, and from Newfoundland southwest to Georgia. The species inhabits low or moist deciduous woods and bottomland forests. It prefers sapling stands of deciduous second-growth or open forests with fairly dense undergrowth of ferns, shrubs, and trees (Moskoff 1995). According to Breeding Bird Survey data for Idaho and Oregon, populations showed a nonsignificant decline over the period 1966 to 1996 (Sauer et al. 1999). Applicant biologists did not detect the veery in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The loggerhead shrike is widely distributed in North America. It ranges from southern Canada to Mexico and from coast to coast. Southern populations are largely residents, while northern populations are at least partially migratory (Miller 1931, Bent 1965). Mild to precipitous declines have been observed in most parts of the United States (Davis and Morrison 1987). In the Pacific Coast and Southwest regions, however, populations appear to be stable to slightly declining (Davis and Morrison 1987). In eastern Oregon, the species is found mainly in sagebrush and juniper (*Juniperus* species) steppe (Marshall et al. 1996). In shrub-steppe habitats of southeast Oregon, no decline was evident for the past 15 years (Keister and Ivey 1994). However, the Breeding Bird Survey indicated significant declines for the species in Oregon and nonsignificant declines in Idaho (Sauer et al. 2001). The species is considered an uncommon breeding bird in the Blue Mountains Province in Oregon (Marshall 1986). Stephens and Sturts (1998) recorded loggerhead shrikes as breeding in areas adjacent to the southern portion of Hells Canyon and being transient in east-central Idaho. However, Applicant biologists considered the loggerhead shrike to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The solitary vireo (*Vireo solitarius*) was recently split by the American Ornithologists' Union into three separate species: the plumbeus vireo of the western interior, Cassin's vireo (*Vireo cassinii*) of the West Coast, and the blue-headed vireo (*Vireo solitarius*) of eastern North America (Curson and Goguen 1998). Although exact distributions are uncertain, Cassin's vireo breeds north of the Snake River, and the plumbeus vireo breeds to the south (Stephens and Sturts 1998). General habitat preferences in the West include open woodlands with shrub understories (DeGraaf and Rappole 1995). Populations may be declining in Idaho, but are generally stable in the West (Dobkin 1994). Applicant biologists did not distinguish between the Cassin's and plumbeus vireos during field surveys (both were reported as plumbeus vireos) and considered the plumbeus vireo to be uncommon to common in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The MacGillivray's warbler is restricted primarily to the Rocky Mountains (Pitocchelli 1995). The species is a riparian specialist, exhibiting very narrow habitat tolerance compared with other insectivorous riparian birds (Dobkin 1994). The species nests in riparian thickets, coniferous forest with dense undergrowth, and moist montane shrublands below 9,000 ft in elevation (Pitocchelli 1995). Overall, the species populations have expanded since the late 1880s in the western United States. Numbers appear to be stable in Idaho, but the Breeding Bird Survey indicated significant declines in Oregon (Sauer et al. 2001). The Applicant considered the MacGillivray's warbler to be uncommon in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The yellow warbler breeds widely from Alaska and northern Canada to the Galapagos Islands, Peru, and Venezuela. The species winters from southern California and southern Florida south to the Brazilian Amazon, Bolivia, and Peru (Lowther et al. 1999). The yellow warbler prefers dense, early second-growth deciduous woodlands. The species is common, but has experienced small declines in the western United States from riparian habitat losses from stream channelization and livestock grazing (DeGraaf and Rappole 1995). Applicant biologists determined that the yellow warbler was common in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Townsend's warbler nests from east-central Alaska south along the Pacific Coast and east to south-central Montana. Townsend's warblers require mature coniferous and mixed coniferous-deciduous forests (DeGraaf and Rappole 1995, Wright et al. 1998). The species is considered a forest-interior nester (Dobkin 1994). Breeding Bird Survey data indicated no significant trend for the western United States from 1966 to 2000 (Sauer et al. 2001). Applicant biologists considered the Townsend's warbler to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Wilson's warbler breeds from northern Alaska and southeastern Labrador to southern California and northern New Mexico (DeGraaf and Rappole 1995). Wilson's warblers prefer wet forest clearings in early stages of regeneration (Ammon and Gilbert 1999). In the West, dense riparian thickets at higher elevations and boggy montane thickets are preferred (Dobkin 1994). The species is common, but declining over much of its breeding range. Populations appear to be stable in Oregon and Idaho (Sauer et al. 2001). The Applicant considered the species to be uncommon in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The yellow-headed blackbird occurs throughout the prairie and mountain meadow wetlands of the western and central United States and Canada (Twedt and Crawford 1995). The species nests in deep-water emergent wetlands throughout unforested regions. Numbers of yellow-headed blackbirds are declining in Idaho, but increasing significantly in both Montana and North Dakota. Numbers are increasing for the West overall and for the continentwide range (Dobkin 1994). Applicant biologists considered the species to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The bobolink (*Dolichonyx oryzivorus*) breeds from British Columbia and Alberta in the north and west eastward to Newfoundland and south to West Virginia. The bobolink has a patchy distribution in the western portion of its breeding range (Martin and Gavin 1995). The species prefers large, open fields of tall grass, grassy hay fields, and clover or grain crops, but also inhabits wet meadows, lightly grazed mixed-grass prairies, and fallow fields. Numbers have declined in the United States since the early 1900s (DeGraaf and Rappole 1995). Applicant biologists did not observe the species in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The grasshopper sparrow (*Ammodramus savannarum*) has a discontinuous breeding range from British Columbia to the Southeast. The range of the species in Oregon is disjunct, with locations that change periodically (Csuti et al. 1997) but that tend to cluster in northeastern Oregon (Marshall et al. 1996). Grasshopper sparrows nest throughout southern Idaho (Stephens and Sturts 1998). Saab and Rich (1997) reported an apparently stable population trend for the grasshopper sparrow in the Great Basin. Grazing may reduce or completely exclude grasshopper sparrow populations (Bock and Webb 1984, Saab et al. 1995) because livestock remove grasses composing the species' main habitat (Janes 1983). Applicant biologists considered the grasshopper sparrow to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The Brewer's sparrow breeds from southwestern Yukon to southern California, central Arizona, and southwestern South Dakota. The species is strongly associated with sagebrush-steppe communities, where it is the dominant bird species. Brewer's sparrows were once common, but are now declining over much of their range because of conversion of shrub-steppe vegetation to agriculture. The species is declining significantly in Idaho and the Columbia River basin (Sauer et al. 2001). Applicant biologists considered the Brewer's sparrow to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The sage sparrow (*Amphispiza belli*) breeds from central Washington and eastern Oregon east through the Great Basin into Wyoming and Colorado and south to southern California, Arizona, and New Mexico. The sage sparrow prefers sagebrush-steppe habitats. Sage sparrows show an overall declining trend across their range, including Idaho (Dobkin 1994). Applicant biologists did not observe the species in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The black-throated sparrow is found in the Great Basin, Mojave, and Colorado deserts. The species typically occurs in a narrow zone between valley or playa floors and steep rocky mountain ranges and escarpments (Bent 1965). The species is found in the southeast corner of Oregon (Marshall et al. 1996) and nests throughout southern Idaho (Stephens and Sturts 1998), including Washington County near Weiser (Marks et al. 1980). The species is at the northern edge of its range in Oregon (Csuti et al. 1997) and was historically very rare in Oregon. In Oregon and Idaho, the species is often observed as a vagrant (Marshall et al. 1996). Applicant biologists considered the black-throated sparrow to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The green-tailed towhee breeds from southeastern Washington, southern Idaho, southwestern Montana, and northwestern and southeastern Wyoming south to southern California, southern Nevada, and central Arizona. The green-tailed towhee is found mainly south of the Snake River Plain in southwestern and south-central Idaho (Dobbs et al. 1998). Generally, the species inhabits relatively arid and shrubby foothills (Dobbs et al. 1998). Applicant biologists considered the green-tailed towhee to be rare in Hells Canyon (Appendix 3 to Technical Report E.3.2-1).

The black rosy-finch breeds above timberline in the Rocky mountains. A subspecies of the black rosy-finch, the Wallowa rosy finch (*Leucostricta atrata wallowa*), occurs in summer around snowfields in the Eagle Cap Wilderness of the Wallowa–Whitman National Forest of northeastern Oregon (Marshall 1986). The status of black rosy-finches in the Wallowa Mountains is unclear, particularly because of their confusing taxonomic status (Marshall et al. 1996). Applicant biologists considered the gray-crowned rosy finch (*L. tephrocotis*) to be uncommon to rare during winter in Hells Canyon, but no black rosy-finches were observed (Appendix 3 to Technical Report E.3.2-1). Breeding populations of this species have not yet been identified in the Hells Canyon Study Area (USFS 1990a).

Mammals

Of the two special status insectivore species potentially occurring in Hells Canyon, the Applicant's biologists documented the coast mole but not the Preble's shrew. They also documented 9 of 10 special status bat species—the Yuma myotis, long-eared myotis (*Myotis evotis*), fringed myotis, long-legged myotis (*Myotis volans*), California myotis (*Myotis californicus*), western small-footed myotis (*Myotis ciliolabrum*), western pipistrelle, Townsend's western big-eared bat, and spotted bat—in Hells Canyon (Table 4 in Technical Report E.3.2-27). Four special status carnivores may occur in Hells Canyon: the American marten, wolverine, fisher, and kit fox. Only the wolverine was reported in the study area. Of the 3 special status rodent and lagomorph species—the northern flying squirrel (*Glaucomys sabrinus*), pygmy rabbit (*Brachylagus idahoensis*), and white-tailed jackrabbit (*Lepus townsendii*)—only the white-tailed jackrabbit was reported. The only special status ungulate, the California bighorn sheep, does not occur in Hells Canyon but occupies upstream portions of the Burnt River, a tributary to the Snake River.

Insectivores—Although widely distributed (Cornely et al. 1992), the Preble's shrew has a discontinuous distribution in the northern portion of the Intermountain West (Csuti et al. 1997). Records suggest that the species may occur throughout the Columbia Plateau and Snake River Plain and extend throughout the northern Rocky Mountains (Hoffman and Fisher 1978). Preble's shrews apparently have been collected in the WWNF (USFS 1990a). In Idaho, the Preble's shrew was removed from the species of concern list because there was no evidence of an Idaho occurrence. Specific information on population status in Oregon is not available. Applicant biologists sampled shrews at selected sites in Hells Canyon (Dukes Creek, Cottonwood Creek, and the Powder River), but no Preble's shrews were captured (Table 4 in Technical Report E.3.2-23).

The coast mole is found in southwestern British Columbia south through western Washington and Oregon to coastal northwestern California and ranges east just into Idaho. Coast moles are found in loose soils of agricultural land, grassy meadows, coniferous and deciduous forests, and riparian areas (Yensen et al. 1986, Csuti et al. 1997, Groves et al. 1997). Few records of the coast mole are available for Idaho. A road-killed specimen was found at the rim of Hells Canyon near Cuprum, Idaho, and other specimens were collected near Cambridge, Idaho, near Hells Canyon (Yensen et al. 1986). Applicant biologists collected a coast mole along Limestone Creek, a tributary to the Snake River, on the Idaho side of Oxbow Reservoir (Technical Report E.3.2-23).

Bats—The Yuma myotis ranges from southwest British Columbia to southern Colorado, Arizona, and northwestern New Mexico. The species occurs throughout Oregon and may be locally abundant (Csuti et al. 1997). In Idaho, the species appears to be restricted to arid areas, caves, and human structures (Groves and Marks 1985). Information on the status of the species in Oregon and Idaho is not available (Marshall et al. 1996). The Yuma myotis was collected in the vicinity of the study area (Keller 1995) and reported at 9 of 140 (13.6%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The long-eared myotis ranges from central British Columbia south to New Mexico and Arizona. Although apparently not abundant, the long-eared myotis is found in forested and riparian habitats throughout Oregon, but is probably least common in the arid portions of southeast Oregon (Csuti et al. 1997). The species also occurs throughout Idaho (Groves and Marks 1985) and was collected in the vicinity of Hells Canyon (Keller 1995). Information on the status of the species in Oregon and Idaho is not available (Marshall et al. 1996). The long-eared myotis was reported at 48 of 140 (34.3%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The fringed myotis ranges from south-central British Columbia south to southern Mexico and east to western Colorado and New Mexico, although the distribution is discontinuous. Habitat requirements are variable but include forests, woodlands, grasslands, and deserts. Nursery colonies are found in caves, mines, and buildings (Groves et al. 1997). Information on the status of the species is very limited. Specimens have been collected in western and northern Idaho (Hall 1981) and in the vicinity of Hells Canyon (Keller 1995). The fringed myotis was reported at 14 of 140 (10.0%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The long-legged myotis ranges from southeast Alaska to central Mexico. The species inhabits coniferous forests but is also found in riparian and desert habitats (Warner and Czaplewski 1984). The bat probably occurs throughout Oregon and Idaho and is one of the more common species of *Myotis* in Oregon (Csuti et al. 1997). Information on the status of the species is unavailable in Oregon and Idaho (Marshall et al. 1996). The long-legged myotis was collected on Craig Mountain, adjacent to the Snake River north of Hells Canyon (Keller 1995). The long-legged myotis was the second most commonly reported bat species (54 of 140 sites, or 38.6%) in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The California myotis is found along the western edge of North America, ranging from British Columbia to Central America, and east to Texas (Hall 1981). The California myotis roosts in caves, crevices, and mines (Groves and Marks 1985) and forages around trees or over open water. The species has been observed near the west-central border of Idaho (Groves et al. 1997). The species was noted at 29 of 140 (20.7%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The western small-footed myotis ranges from extreme southern British Columbia to the northern edge of Mexico. In Oregon, the species is found in valleys and ponderosa pine (*Pinus ponderosa*) forests east of the Cascade Range where habitat remains largely unmodified. Population numbers are unknown, and the sensitive species status needs to be reevaluated in Oregon (Marshall et al. 1996). The western small-footed myotis was reported at 17 of 140 (12.1%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The silver-haired bat (*Lasionycteris noctivagans*) occurs throughout much of North America, including Oregon and Idaho (Groves and Marks 1985, Marshall et al. 1996). The species prefers, and is most abundant in, old-growth Douglas-fir/western hemlock (*Tsuga heterophylla*) forests (Marshall et al. 1996). Information on the status of the species in Oregon and Idaho is not available (Marshall et al. 1996). The species was collected in the vicinity of Hells Canyon (Keller 1995). The silver-haired bat was the most commonly reported species (59 of 140 sites, or 42.1%) in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The western pipistrelle ranges from southern Washington and eastern Oregon south along the coast of California to Baja California and west through Arizona and western Mexico (Hall 1981). The western pipistrelle occupies desert flats and canyons and roosts in caves, on cliffs, and in crevices near water (Groves et al. 1997). Very little specific information is available on this species in Idaho or Oregon, but it was collected in the vicinity of Hells Canyon (Keller 1995). The species was reported at only 6 of 140 (4.3%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The spotted bat is restricted to western North America and northern Mexico (Hall 1981). Little is known about the status of the spotted bat. The species appears to be widespread but rarely abundant (Fenton et al. 1987). It seems to prefer arid areas with canyons and cliffs for roosting (Poché and Bailie 1974, Poché and Ruffner 1975, Woodsworth et al. 1981, Leonard and Fenton 1983). Two records are available on spotted bats in eastern Oregon, where it is probably a rare but widely distributed species (Hall 1981, Csuti et al. 1997). The spotted bat was recorded at only 1 of 140 sample sites in Hells Canyon (Table 4 in Technical Report E.3.2-27). Applicant biologists also heard spotted bats at Battle Creek and the confluence of the Salmon River in Hells Canyon.

The Townsend's western big-eared bat occurs throughout western North America from British Columbia to southern Mexico and east to South Dakota, Oklahoma, and Texas. The species is widely distributed throughout the Intermountain Region. The Townsend's western big-eared bat uses juniper/pine forests, deciduous forests, mixed coniferous forests, and shrub-steppe at elevations from sea level to 3,300 m (10,825 ft). The species does not migrate, and between October and February, it occupies hibernacula within summering areas. The species is one of the better-studied bats despite the fact that it is relatively rare and populations are declining (Csuti et al. 1997). An estimated 2,800 Townsend's big-eared bats occur in Oregon (1,600 east of the Cascade Range). Population numbers are not available for Idaho. However, the species was observed on Craig Mountain adjacent to the Snake River north of Hells Canyon (Keller 1995). The Townsend's big-eared bat was reported at 21 of 140 (15%) sites sampled in Hells Canyon (Table 4 in Technical Report E.3.2-27).

The pallid bat ranges from southern British Columbia through Arizona and New Mexico. The bat inhabits arid regions having rocky habitats near water. Roosts are located in shallow caves, cliff overhangs, and human structures (Hermanson and O'Shea 1983). The species is uncommon in Oregon, with only localized populations. Pallid bats were recorded acoustically near Hells Canyon (Keller 1995). Populations have declined since the 1930s (Csuti et al. 1997), but specific information on species status is unavailable in Oregon and Idaho (Marshall et al. 1996). The species was not reported during extensive sampling in Hells Canyon (Table 4 in Technical Report E.3.2-27).

Carnivores—The American marten inhabits coniferous forests of North America, including Oregon, Idaho, Washington, Montana, Wyoming, Colorado, Utah, New Mexico, Nevada, and California (Strickland et al. 1982). In Oregon, the marten is a protected sensitive-vulnerable species (54 of 140 sites, or 38.6%) (ORNHP 1995), but a harvested furbearer in Idaho (Will 1995). Though marten are relatively common in the Blue and Wallowa mountains of northeastern Oregon (Marshall et al. 1996), they were assigned a sensitive status in Oregon because of declining habitat quantity and quality from harvest of mature and old-growth timber. Martens have been documented to occur at upper elevations adjacent to Hells Canyon in Oregon (USFS 1992, 1993; Schommer 1994). Martens may also occur adjacent to Hells Canyon in the Seven Devils and Cuddy mountains in Idaho. Adequate information is not currently available to assess population status or distribution of marten in Hells Canyon.

The wolverine has a circumboreal distribution. In North America, the species occurs in Alaska and across the boreal forests of Canada south into the northwestern United States. Hash (1987) described a contraction in the North American range of the wolverine beginning around 1840 with the onset of extensive exploration, fur trade, and Euro-Asian settlement. State records suggest very low wolverine numbers in Montana, Idaho, Oregon, and Washington from the 1920s through 1950s, with increases in wolverine sightings since the 1960s (Banci 1994). The distribution and connectivity of wolverine populations in the northwestern United States are largely unknown. However, Idaho and Montana are known to support reproducing populations of wolverines (Hornocker and Hash 1981, Copeland 1996). The present-day distribution of the wolverine in Idaho is probably the mountainous portions of the state from the South Fork Boise River north to the Canadian border (Groves 1988). In Oregon, the wolverine occurs statewide in mountainous regions (Marshall et al. 1996).

The distribution and status of the wolverine in Hells Canyon is currently unknown, but the Seven Devils Mountains are believed to contain suitable wolverine habitat and may provide an important corridor linking known populations in central Idaho (Copeland 1996) and northeast Oregon (Schommer 1994). Applicant biologists investigated the potential distribution of wolverine in the Northwest and the importance of Hells Canyon and the Seven Devils Mountains for connecting populations in Idaho and Oregon (Technical Report E.3.2-29). Biologists constructed a hypothesized distribution map for the wolverine from existing data (Copeland 1996, Hart et al. 1997), identified potential movement corridors in the region, and confirmed the presence of wolverines in the Seven Devils Mountains during an aerial survey in March 1998 (Technical Report E.3.2-29).

Applicant biologists reported that a wolverine track was observed in the Seven Devils Mountains (Technical Report E.3.2-29) and that an unconfirmed wolverine observation was recorded for the Idaho side of Hells Canyon near Eagle Bar (section 5.2.3. in Technical Report E.3.2-28). In addition, sightings across the arid mountains of central Oregon suggest a corridor of wolverine movement from the Cascade Range to the Wallowa Mountains. Adjacent to this potential movement corridor, the Seven Devils Mountains form a bottleneck of mountainous habitats between Oregon and Idaho. The Seven Devils Mountains may provide the only suitable habitat linking the reproducing population in central Idaho (Copeland 1996) with northeast Oregon and also potentially with the southern Cascade Range. The lack of previous sightings suggested limited dispersal between Oregon and Idaho; limited dispersal may impact the regional viability of wolverine. Maintaining and enhancing the integrity of movement corridors between the Seven Devils Mountains and other contiguous mountain habitats in Idaho and Oregon may be essential for ensuring regional wolverine persistence (Technical Report E.3.2-29).

The fisher occurs in North America from British Columbia to Nova Scotia south to the northeastern United States. Fishers also occur in Montana, central Idaho, northwestern Wyoming, Oregon, and California. They potentially occur adjacent to Hells Canyon in the Wallowa Mountains of Oregon and Seven Devils Mountains of Idaho (Spahr et al. 1991, Marshall et al. 1996). The fisher is classified as a species of concern by the USFWS and as sensitive critical by the ODFW (ORNHP 1995). The IDFG classifies the fisher as a species of special concern; the BLM and USFS classify it as sensitive (IDCDC 1994). The fisher is sensitive in Oregon and Idaho because of its general rarity and its questionable status as a viable species. Because the fisher is a secretive, low-density species, most population information is available only from trapping records. Because fishers are no longer trapped in Idaho or Oregon, little is known about their populations in these states (Spahr et al. 1991). Currently, no information is available on the status and distribution of fishers in Hells Canyon. The fisher was reported to occur in the Wallowa and Seven Devils mountains (Schommer 1994). However, Applicant biologists did not detect this species during carnivore and furbearer surveys in Hells Canyon (Technical Report E.3.2-28).

The northern river otter was originally found in most major waterways of the North American continent until at least the eighteenth century. Habitat changes during Euro-Asian settlement and overharvest of the animal in some areas caused some localized and regional extirpation. Otter densities in Idaho have been estimated at one animal for each 2 to 3 linear kilometers (1.2–1.9 linear miles) of waterway in favorable habitat (Melquist and Hornocker 1983). Applicant biologists did not detect river otter during scent-post or camera surveys, but the species was observed incidentally on each of the HCC reservoirs and in the Snake River below Hells Canyon Dam (Table 1 in Technical Report E.3.2-25 and section 5.2.3. in Technical Report E.3.2-28).

The kit fox is narrowly specialized, adapted to desert and semiarid habitats of western North America (Egoscue 1962, Samuel and Nelson 1982). Kit fox is classified as a species of special concern by the IDFG, as threatened by the ODFW, and as sensitive by the BLM (IDCDC 1994, ORNHP 1995). The kit fox was originally listed as threatened in Oregon due to a scarcity of records, combined with the animal’s susceptibility to habitat alteration, predator control programs, trapping, and incidental shootings. Considering the currently known distribution of the species (Samuel and Nelson 1982), the kit fox is probably not present in Hells Canyon or the immediate vicinity. Applicant biologists did not detect kit fox incidentally or during scent-station or camera surveys in Hells Canyon (Technical Reports E.3.2-23 and E.3.2-25 and section 5.2.3. in Technical Report E.3.2-28).

Rodents—The northern flying squirrel ranges from Alaska east through most of Canada and south into the Rockies, Great Lakes Region, and Appalachian Mountains (Verts and Carraway 1998). The northern flying squirrel is associated with cool, moist, mature coniferous and deciduous forests with abundant standing and downed snags (Groves et al. 1997). The diet of this nocturnal species includes lichen, fungi, seeds, fruits, nuts, buds, and insects (Groves et al. 1997, Verts and Carraway 1998). Applicant biologists did not observe flying squirrels in Hells Canyon (Technical Reports E.3.2-24 and E.3.2-25).

Lagomorphs—Pygmy rabbits are found in seven western states, but are mostly confined to the Great Basin and some portions of the adjacent Intermountain Region of the western United States (Green and Flinders 1980a). In Oregon and Idaho, the species appears to occur in only isolated subpopulations (Weiss and Verts 1984). Pygmy rabbits are closely associated with dense or clumped stands of big sagebrush growing in deep, loose soils (Green and Flinders 1980a,b; Weiss and Verts 1984). Asherin and Claar (1976) did not record pygmy rabbits in Hells Canyon. Applicant biologists suspected that the pygmy rabbit occurs in shrub-steppe habitats adjacent to the southern end of Brownlee Reservoir, but none were observed (Technical Report E.3.2-25).

The white-tailed jackrabbit occurs primarily in the Great Basin and northern Great Plains from the Sierra Nevada Mountains to the Mississippi River and from central Canada to northern New Mexico. The species is found in open grasslands and montane shrublands above shrub-steppe environments and in open pine forests and alpine tundra at higher elevations. In Oregon, where once considered common, the white-tailed jackrabbit now seems to be distributed discontinuously in a few mountain ranges and valleys. Conversion of native grasses to exotic annual grasslands is thought to have reduced the species' range (Csuti et al. 1997). Applicant biologists incidentally observed the white-tailed jackrabbit in sagebrush-dominated shrubland south of the Powder River arm of Brownlee Reservoir (Technical Report E.3.2-38).

Ungulates—Bighorn sheep occur as isolated populations throughout the western United States. The California bighorn sheep (*Ovis canadensis californiana*) is found in desert canyons of southwestern Idaho and Oregon. The Rocky Mountain bighorn sheep is found in central Idaho and northeastern Oregon, including Hells Canyon. The range of California bighorns in Oregon extends from southeastern Oregon north to the Burnt River, which intersects the Snake River at Brownlee Reservoir. In Idaho, California bighorns only occur south of the Snake River. Fifteen California bighorns were reintroduced to the Burnt River in 1987 on BLM lands. In 1997, the Burnt River minimum population was estimated at 73 sheep. Although population status in Hells Canyon is precarious (Technical Reports E.3.2-31 and E.3.2-34), Applicant biologists regularly observed Rocky Mountain bighorn sheep throughout much of Hells Canyon (Technical Report E.3.2-45) but observed no California bighorn sheep in Hells Canyon (Technical Report E.3.2-38).

Amphibians and Reptiles

Eleven special status amphibian and reptile species potentially occur within Hells Canyon (Table E.3.2-1); these species constitute most of the special status amphibians and reptiles in Idaho and eastern Oregon. These include two former USFWS Category 2[4] species (the inland tailed frog [*Ascaphus montanus*][5] and northern sagebrush lizard [*Sceloporus graciosus*]). Hells Canyon may also contain the following special status species: the desert horned lizard, tiger salamander (*Ambystoma tigrinum*), western toad, northern leopard frog (*Rana pipiens*), Woodhouse's toad (*Bufo woodhousii*), Mojave black-collared lizard (*Crotaphytus bicinctores*), ringneck snake, longnose snake (*Rhinocheilus lecontei*), and ground snake (*Sonora semiannulata*). The distribution and status of these species were evaluated in Technical Report E.3.2-36.

Applicant biologists observed three of five special status amphibian species—the western toad, Woodhouse's toad, and inland tailed frog—(Figures 13 and 14 in Technical Report E.3.2-36) and

4. Before 1996, candidate species were subdivided into categories 1, 2, and 3. Category 2 indicated that the USFWS had information suggesting that proposing to list the species as endangered or threatened was appropriate, but that conclusive data on biological vulnerability and threat were not available at that time to support proposed rules. In 1996, the USFWS formed one list of candidate species by eliminating the categories and dropping the species that had previously appeared in categories 2 and 3.
5. Before 2001, this species was called the tailed frog, *Ascaphus truei*. Results of mitochondrial DNA testing led taxonomists to separate the tailed frog into two species: coastal (*A. truei*) and inland (*A. montanus*) tailed frogs.

only one of six special status reptile species—the sagebrush lizard—(Figure 5 and 6 in Technical Report E.3.2-36) in Hells Canyon.

Frogs—The northern leopard frog has one of the broadest ranges of North American frogs. The species occurs in the Northwest in areas adjacent to the Columbia and Snake rivers (Csuti et al. 1997, Groves et al. 1997). The species occurs in north-central Oregon along the Columbia River and in the Snake River drainage of northern Malheur and southern Baker counties. This frog is known in Oregon mostly from older records, and recent surveys have not detected it in the state (Csuti et al. 1997). Anecdotal information exists for the frog's decline in Idaho (Groves et al. 1997). The predicted distribution of the northern leopard frog includes the southern portion of Hells Canyon near Farewell Bend, Oregon (Groves et al. 1997). However, Applicant biologists did not detect the northern leopard frog in Hells Canyon (Technical Report E.3.2-36).

The inland tailed frog ranges in the Rocky Mountains from southeast British Columbia to northern Idaho and from southeast Washington to northeast Oregon. The species is found in cold, fast-flowing permanent streams in forested areas. In Oregon, the species occurs on the west slopes of the Cascade Range, Coast Range, and Wallowa Mountains. The status of the species is unknown, but there is evidence of a decline (Marshall et al. 1996), possibly from timber harvest (Csuti et al. 1997). The tailed frog is predicted to occur adjacent to Hells Canyon in Oregon and Idaho at higher elevations (Csuti et al. 1997, Groves et al. 1997). During spring and summer of 1996 through 1998, Applicant biologists surveyed eight tributaries below Hells Canyon Dam, five tributaries to Brownlee Reservoir, and one tributary to each of Oxbow and Hells Canyon reservoirs for the presence of tailed frogs (Table 10 in Technical Report E.3.2-36). Tailed frogs were confirmed in five tributaries (33% of streams surveyed): Brownlee, Dukes, Deep, Granite, and Sheep creeks (Table 10 in Technical Report E.3.2-36). In May 1997, one adult female tailed frog was observed on the rocky shore of the Snake River at the confluence of the Snake River and Granite Creek.

Predictive modeling for the inland tailed frog indicated that 28 tributaries or segments of tributaries (19 on the Idaho side and 9 on the Oregon side) to the Snake River provide potential habitat for tailed frogs within Hells Canyon (Figure 4 in Technical Report E.3.2-36). All five tributaries where tailed frogs were found were predicted to have tailed frogs. However, no tailed frogs were found at five tributaries that were predicted to have tailed frogs. In addition, biologists surveyed five tributaries where tailed frogs were predicted to be absent, and no tailed frogs were observed.

Toads—The western toad ranges from southeast Alaska to northern California and western Montana. The species prefers forested and shrubby areas from sea level to high mountains. The species is widely distributed in Oregon, but absent in the valleys of the Great Basin (Marshall et al. 1996). Western toads have adapted to human-modified environments such as irrigation canals, but they have disappeared from areas where they were once common (Csuti et al. 1997). Many factors have been investigated to determine the cause of widespread toad declines—including episodic acidification (Vertucci and Corn 1996), disease (Carey 1993), and ultraviolet radiation (Corn 1998)—but the cause of decline is still unclear. Chytrid fungus has been implicated as a likely cause of amphibian die-offs around the world and has been isolated in toad populations in Colorado. The western toad was considered common throughout Hells Canyon; Applicant biologists recorded the species at 27 wetlands, 8 backwater ponds, and 38 other areas (Figure 14c in Technical Report E.3.2-36).

The Woodhouse's toad ranges from the eastern seaboard of the United States west as far as Montana and the southeast corner of California. The species prefers riparian habitats, sagebrush flats, and fields. Disjunct populations occur along the Snake River in Idaho and Oregon. The status of the species is unknown, other than its presence as isolated populations within limited areas (Marshall et al. 1996). The Woodhouse's toad was not observed during amphibian surveys of wetlands, but two incidental observations were made along Brownlee Reservoir (Figure 13d in Technical Report E.3.2-36).

Salamanders—The tiger salamander is the farthest-ranging amphibian in North America. This salamander lives in grassland and shrub-steppe habitats and breeds in warm ponds or shallow lake edges in mid to late spring. Most records in the region are from the Columbia River basin of eastern Washington and the Great Basin of southeastern Idaho (Corkran and Thoms 1996). Isolated populations occur at scattered locations in Oregon. The tiger salamander is considered sensitive in Oregon because of general rarity and habitat limitations (Marshall et al. 1996). The species was not observed in Hells Canyon (Technical Report E.3.2-36).

Snakes—The longnose snake has been reported in Canyon, Ada, Elmore, and Owyhee counties in Idaho (Diller and Wallace 1981) and is more abundant on the south side of the Snake River than on the north side (Diller and Johnson 1982). The species was collected in areas adjacent to various agricultural lands, rocky and sandy areas, open desert land, and riparian habitats (Diller and Wallace 1981). Obvious habitat preferences were not found for the longnose snake in southwestern Idaho (Diller and Wallace 1981, Diller and Johnson 1982). The predicted distribution of this species does not include Hells Canyon (Groves et al. 1997), and Applicant biologists did not observe the species (Technical Report E.3.2-36).

The western ground snake has been reported in Canyon, Ada, Owyhee, and Elmore counties (Slater 1941, Tanner 1941, Linder and Fichter 1977, Diller and Wallace 1981). The snake appears to be rare, but locally abundant in suitable habitat. It is fossorial (adapted to burrowing) and preys on a variety of invertebrates (Vitt and Ohmart 1978). In the SRBPNCA, western ground snakes were found only in or near talus or scree slopes (Diller and Wallace 1981). The predicted distribution of this species does not include Hells Canyon (Groves et al. 1997), and Applicant biologists did not observe the species (Technical Report E.3.2-36).

The ringneck snake can be found from southern Washington and Idaho to northern Baja California and the southern part of the Mexican Plateau (Stebbins 1985). The species is restricted to mountains and watercourses in the arid parts of the West, where it may descend to desert areas. The species is predicted to occur on the Idaho side of the Snake River in the northernmost portion of Hells Canyon (Groves et al. 1997), but was not observed by Applicant biologists (Technical Report E.3.2-36).

Lizards—The Mojave black-collared lizard ranges from northeastern California to southeastern Oregon and adjacent parts of Idaho, Nevada, and western Utah. The species is found in sparsely vegetated, dry hillsides, in areas with talus slopes, rock, and boulders (Groves et al. 1997). Little is known about the status and distribution of the Mojave black-collared lizard in Idaho. The predicted distribution of this species is south of Hells Canyon (Csuti et al. 1997, Groves et al. 1997). Applicant biologists conducted walking surveys in the southern portion of Hells Canyon where the species potentially occurs, but did not detect the species (section 3.2.4. in Technical Report E.3.2-36).

The desert horned lizard is found from southeastern Oregon, southwestern Idaho, and northern Utah south through the southwestern deserts to northern Mexico. In arid regions, including sandy flats, alluvial fans, and edges of dunes, the desert horned lizard is found in sagebrush or in salt-desert-shrub, creosote-bush, greasewood, and cactus deserts. The predicted distribution of the species includes the southern portion of Hells Canyon (Csuti et al. 1997, Groves et al. 1997), but Applicant biologists did not report the species (Technical Report E.3.2-36).

The sagebrush lizard ranges from southern Montana to northwestern New Mexico west to Washington, Oregon, California, and northern Baja California. This species is found from sea level to about 3,200 m, in areas with open ground and low shrubs in sagebrush shrublands, chaparral, juniper woodlands, and open coniferous forests. This lizard is most common in the sagebrush plains of southeastern Oregon and Idaho (Csuti et al. 1997, Groves et al. 1997). Applicant biologists observed the sagebrush lizard on the Idaho side of Brownlee Reservoir and near Oxbow Dam (Figure 5a in Technical Report E.3.2-36), but this species was considered rare.

Insects

Eleven insect species were evaluated for their presence and status in the Hells Canyon Study Area. Of these 11 species, 7 were excluded because 1) their special status was rejected due to taxonomic reasons (Malheur tiger beetle [*Malthodes glyphidius*]) (ORNHP 2001), or 2) the species were determined to be locally abundant (rural skipper [*Ochlodes agricola*], Peck's skipper [*Polites coras*], Beartooth copper butterfly [*Lycaena phlaeas*], Wallowa Mountains gazelle beetle [*Nebria wallowae*], LaBonte's gazelle beetle [*Nebria labontei*], and long dash skipper [*Polites mystic*]). Therefore, only 4 species were evaluated: the Columbia River tiger beetle (*Cicindela columbica*), silver-bordered fritillary (*Boloria selene*), Johnson’s hairstreak (*Mitoura johnson)*, and Yuma skipper (*Ochlodes yuma*) (Table E.3.2-1).

The Columbia River tiger beetle is found along sandy shores of the Snake and Columbia rivers and their tributaries. Tiger beetle larvae ambush their insect prey from burrows in sandy shores. The main threat to the survival of this species is the degradation of the sandy shores in which they burrow and lay eggs. Construction, flooding caused by dams, and off-road vehicles are potential threats to the Columbia River tiger beetle (Pacific Biodiversity Institute 2001).

The silver-bordered fritillary ranges from central Alaska across central Canada to Newfoundland and from the eastern half of Washington across the northern half of the United States. This species prefers moist to wet areas, including bogs, marshes, and wet meadows, and occurs primarily in the center of Idaho, including counties adjacent to Hells Canyon (Digital Atlas of Idaho 2000). The species also occurs in Baker County, Oregon (Struttman 2000).

The Johnson's hairstreak ranges from southern British Columbia south to central California, and an isolated population occurs from northeastern Oregon into central Idaho (Digital Atlas of Idaho 2000). This species occurs most commonly in thick coniferous forests, especially old growth, and occasionally in other woodlands. The species has been reported in Adams County, Idaho (Digital Atlas of Idaho 2000) and is generally very localized and rare (Opler et al. 1995).

The Yuma skipper ranges from central California east through Nevada, southern Utah, Colorado, and Arizona. Isolated populations occur in Washington, Oregon, New Mexico, and Idaho. This species prefers freshwater marshes, streams, ponds, seeps, sloughs, springs, and canals where its host plant, the common reed (*Phragmites australis*), occurs. This species has been recorded for Wallowa County, Oregon (Struttmann 2000).

The Applicant did not survey invertebrates in Hells Canyon because Frank Merickel (Curator of the WFBARR Entomological Museum, University of Idaho) indicated that none of the four potentially sensitive invertebrates occur along the Snake River in Hells Canyon. Information provided by the Entomological Museum suggests little reason to expect the HCC to affect special status invertebrate species. The closest known population of the Columbia River tiger beetle occurs along the lower Salmon River between Slate and Eagle creeks (Shook 1981). Surveys were conducted by Shook (1981) along the Snake River from the confluence of the Salmon River to Heller Bar, but Columbia River tiger beetles were not reported.

E.3.2.1.4. Wildlife Resources Downstream of the Hells Canyon Complex

Influences of the HCC on wildlife resources are most associated with the three reservoirs of the complex (see section E.3.2.4.). Conversely, the HCC has relatively less influence on wildlife associated with the unimpounded section of the Snake River downstream of Hells Canyon Dam.

Therefore, the Applicant conducted a less comprehensive review and investigation of wildlife resources downstream of Hells Canyon Dam.

E.3.2.1.4.1. Nongame Birds

See section E.3.2.1.3.1. for general information on nongame birds (Technical Report E.3.2-1). Land cover types available in Hells Canyon downstream of Hells Canyon Dam influence the composition and densities of bird communities present (Tables 4–7 and 9 in Technical Report E.3.2-1). Topography, soil substrate, and precipitation change markedly along the Snake River from Weiser, Idaho, to the confluence with the Salmon River and affect the distribution of the vegetation. Steep, rocky slopes characterize northern portions of Hells Canyon, and hackberry and alder dominate many riparian areas (Figures 6 and 7 in Technical Report E.3.2-1). In contrast, southern portions of Hells Canyon have more moderate soil-covered slopes, and cottonwood and diverse shrubby habitats dominate many riparian areas (Figures 6 and 7 in Technical Report E.3.2-1).

In the reaches of the Hells Canyon Study Area, the fewest number of nongame bird species, as well as low densities, were observed in the unimpounded reach downstream of Hells Canyon Dam. Lower densities were found in *Forested Wetland* and *Scrub-Shrub Wetland* cover types along the unimpounded reach than were found along Brownlee and Oxbow reservoirs. The vegetation distribution along the study reaches could explain these differences.

Bird densities were generally found to be higher in the cottonwood vegetation associations than in hackberry or alder associations (Figure 12 in Technical Report E.3.2-1). During spring and fall, the willow/cottonwood vegetation association appeared to be particularly important for birds, with densities approximately twice as high as those in other *Forested Wetland* vegetation associations. Other studies have also found that stands dominated by cottonwood had the greatest species richness and the highest densities when compared with other riparian plots (Stamp 1978, Strong and Bock 1990). For *Scrub-Shrub Wetland* vegetation associations, lower bird densities were found in hackberry vegetation associations than in the more diverse rose/snowberry vegetation association (Figure 13 in Technical Report E.3.2-1).

The distribution of the vegetation appears to provide one possible explanation for the differences in bird abundance among reaches. Alternatively, the *Scrub-Shrub Wetlands* and *Forested Wetlands* in the Hells Canyon reach are often situated in narrow, rocky canyons that provide little opportunity for foraging outside the riparian zone and limited connectivity and proximity to other riparian areas. Therefore, species requiring large areas for foraging might be limited. Also, rocky substrate dominates in this reach, perhaps limiting vegetation and the availability of invertebrate prey species.

E.3.2.1.4.2. Migrant Shorebirds

Shorebirds were not specifically studied in the reach below Hells Canyon Dam because little available habitat is present there compared with the reservoir reaches, which have relatively large areas of mudflats exposed during drawdowns (Technical Report E.3.2-2). In the downstream reach below Hells Canyon, shorebirds were observed in small numbers. The spotted sandpiper was considered uncommon, while the killdeer and American avocet (*Recurvirostra americana*) were rarely observed.

E.3.2.1.4.3. Upland Game Birds

Upland game birds were reported during general bird surveys in the entire study reach, including the reach below Hells Canyon Dam (Technical Report E.3.2-1). The habitat of mountain quail was also evaluated for the entire study reach, including the reach below Hells Canyon Dam (Technical Report E.3.2-6). Information from these studies is summarized here.

Eight species of upland game birds, including the chukar and gray partridge, were reported in the reach below Hells Canyon Dam during general bird surveys and incidentally during other field activities (Appendix 3 to Technical Report E.3.2-1). The chukar and gray partridge were considered abundant and common, respectively. The ruffed grouse and California quail were observed commonly, while the blue grouse was reported as uncommon. The three remaining species—the ring-necked pheasant, wild turkey, and mountain quail—were rarely reported (5 observations).

A landscape-level habitat model for mountain quail was applied to the Hells Canyon Study Area to evaluate the distribution and quality of mountain quail habitat (Technical Report E.3.2-6). High-quality habitat for mountain quail was identified in many riparian draws, which were largely composed of *Scrub-Shrub Wetland* and *Forested Wetland* cover types. These cover types, however, were classified on only 1,012 ha, which represented 2.88% of the Hells Canyon Study Area. Approximately 29% of suitable mountain quail habitat occurs in the reach below Hells Canyon Dam. Historically, mountain quail in this area inhabited narrow, shrubby riparian draws, which have limited coverage in the study area. Habitat quality below Hells Canyon Dam was very similar to the average value calculated for the entire study area (HSI = 0.36) (Table 5 in Technical Report E.3.2-6). Results of this study do not explain why mountain quail numbers have severely declined in the Hells Canyon Study Area. Factors other than habitat may be responsible for the quail's decline in Idaho and eastern Oregon.

E.3.2.1.4.4. Waterfowl

The Applicant conducted surveys of nesting waterfowl in the reach above Hells Canyon Dam (Technical Report E.3.2-11). The reach below Hells Canyon Dam was excluded because little suitable habitat for waterfowl production, such as emergent wetlands, occurs along this swift-flowing river. However, some production takes place in this reach, as evidenced by some goslings (Canada goose) that were encountered during field activities. In general, this reach provides only limited habitat suitable for waterfowl production.

During the winters of 1994 through 1999, Applicant biologists conducted annual aerial waterfowl counts of the Snake River between Weiser, Idaho, and the confluence of the Snake and Salmon rivers, coinciding with the annual Midwinter Waterfowl Count (section 3.2.1.3.4. in Technical Report E.3.2-12). The entire study reach was surveyed in one day. The total number of waterfowl numbers counted over the winter seasons from 1994 through 1999 averaged 7,905 (± 3,295 STD) birds over the entire surveyed reach (RM 351.2–RM 188.2 and 10 river miles along the Powder River). Numbers of waterfowl per river mile did not differ among years, but did differ among reaches. The highest numbers of waterfowl were reported in the unimpounded reach above Farewell Bend (169.3 ± 68.5 STD birds/river mile). The lowest numbers of birds were counted in the unimpounded reach below Hells Canyon Dam (1.3 ± 0.7 STD birds/river mile). These trends were consistent among years (Figure 9 in Technical Report E.3.2-12). Species richness was highest in the unimpounded reach above Farewell Bend (13 species), dropping to 6 species in the unimpounded reach below Hells Canyon Dam. The lack of suitable feeding and loafing areas (slack water) below Hells Canyon Dam limits the use of this area by wintering waterfowl.

E.3.2.1.4.5. Nesting Colonial Waterbirds

Suitable habitat for nesting colonial waterbirds is extremely limited in the reach below Hells Canyon Dam. Likewise, suitable foraging areas are limited. Therefore, nesting colonial waterbirds were not encountered in the downstream reach of the study area.

E.3.2.1.4.6. Nesting Diurnal Raptors

Surveys of nesting raptors were not conducted downstream of Hells Canyon Dam. However, habitat along Hells Canyon Reservoir is similar to habitat downstream of Hells Canyon Dam in topography, geology, and vegetation (Technical Reports E.3.3-1 and E.1-2). Therefore, the raptor community along Hells Canyon Reservoir is probably similar to that in the downstream reach. Along Hells Canyon Reservoir, the golden eagle had the highest number of nesting territories, followed by the American kestrel, prairie falcon, and peregrine falcon (Table 4 in Technical Report E.3.2-14). Downstream, the golden eagle was considered common, while the American kestrel was uncommon during nongame bird surveys. Additional species observed during nongame bird surveys and other field activities in the downstream reach were the bald eagle, osprey, sharp-shinned hawk, Cooper’s hawk, northern goshawk, red-tailed hawk, turkey vulture, and peregrine falcon. Both the northern goshawk and the peregrine falcon were considered to be rare; all other species were reported to be uncommon, except for the turkey vulture, which was reported to be common (Appendix 3 to Technical Report E.3.2-1).

E.3.2.1.4.7. Small Mammals

The small mammal community downstream of Hells Canyon Dam was sampled using two approaches. A general survey of the reach was conducted in 1996 (Technical Report E.3.2-24), and more intensive trapping at three locations took place in 1998 (Technical Report E.3.2-23). These two studies are summarized here.

In 1997, Dr. B. Eshelman, Idaho State University, contracted with the Applicant to conduct preliminary studies to describe small mammal resources downstream of Hells Canyon Dam (Technical Report E.3.2–24). Trapping took place at 11 tributaries (Appendix A to Technical Report E.3.2-24), providing a diversity of habitats in which small mammals resided. A minimum of 25 and a maximum of 60 (two lines of 30) snap traps were placed in each of the sample areas (Table 1 in Technical Report E.3.2-24). A maximum of four Havahart traps were placed within the same general area. The deer mouse and montane vole were the most frequently captured small mammals during the study, accounting for 84 and 12% of the animals captured, respectively (Figure 1 in Technical Report E.3.2-24). Three bushy-tailed woodrats were captured. Only one shrew (the vagrant shrew) was captured. Special status species were not captured. Most of the common small mammals expected to be present in the canyon were captured in this study (Table 3 in Technical Report E.3.2-24).

In 1997 and 1998, Applicant biologists conducted more extensive and intensive trapping at three sites in the Pittsburgh Creek area (Figure 1 in Technical Report E.3.2-23). Trapping was conducted in April, and trap lines were placed in all available cover types at each site. Four cover types were sampled (*Forested Wetland*, *Grassland*, *Mountain Shrubland*, and *Forested Upland*). Trap lines consisted of 25 stations set 10 m apart, with two traps at each station. Sherman live traps and snap traps (either Museum Specials at every fifth station or Victor mouse traps) were placed at each station. Trapping continued for three consecutive nights following the prebaiting period, for a total of 4,205 trap nights. Five species of small mammals were captured along trap lines (Table 5 in Technical Report E.3.2-23). Two species were relatively common: the deer mouse and montane vole. The three remaining species—the western harvest mouse, western jumping mouse, and vagrant shrew—were caught in small numbers. Small mammal abundances ranged between 40.1 and 20.1 small mammals captured per 100 trap nights and averaged 31.3 ± 7.2 small mammals per 100 trap nights (Table 6 in Technical Report E.3.2-23). Small mammal abundance did not differ among cover types and is similar to that reported for southern Idaho (Tables 8 and 9 in Technical Report E.3.2-23). Overall, small mammal abundance tended to increase from Brownlee Reservoir (18.8 ± 9.8 mammals/100 trap nights) to the reach below Hells Canyon Dam (31.3 ± 7.2 mammals/100 trap nights) (Table 6 in Technical Report E.3.2-23). Species diversity differed considerably among cover types. The highest species diversity was found for the *Mountain Shrubland* cover type ($H' = 0.72$); the lowest, for *Grassland* ($H' = 0.23$)

(Table 7 in Technical Report E.3.2-23). Small mammal species were not associated with specific cover types (Figure 3 in Technical Report E.3.2-23). Small mammal communities in upland and riparian habitats were similar in both relative abundance and composition.

E.3.2.1.4.8. Medium-Sized Mammals

The Applicant assessed the presence of medium-sized mammals in two studies. A general reconnaissance survey was conducted downstream of Hells Canyon Dam in 1996 (Technical Report E.3.2-24). An intensive and extensive survey was conducted of the entire study area from 1995 through 1999 (Technical Report E.3.2-25).

In 1997, Dr. B. Eshelman, Idaho State University, contracted with the Applicant to conduct preliminary studies to describe medium-sized mammal resources downstream of Hells Canyon Dam (Technical Report E.3.2–24). Trapping took place at 11 tributaries (Appendix A to Technical Report E.3.2-24). A maximum of four Havahart traps and four camera traps were placed at locations that had a high likelihood of capture of medium-sized mammals (Table 1 in Technical Report E.3.2-24). The coyote, raccoon, striped skunk, and northern river otter were reported during these surveys (Table 2 in Technical Report E.3.2-24). These species appeared to be widespread in the downstream reach.

The Applicant investigated the medium-sized mammal community in the Hells Canyon Study Area between 1995 and 1999 (Technical Report E.3.2-25). Five hundred seventy-seven point-count surveys were conducted. Of these, 477 were in riparian habitat and 94 were in upland habitat surveys. Surveys were conducted during four seasonal periods: spring (May), summer (June), fall (late September through early October), and winter (late January). Four species were observed during point-count surveys. The red squirrel was the most common species, followed by the coyote, mountain cottontail, and American beaver (Table 4 in Technical Report E.3.2-25). Eight species of medium-sized mammals were observed incidentally, during scent-post surveys, or at remote camera stations: the American badger, long-tailed weasel, common raccoon, northern river otter, bobcat, porcupine, striped skunk, and western spotted skunk (Table 1 in Technical Report E.3.2-25).

E.3.2.1.4.9. Bats

The Applicant participated with the USFS in surveying bats along the Snake River between the Washington state line and Hells Canyon Dam (RM 174–RM 264) (Technical Report E.3.2-27). Between 1995 and 1997, USFS personnel from the Wallowa Valley Field Office at the HCNRA spent approximately 200 hours surveying for bats. Ten species were recorded at 46 sites along 111.6 mi of Snake River corridor (Table 3 in Technical Report E.3.2-27). Three additional species—the spotted bat, hoary bat, and fringed myotis—were recorded in the uplands of Hells Canyon. Two more species may occur based on nearby distribution and dispersal characteristics—the pallid bat and red bat. The red bat may be a rare species or accidental vagrant. The Townsend's western big-eared bat, spotted bat, western pipistrelle, and Yuma myotis appear to be limited to canyons of the Snake, Imnaha, and Grande Ronde rivers. Yuma myotis colonies were found in most buildings and mine shafts. Six Townsend's western big-eared bat colonies, collections sites, and satellite sites were reported. In addition, three Townsend's big-eared bat maternity colonies were found (two of which have been gated), and at least two more may be present. The Mountain Chief Mine is a known bat hibernacula; up to 26 Townsend's big-eared bats use this site (Appendix 1 to Technical Report E.3.2-27).

E.3.2.1.4.10. Carnivores and Furbearers

In 1996, Applicant biologists placed 13 remote-camera stations between Hells Canyon Dam and the confluence of the Snake and Salmon rivers to survey for mammalian carnivore and furbearer species (Table 7 in Technical Report E.3.2-28). In 105 survey days of remote camera stations, 4 target species were documented, including the black bear, common raccoon, coyote, and western spotted skunk. An additional 6 target species were observed incidentally from 1995 to 2000, including the American beaver, mountain lion, striped skunk, northern river otter, wolverine, and Canada lynx. Tracks of a wolverine were observed in the Seven Devils Mountains (Technical Report E.3.2-29). Other species occurring in the reach downstream of Hells Canyon Dam, but not observed during the survey, are the American marten and fisher (see section E.3.2.1.4.10.). Although remote-camera systems have been used to survey some carnivore and furbearer populations, detection rates in Hells Canyon were too low for Applicant biologists to make population inferences.

E.3.2.1.4.11. Big Game

E.3.2.1.4.11.1. Mountain Goat

Historically found in Hells Canyon, mountain goats were absent by the 1930s. They were reintroduced to the Seven Devils Mountains in Idaho in 1962 and 1964 and released into the Oregon side of Hells Canyon in 2000. The current winter distribution of the mountain goat is restricted primarily to the Idaho side of Hells Canyon Reservoir and the Snake River downstream of Hells Canyon Dam (IDFG Management Units 18 and 22). In summer, mountain goats typically move to the Seven Devils Mountains adjacent to the Snake River (IDFG 1981, Kuck 1986).

In April 1996, Applicant biologists counted 117 goats, with a kid:adult ratio of 11.4%. Nine goats were observed above Hells Canyon Dam, and the kid:adult ratio above the dam was 29%. The remaining goats were observed below Hells Canyon Dam, with a kid:adult ratio of 10.2% (Technical Report E.3.2-33). In 1999, IDFG biologists estimated the Hells Canyon population at 237 (plus or minus 67) goats (Toweill 2001). This number is substantially greater than the 1996 minimum population estimate of 117 goats (Technical Report E.3.2-33). The IDFG also deemed the population healthy enough to allow 18 goats to be captured from Hells Canyon for release in another part of the state. Made after the Applicant's survey, the IDFG survey indicates a much larger and probably growing mountain goat population in Hells Canyon.

E.3.2.1.4.11.2. Rocky Mountain Bighorn Sheep

Historically, Rocky Mountain bighorn sheep were abundant. However, by 1945 they were extirpated from Hells Canyon and surrounding areas by introduced diseases, overharvest, and competition for forage with domestic livestock. Rocky Mountain bighorn sheep reintroductions and habitat management have been ongoing since 1971. Three hundred fifty-seven bighorn sheep from 9 source populations have been released into the project area. As of 1996, about 700 bighorn sheep occur in 14 herds. The population increased at an average annual growth rate of 7%. Diseases transmitted by livestock and unknown sources have been an important factor limiting population growth. At least 7 disease epidemics have reduced the population's annual growth rate by about 40%. Considerable Rocky Mountain bighorn sheep habitat, particularly summer range, exists in the Wallowa, Seven Devils, and Blue mountains. Occupied habitat exists along the Snake River downstream of Hells Canyon Dam (Figure 9 in Technical Report E.3.2-31).

Extensive year-round habitat occurs on low-elevation grasslands in Hells Canyon (Figures 10 and 11 in Technical Report E.3.2-31).

E.3.2.1.4.11.3. Black Bear

Black bear are year-long residents of Hells Canyon (Wilson 1975, IDFG 1993). Although black bears have a specific home range (Hamilton 1978), they are relatively nomadic and often move large distances (Rogers 1977). Black bears may be observed in most habitats within Hells Canyon, especially regions with timber (John Beecham, IDFG, Boise, personal communication). Specific black bear density data are not available for Hells Canyon; however, Beecham (1983) reported one bear per 1.3 km^2 for the study area southeast of Council, Idaho, and these data are probably comparable to timbered portions of Hells Canyon with quality bear habitat (John Beecham, IDFG, Boise, personal communication). Beecham (1983) noted that annual variation in reproductive success is the main factor influencing short-term population fluctuations; climate affects availability of nutritious food and is probably the primary extrinsic factor controlling long-term population levels.

E.3.2.1.4.11.4. Mountain Lion

Aside from human disturbance, the lack of necessary stalking cover may limit the distribution of mountain lions (Currier 1976). No data (or studies) were located that provided information on the distribution of mountain lions in Hells Canyon (Technical Report E.3.2-34). However, based on many studies that associated the location of lions with deer and elk herds, distributional information on these prey species may indicate areas of use by lions. Lions most likely use habitats having deer and/or elk and rugged topography that enhances hunting (stalking) opportunities.

E.3.2.1.4.11.5. Mule Deer

Mule deer are found in most habitats throughout the Hells Canyon region. Distribution may be influenced as much by hunter access and recreational disturbance as by habitat quality.

E.3.2.1.4.11.6. Elk

Elk are commonly reported in the Hells Canyon region (for example, USFWS 1964, Wilson 1975, Asherin and Claar 1976, McKern 1976, U.S. Department of Energy 1984, Meatte 1990, and ODFW 1997). No research data were located that documented specific elk distribution within Hells Canyon.

Estimates of the total population of elk in Hells Canyon (on the Oregon and Idaho sides) are not available. Data from Oregon and Idaho are not directly comparable because of different configurations and establishment of management units. Also, the management units are not a direct reflection of animal distribution or abundance within Hells Canyon because some of the unit boundaries extend beyond hydrologic boundaries of Hells Canyon. In addition, new survey methods have been implemented during recent years, and these are responsible for some changes in numbers by unit (G. Keister, ODFW, Baker City, personal communication). Therefore, these data should be viewed with caution.

E.3.2.1.4.12. Reptiles and Amphibians

Below Hells Canyon Dam, backwater ponds along the Snake River may provide important breeding sites for amphibians, particularly the western toad (Palmer 1991). To identify these ponds, Applicant biologists examined aerial photographs (taken August 9, 1997) and digital orthophoto quads (from June 23, 1994, and August 7, 1994, at 1:80,000-scale and from May 22, 1992, at 1:40,000-scale) showing areas along the Snake River where backwater ponds form along sandbars and gravel bars as water recedes after spring runoff. The size and shape of the backwater ponds remained fairly similar over time (1955–1997) (Figures 9–12 in Technical Report E.3.2-36). Other wetlands within the 0.5-mile corridor were also identified from topographic maps. During the spring and summer seasons of 1996 through 1999, 14 of 21 identified backwater ponds were surveyed for breeding western toads (Table 3 in Technical Report E.3.2-36). Eight (57%) of the ponds contained western toads, and 6 (43%) of the ponds exhibited evidence of western toad breeding. Nine wetlands not associated with the Snake River were also visited (Table 3 in Technical Report E.3.2-36). Western toads were present at 3 of these wetlands, and breeding was confirmed at 2 sites. Long-toed salamander larvae were reported at 3 sites below Hells Canyon Dam, but Pacific chorus frogs were found only incidentally.

In 1997, seven streams—Battle, Granite, Sheep, Temperance, Kirkwood, Cache, and Birch creeks—were surveyed below Hells Canyon Dam for inland tailed frogs. Biologists surveyed approximately 100 m of the riverbed along each stream, starting at the closest access point from the Snake River and progressing upstream. Tailed frogs were confirmed in 3 of 7 tributaries: Deep, Granite, and Sheep creeks (Table 10 in Technical Report E.3.2-36). One adult female tailed frog was found on the rocky shore of the Snake River at the confluence with Granite Creek. Predictive modeling of tailed frog habitat suggested that 28 tributaries, or segments of tributaries (19 in Idaho and 9 in Oregon), to the Snake River provide potential habitat for the tailed frog within Hells Canyon (Figure 4 in Technical Report E.3.2-36).

In the downstream reach, three amphibian species—the western toad, Pacific chorus frog, and long-toed salamander—were considered abundant, while the inland tailed frog was considered uncommon. Five reptile species were recorded during timed searches in the downstream reach: the western fence lizard, western rattlesnake, racer, gopher snake, and western skink. The western terrestrial garter snake and common garter snake were observed incidentally.

E.3.2.1.4.13. Threatened, Endangered, Candidate, and Special Status Species

E.3.2.1.4.13.1. Threatened, Endangered, and Candidate Species

See section E.3.2.1.3.13. for a short description of the habitat and distribution of threatened, endangered, and candidate species and for general background information. Specific information about the distribution and numbers of threatened, endangered, and candidate species downstream of Hells Canyon Dam is provided in this section.

Bald Eagle

Small numbers of bald eagles winter along the Snake River below Hells Canyon Dam (0.4 bald eagles/mi averaged over the winters 1993–1998) (Technical Report E.3.2-16). Only 7.7% of these bald eagles were subadults (Technical Report E.3.2-16). Bald eagle roost sites were identified along the Snake River and associated reservoirs up to Hells Canyon Dam (Technical Report E.3.2-17), but such efforts were not expanded below Hells Canyon Dam. No bald eagle nesting was found along the Snake River below Hells Canyon Dam (Technical Report E.3.2-38).

Peregrine Falcon

Historic Nest Sites—Peregrine falcons historically nested at two locations along the Snake River in Hells Canyon (Bechard et al. 1987). One historical site was in Oregon near Hells Canyon Dam. The other site was near the confluence of the Grand Ronde and Snake rivers. At least until 1967, peregrines at this second site produced wild young. Peregrines were reintroduced at this site in 1987 (Bechard et al. 1987). Since 1987, the WWNF has cooperated with the ODFW and the Peregrine Fund in annually releasing peregrines at P.O. Saddle in Hells Canyon.

Nest Surveys—In 1996, the USFS in cooperation with the Applicant, under a challenge cost-share grant, conducted a survey of nesting peregrine falcons (Technical Report E.3.2-18). The survey area was a 10- by 3-mi section of Hells Canyon along the Oregon side of the Snake River near Hells Canyon Dam, from Steamboat Creek to Black Mountain. One active peregrine falcon nest site was found, and one female falcon fledged. The nest site is located near a historical site. During 1997–2000, peregrine falcon pairs were observed at the nest exhibiting behaviors indicative of occupancy (such as prey delivery, copulation, and territory patrolling). In 2001, only a single bird was observed. The nest was located on a remote cliff face, at a distance too far for biologists to accurately determine breeding success.

Canada Lynx

Applicant biologists reported an unconfirmed Canada lynx sighting below the confluence with the Salmon River near Cave Creek on the Idaho side of the Snake River. Information from the IDCDC and the Oregon Natural Heritage Program (ORNHP) indicate that Canada lynx are present in the Seven Devils Mountains of Idaho and the Wallowa Mountains of Oregon. The documented sighting closest to the Hells Canyon Study Area was on Grizzly Ridge between the Imnaha and Snake rivers. Eight Canada lynx were recorded in Oregon in the vicinity of the study area, five of which were reported in the 1990s. In Idaho, one Canada lynx observation from the 1950s was recorded in the Seven Devils Mountains. During a three-year study in the WWNF, Schommer (1994) reported nine Canada lynx tracks and sightings.

Gray Wolf

The current wolf distribution in Idaho includes the northern border adjacent to Canada and Montana and the central Idaho wilderness and adjacent national forests that border the

Hells Canyon Study Area (Spahr et al. 1991). Wolves have been reported on a number of occasions on the Oregon side of the Snake River and most likely crossed the Snake River. Some of these wolves may have crossed the Snake River below Hells Canyon Dam. However, wolves were not observed during the period of intensive field work (1995–2001) along the unimpounded reach of the Snake River below Hells Canyon Dam.

Idaho Ground Squirrel

The distribution of both the northern and southern Idaho ground squirrel does not extend to the unimpounded reach of the Snake River downstream of Hells Canyon Dam (Gill and Yensen 1992).

Yellow-Billed Cuckoo

The yellow-billed cuckoo was not observed in the Hells Canyon Study Area, including the unimpounded reach downstream of Hells Canyon Dam (Appendix 3 to Technical Report E.3.2-1).

Columbia Spotted Frog

The Columbia spotted frog has been reported at higher elevations in the Wallowa Mountains and Craig Mountain outside the Hells Canyon Study Area (Llewellyn and Peterson 1995, Csuti et al. 1997). However, the species was never observed along the Snake River downstream of Hells Canyon Dam (Technical Report E.3.2-36).

E.3.2.1.4.13.2. Special Status Species

See section E.3.2.1.3.13. for a short description of special status species and for general background information. Specific information on the presence (or absence) of special status species in the unimpounded reach of the Snake River downstream of Hells Canyon Dam is provided in this section.

Birds

Waterbirds (*Loons, Grebes, Pelicans, Swans, Ducks, Gulls, Terns, and Wading Birds*)—Of the 13 species of special status waterbirds that potentially occur along the unimpounded reach of the

Snake River downstream of Hells Canyon Dam (the common loon, horned grebe, trumpeter swan, harlequin duck, American white pelican, Franklin's gull, black tern, great egret, snowy egret, white-faced ibis, greater sandhill crane, long-billed curlew, and upland sandpiper) (Table E.3.2-1), only one was observed: the sandhill crane (Appendix 3 to Technical Report E.3.2-1).

Upland Game Birds—Four species of upland game birds (the greater sage grouse, Columbian sharp-tailed grouse, mountain quail, and spruce grouse) (Table E.3.2-1) could potentially occur in the reach below Hells Canyon Dam. However, only the mountain quail was actually observed (Appendix 3 to Technical Report E.3.2-1). The Applicant also searched for mountain quail in areas studied by Ormiston (1966) in the HCNRA (Big Canyon Creek) but reported locating no quail (Technical Report E.3.2-5). Although no mountain quail were found in Big Canyon Creek, isolated populations are believed to exist elsewhere in the HCNRA (Stephen and Sturts 1998). The IDCDC documented recent mountain quail sightings in Hells Canyon at Granite Creek (1993), Blue Creek (1999), and Big Bar (1996). Applicant biologists incidentally observed mountain quail at Temperance Creek and above Pittsburg Landing (section 6.2. in Technical Report E.3.2-3). Spruce grouse were not observed in the Hells Canyon Study Area but could be expected at high elevations near the canyon rim (section 6.2. in Technical Report E.3.2-3).

Diurnal Birds of Prey—Only two special status diurnal birds of prey (the northern goshawk and prairie falcon) of six (the northern harrier, northern goshawk, ferruginous hawk, Swainson's hawk, merlin, and prairie falcon) (Table E.3.2-1) were observed in the reach downstream of Hells Canyon Dam (Appendix 3 to Technical Report E.3.2-1). The northern goshawk and prairie falcon possibly also nest in the downstream reach (Table 1 in Technical Report E.3.2-15).

Owls—Two (the flammulated owl and northern pygmy owl) of five special status species of owls (the great gray owl, burrowing owl, boreal owl, flammulated owl, and northern pygmy-owl) (Table E.3.2-1) were reported in the reach downstream of Hells Canyon Dam (Appendix 3 to Technical Report E.3.2-1).

Nonpasserines (*Hummingbirds, Woodpeckers, and Swifts*)—Eight (the Vaux's swift, calliope hummingbird, rufous hummingbird, pileated woodpecker, Lewis' woodpecker, white-headed woodpecker, red-naped sapsucker, and Williamson's sapsucker) (Table E.3.2-1) of 10 special status species of hummingbirds, woodpeckers, and swifts were observed in the reach downstream of Hells Canyon Dam (Appendix 3 to Technical Report E.3.2-1). The two special status species that were not reported from this group were the black-backed and three-toed woodpeckers (Appendix 3 to Technical Report E.3.2-1).

Passerines—Only eight (the willow flycatcher, bank swallow, Swainson's thrush, plumbeus vireo, MacGillivray's warbler, yellow warbler, Townsend's warbler, and Wilson's warbler) of 23 special status passerine species (the olive-sided flycatcher, dusky flycatcher, cordilleran flycatcher, Hammond's flycatcher, willow flycatcher, bank swallow, pygmy nuthatch, Swainson's thrush, veery, loggerhead shrike, plumbeus vireo, Townsend's warbler, yellow warbler, MacGillivray's warbler, Wilson's warbler, green-tailed towhee, bobolink, Brewer's sparrow, sage sparrow, grasshopper sparrow, black-throated sparrow, yellow-headed blackbird, and black rosy-finch) (Table 3.2-1) were observed in the reach downstream of Hells Canyon Dam (Appendix 3 to Technical Report E.3.2-1). However, 19 of 23 special status species were observed in the project vicinity (section E.3.2.1.4.2.); this higher number is probably a function of the much higher intensity of general field work activities conducted in the project vicinity compared with that conducted downstream of Hells Canyon Dam. Most of the special status species that were observed above, but not below, Hells Canyon Dam were considered to be either uncommon or rare (Appendix 3 to Technical Report E.3.2-1) and may only be detected with considerably higher survey effort.

Mammals

Insectivores (*Shrews, Moles, and Bats*)—Nine (the Yuma myotis, long-eared myotis, fringed myotis, long-legged myotis, California myotis, western small-footed myotis, western pipistrelle, Townsend's big-eared bat, and spotted bat) of 12 special status species were observed in the reach downstream of Hells Canyon Dam (Table E.3.2-1) (Technical Reports E.3.2-23, E.3.2-25, E.3.2-27, and E.3.2-38).

Carnivores—Five special status carnivorous species (the kit fox, American marten, wolverine, fisher, and northern river otter) (Table E.3.2-1) may occur downstream of Hells Canyon Dam. The kit fox, American marten, and fisher were not observed (Technical Reports E.3.2-28 and E.3.2-29). However, the American marten was reported by IDFG personnel to occur on Cuddy Mountain in the vicinity of the Hells Canyon area (Technical Report E.3.2-28). The fisher was also reported to occur in the Wallowa and Seven Devils mountains (Schommer 1994). However, Applicant biologists did not report this species during surveys in the Hells Canyon Study Area (Technical Report E.3.2-28). A wolverine track was reported in the Seven Devils Mountains (Technical Report E.3.2-29), as well as an incidental sighting on the Idaho side of Hells Canyon near Eagle Bar (section 5.2.3. in Technical Report E.3.2-28). The northern river otter was observed incidentally and uncommonly below Hells Canyon Dam (Table 1 in Technical Report E.3.2-25 and section 5.2.3. in Technical Report E.3.2-28).

Rodents and Lagomorphs—None of the three special status species (the northern flying squirrel, pygmy rabbit, or white-tailed jackrabbit) (Table E.3.2-1) were reported to occur in the reach below Hells Canyon Dam (Technical Reports E.3.2-23, E.3.2-24, and E.3.2-25).

Ungulates—The only special status ungulate species, the California bighorn sheep (Table E.3.2-1), was not observed downstream of Hells Canyon Dam. However, Rocky Mountain bighorn sheep inhabit Hells Canyon both upstream and downstream of Hells Canyon Dam.

Amphibians and Reptiles

Amphibians—Two (the western toad and inland tailed frog) of four amphibian species of concern (the northern leopard frog, inland tailed frog, western toad, and Woodhouse's toad) (Table E.3.2-1) were reported in the unimpounded reach of the Snake River downstream of Hells Canyon Dam (Figures 13 and 14 in Technical Report E.3.2-36).

When Applicant biologists surveyed eight tributaries downstream of Hells Canyon for tailed frogs, the species was found in three tributaries to the Snake River: Deep, Granite, and Sheep creeks (Table 10 in Technical Report E.3.2-36). In May 1997, one adult female tailed frog was observed on the rocky shore of the Snake River at the confluence with Granite Creek.

During spring and summer of 1996 through 1999, Applicant biologists surveyed 14 backwater ponds below Hells Canyon Dam for breeding western toads (Table 3 in Technical Report E.3.2-36). Eight (57%) of the ponds contained western toads, and 6 (43%) of the ponds showed evidence of their breeding. In addition, 9 wetlands not associated with the Snake River were surveyed below Hells Canyon Dam (Table 3 in Technical Report E.3.2-36). Western toads were present at 3 of these wetlands, and breeding was confirmed at 2 sites (Table 3 in Technical Report E.3.2-36). The presence of western toad tadpoles in backwater ponds surveyed below Hells Canyon Dam indicates that western toads breed effectively in relatively permanent backwater ponds. However, some of the ponds were surveyed on only one occasion, so surveyors may have missed breeding western toads, tadpoles, or both. When the western toad was present at a backwater pond, the number of tadpoles and adults counted often exceeded thousands of individuals, suggesting that the western toad continues to breed successfully below Hells Canyon Dam.

Reptiles—No special status snake species (the longnose, western ground, and ringneck snakes) or special status lizards (the Mojave black-collared, desert horned, and northern sagebrush lizards) (Table E.3.2-1) were reported in the unimpounded reach of the Snake River downstream of Hells Canyon Dam (Figures 5 and 6, respectively, in Technical Report E.3.2-36).

Insects

Eleven insect species were evaluated for their presence and status in Hells Canyon. Of these 11 species, 7 were excluded because 1) the special status was rejected (Malheur tiger beetle) (ORNHP 2001), or 2) the species were determined to be locally abundant (the rural skipper, Peck's skipper, Beartooth copper butterfly, Wallowa Mountains gazelle beetle, and LaBonte's gazelle beetle, long dash skipper.

The four remaining species that could potentially occur in the reach downstream of Hells Canyon Dam are the Columbia River tiger beetle, silver-bordered fritillary, Johnson’s hairstreak, and Yuma skipper (Table E.3.2-1). Little is known about the distribution, biology, and ecology of these species.

E.3.2.1.5. FERC-Permitted Transmission Lines and Associated Service Roads

One transmission line is associated with FERC Project No. 1971. The Applicant operates and maintains the Pine Creek–Hells Canyon 69-kilovolt (kV) line (Line 945) on 22 mi (36.5 km) of rights-of-way (ROW) with less than 1 mi of service roads. These 50-ft-wide ROW extend from the Pine Creek Substation at Oxbow, Oregon, to Hells Canyon Dam and run alongside a paved road on the Idaho side of Hells Canyon Reservoir (Figure E.1-2). The study area for the transmission line is limited to public land under the jurisdiction of state or federal authorities. About 93% of the line is located on public land. The service road spurs were built originally to facilitate line construction and are now used to provide access for line maintenance. A description of wildlife groups and species found in the HCC study area is provided in section E.3.2.1.3. Threatened, endangered, candidate, and special status species are listed in Table E.3.2-1. Most of the descriptions and listed species are applicable to the Pine Creek–Hells Canyon line (Line 945). In addition, studies specific to the Applicant's transmission lines, which included the Pine Creek–Hells Canyon line (Line 945), were conducted for elk, mule deer, Rocky Mountain bighorn sheep, and mountain goat (Technical Report E.3.2-31), bird collisions (Technical Report E.3.2-19), and bird electrocutions (Technical Report E.3.2-20). Technical Report E.3.2-37 summarizes the findings of the three reports on all the transmission lines and describes existing resources for additional wildlife species. The following sections are based on the information in Technical Report E.3.2-37 for the Pine Creek–Hells Canyon line (Line 945) and include descriptions of current habitat conditions; big game; threatened, endangered, and candidate species; and other special status species.[6]

E.3.2.1.5.1. Current Habitat Conditions

The Applicant summarizes information on wildlife habitat based on Technical Report E.3.2-37. (Figure 6 in Technical Report E.3.2-37). The 22-mi-long Pine Creek–Hells Canyon line (Line 945) is entirely within Hells Canyon. The terrain is steep, with a mosaic of Grasslands, Shrub Savanna, and Shrublands cover types. The line runs along the eastern shore of Hells Canyon Reservoir from Oxbow Dam to Hells Canyon Dam adjacent to a paved road and is mostly (93.3%) classified as disturbed habitat. More than 50% of the area in this habitat type is

6. When not otherwise specified, records of sightings of species near the line were obtained from the ORNHP, the IDCDC, and the Applicant. Though the ORNHP and IDCDC are state repositories for site-specific information on rare animals and plants, they did not necessarily have survey information specifically for transmission-line areas, unless noted.

disturbed by humans, and total vegetation cover is less than 15%. However, in a few locations the transmission line leaves the road shoulder for short distances and travels over grasslands (2%), reservoir (2%), rock (2.3%), big sagebrush (0.2%), shrub riparian vegetation (0.1%), and ponderosa pine (0.1%) (Technical Report E.3.3-4). Small amounts of riparian vegetation occur throughout numerous drainages that bisect the line. Forest riparian vegetation is most prominent near Big Bar along Allison Creek and at Eckels and Kinney creeks. The major landscape-changing processes in this region include livestock grazing and wildfire (Quigley and Arbelbide 1997).

E.3.2.1.5.2. Wildlife Resources

E.3.2.1.5.2.1. Ungulates

Mule deer, elk, Rocky Mountain bighorn sheep, and mountain goats occur near the Pine Creek–Hells Canyon line (Line 945). Big game resources for the Hells Canyon area, including habitat, population status, and movements, are described in section E.3.2.1.3.11. Some of this information is from Technical Report E.3.2-31, which evaluated several of the Applicant's transmission-line corridors. Mountain goats are common at middle to high elevations below Hells Canyon Dam but probably rarely, if at all, venture to the lower elevation of the Pine Creek–Hells Canyon line (Line 945).

E.3.2.1.5.2.2. Threatened, Endangered, and Candidate Species

Federal threatened, endangered, and candidate species that occur, or are likely to occur, near the Pine Creek–Hells Canyon line (Line 945) include the bald eagle, peregrine falcon, Canada lynx, and gray wolf. See section E.3.2.1.3.13. for status definitions. A short description of the habitat and distribution of threatened, endangered, and candidate species within the Hells Canyon area, as well as general background information, is provided in section E.3.2.1.3.13.1. Specific information on the distribution and numbers of species in the vicinity of the Pine Creek–Hells Canyon line (Line 945) is provided in this section. Information summarized here is from Technical Report E.3.2-37. For this report, the Applicant evaluated the likelihood of occurrence of each species in the ROW based on records of sightings, species distribution information from the literature, and presence of primary breeding habitat (Csuti et al. 1997, Groves et al. 1997, Kagan et al. 1999, Scott et al. 2001).

Bald Eagle

In the HCC, bald eagle wintering populations are present from about November through March, and a small nesting population is probably present year-round (Technical Report E.3.2-37). There are two known nesting territories along the Pine Creek–Hells Canyon line (Line 945). One was established in 1998; the other, in 2003.

Peregrine Falcon

Although no longer an endangered species, the delisted peregrine falcon is being monitored until 2004. One peregrine falcon nesting territory is known near the Pine Creek–Hells Canyon line (Line 945). It is located west of Hells Canyon Dam, 0.8 mi from the line's terminus. The line is likely within the falcon's foraging home range.

Canada Lynx

The Canada lynx is rare: there are no records of sightings in Hells Canyon. Therefore, the species is extremely unlikely to occur near the Pine Creek–Hells Canyon line (Line 945).

Gray Wolf

A very rare mammal, the gray wolf has very low potential to occur near the Pine Creek–Hells Canyon line (Line 945). However, there has been one incidental observation near the line. Wolves in Idaho may infrequently use Hells Canyon as a travel corridor for movement into Oregon.

E.3.2.1.5.2.3. Special Status Species

See section E.3.2.1.3.13.2. for a discussion of special status species, as well as general background information. Specific information on the presence (or absence) of special status species that occur in the vicinity of the Pine Creek–Hells Canyon line (Line 945) is presented in this section (see also Table 21 in Technical Report E.3.2-37).

Amphibians

The western toad, a species that is relatively common in the HCC, is the only special status amphibian likely to occur in the ROW of the Pine Creek–Hells Canyon line (Line 945). Although there are no records for the species near the line, three potential breeding wetlands were identified near the line (Technical Report E.3.2-36).

Upland Game Birds

The mountain quail is the only special status upland game bird species with potential to occur in the ROW of the Pine Creek–Hells Canyon line (Line 945), and it would be present in winter months. There is one record of this species within 1 km of the ROW. See section E.3.2.1.3.3. for a thorough description of the Hells Canyon area.

Birds of Prey

The northern goshawk is the only special status birds of prey species (other than the already discussed bald eagle and peregrine falcon) that may be present near the transmission-line ROW. There are three records within 1 km of the line for occurrences between fall and spring. The area is unsuitable for nesting but may provide wintering or migration habitat.

Woodpeckers

The Lewis' woodpecker is the only special status woodpecker species that is likely to occur near the Pine Creek–Hells Canyon line (Line 945). There are two records of this species within 1 km of the ROW.

Passerines

Five special status passerine species have distributional ranges near the Pine Creek–Hells Canyon line (Line 945). See section E.3.2.1.3.13. for species abundances in and background information for Hells Canyon. The willow flycatcher was considered rare, with low likelihood of occurring in suitable habitat. There is one record of a willow flycatcher within 1 km of the line. Eight records are known for the plumbeus vireo, 3 for the Wilson's warbler, and 12 for the MacGillivray's warbler within 1 km of the ROW; these species were all considered uncommon. The yellow warbler had 23 records within 1 km of the ROW and was considered common and likely to occur in riparian habitat in the ROW.

Bats

The Townsend's western big-eared bat is a wide-ranging species that was rated as uncommon but with moderate potential to occur near the Pine Creek–Hells Canyon line (Line 945). The three other special status bat species (the spotted bat, fringed myotis, and western pipistrelle) are more likely to occur downstream of the transmission line, below Hells Canyon Dam. The line runs within 300 m of the Big Bar bat area, which has several well-known roosting locations. Approximately 30 caves and mines, including the gated Redfish Cave, are located in the limestone cliffs in the vicinity of Big Bar/Allison Creek. Four of these caves house Townsend's big-eared bat roosts; four, roosts for unknown bat species; one, a Yuma myotis maternity colony; and one, a little brown myotis roost. There are records of bats for most other caves in the area (Technical Report E.3.2-46).

Carnivores

Other than the Canada lynx and gray wolf, the northern river otter is the only special status carnivore with the potential to occur near the Pine Creek–Hells Canyon line (Line 945). It is a common species that may occur at any water crossing area of the ROW.

E.3.2.2. Measures or Facilities Recommended by the Agencies

To consolidate measures, the Applicant has included measures or facilities recommended by the agencies in section E.3.2.3.3. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.3.2.3. Applicant's Existing and Proposed Measures or Facilities

E.3.2.3.1. Existing Measures or Facilities to Be Continued or Maintained

No existing measures or facilities are proposed for continuation during the next license period.

E.3.2.3.2. New Measures or Facilities Proposed by the Applicant

The Applicant proposes five categories of protection, mitigation, and enhancement (PM&E) measures. These measures are organized according to spatial impacts of the HCC on wildlife resources. The Applicant proposes four measures for the area, including the HCC reservoirs and the river reach downstream of Hells Canyon Dam, and one measure for the transmission-line right-of-way (ROW) for the Pine Creek–Hells Canyon line (Line 945). PM&E measures are implemented to address specific types of issues and impacts identified in section E.3.2.4.

For each PM&E measure, at least one type of action is noted: acquisition, cooperative project, or management program. These three actions were identified and defined by the Terrestrial Resources Work Group (TRWG). Acquisition was defined as acquiring lands and managing and operating them to mitigate for identified impacts of modeled proposed operations that have been identified (Technical Report E.3.2-45). Acquisition would include any of the following actions by the Applicant: 1) acquiring properties in fee title, including water rights and federal and state grazing permits; 2) acquiring conservation easements; and 3) providing funds for operation and maintenance (O&M) of the property. Cooperative project was defined as participating with partners (such as state and federal agencies and nongovernmental organizations) to address impacts on lands other than those owned or acquired by the Applicant. The Applicant's participation in cooperative projects would include one or more of the following: 1) funding, 2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials. Finally, management program was defined as developing and implementing a program to address impacts and resource stewardship needs on Applicant-owned lands or Applicant-held ROW. This program would include the Applicant's developing and implementing best management practices or resource management plans.

E.3.2.3.2.1. Hells Canyon Complex Reservoirs and Downstream of Hells Canyon Dam

Four PM&E measures focus on the HCC reservoirs and the reach downstream of the Hells Canyon Dam. These measures, categorized by type of action, are as follows:

Acquisition—Acquisition of upland and riparian habitat

Cooperative Projects—1) Enhancement of habitat on four Snake River islands in cooperation with the IDFG (Gold Island) and ODFW (Huffman, Patch, and Porter Islands) and 2) cooperative enhancement of low-elevation riparian habitat and reintroduction of mountain quail in areas adjacent to the HCC reservoirs

Management Program— Management of wildlife resources on Applicant-owned lands associated with the HCC

E.3.2.3.2.1.1. Acquisition of Upland and Riparian Habitat

Justification

Continued operation of the HCC would affect wildlife habitat and wildlife species, including threatened, endangered, and special status species, associated with the three reservoirs (Technical Report E.3.2-45). Impacts occur in the fluctuation, shoreline, and mule deer winter range (or crucial winter range) zones. Impacts to each zone are summarized below.

Reservoir Fluctuation Zone—The Applicant estimated that proposed operations would prevent the fluctuation zone of 1) Brownlee Reservoir from supporting 372 acres of riparian and 5,448 acres of upland habitats, 2) Oxbow Reservoir from supporting 7 acres of riparian and 82 acres of upland habitats, and 3) Hells Canyon Reservoir from supporting 9 acres of riparian and 231 acres of upland habitats (Technical Report E.3.2-40). Therefore, the Applicant concludes that proposed operations of the HCC would impact 6,149 acres (388 acres riparian and 5,761 acres upland habitat) of wildlife habitat in the reservoir fluctuation zones (Table 2 in Technical Report E.3.2-45).

Reservoir and River Shoreline Zone—The loss and fragmentation of riparian habitat are major factors contributing to the decline of many wildlife species, including threatened, endangered, candidate, and special status species in the West (Technical Reports E.3.2-38, E.3.2-40, and E.3.2-41). The Applicant concludes that neither proposed operations nor full pool run-of-river operations would significantly alter the current composition of riparian and upland habitats within shoreline zones of Oxbow and Hells Canyon reservoirs or downstream of Hells Canyon Dam (Technical Reports E.1-4, E.3.2-40, E.3.2-45, and E.3.3-3). After investigating current conditions, the Applicant estimated that proposed operations would not alter habitat within the shoreline zone of Brownlee Reservoir, but that full pool run-of-river operations would convert 343 acres of upland habitat into riparian habitat (Technical Report E.3.2-40). Therefore, the Applicant concludes that proposed operations would preclude the establishment of 343 acres of riparian habitat in the shoreline zones of Brownlee Reservoir currently occupied by upland habitat. The Applicant also concludes that mitigation for 343 acres of riparian habitat would constitute mitigation for habitats within the shoreline zone of Brownlee Reservoir of threatened, endangered, candidate, and special status species that would be affected by proposed operations of the HCC (Technical Report E.3.2-45).

The Applicant also concluded that it is not possible to eliminate the influence on shoreline erosion from water-level fluctuations of the HCC that are necessary for flood control, anadromous fish spawning and protection, downstream navigation, and hydroelectric generation (Technical Report E.3.2-42). Therefore, the Applicant proposes to mitigate for 90 acres of reservoir and river shoreline that would be expected to erode during the next license period because of HCC operations. Additional measures for cooperative projects to stabilize and enhance specific sites in Hells Canyon are proposed (section E.3.3.3.) because of the importance placed on cultural, recreational, and aesthetic resources.

Mule Deer Winter Range Zone—The Applicant assessed three types of effects of the HCC on mule deer: inhibited movements, limited habitat selection, and reservoir-related mortality (such as from drowning, predation along shorelines, and icing). Though the Applicant concluded that the complex did not significantly impact deer movements, the Applicant discovered that both reservoir-related mortality and the loss of low-elevation winter habitat impacted deer. An estimated 582 acres of habitat, in addition to 5,820 acres of low-elevation habitat prevented from establishing in the fluctuation zone of Brownlee Reservoir (see section E.3.2.4.1.1.6.), would be required to mitigate for winter range that is unavailable in this zone of Brownlee Reservoir (Technical Report E.3.2-45). After quantifying reservoir-related mortality during years with mild to moderate winter conditions and years with harsh winter conditions, the Applicant concludes that the complex (primarily Brownlee Reservoir) impacts the capability of the HCC winter range to support mule deer. An estimated 16,418 acres of habitat would be required to mitigate for impacts to winter range of mule deer (Technical Report E.3.2-45).

Goal

The goal of this measure is to acquire, enhance, and manage 23,582 acres to mitigate for the estimated impacts of proposed operations. The Applicant would potentially include some of its currently owned lands that have high wildlife value. Land acquisition and management by the Applicant would include 1) acquiring properties in fee title (including water rights, federal and state grazing allotments, and other associated land-use privileges), 2) acquiring conservation easements, and 3) providing O&M funds for the Applicant to manage the acquired properties. The Applicant anticipates that rangelands acquired for mitigation purposes would probably be working ranch properties. Cattle production would probably continue as a tool for management of the property. However, overall management would focus on meeting mitigation needs for wildlife and botanical resources.

Through the creation of an integrated wildlife habitat program, the Applicant proposes to provide general land stewardship on newly acquired properties in conjunction with currently owned lands (Technical Reports E.6-1 and E.6-2). The integrated wildlife habitat program would prioritize the protection and enhancement of big game winter range and riparian/wetland and upland habitats—protection and enhancement that would alleviate identified impacts and prevent future impacts. Detailed goals and objectives for wildlife resources on Applicant-owned lands would be developed during creation of the management program and integrated with goals for other natural resources and land uses occurring on Applicant-owned lands. In compliance with the Applicant's *Hells Canyon Resource Management Plan* (Technical Report E.6-1), the integrated wildlife habitat program would provide both universal and site-specific guidance for managing wildlife resources on the Applicant's newly acquired and currently owned lands.

Description

Because the resource management plan would provide broad, general guidance for resource management on the Applicant's lands in Hells Canyon (Technical Report E.6-1), the Applicant's Interdisciplinary Team for that document would create an integrated wildlife habitat program and develop wildlife management goals and objectives for Applicant-owned lands (see section E.3.2.3.2.1.4.). During creation of the integrated wildlife habitat program, the Applicant would develop a general wildlife management plan with strategies and policies for achieving the wildlife goals and objectives that apply universally to Applicant-owned lands. The wildlife management plan would be developed cooperatively with natural resource agencies and landowners of adjacent properties. It would guide decisions about wildlife management actions on Applicant-owned lands. Additionally, detailed site plans would be developed for individual assemblages of lands with unique resources, conditions, and objectives (for example, special management areas) (see Technical Report E.6-1). Site-specific objectives would fit within the overall framework of the wildlife management plan and the resource management plan.

Specifically, the Applicant would seek advice from natural resource agencies and landowners of adjacent properties on the following issues:

- Prioritizing land acquisition and general management objectives
- Coordinating surrounding land-use activities
- Developing specific objectives for weed management
- Developing specific objectives for protecting sensitive plant species
- Finding opportunities to participate in existing habitat improvement programs
- Creating zones within the larger management area to more effectively use resources or treatments
- Coordinating habitat improvement projects
- Determining meeting and reporting frequency
- Complying with legal issues
- Reviewing annual work plans, budgets, and status reports

Most impacts to wildlife from the HCC are related to Brownlee Reservoir. Therefore, acquired properties should preferably be near the complex reservoirs (that is, within the rims of Hells Canyon and between the upstream end of Brownlee Reservoir and Hells Canyon Dam). At this time, however, the Applicant proposes no specific locations to acquire for mitigation because there are too many uncertainties about the ultimate availability and selection of properties. Nonetheless, certain characteristics are desirable. Generally, the Applicant would prefer properties that consist of large, contiguous parcels having potential for maximum habitat diversity. Such properties would simultaneously benefit many natural and cultural resources. Associated water rights and springs would be part of the acquisition. Parcels with associated livestock allotments could be especially desirable. Specific cover types that would be preferred on acquired lands are all the riparian types (*Emergent Herbaceous Wetland*, *Forested Wetland*, and *Scrub-Shrub Wetland*) and several highly valued upland cover types (*Forested Upland*, *Shrubland*, *Grassland*, and *Shrub Savanna*). Generally, desirable sites would benefit big game; threatened, endangered, candidate, and special status species; neotropical migrant birds; and upland game birds (such as the greater sage grouse and sharp-tailed grouse).

Associated Benefits

An integrated wildlife habitat program, implemented through the Applicant's Interdisciplinary Team (Technical Report E.6-1), would be developed in coordination with other land uses and resource management plans. During program development of sound management practices, the Applicant would consider and balance opportunities for mitigating impacts to wildlife, while also benefiting other natural resources (for example, botanical, aquatic, and cultural) and providing resource uses (for example, recreation and grazing).

Implementation or Construction Schedule

Acquiring, enhancing, and managing upland and riparian habitat and developing an integrated wildlife habitat program for Applicant-owned lands associated with the HCC would include the following tasks and schedule:

Time Frame	Action
Within 1 year after license is issued	Form Interdisciplinary Team Begin identifying and acquiring parcels Initiate integrated wildlife habitat program
2–5 years after license is issued	Acquire property
Within 5 years after license is issued	Complete wildlife management plan
5–30 years after license is issued	Implement wildlife management plan: • Hire management personnel • Build and improve infrastructure (buildings, equipment, access) • Conduct habitat enhancement and land stewardship projects • Present annual reports, including annual budget and annual progress reports
For life of license	Provide resource stewardship, including O&M budget

Cost Estimate

The Applicant estimates the following costs associated with acquiring, enhancing, and managing upland and riparian habitat within an integrated wildlife habitat program:

Action	Cost (30 years)
Acquisition	
Acquisition of 23,582 acres (821 riparian, 22,761 upland) @ $400/acre	$9,432,000
O&M	
Annual labor for O&M[a]	$280,000
Annual building maintenance and materials purchase[b]	$65,000
Annual improvements (for example, plantings, fencing, weed control)[c]	$290,000

Action	Cost (30 years)
Consultation with Hells Canyon Complex Interdisciplinary Team	$15,000
Total for annual O&M budget	$650,000
Grand total for acquisition and O&M for assumed life of license (30 years)[d]	$28,932,000

a. *Annual labor for O&M*—Provides adequate personnel and budget to complete tasks, including 1) consulting with agencies and other interested land management organizations and cooperating and coordinating with adjacent land owners (private, county, state, and federal); 2) implementing monitoring and reporting processes; 3) planning and maintaining various wildlife and botanical improvement projects (for example, planting riparian vegetation; controlling noxious weeds; improving upland habitat; maintaining and patrolling fences; maintaining roads, docks, ramps, and other facilities); 4) establishing wildlife food plots; 5) protecting land from trespass or open-range grazing; 6) preparing timely budgets and annual reports; and 7) conducting tours and giving presentations to the public and special interest groups.

b. *Annual building maintenance and material purchase*—Includes tasks such as maintaining buildings and machinery, making capital improvements, and purchasing materials for habitat improvement projects.

c. *Annual improvements*—The Applicant expects that the following tasks would be included: 1) restoring and expanding riparian cover types by planting native species, fencing springs and streams; 2) restoring and expanding upland cover types by planting native species, fencing to protect sensitive areas from grazing and other disturbances, fencing and making other improvements to encourage grazing dispersal and to control use levels; 3) implementing integrated weed management measures; and 4) implementing protection measures for rare and special plant and animal species or communities.

d. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC's discretion for setting a new license term.

Location Map

At this time, the Applicant proposes no specific parcels for acquisition, but would prioritize the acquisition of lands near the HCC reservoirs (within the rims of Hells Canyon and between the upstream end of Brownlee Reservoir and Hells Canyon Dam). However, acquisition opportunities within Hells Canyon may be limited by 1) the willingness of private landowners to sell suitable properties, 2) excessive costs of suitable properties, and 3) the number of private properties having desirable characteristics or the potential to develop desirable characteristics. The Applicant has not inventoried natural resource (for example, wildlife, botanical, aquatic, and cultural) values on all private properties within Hells Canyon. Priority will be placed on on-site mitigation for impacted lands.

E.3.2.3.2.1.2. Enhancement of Habitat on Four Snake River Islands in Cooperation with the Idaho Department of Fish and Game (Gold Island) and Oregon Department of Fish and Wildlife (Huffman, Patch, and Porter islands)

Justification

The Applicant projected that proposed HCC operations would affect the establishment and extent of riparian habitats (Technical Report E.3.2-40). This effect would in turn impact waterfowl brooding habitat. In addition, drafting of Brownlee Reservoir during the waterfowl brooding period would cause riparian habitat in shoreline zones to become unavailable. Enhancing habitats associated with islands in upstream portions of Brownlee Reservoir and between Weiser and Brownlee Reservoir would benefit waterfowl affected by the complex (Technical Report E.3.2-45).

Goal

The Applicant proposes to work cooperatively with the IDFG and ODFW to enhance habitats on four Snake River Islands (Gold, Patch, Porter, and Huffman). As part of its mitigation for original construction of the HCC, the Applicant purchased the islands and then conveyed ownership of Gold Island to the IDFG and the other three islands to the ODFW (then called the Oregon State Game Commission). With this PM&E measure, the Applicant's primary objective is to enhance riparian and upland habitat at these islands for waterfowl and for threatened, endangered, candidate, and special status species.

Description

On March 16, 1959, the Applicant agreed to purchase four islands and convey ownership to the states of Idaho and Oregon. The Applicant conveyed Gold Island (located in Canyon County, Idaho) to the IDFG and Patch, Porter, and Huffman islands (located in Malheur County, Oregon) to the ODFW. Both agencies agreed that the Applicant's conveyance of the islands to the states constituted full satisfaction of provisions in the original HCC license (article 37). The islands were to be managed for public hunting and fishing and for the restoration, protection, and propagation of waterfowl and upland game birds.

All islands were farmed prior to the Applicant's acquisition. The IDFG cultivates plots to produce food for wildlife on Gold Island. However, the antiquated irrigation system is failing, a condition that will limit future food plots. The ODFW cultivated wildlife food plots on Porter and Patch islands, but stopped actively managing these plots when the barge that provided access to the island failed. Limited management has caused weeds to infest all four islands, and little native vegetation persists. The degraded habitat conditions on the islands currently provide minimal benefit to waterfowl; upland game birds; and threatened, endangered, candidate, and special status wildlife species.

Therefore, the Applicant proposes to cooperate with the IDFG and ODFW and assist with managing the islands for wildlife. The Applicant would seek to cooperate in island-management projects that enhance riparian and upland areas providing waterfowl nesting, brood rearing, and wintering habitats. Examples of management projects include controlling noxious weeds and other undesirable plants; planting native herbaceous, shrub, and tree species; and establishing wildlife food plots. The Applicant would also seek to cooperate in projects that upgrade equipment used for vegetation management. For example, an efficient, functioning irrigation system would facilitate rehabilitation of riparian and upland habitats.

Associated Benefits

Enhancing riparian and upland habitats for waterfowl, especially by controlling weedy plant species, would provide many associated benefits for other wildlife, botanical, and aquatic resources, as well as recreational resources. In the western United States, riparian habitats cover only 0.5% of the landscape, but they support a disproportionately large diversity and abundance of wildlife. Therefore, improving riparian habitat would enhance the biological diversity of many wildlife communities (Technical Reports E.3.2-38 and E.3.2-40). Enhancing the suitability of riparian habitat for waterfowl would include increasing the extent and diversity of native woody plant species, thereby benefiting botanical resources. Increasing the extent and functioning of both riparian and upland habitats would probably also improve water quality (by improving temperature and dissolved oxygen) for aquatic resources. Habitat enhancements could also increase the diversity and abundance of many desirable wildlife species, including neotropical migrant birds. Wildlife-oriented recreational opportunities (consumptive and nonconsumptive) would also be enhanced.

Implementation or Construction Schedule

Within the first year after a license is issued for the HCC, assuming that cooperative projects were planned at that time, the Applicant would begin participating in island management and continue to participate for the life of the license. If cooperative projects were not ready to be implemented within the first year, the Applicant would begin participating in cooperative projects as opportunities occurred.

Cost Estimate

The Applicant proposes to contribute funding, equipment, personnel, logistical support, and expertise to cooperative island-management projects that would be initiated by the IDFG and ODFW. The Applicant would contribute to projects that enhance riparian and upland habitat. After a license is issued, the Applicant would contribute a maximum of $26,000 per year over an assumed 30 years ($780,000 total).

Location Map

For location information, see Figure E.3.2-1.

E.3.2.3.2.1.3. Cooperative Enhancement of Low-Elevation Riparian Habitat and Reintroduction of Mountain Quail in Areas Adjacent to the Hells Canyon Complex Reservoirs

Justification

Historically, mountain quail were found in large numbers in west-central Idaho. However, populations have declined significantly (Technical Reports E.3.2-4 and E.3.2-5), a trend that prompted a petition for protection under the ESA. The Applicant found that impacts to low-elevation riparian habitat adjacent to the HCC might reduce opportunities for mountain quail recovery. Proposed operations of Brownlee Reservoir could inhibit the establishment of quail by decreasing the interconnectedness of shoreline riparian habitats (Technical Reports E.3.2-6 and E.3.2-41). In addition, the majority of suitable winter habitat for mountain quail is composed of low-elevation riparian areas (Technical Report E.3.2-6), areas that are especially prone to disturbance from human activities associated with recreation, roads, and the Applicant's O&M activities (Technical Report E.3.2-46).

The Applicant determined that numerous tributaries to the reservoirs contain small patches of suitable but isolated mountain quail habitat (Technical Report E.3.2-6). The likelihood of establishing mountain quail populations adjacent to the complex reservoirs would improve if suitable habitat in tributaries were interconnected by woody riparian vegetation along reservoir shorelines. Therefore, cooperative efforts to enhance low-elevation riparian habitat and reintroduce a quail population would facilitate mountain quail restoration in Hells Canyon (Technical Report E.3.2-45).

Goal

The Applicant proposes to cooperate with state and federal wildlife management agencies to develop and implement a mountain quail restoration project adjacent to the HCC reservoirs. The Applicant would participate in enhancing low-elevation riparian habitat and reintroducing a mountain quail population.

Description

Habitat degradation has been considered a primary cause of the elimination of mountain quail from much of their former range in the Intermountain West, including Hells Canyon. Therefore, habitat enhancement and restoration must often occur before reintroduction efforts can be successful. Although habitat conditions are often below optimal, the Applicant found that suitable mountain quail habitat currently occurs adjacent to the HCC reservoirs (Technical Report E.3.2-6). However, mountain quail populations are absent in most of those suitable habitats (Technical Reports E.3.2-3 and E.3.2-38). The Applicant proposes to cooperate in efforts of state and federal agencies to enhance the quality of mountain quail habitat and restore mountain quail populations adjacent to the reservoirs. The Applicant would contribute funding, equipment, personnel, logistical support, and expertise to cooperative restoration projects. Currently, state and federal agencies have no detailed proposals for initiating a mountain quail restoration project in Hells Canyon. Therefore, the Applicant cannot provide details about specific actions for participating in such restoration efforts.

Associated Benefits

Enhancing riparian habitat would provide many associated benefits for other wildlife, botanical, and aquatic resources. During winter, mountain quail need woody riparian habitat at low elevations. Though riparian habitats in the western United States cover only 0.5% of the landscape, they support a large diversity and abundance of wildlife. Therefore, the biological diversity of many wildlife communities would be enhanced with riparian habitat enhancement (Technical Reports E.3.2-38 and E.3.2-40). Native fruit-producing species, especially black hawthorn, are important components of riparian areas that provide suitable high-quality mountain quail habitat. Because enhancing the suitability of riparian habitat for mountain quail would involve increasing the extent and diversity of native woody plant species, botanical resources would also be enhanced. And increasing the extent and functioning of riparian habitats would probably improve water quality (for example, temperature and dissolved oxygen) for aquatic resources.

Implementation or Construction Schedule

Within the first year after a license is issued for the HCC, assuming cooperative projects were planned at that time, the Applicant would begin participating in mountain quail projects and continue participating for the next five consecutive years. Otherwise, the Applicant would begin participating in cooperative mountain quail projects as opportunities occur.

Cost Estimate

The Applicant proposes to contribute funding, equipment, personnel, logistical support, and expertise to cooperative mountain quail projects that may be initiated by state and federal resource agencies. The Applicant would contribute to projects for riparian habitat enhancement and population translocations in Hells Canyon. The Applicant would contribute a maximum of $20,000 per year over five years ($100,000 total) after a license is issued for the HCC.

Location Map

State and federal wildlife agencies have not identified or planned any specific mountain quail restoration projects. Therefore, no specific habitat enhancement or population restoration sites have been identified. Nonetheless, the Applicant proposes that maps of suitable mountain quail habitat adjacent to the HCC reservoirs be used to guide project planning in Hells Canyon (Technical Report E.3.2-6).

E.3.2.3.2.1.4. Management of Wildlife Resources on Applicant-Owned Lands[7] Associated with the Hells Canyon Complex

Justification

Within the FERC project boundary for the HCC, the Applicant owns approximately 3,450 nonflooded acres of land in fee (known as project lands) (Technical Report E.6-1). The Applicant also owns another approximately 1,850 acres of land within Hells Canyon but outside the FERC project boundary (known as nonproject lands). The Applicant uses project lands primarily for O&M of the complex. However, secondary activities and land uses also occur on project lands, as well as on nonproject lands, and include recreation, livestock grazing, road use, and agriculture. In addition, many of these lands are situated along the shoreline of Brownlee Reservoir, and wildlife habitats on these lands are impacted by reservoir operations (Technical Reports E.3.2-45 and E.6-1).

The Applicant determined that O&M activities, road use, land management, and recreation on both project and nonproject lands can affect wildlife resources (Technical Reports E.3.2-46, E.6-1, and E.6-2). The Applicant specifically identified potential disturbance impacts to big game, roosting and nesting bald eagles, and nesting neotropical migrant passerines. Proposed reservoir operations were also estimated to decrease the extent and interconnectedness of riparian habitat along the shoreline of Brownlee Reservoir, a condition that affects waterfowl habitat and passerine nesting habitat (Technical Reports E.3.2-40 and E.3.2-45). In addition, recreation and livestock grazing on Applicant-owned lands degrade some wildlife habitats (Technical Reports E.3.2-45, E.6-1, and E.6-2), and the Applicant is concerned that future changes in recreation might impact colonial waterbird rookeries and bat hibernacula. Therefore, the Applicant proposes that certain Applicant-owned lands[7] be managed to 1) protect wildlife resources from potential impacts, 2) mitigate for identified impacts to wildlife resources, and 3) enhance the future value of wildlife resources.

Goal

To ameliorate identified impacts and provide general land stewardship, the Applicant proposes to create an integrated wildlife habitat program for wildlife resources associated with Applicant-

7. This measure applies only to Applicant-owned lands that are nonflooded, for which the Applicant owns all rights, and that are designated in the *Hells Canyon Resource Management Plan*.

owned lands. The general goals of such a program would be to prioritize the protection and enhancement of mule deer winter range and riparian/wetland habitats. Protecting and enhancing these habitats would also alleviate identified impacts and prevent future impacts to wildlife. Detailed goals and objectives for wildlife resources on Applicant-owned lands would be developed during creation of the management program and integrated with goals for other natural resources and land uses occurring on Applicant-owned lands. Complying with the Applicant's *Hells Canyon Resource Management Plan* (Technical Report E.6-1), the integrated wildlife habitat program would provide both universal and site-specific guidance for managing wildlife resources on Applicant-owned lands.

Description

The Program—During the life of the new license for the HCC, the Applicant's integrated wildlife habitat program would consist of three phases: planning, implementation, and adaptive monitoring. The planning, or development, phase would include several tasks for first understanding the wildlife resources (habitats and populations) occurring on Applicant-owned lands and then building overall and site-specific management goals and objectives. Management goals and objectives would be developed cooperatively by the Applicant's Interdisciplinary Team (Technical Report E.6-1), natural resource agencies, and landowners of adjacent properties. Also during the planning phase of the program, the Applicant would develop a generalized wildlife habitat management plan with strategies and policies for achieving the goals and objectives that apply universally to Applicant-owned lands. The Applicant's wildlife habitat management plan would guide decisions about wildlife habitat management and land uses on Applicant-owned lands. In addition, detailed site plans would be developed for individual assemblages of lands with unique resources, conditions, and objectives (for example, special management areas) (see Technical Report E.6-1). Site-specific objectives would fit within the overall framework of the wildlife habitat management plan.

During the program's implementation phase, the Applicant would design and initiate an array of integrated projects consistent with the *Hells Canyon Resource Management Plan* (Technical Report E.6-1). These projects would protect and enhance wildlife resources by working toward overall and site-specific goals and objectives. Individual short- and long-term projects would be initiated at varying times during the license period. Depending on wildlife habitat resource needs, projects might be applied universally to all Applicant-owned lands designated for wildlife habitat management or to individual parcels as guided by site plans. To alleviate identified impacts, management projects would target habitat enhancement (such as riparian rehabilitation) and resource protection from human activities (such as O&M and recreational activities) and from land uses (such as livestock grazing). A project plan would be developed before a proposed project were implemented. The project plan would describe objectives, justification, planning, methods, monitoring, and reporting for individual projects.

The Applicant would monitor the progress of management projects and the condition of resources on Applicant-owned lands. Within the goals and objectives of the wildlife habitat management plan, wildlife monitoring would provide feedback that would enable revision of the management plan to suit future resource conditions and needs. Monitoring would also identify the need for new projects. For projects specifically designed to mitigate identified impacts, the Applicant would also monitor land uses and use by humans to gauge whether impacts have been mitigated and to predict future effects. As outlined in individual project plans, monitoring would assess the results of those projects. Monitoring results for individual projects would be reported at appropriate intervals, depending on project schedules. An annual monitoring report would discuss overall progress of the integrated wildlife habitat program.

Projects—Although a wildlife habitat management plan has not yet been developed, the Applicant has identified current needs for several projects specifically designed to alleviate identified impacts (Technical Report E.3.2-45). Specific projects for alleviating impacts would include managing road use and maintenance and human activities (for example, O&M activities and recreation) near bald eagle winter roosts, bald eagle nests, big game concentration areas, colonial waterbird rookeries, and bat hibernacula (Technical Report E.3.2-46). The Applicant would also mitigate for impacts to wildlife habitat by enhancing riparian habitats, managing livestock grazing, and providing land stewardship on Applicant-owned lands. In addition, the Applicant proposes to monitor these resources to verify the success of mitigation projects. The Applicant anticipates that other projects addressing site-specific resource needs and land stewardship needs would be identified when the integrated wildlife habitat program is developed. Although project details would be developed during creation of the program, the Applicant proposes a series of measures focused on habitat management and constraints on O&M and recreation. These measures are listed under Cost Estimates.

Associated Benefits

The integrated wildlife habitat program is proposed for lands in Hells Canyon that are currently owned by the Applicant. Additional lands could also be included in the program. Overall objectives for resources in Hells Canyon would provide the framework within which the Applicant would manage lands for wildlife habitat. However, site-specific resource values would also be considered when site plans were developed for individual or logical groupings of parcels. Within the framework of the overall wildlife habitat program objectives, site plans would consider a local area's specific resource values and needs.

Lands newly acquired by the Applicant for mitigation—especially those adjacent to lands already owned by the Applicant—could be easily incorporated into the integrated wildlife habitat program. The program's hierarchical and comprehensive structure would provide a way to efficiently initiate management of newly acquired lands. Key elements of the program's three phases (planning, implementation, and adaptive monitoring) would be applied to newly enrolled lands, thereby resulting in a site plan for each new acquisition.

The integrated wildlife habitat program, functioning through the Applicant's Interdisciplinary Team (Technical Report E.6-1), would be developed in coordination with other resources and land uses. During program development for sound land management practices, the Applicant would consider and balance opportunities for mitigating its impacts to wildlife habitat, while also benefiting other natural resources (such as botanical, aquatic, and cultural) and providing resource uses (such as recreation and cattle grazing). The Applicant would develop wildlife habitat management objectives and projects in coordination with neighboring landowners, land stewards (for example, state and federal resource agencies), and the public.

Implementation or Construction Schedule

Managing wildlife resources and implementing an integrated wildlife habitat program for Applicant-owned lands associated with the HCC would include the following phases and tasks:

Time Frame	Action
Within 2 years after license is issued	Planning Phase • Inventory resources and land uses • Determine management authority • Establish overall management goals and objectives for wildlife habitat • Develop an integrated management strategy • Balance wildlife habitat objectives with multiple resource/land uses • Develop a wildlife management plan
Within 4 years after license is issued	Implementation Phase • Design management projects • Develop site-specific objectives • Develop site plans • Develop initial project plans • Initiate projects
Beginning 4 years after license is issued and continuing for the life of the license	Adaptive Monitoring Phase • Monitor mitigation progress • Monitor project progress • Adapt ongoing projects as needed • Develop new projects as needed • Update management and site plans as needed • Produce monitoring reports

Cost Estimates

The Applicant estimates the following costs associated with managing wildlife resources within an integrated wildlife habitat program:

Resource Impact	Impact Source	Mitigation Project	Mitigation Monitoring	Annual Project Cost	Total Cost (30 years)
Riparian habitat degradation	Dispersed recreation	Riparian habitat management and enhancement	Neotropical migrant bird status	Management and monitoring = $9,167	$275,000
Waterfowl habitat preclusion	Reservoir operations	Management of Powder River arm	Waterfowl population status	Management = $5,800 Monitoring = $3,000	$264,000
Wildlife habitat degradation	Livestock grazing	Habitat/ grazing management, land stewardship	Habitat and land use status	Management and monitoring = $87,633	$2,629,000
Wintering big game	Human disturbance	O&M and recreation constraints	Mule deer population status	Monitoring = $30,000	$900,000
Bald eagle roosting	Human disturbance	O&M and recreation constraints	Winter bald eagle status	Management = $1,567 Monitoring = $1,500	$92,000
Bald eagle nesting	Human disturbance	O&M and recreation constraints	Nest success	Management and monitoring = $4,000	$120,000
Colonial waterbird rookeries	Human disturbance	O&M and recreation constraints	Nest occupancy	Management and monitoring = $1,500	$45,000
Bat hibernacula	Human disturbance	O&M and recreation constraints	Human use levels	Management and monitoring = $1,500	$45,000
Total				$145,667	4,370,000

Location Map

Applicant-owned lands that are not flooded are widely distributed, but typically occur along the HCC reservoirs. Many of these lands occur as relatively small and disjunct parcels, though some relatively large parcels are located near Barber Flats, the Oxbow Bypass, McCormick Park, Woodhead Park, and the Powder River arm.

Adjacent to the mouth of the Powder River, the Applicant has been involved in establishing a small wildlife management area in cooperation with the ODFW and other interested parties since the early 1990s. The Applicant currently owns approximately 224 acres of land around the Powder River pool (upstream of Hewitt Park) (Figure E.6-2), but has allowed other uses through use agreements. The Applicant is actively trying to expand wildlife habitat along the Powder River arm by working with adjacent landowners. Technical Report E.6-2 provides maps and a general description of Applicant-owned lands associated with the complex.

E.3.2.3.2.2. Transmission Lines and Associated Service Roads

One new measure for wildlife resources is associated with the single HCC transmission line—the Pine Creek–Hells Canyon 69-kV line (Line 945): development and implementation of a transmission-line O&M plan. This measure is primarily a management program action; it requires no acquisition of land.

E.3.2.3.2.2.1. Development and Implementation of Transmission-Line Operation and Maintenance Plan

Justification

The Applicant performs O&M activities to ensure the structural and engineering integrity of the transmission-line system and thereby the safety and reliability of these lines (Technical Reports E.3.2-45 and E.3.3-4). Some of these activities, however, may affect wildlife species, wildlife habitat, or both. Impacts include habitat degradation, disturbance to wildlife during sensitive periods, and bird electrocutions. Wintering big game and threatened, endangered, candidate, and special status species are at risk from these impacts, as summarized below.

Wintering Big Game—The Applicant concluded that direct impacts to habitat are small in scale and localized (Technical Report E.3.2-37). Little ground is disturbed during the infrequent road and structure maintenance for the Pine Creek–Hells Canyon line (Line 945). The majority of the line (93%) is alongside a paved, well-used road. Most of the Applicant's vegetation management consists of trimming overstory trees over a very small portion of the line (less than 400 m in total). Scheduled O&M activities may temporarily and locally displace big game.

Threatened, Endangered, Candidate, and Special Status Species—Bald eagles may be disturbed by O&M activities that occur within 400 m of nesting, perching, and roosting sites (Technical Report E.3.2-37). Other nesting raptors, particularly the northern goshawk, may also be disturbed by O&M activities.

Neotropical migrant birds (for example, the yellow warbler) commonly nest in riparian habitat (Technical Report E.3.2-1). The Applicant assumes that any major O&M activities, particularly vegetation clearing, in or near riparian habitat during the bird breeding season, may impact neotropical birds (Technical Report E.3.2-37). However, vegetation clearing along the Pine Creek–Hells Canyon line (Line 945) is limited, and therefore impacts are expected to be minimal.

Raptor Electrocution—Raptors are at risk for electrocution because of their relatively large size and frequent use of powerline structures for perching and nesting. Most lines that electrocute raptors in North America are distribution lines energized at voltage levels between 1 and 69 kV. Birds risk electrocution on certain types of power poles that allow a bird to touch 1) a conductor and a ground or 2) two conductors simultaneously. The wires on larger transmission structures are sufficiently spaced to prevent electrocution. The Applicant concluded that Pine Creek–Hells Canyon line (Line 945) has the potential to cause raptor electrocutions (Technical Reports E.3.2-19 and E.3.2-37). Bald eagles are at low risk of electrocution on this line because of abundant natural substrate for perching, resulting in less propensity to perch on power poles.

Goals

To minimize impacts to wildlife, the Applicant proposes to adaptively manage O&M activities within the transmission-line ROW to protect wildlife resources and enhance habitat conditions.

Description

The Applicant's proposed transmission-line O&M plan protects wildlife species and habitat through numerous mechanisms, including the following:

- Constraints on O&M activities based on type of O&M activity and on wildlife requirements for habitat and time periods

- Requirements for habitat rehabilitation following ground-disturbance events
- An adaptive management approach that uses monitoring results of threatened, endangered, candidate, and special status wildlife species to ensure adequate protection and enhancement measures
- Implementation of best management practices for maintaining the transmission line and service roads and protecting raptors from electrocution

These measures are defined more fully for each identified potential impact.

Constraints on O&M Activities—The Applicant proposes to restrict the timing and location of the O&M activities that may impact certain wildlife species during critical periods. Restrictions would govern O&M activities that impact big game winter range, nesting habitat of riparian birds, raptor nests, and bald eagle perching and roosting areas. Applicant biologists have identified time periods when specific species are particularly sensitive to disturbance (Technical Report E.3.2-37). In addition, O&M activities would employ methods considered to minimize impacts to species and habitat, where applicable.

Site Rehabilitation—The Applicant proposes to repair measurable damage to resources and roads caused by routine, emergency, and major O&M activities. To improve resource conditions, reduce erosion, and minimize spread of noxious weeds, the Applicant would revegetate roads, structure sites, and other areas that are measurably affected by ground-disturbing O&M activities. The seed mix and techniques used for any restoration and revegetation project would be determined in consultation with the appropriate land management agency.

Monitoring and Management of Wildlife Species—To reduce impacts to wildlife and to improve habitat conditions, the Applicant proposes to integrate monitoring and management activities into an adaptive management program. Information from monitoring activities would be coordinated with O&M constraints and implementation of best management practices (abbreviated as BMP in tables or figures). In addition, monitoring results would provide a basis for identifying and selecting cooperative habitat enhancement projects.

- Nesting Raptors. The Applicant proposes to inventory raptor nests that occur on transmission-line structures annually throughout the term of the license. Location, type of structure, date identified, presence of artificial nesting platform, and species of raptor would be documented, and the data would be managed in a geographic information system. In addition, the Applicant proposes to annually survey within 800 m of the transmission line for new bald nests as long as the species is federally listed.

- Raptor Electrocution. The Applicant proposes to continue monitoring bird electrocution. Large birds of prey (such as eagles) may be at risk on some structures along the Pine Creek–Hells Canyon line (Line 945) (Technical Report E.3.2-19). To reduce the risk of electrocution to fledgling bald eagles, the Applicant previously added conductor covers to one phase of all structures within 0.5 km of a bald eagle nest located near the line. The Applicant will reevaluate all poles along the Pine Creek–Hells Canyon line (Line 945) that are considered to be of high or medium risk to perching raptors (Technical Report E.3.2-19). Criteria in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC 1996) will be followed when modifications to structures are made.

  The Applicant will conduct systematic patrols of the transmission line annually and document and report all bird mortalities that may have resulted from electrocution. The Applicant maintains a database of all reported electrocutions, including the line information, structure type, species, carcass condition, date found, topographic and geographic information, and reporting agency.

- Service Roads. Most of the service roads associated with the Pine Creek–Hells Canyon line (Line 945) are short spurs off of the Hells Canyon Road. Where applicable, the Applicant proposes to develop maintenance standards for service roads based on agencies' existing land management directives and in direct consultation with appropriate agencies on a site-specific basis. To protect wildlife at sensitive locations or times, the Applicant would restrict the public from using certain service roads based on a case-by-case consultation with appropriate state and federal agencies.

Associated Benefits

Managing the timing of O&M activities and rehabilitating habitat would benefit many wildlife species other than those targeted by these actions. Noxious weed control, best management practices for roads, reseeding, and other actions would benefit habitat conditions and thereby benefit wildlife habitat and species.

In addition to protecting wildlife resources, the O&M plan would also have measures for protecting cultural, botanical, aesthetic, and aquatic resources; controlling erosion; reducing fire hazards; and managing travel and access.

Implementation or Construction Schedule

Management actions associated with the transmission-line O&M plan would follow the schedule below.

Time Frame	Action
Within 1 year after license is issued	• Develop transmission-line O&M plan • Develop species monitoring plans
Beginning 2 years after license is issued and continuing for the life of the license	• Implement O&M plan, including adaptive management response to monitoring feedback • Implement species monitoring programs • Continue development and implemention of cooperative habitat enhancement projects

Cost Estimate

The Applicant estimates the costs associated with the transmission-line O&M plan as follows:

Action	Time Frame (years)	Annual Cost	Total Cost (30 years)
Development and implementation of O&M Plan (see section E.3.3.3.)			
Monitoring and Management			
• Nesting raptors	1–30	$2,000	$60,000
Nests on structures	1–30		
Bald eagle nests	1–30		
• Raptor electrocution	1–30	$2,500	$75,000
Adaptive management actions for raptors	1–30, as needed	$1,000	$30,000
Service road BMPs (see section E.3.3.3.)			
Total			$165,000

Location Map

See Figure E.1-2 for a map of the transmission line associated with the HCC.

E.3.2.3.3. Measures or Facilities Recommended by the Agencies

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.3.2.3.3.1. Accepted or Conditionally Accepted Measures or Facilities

Bureau of Land Management comment letter, dated January 9, 2003

BLM2-243

> PM&E's were displayed in Exhibit 3...choosing land for acquisition. IPC should coordinate with BLM closely before purchase.

Response

The Applicant is proposing to acquire and manage 23,582 acres of private lands within the winter range zone along the HCC reservoirs. Acquisition and management of private lands would protect and enhance many acres of existing habitat into the future. The protection and enhancement of wildlife values would be the top priority for the 23,582 acres of lands that are specifically acquired and managed to mitigate for HCC impacts to wildlife. The Applicant anticipates that the BLM and other natural resource agencies would be involved with implementing the Applicant's mitigation measures at levels specified by FERC.

BLM2-250

> The reservoirs have changed water bird...riparian areas would improve nest opportunities and success. BLM agrees that improved habitat on the remaining Snake River islands is necessary. Shoreline grazing on the reservoirs needs to be controlled and large fast growing trees should be planted for colony nesting birds. Emergent and submergent vegetation...these mitigations into their FLA.

Response

The loss of islands due to inundation of the HCC is an impact resulting from construction and operation of the HCC under the original license (FERC No. 1971). The Applicant does not consider impacts that occurred during the original HCC license period. Nevertheless, the Applicant agrees with the BLM that islands are important for a variety of wildlife resources. Therefore, the Applicant proposes to enhance habitat on four Snake River islands in cooperation with the IDFG (Gold Island) and ODFW (Huffman, Patch, and Porter islands) (see section E.3.2.3.2.1.2.).

The Applicant agrees with the BLM that shoreline grazing along the reservoir reaches should be controlled. The Applicant will require that livestock grazing be kept 75 ft back from (above) the average high-water mark along the HCC reservoirs on Applicant-owned and controlled lands. Most grazing on Applicant-controlled lands is from livestock grazing on either other private lands (that is, lands not owned or controlled by Applicant) or federal lands (managed by the BLM or USFS). The Applicant suggests that the BLM take responsibility for grazing practices on its lands, prevent livestock from using riparian areas, and generally take a more active role in managing livestock.

The unimpounded Weiser reach is lined with large trees (Technical Report E.3.3-1). Likewise, large trees grow on islands in this reach that are used by colony-nesting birds (see Technical Report E.3.2-13). The Applicant agrees with the BLM that additional planting of trees on islands, if practical and feasible, may enhance nesting habitat for colony-nesting waterbirds. However, management plans for islands owned by the ODFW and IDFG will be developed at some future date, and any tree plantings are subject to the management objectives of these agencies.

BLM2-258

> Transmission lines and the transmission service roads...road section. Limiting public use of these roads would reduce impacts and stress on wildlife.

Response

The Applicant has decided to remove all transmission lines associated with the HCC from this final license application, with the exception of the Pine Creek–Hells Canyon 69-kV line (Line 945). This line parallels the Oxbow–Hells Canyon Road and typically occurs in the road verge, resulting in minimal service roads.

The Applicant agrees that limiting public access on transmission-line service roads may reduce negative impacts to natural resources. Because most service roads occur on federal lands, federal agencies are responsible for appropriate management of such road use.

Idaho Department of Fish and Game comment letter, dated January 10, 2003
IDFG1-124

> Additionally, construction and operation of the Hells Canyon Complex eliminated...bald eagle use (Isaacs et al. 1992).
>
> Recommendation: IPC should focus habitat management on protecting potential perch and nesting trees and roosting habitat. IPC should explore the potential to increase trees in the project area and address this as a viable PM&E measure. Importantly, IPC should limit human activities known to disturb bald eagles or that conflict with bald eagle use."

Response

The elimination of trees within reservoir inundation zones is considered an impact that occurred at the time of construction of the HCC and initial filling of the reservoirs. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See: City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000). The existing abundance of trees upslope of the HCC reservoirs would not decrease due to HCC modeled proposed operations during the next license period.

The Applicant agrees with the IDFG that potential perch and nesting trees and roosting habitat should be protected. The Applicant agrees that it would be worthwhile to explore opportunities to increase trees in the study area for potential perching and nesting habitat. The Applicant has investigated potential conflicts between wintering and nesting bald eagles and human activities and has proposed specific PM&E measures (section E.3.2.3.2.1.4.) to minimize such potential impacts.

IDFG1-131

> We believe IPC should pursue a significant land purchase in the Hells Canyon.

Response

The Applicant is proposing to acquire and manage 23,582 acres of existing but privately owned lands in Hells Canyon, land that would meet or have the potential to meet criteria that were established by the TRWG and reiterated in section E.3.2.3. The protection and enhancement of wildlife and botanical values would be the top priority for the 23,582 acres of lands that are specifically acquired and managed to mitigate for HCC impacts to wildlife.

IDFG1-135

> The cost estimate of acquisition and O&M for proposed actions have utility and provide relative scale for funds to be committed to different aspects of mitigation. However, we

> recommend that mitigation obligations be quantified in habitat-based terms as well, so that effective monitoring can be applied and progress can be measured.

Response

The Applicant standardized estimates of HCC impacts to wildlife habitat as “impacted acres” of riparian and upland habitats and winter range (Technical Report E.3.2-45). Impacted acres form the basis of the Applicant’s habitat-based measures. The Applicant proposes that the monitoring and progress of mitigation should be based on the site potential and corresponding management objectives for individual habitats that occur on lands acquired and managed for mitigating impacts to wildlife and botanical resources. Management objectives for mitigation lands would be developed as part of the integrated wildlife management program described in section E.3.2.3. Management objectives would be developed with input from state and federal resource agencies.

IDFG1-136

> IDFG concurs with IPC’s description of desired characteristics for acquired properties. We further recommend a stated intent by IPC to distribute acquisitions either equally by states or in proportion by state to the habitat impacts of the projects, with a formal process of IDFG/ ODFW concurrence in deviating from the distribution goal for compelling reasons.

Response

The Applicant appreciates the IDFG’s concurrence with desired characteristics for properties that the Applicant would acquire and manage. The Applicant anticipates that FERC would provide guidance for a distribution (between Idaho and Oregon) of lands acquired to mitigate for wildlife and botanical resources impacted by HCC operations.

IDFG1-141

> IDFG supports IPC's approach to the creation of...highest priority for protection using the appropriate measures. The IDFG wishes to be involved with the IPC's proposed Interdisciplinary Team to implement and monitor progress of initiatives.

Response

The Applicant anticipates that the IDFG and other natural resource agencies would be involved with implementation of the Applicant's mitigation measures at levels specified by FERC.

Oregon Department of Fish and Wildlife comment letter, dated January 10, 2003
ODFW2-82

> IPC indicates that most impacts...availability and selection of properties.
>
> Recommendation: Establish and fund a Land Acquisition Plan and Program. The following elements should be included:
>
> 3. Development of a plan that clearly identifies fish and wildlife habitat enhancement and public access for fishing and hunting as important objectives.

Response

As in all traditional relicensing processes, conceptual PM&E measures are first proposed. In issuing the license, FERC directs the Applicant to develop the measure in detail, incorporating agency consultation. After consulting with agencies, the measure is developed in detail by the Applicant and submitted to FERC, along with agency comments. FERC then determines the adequacy of the detailed measure, either approving the plan or requiring further modification. The agencies, then, are involved in developing the specific measure and can comment in that process to FERC regarding both the consistency of the specific measure with their plan and the adequacy of proposed funding.

4. Acquisition of conservation lands or easements that are managed to maximize wildlife habitat and include public fishing and hunting opportunities.

Response

The Applicant will follow FERC mandates but expects that wildlife and botanical resources would be prioritized on lands that are acquired and managed for mitigating HCC impacts during the next license period. As appropriate for meeting FERC-mandated mitigation requirements, the Applicant would also consider compatible land uses and recreational activities on lands acquired and managed for wildlife and botanical mitigation.

5. The land acquisition program must specify approved uses of the land to assure that the major goals of the program are not compromised. Compatible uses could include low impact recreation opportunities such as hiking trails and access to the river bank and wildlife habitat protection and improvement projects. All lands set aside for conservancy should have development restrictions, limiting and controlling human access and impacts.

Response

Management objectives for mitigation lands would be developed as part of the integrated wildlife management program described in section E.3.2.3. Management objectives would be developed in cooperation with state and federal resource agencies. As appropriate for meeting FERC-mandated mitigation requirements, the Applicant would also consider compatible land uses and recreational activities on lands that are acquired and managed for wildlife and botanical mitigation.

6. Property that contains degraded wildlife habitat may be considered if measures are included to restore the land to increase wildlife habitat.

Response

The Applicant will follow FERC mandates but expects that wildlife and botanical resources would be prioritized on lands that are acquired and managed for mitigating HCC impacts during the next license period. Management objectives for mitigation lands would be developed as part of the integrated wildlife management program described in section E.3.2.3. Management objectives would be developed in cooperation with state and federal resource agencies.

7. Sites for potential acquisition should include lands around Brownlee Reservoir, the Powder River Arm, or the Lookout Mountain or Pine Creek Management Units.

Response

The Applicant believes that there are many opportunities in Hells Canyon to protect wildlife habitat. This list includes lands around Brownlee Reservoir, the Powder River arm, Lookout Mountain, and Pine Creek. An extensive list was developed by the TRWG (see meeting documentation for the May 15, 2001, TRWG meeting in section VI of the Consultation Appendix).

9. Program needs to include criteria to ensure consistency with ODFW's Policies.

Response

The new license will likely require the Applicant to consider ODFW policies in developing the program.

ODFW2-88

> IPC reports that…, so the success of such releases and habitat can be evaluated.
>
> Recommendation: ODFW supports...of riparian habitat. IPC should also purchase radios and assist with tagging and release of mountain quail in Hells Canyon. IPC should provide personnel to monitor radio-marked quail released into suitable habitat to evaluate the success of such releases and habitat use.

Response

Within the first year after receiving a new FERC license for the HCC, the Applicant would evaluate any reasonable ODFW proposals that are within the Applicant's funding limits for mountain quail reintroduction. Proposals would include reasonable requests to assist with supplies and personnel required for the reintroduction program.

ODFW2-93

> IPC concluded that Line 945, Oxbow–Hells Canyon Line...on incidental observations. Active monitoring needs to occur.
>
> Recommendation: IPC should conduct active monitoring for electrocution mortalities and include a detailed monitoring plan in the FLA.

Response

For many years, the Applicant has implemented a Company-wide program that documents and addresses avian electrocution problems for *all* transmission lines of all voltage. Applicant will continue this industry-wide recognized program.

ODFW2-99

> IPC proposes to inventory raptor nests...and sharp-tailed grouse leks.
>
> Recommendation: ODFW supports the proposed [raptor] monitoring. This information should be provided yearly *to ODFW and other natural resource management agencies.*

Response

The Applicant has removed all transmission lines associated with the HCC from this final license application, with the exception of the Pine Creek–Hells Canyon 69-kV line (Line 945). Therefore, the Applicant will only be developing an O&M plan within the FERC relicensing process for this line. The Applicant will follow the new license article directives to report monitoring efforts.

ODFW2-101

> Recommendation: IPC needs to coordinate development of best management practices with ODFW and other natural resource agencies. These best management practices should be included in the FLA.

Response

The Applicant has decided to remove all transmission lines associated with the HCC from this final license application, with the exception of the Pine Creek–Hells Canyon 69-kV line (Line 945). Therefore, the Applicant will only be developing an O&M plan within the FERC relicensing process for this line. The Applicant's O&M plan will address potential impacts along the Pine Creek–Hells Canyon line (Line 945).

E.3.2.3.3.2. Rejected Measures or Facilities and Explanations for Rejection

Bureau of Land Management comment letter, dated January 9, 2003

BLM1-140

> The BLM objective in relicensing...two operational scenarios. Therefore, when the BLM recommends lands to be acquired to mitigate for the on-going continued impacts of the HCC over the new license term, the BLM will stipulate mitigation for the inundation zone as well as for the shoreline and fluctuation zones.

Response

The Applicant rejects the BLM's recommendation. The lands within reservoir inundation zones were impacted during construction and operation of the HCC under the original FERC License No. 1971. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See: City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

BLM1-191

> Upland habitats inundated by the reservoirs...game species. As mitigation, the BLM will recommend that IPC use a 1:1 habitat replacement ratio where upland habitats are of equal (crucial winter range) value and at least a 2:1 replacement ratio where the upland habitat is of lesser quality (winter range zone).

> Likewise, riverine riparian habitats that have been inundated...questionable. Therefore, as compensation, the BLM will recommend that IPC at least a 2:1 replacement ratio where the riparian habitat is of lesser quality.

Response

The Applicant rejects the BLM's claim that the Applicant use a 2:1 replacement ratio for the impacted acres in the fluctuation, shoreline, and winter range zones. The BLM's requirement of a 2:1 replacement ratio is unsubstantiated. The Applicant is unclear how the BLM derived this replacement ratio.

The Applicant acknowledges that the modeled proposed operations in the fluctuation zone would impact low-elevation winter range and that low-elevation winter range has greater habitat capability than winter range at higher elevations. Accordingly, the Applicant's analyses in Technical Report E.3.2-45 determined that the fluctuation zone of Brownlee Reservoir impacted low-elevation winter range by an additional 10%, which resulted in an additional 582 acres proposed in the measure for acquisition of upland and riparian habitat described in section E.3.2.3.2.1.1. Lands within reservoir inundation zones were impacted during construction and operation of the HCC under the original FERC License No. 1971. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See: City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000). Therefore, a 2:1 replacement ratio for the inundation zone is not relevant.

The Applicant believes that the proposed acquisition and management of 23,582 acres would sufficiently mitigate for measured impacts of modeled proposed operations to botanical and wildlife resources in the fluctuation, shoreline, and winter range zones of the HCC.

BLM2-228

> IPC suggests an interdisciplinary team is needed to assist in the long term management of the canyon. BLM would expect to see within 3 months of issuance of a new project license the establishment of a Terrestrial Working Group for the purpose of consulting with IPC in the design of restoration, protection, management and monitoring plans review and evaluation of data, and in the development of adaptive management or other recommendations. The Forest Service, Bureau of Land Management, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, Fish and Wildlife Service, the Idaho Power Company, Tribal governments, and those Non-Governmental Organizations who have expressed an interest would be invited to participate, at a minimum. IPC would provide funds to support this group and would implement their required management actions in accordance with this group. IPC would also maintain, and make public, records of consultation, and would forward those records with any recommendations to the appropriate agencies and FERC. The groups shall establish communication protocols to facilitate interaction between group members, which allow for open participation, peer review, and communication between all parties.

Response

The Applicant is open to the BLM’s suggestion to form an interdisciplinary management team. The Applicant anticipates that the membership and function of the team would be determined at the time of licensing. The Applicant expects that members of the interdisciplinary management team, and not the Applicant, would fund their activities in this group. Furthermore, the Applicant would implement mitigation measures in accordance with license articles issued by FERC at the time of licensing and anticipates that the interdisciplinary management team would play an advisory role. Also, the Applicant would comply with FERC reporting requirements. Any reporting requirements under the new license are anticipated to be in consultation with appropriate agencies and other interested parties.

BLM2-255

> Mitigation could include closing the Snake River road during the winter for 6 or 8 miles near Swedes Landing or maybe not plowing snow on this road in severe winters thus allowing snow to close the road. The roads along Oxbow and Hells Canyon...been reduced with increased recreation use.

Response

The Applicant rejects the BLM's recommendation. The BLM implies that the Applicant should be responsible for all road-related impacts and corresponding mitigation. The TRWG agreed (see meeting documentation for the November 19, 1997, TRWG meeting in section VI of the Consultation Appendix) that the Applicant would study all project-related roads, not that management responsibility for all roads within the project area would be assumed by the Applicant.

The Applicant agrees with the BLM that roads and their associated human activities may in some cases adversely affect wildlife. However, the BLM contradicts itself on wildlife, recreation, and public access issues. The BLM supports the Applicant's assistance with enhancing dispersed recreation sites on BLM-owned lands (Swedes Landing, Copper Creek, Airstrip, Bob Creek, and Westfall sites). However, these sites and others occur in crucial big game winter range or riparian habitat or both, areas where enhanced recreational activities may potentially impact wintering big game. Furthermore, the BLM suggests that the Applicant should improve the Huntington–Richland Road (Snake River Road) to aid increased year-long recreational access to Spring Recreation Site and Swedes Landing, but it also recommends that the Snake River Road should be closed during winter, although the Applicant has no jurisdiction over this road.

The Applicant rejects the notion of enhancing recreational access that leads to increased recreation-wildlife interactions and mitigation for such impacts. Therefore, the Applicant requests that the BLM 1) recognize the inherent trade-offs between recreational access and wildlife resources, 2) establish site-specific prioritizations between protecting wildlife and providing recreational access, and 3) provide the Applicant with nonconflicting recommendations for proposed mitigation measures.

BLM2-256

> IPC should join other agencies in developing a road management plan for the canyon. IPC should contribute to operation and maintenance (O&M) costs for all main access roads into the canyon including the Snake River road and the Homestead Canyon road in Oregon, and the Steck road in Idaho because their use is directly related to use of the project.

Response

The Applicant pays federal, state and local taxes to support the operation and maintenance of these public roads in both Oregon and Idaho. Therefore, additional contributions for O&M are not warranted. Responsibility for road management planning is likewise an obligation of the public agencies having jurisdiction over such roads.

BLM2-259

> An extra effort must be made...impact to birds. A program to determine line visibility and then implement mitigation could help to reduce bird collisions with transmission lines. Erection of nesting poles...problem poles could reduce electrocutions.

Response

The Applicant has decided to remove all transmission lines associated with the HCC from this final license application, with the exception of the Pine Creek–Hells Canyon 69-kV line (Line 945). Avian collision typically occurs where lines cross water bodies. No collision sites are known or expected along the Pine Creek–Hells Canyon line (Line 945). Therefore, the Applicant does not believe that a program is warranted to either increase visibility of or help reduce collision with the line. For many years the Applicant has implemented a Company-wide program that documents and addresses avian electrocution problems for *all* transmission lines of all voltage. The Applicant will continue this industry-wide recognized program.

BLM2-266

IPC should identify pre project habitat conditions, acres by vegetation type (upland/ riparian) and by land ownership, and islands and cliff habitat.

Response

The Applicant presented acres of lands inundated and associated ownership in Table E.6-2. Permanent inundation of lands by the HCC is an impact resulting from construction and operation of the HCC under the original license (FERC No. 1971). In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See: City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

BLM2-268

No studies except on bats...not replenish all that remains trapped in the HCC.

IPC should analyze impacts to BLM resources including, but not limited to, erosion, riparian changes, upland vegetation below the mouth of the Salmon River to Captain John Creek and provide mitigation and/or compensation for these impacts.

Response

The Applicant rejects the BLM's recommendation to extend the study area to Captain John Creek for the following reasons. During discussions in the TRWG between July 9, 1996, and November 14, 1996, resource issues and problem statements were developed, culminating in the *Formal Consultation Package for Relicensing: Hells Canyon Project* (FCP, January 1997) (IPC 1997). The Applicant proposed to confine terrestrial resources studies from Weiser, Idaho, to the confluence of the Snake and Salmon rivers. This study reach is described in more detail in the FCP (section V:2-3) and for each of the proposed studies. The BLM did not comment on the draft FCP. However, the Applicant received a document entitled "Identified BLM Issues for the Hells Canyon Complex of Dams FERC Relicensing" on December 20, 1999, more than two years after the FCP had been published. In this document, the BLM stated that the project area should extend from Weiser to Captain John Creek, although the BLM had been involved in extensive discussions about study issues and development, including the extent of the study area, from June 10, 1997, through October 27 and 28. During the TRWG meeting of March 31, 1998, the decision was made by the TRWG that "expansion [of the study area] *was deemed unnecessary* [italics added] based on earlier TRWG recommendations for study area size."

Furthermore, prior to submittal of the BLM's "Identified BLM Issues for the Hells Canyon Complex of Dams FERC Relicensing" on December 20, 1999, the Applicant produced a second, revised set of detailed study plans, entitled *Terrestrial Final Study Plans*, which were made available between November 19, 1998, and March 2000. Thus, the BLM was fully aware of the extent of the study area for the proposed studies.

Bureau of Land Management comments at the joint agency meeting, held March 5 and 6, 2003

Recommended construction of islands in the Powder River Arm

Response

The Applicant rejects the BLM's recommendation. The Applicant does not see any merit in the BLM's suggestion to create islands in the west end of the Powder River pool. The Powder River pool is very shallow, and islands, if they could be created, would be attached to the mainland for a significant part of the year, providing little, if any, secure habitat for nesting waterfowl. Moreover, there are serious concerns about the impacts of island creation on recreational activities, such as boating and fishing, in the Powder River pool.

U.S. Forest Service comment letter, dated January 8, 2003

USFS2-156 and USFS2-188

> The Forest Service will recommend mitigation for all of the on-going continued impacts of the HCC over the new license term including the inundation zone as well as the shoreline and fluctuation zones. IPC did not fully disclose...to NFS lands and resources.
>
> Upland habitats inundated by the Hells Canyon Reservoir...other big game species. To determine mitigation needs, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where upland habitats are of equal (crucial winter range) value and a 2:1 replacement ratio where the upland habitat is of lesser quality (winter range zone).
>
> Likewise, riverine riparian habitats that have been inundated...habitats is questionable. Therefore, to determine mitigation needs, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where riparian habitats are of equal high quality value and a 2:1 replacement ratio where the riparian habitat is of lesser quality.

Response

The Applicant disagrees with the USFS. The Applicant provided analyses and proposed PM&E measures on the impacts of modeled proposed operations on the fluctuation and shoreline zone but not on the inundation zone. The Applicant maintains that lands within reservoir inundation zones (described in Technical Report E.3.2-45) are not considered to be impacted under modeled proposed operations. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See: City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000). The lands within the reservoir inundation zones were impacted during construction and operation of the HCC under the original license (FERC No. 1971). Interestingly, the USFS appears to be rather ambivalent about pre-project information. Region 6, USFS regulations (V10.16.2000) state that "[T]he intent of the Forest Service is to mitigate for the continued impacts caused by a project and its operations over the term of a new license. *It is not the intent of the Forest Service to mitigate for past impacts* [italics added]." If, indeed, the USFS has no intent to mitigate for past impacts, clearly quantitative information on acres of habitat inundated should be irrelevant to the USFS.

The USFS has provided no justification for a 2:1 replacement ratio for impacted winter range. The Applicant requests that the USFS disclose any analyses that form the basis for the recommended replacement ratio for impacted acres. The Applicant believes that the proposed acquisition, protection, and management of 22,761 upland acres would sufficiently mitigate for measured impacts of modeled proposed operations to botanical and wildlife resources in the fluctuation, shoreline, and winter range zones of the HCC.

The USFS provides no justification for a 2:1 replacement ratio for riparian habitat of lesser quality. The Applicant requests the USFS provide a definition of "lesser" quality compared with "higher" quality and identify on what kind of conditions its definition is based. The Applicant requests that the USFS fully disclose any analyses that form the basis for its recommended replacement ratio for impacted riparian acres.

Idaho Department of Fish and Game comment letter, dated January 10, 2003

IDFG1-133

> Because much of the high quality mule deer winter-range has been inundated by the projects, we recommend that in-kind, off-site mitigation be available as an option to secure high quality, but threatened mule deer winter-range.

Response

The Applicant believes that there are many opportunities in Hells Canyon to protect existing high-quality winter range and effectively enhance existing suboptimal winter range. Therefore, the Applicant prefers on-site mitigation because of the many existing opportunities within Hells Canyon to mitigate for HCC impacts to wildlife and botanical resources during the next license period.

IDFG1-139

> At the time of acquisition by IPC in 1959, Gold Island...waterfowl and upland game birds and for hunting and fishing by the public. This situation needs to be remedied by IPC during the new license term by improving wildlife habitat through enhanced operation and maintenance funding.

Response

The Applicant is committed to working cooperatively with the IDFG to develop a management plan for Gold Island. Once a site-specific plan is available, a more accurate annual budget can be developed. In the absence of any plans, the Applicant believes that the proposed cooperative PM&E measure for the island is adequate.

The Applicant notes that Gold Island has apparently not served the purpose that was originally anticipated, as described by the IDFG. However, the Applicant was under no obligation to provide O&M funds for the management of the deeded islands, including Gold Island, under the terms of article 37 of the original license (FERC No. 1971).

IDFG1-140

> The habitat enhancement and restoration projects...mountain quail populations for many years. We request that IPC cooperate in mountain quail restoration efforts for the full term of the new license for the Hells Canyon projects. This is a measure that the IDFG supports. Is 20,000 dollars/year adequate...federal agencies and tribes.

Response

The Applicant rejects the IDFG's recommendation. The Applicant has proposed to participate in cooperative efforts initiated by state and federal agencies to enhance low-elevation riparian habitat for mountain quail and reintroduce mountain quail in areas adjacent to the HCC (section E.3.2.3.2.1.3.). The Applicant believes that state and federal agencies should take a lead role in cooperatively funding mountain quail reintroduction and habitat enhancement efforts. The Applicant will evaluate and consider proposals (including reintroduction studies) for cooperative mountain quail projects within the first year after receiving a FERC license for the HCC.

The Applicant believes that five years should be adequate time to implement riparian enhancements that target mountain quail habitat in low-elevation riparian areas. Riparian habitats can respond quickly when enhancements are protected from perturbations such as grazing. Considering durations of other efforts to initiate reestablishment of gallinaceous species, the Applicant also believes that five years should be sufficient to implement a sound restoration effort. The five-year duration assumes that agencies propose well designed and efficient projects that are also adequately executed. Currently, agencies have no detailed proposals for initiating projects enhancing mountain quail habitat or restoring mountain quail populations. Therefore, the costs outlined in this final license application are general and represent the Applicant's contribution to cooperative mountain quail projects. Total costs of projects would be detailed in consultation with cooperating agencies during planning phases of proposed cooperative projects.

Oregon Department of Fish and Wildlife comment letter, dated January 10, 2003

ODFW1-16

> ODFW believes that the annual mortality rate...mule deer study to take place during a severe winter. ODFW also recommends that IPC acknowledge loss of winter range habitat due to reservoir inundation and propose mitigation for this loss.

Response

The Applicant rejects the ODFW's recommendation. The Applicant considers that lands within reservoir inundation zones were impacted during construction and operation of the HCC under the original license (FERC No. 1971). In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000). The FERC has determined that, where project works already exist and are part of the existing environment, it is not reasonable to analyze the effects of relicensing using a pre-project environmental baseline. The Applicant rejects the need for analysis and mitigation of impacts that occurred during the original HCC license.

The ODFW also does not acknowledge that the Applicant is proposing to mitigate for the 6,149 acres of lands that are at least seasonally inundated within the reservoir fluctuation zones (described in Technical Report E.3.2-45). Acreages within the reservoir fluctuation zones were determined with modeled proposed operations having maximum vertical water-level fluctuations of 101 ft for Brownlee Reservoir and 10 ft for Oxbow and Hells Canyon reservoirs.

The Applicant also acknowledges that the modeled proposed operations in the fluctuation zone impact low-elevation winter range and that low-elevation winter range generally has greater habitat capability than winter range at higher elevations. Accordingly, the Applicant's analyses in Technical Report E.3.2-45 determined that the fluctuation zone of Brownlee Reservoir impacted low-elevation winter range by an additional 10%, which resulted in an additional 582 acres proposed in the measure for acquisition of upland and riparian habitat described in section E.3.2.3.2.1.1. Technical Reports E.3.2-40 and E.3.2-45 detail the Applicant's analysis.

ODFW2-81

> IPC needs to look for existing habitat....All suitable land is currently being used by wildlife.
>
> Recommendation: A "lower-pool" operation...and proposed operations. IPC needs to acquire land for lost riparian, winter range, and critical low elevation winter range habitat (~ 36,000 acres) at a 3:1 replacement to offset existing values of land restored and to recognize that true "low elevation" land within Hells Canyon is now inundated by the project. IPC's land acquisition program needs to be consistent with ODFW wildlife and habitat mitigation policies and objectives.

Response

The Applicant rejects ODFW's recommendation that about 36,000 acres of wildlife habitat need to be mitigated for. The Applicant is proposing to acquire and manage available lands in Hells Canyon that meet or have the potential to meet criteria that were established by the TRWG and reiterated in section E.3.2.3. The Applicant is not proposing a 1:1 mitigation ratio. The Applicant actually estimated an additional 582 impacted acres (10%) in addition to Brownlee Reservoir's fluctuation zone (5,820 acres) to capture the additional low-elevation value of the fluctuation zone for big game winter range.

Low-elevation lands within reservoir inundation zones were impacted during construction and operation of the HCC under the original license (FERC No. 1971). FERC has determined that, where project works already exist and are part of the existing environment, it is not reasonable to analyze the effects of relicensing using a pre-project environmental baseline. The Applicant rejects the need for analysis and mitigation of impacts that occurred during the original HCC license.

The Applicant is unclear why the ODFW is proposing that the Applicant acquire and manage 36,000 acres. The ODFW has not provided any data or relevant information that justifies mitigation for 36,000 acres. Furthermore, the ODFW has not provided any justification for a 3:1 replacement ratio for the acquisition and management of lands to mitigate for impacts to wildlife and botanical resources from modeled proposed operations.

ODFW2-82

> IPC indicates that most impacts...availability and selection of properties.
>
> Recommendation: Establish and fund a Land Acquisition Plan and Program. The following elements should be included:
>
> 1. Funding and development of a habitat fund with dedicated funds for riparian, wetlands, and riverine lands acquisition;

Response

The Applicant disagrees with the ODFW. The Applicant does not believe that a land acquisition plan and program would provide any better guidance to the acquisition of upland and riparian habitat than the Applicant-proposed PM&E measure to acquire such habitat (see section E.3.2.3.2.1.1. Acquisition of Upland and Riparian Habitat). Similar land characteristics, as mentioned by the ODFW for acquired lands, are presented by the Applicant in section E.3.2.3.2.1.1., including funding for acquisition of lands and an O&M budget. Obviously, since specific parcels have not been identified, the Applicant is unable to provide details about specific programs, plans, and budgets for such lands at this time.

2. Implementation of the habitat fund with a multi-agency committee with representation from fish and wildlife agencies, federal land management agencies, Native American Tribes, and IPC.

Response

The Applicant is open to the ODFW's suggestion to form an interdisciplinary management team. The Applicant anticipates that the membership and function of the team would be determined at the time of licensing.

8. Development of criteria for managing a land acquisition and habitat fund. Criteria could include numbers of species positively affected, connectivity, habitat values, public access for fishing, hunting, observation, and proximity to other public lands or high value lands.

Response

The Applicant is proposing to acquire and manage available lands in Hells Canyon that meet or have the potential to meet criteria established by the TRWG (see meeting documentation for the May 15, 2001, TRWG meeting in section VI of the Consultation Appendix). The Applicant believes that many opportunities exist in Hells Canyon. Land acquisition would occur in consultation with state and federal agencies, tribes, and other interested parties to ensure that all important criteria were considered.

ODFW2-83

IPC should initiate acquisition and enhancement of habitat prior to receiving the new license.

Response

It is the Applicant's intention to implement some of the PM&E measures that are proposed in the license application soon after filing the final license application. For example, if the Applicant determines that property that is acceptable to the Applicant and contains suitable habitat is available for purchase, the Applicant may choose to secure an option to buy that property rather than waiting until after a new license is issued. The Applicant would only implement PM&E measures early, however, if it received proper "credit" for doing so.

ODFW2-101

> Implementation of species monitoring plans...of best management practices.
>
> Recommendation: IPC should include species monitoring plans and the O&M plan in the FLA. Implementation of these plans should occur prior to receiving the final license.

Response

The Applicant has decided to remove all transmission lines associated with the HCC from this final license application, with the exception of the Pine Creek–Hells Canyon 69-kV line (Line 945). Therefore, the Applicant will only be developing an O&M plan within the FERC relicensing process for the Pine Creek–Hells Canyon line (Line 945). The Applicant will address potential impacts along this line.

O&M plans for the transmission lines that are not included in this final license application will be developed in conjunction with the appropriate agencies during the permitting process for those lines.

ODFW3-22

> IPC concludes that,...will be ongoing and require mitigation.
>
> Recommendation: IPC should use at least a 3:1 ratio for mitigation of riparian habitat lost by ongoing shoreline impacts of reservoir and tailrace fluctuations. Timing of acquisition and habitat restoration as well as the quality of lands acquired need to be included in the calculation of habitat units required for mitigation.

Response

The Applicant rejects the ODFW's recommendation. The ODFW provides no justification for a 3:1 replacement ratio for impacted riparian and winter range. ODFW's unsubstantiated quantitative 3:1 replacement ratio is inconsistent with other agency-recommended ratios of 2:1. It is not clear how these replacement ratios were derived and why there is a disagreement among agencies. The Applicant requests that the ODFW disclose any analyses that form the basis for its recommended 3:1 replacement ratio for impacted acres. The Applicant believes that the proposed acquisition, protection, and management of 23,582 acres would sufficiently mitigate for measured impacts of modeled proposed operations to botanical and wildlife resources in the fluctuation, shoreline, and winter range zones of the HCC. The Applicant would seek advice from natural resource agencies for prioritizing land acquisition and general management objectives. The Applicant rejects the ODFW's recommendation to calculate habitat units for acquired lands. The Applicant, in cooperation with other TRWG members, focused on mitigation of upland and riparian acreage, not on habitat units.

Oregon Department of Fish and Wildlife comments at the joint agency meeting, held March 5 and 6, 2003

> Recommended winter feeding of mule deer

Response

The Applicant rejects winter feeding of mule deer as a recommended measure to be included in a new FERC license. Since the mid-1970s, the Applicant, in cooperation with the ODFW and Powder River Sportsmen (a local organization), has provided funding, when requested by the ODFW, to assist in purchasing and distributing feed to big game during extreme winter conditions and stress. The Applicant is willing to continue winter feeding of big game in the Powder River, Halfway, and Richland areas in Oregon as an Applicant-sponsored stewardship activity during the new license period.

Recommended equipment purchase for island maintenance

Response

The Applicant is appreciative of the strong ODFW support for the Applicant's cooperative island management PM&E measure. At this time, sparse information is available on the vegetative condition of the islands (that is, vegetation association, distribution, and composition). Until additional vegetation data are collected and discussions have ensued with the ODFW and IDFG on management objectives, specific plans cannot be developed to effectively and efficiently manage these islands. This tentativeness also extends to the funding required to cooperatively manage these islands. Based on information available to date and the Applicant's experience in land management activities, the Applicant believes that the proposed funding level is both adequate and reasonable.

Recommended purchase of Goat Island

Response

The Applicant is proposing to acquire and manage available lands in Hells Canyon that meet or have the potential to meet criteria established by the TRWG. The Applicant believes that many opportunities exist in Hells Canyon, including Goat Island. Land acquisition would occur in consultation with state and federal agencies, tribes, and other interested parties.

Recommended construction of islands in the Powder River Arm

Response

The Applicant does not see any merit in the ODFW's suggestion to create islands in the west end of the Powder River pool. The Powder River pool is very shallow, and islands, if they could be created, would be attached to the mainland for a significant part of the year, providing little, if any, secure habitat for nesting waterfowl. Moreover, there are serious concerns about the impacts of island creation on recreational activities, such as boating and fishing, in the Powder River pool.

E.3.2.4. Anticipated Impacts on Wildlife Resources

E.3.2.4.1. Hells Canyon Complex and Vicinity

E.3.2.4.1.1. Reservoir Operations

Identifying impacts to wildlife is an important concern for relicensing the HCC (FERC 1990, IPC 1997). During the Applicant's relicensing consultation, state and federal resource agencies, nongovernmental organizations, and the public identified many issues and expressed concerns about potential impacts to wildlife habitat (IPC 1997) (see the Consultation Appendix). The Applicant and the TRWG categorized the numerous individual issues into logical groupings of issues. Primary groupings of issues were that operations of the reservoirs 1) accumulate contaminants that are potentially toxic to wildlife in the portion of Brownlee Reservoir that is permanently inundated (also known as the reservoir inundation zone); 2) prevent perennial low-elevation wildlife habitat from becoming established between reservoir maximum operational drafting depths and full-pool shorelines (known as operational fluctuation zones); 3) prevent the establishment of perennial riparian habitat along full-pool reservoir shorelines (reservoir shoreline zones); 4) fragment patches of riparian habitat in the reservoir shoreline zones; 5) limit waterfowl brooding habitat in the shoreline zones; 6) decrease habitat for threatened, endangered, candidate, and special status species in the shoreline zones; and 7) reduce the capability of winter range (winter range zone) to support mule deer (IPC 1997) (see the Consultation Appendix). Reservoir zones are defined in Technical Report E.3.2-45.

The Applicant conducted numerous studies to investigate issues about potential impacts to wildlife. The Applicant evaluated and compared operational impacts to wildlife for two potential operational scenarios: 1) modeled proposed operational scenario for the complex and 2) full pool run-of-river scenario in which hydroelectric operations would not influence reservoir water surface elevations (see Technical Report E.1-4 for a description of operational scenarios). For individual wildlife issues, studies were designed to 1) describe existing resource conditions, 2) identify potential impacts from the modeled proposed operations of the complex during the next license period, and 3) estimate magnitudes of operational impacts.

E.3.2.4.1.1.1. Reservoir Contaminants in the Brownlee Reservoir Inundation Zone

The accumulation of chemical contaminants in the wildlife food web is of national concern (Aulerich et al. 1974, Heinz 1979, Bayer 1981). These compounds enter and contaminate the wildlife food web through the prey of fish-eating wildlife species. Therefore, the Applicant evaluated the biomagnification of analytes for two fish-eating species: the northern river otter and great blue heron (Technical Report E.3.2-22). When conservative, non-species-specific values were used as the basis of comparison, results suggested that total DDT/DDE (DDE is a primary decomposition of DDT) significantly exceeded benchmarks for both species but that all other analytes were either near or below all comparison values. The Applicant concluded that most contaminants, except for total DDT/DDE, in Brownlee Reservoir pose minimal risk to fish-eating wildlife.

When evaluating the feasibility of removing DDT/DDE from Brownlee Reservoir, the Applicant concluded that a sediment remediation program (for example, treatment or removal) would be impractical and must be implemented in conjunction with nonpoint source reduction to ensure long-term effectiveness (Technical Report E.3.2-22). The Applicant further concluded that contaminants accumulate in the inundation zone of Brownlee Reservoir independently of HCC operations and that any risk reduction possible from remediation efforts in Brownlee Reservoir would be negligible.

E.3.2.4.1.1.2. Habitat in Reservoir Fluctuation Zones

In Hells Canyon, low-elevation areas provide crucial habitat (for example, riparian habitat and winter range) for many wildlife species and populations. The Applicant conducted two integrated studies (Technical Reports E.3.2-40 and E.3.2-44) that investigated potential impacts to wildlife habitat within the fluctuation zone from operation of the HCC reservoirs. First identified were historical conditions of wildlife habitat along the Snake River in Hells Canyon (Technical Report E.3.2-44); these conditions were then specifically assessed for potential habitat impacts from proposed operations of the HCC reservoirs (Technical Reports E.1-4 and E.3.2-40).

The HCC reservoirs inundated some of the lowest-elevation wildlife habitat in the region (Technical Report E.3.2-44). The reservoirs also formed fluctuation zones when water levels were manipulated during historical operations (Technical Report E.3.2-40). Although drafting of Brownlee Reservoir has historically varied within and among years, relatively large seasonal fluctuations were common. But even during years with a large spring runoff, fluctuations rarely extended to 101 vertical feet below the full-pool elevation (2,077 ft msl) for flood control (Technical Report E.1-4). The fluctuation zones of Oxbow and Hells Canyon reservoirs were relatively small (typically less than 5 ft) (Technical Report E.1-4). The Applicant determined that, because water levels changed daily and seasonally during historical operations, low-elevation habitat was prevented from establishing in the reservoir fluctuation zones (Technical Reports E.3.2-40 and E.3.2-45).

The Applicant concluded that the current lack of wildlife habitat in the low elevations of the fluctuation zone would persist into the future, regardless of the operational scenario used (Technical Report E.3.2-40). That is, under either proposed operations or full pool run-of-river operations, the reservoir fluctuation zones would be at least seasonally inundated. Therefore, the Applicant concludes that proposed operations would permanently and completely eliminate the capability of the fluctuation zones to support quality wildlife habitat (Technical Reports E.3.2-40 and E.3.2-45).

The Applicant estimated that 5,820 acres in the 101-ft fluctuation zone of Brownlee Reservoir, 89 acres in the 10-ft fluctuation zone of Oxbow Reservoir, and 240 acres in the 10-ft fluctuation zone of Hells Canyon Reservoir are affected by operations and therefore impact wildlife

(Technical Reports E.3.2-40 and E.3.2-45). To further evaluate impacts to wildlife, the Applicant estimated theoretical amounts of perennial riparian and upland habitats that proposed operations would prevent from establishing in the fluctuation zones. The Applicant estimated that proposed operations would prevent 1) Brownlee Reservoir from supporting 372 acres of riparian and 5,448 acres of upland habitats, 2) Oxbow Reservoir from supporting 7 acres of riparian and 82 acres of upland habitats, and 3) Hells Canyon Reservoir from supporting 9 acres of riparian and 231 acres of upland habitats (Technical Reports E.3.2-40 and E.3.2-45). The Applicant concludes that proposed operations would impact 6,149 acres (388 acres riparian habitat and 5,761 acres upland habitat) of wildlife habitat within the fluctuation zones of the three HCC reservoirs. Protecting (for example, through acquisition) and enhancing riparian and upland wildlife habitat would constitute appropriate mitigation for operational impacts to the reservoir fluctuation zones.

E.3.2.4.1.1.3. Riparian Habitat in Reservoir Shoreline Zones

Habitat loss and fragmentation, especially of crucial habitats, are major factors contributing to the decline of many wildlife species (Harris 1984, Saunders et al. 1991). In the western United States, riparian habitats comprise only 0.5% of the landscape (Ohmart and Anderson 1986), but the structural and vegetative complexity of these habitats supports a disproportionately large diversity and abundance of wildlife (Parker and Thomas 1979, Szaro 1980, Brinson et al. 1981, Knopf et al. 1988, Saab et al. 1995). Reservoir operations often affect crucial riparian wildlife habitat, particularly where large seasonal water-level fluctuations occur. Such fluctuation, by creating new full-pool reservoir shorelines, prevents riparian vegetation from establishing (Lewke and Buss 1977).

Because of the value of riparian habitat for wildlife in the semiarid environment of Hells Canyon, the Applicant conducted two integrated studies to assess impacts of proposed operations on riparian habitat within the reservoir shoreline zones (that is, within 50 planimetric meters upslope of full-pool shorelines) (Technical Report E.1-4). Technical Report E.3.2-41 describes current levels of riparian fragmentation within shoreline zones. Technical Report E.3.2-40 assesses impacts from proposed operations on the establishment of riparian habitat in shoreline zones. Further details are provided in Technical Report E.3.2-45.

Currently, large seasonal drafting of Brownlee Reservoir has limited the extent (Technical Report E.3.3-1) and contributed to the typically fragmented pattern (that is, small, narrow, and isolated) of riparian habitat in the shoreline zone of this reservoir (Technical Report E.3.2-41). In contrast to Brownlee Reservoir, both Oxbow and Hells Canyon reservoirs have shoreline zones that currently contain riparian cover types (that is, *Forested Wetland*, *Scrub-Shrub Wetland*, *Shore & Bottomland Wetland*, and *Emergent Herbaceous Wetland*) where the substrate and topography is suitable. At these reservoirs, a relatively wide band of riparian habitat was historically promoted by daily water surface fluctuations that were small and regular and water levels that returned to near full pool each day. Daily water levels near full pool, as well as a lack of large seasonal fluctuations, "irrigated" riparian vegetation each day during the growing season (Technical Reports E.3.3-3 and E.3.2-44). Oxbow and Hells Canyon reservoirs have riparian habitat that is relatively well developed and that is less fragmented within shoreline zones than the riparian habitat of Brownlee Reservoir (Technical Reports E.3.2-41 and E.3.3-1).

Modeled proposed operations would be similar to patterns of water surface elevations that (from historical HCC operations) occurred during the vegetation growing season (Technical Report E.1-4). Therefore, the Applicant concludes that if proposed operations occurred for 30 years or more, the relative composition of riparian and upland habitats within all three reservoir shoreline zones would remain unchanged from existing conditions (Technical Report E.3.2-40). Similarly, full pool run-of-river operations would not alter the relative composition of riparian and upland habitats from existing conditions within shoreline zones of Oxbow and Hells Canyon reservoirs (Technical Reports E.3.2-40 and E.3.2-45). Therefore, the extent and connectedness of riparian habitat in shorelines zones of Oxbow and Hells Canyon reservoirs would remain essentially unchanged regardless of operation scenario.

However, current habitat conditions within the shoreline zone of Brownlee Reservoir would change under full pool run-of-river operations. Under full pool run-of-river operations, reservoir water surface elevations would be held constantly at full pool, a level that would promote establishment of an estimated 343 additional acres of riparian habitat (Technical Reports E.3.2-40 and E.3.2-45). In contrast, proposed operations would maintain large seasonal fluctuations of Brownlee Reservoir. Therefore, the Applicant concludes that proposed operations would prevent 343 acres of riparian habitat from establishing in areas of the Brownlee Reservoir shoreline zone that are currently occupied by upland habitat (Technical Report E.3.2-40). The Applicant also concludes that proposed operations would maintain the current distribution of highly fragmented riparian habitats (Technical Report E.3.2-41). Habitat management actions designed to protect (for example, through acquisition) or develop 343 acres of interconnected riparian vegetation would constitute appropriate mitigation for impacts of modeled proposed operations to riparian habitat in the shoreline zone of Brownlee Reservoir.

E.3.2.4.1.1.4. Waterfowl Brooding Habitat in Reservoir Shoreline Zones

Waterfowl are an important international wildlife resource with high public and ecological importance. Habitats for waterfowl nesting and brood rearing have been severely reduced across North America and are often locally limited (Smith et al. 1989). Because of the potential for hydroelectric operations to impact brooding habitat in the reservoir shoreline zones (within 50 planimetric meters upslope of full-pool shorelines) (Lewke and Buss 1977, Tabor et al. 1980, Duebbert 1982), the Applicant conducted two studies to evaluate impacts of proposed operations to such habitat (IPC 1997). Technical Report E.3.2-11 describes the relative distribution and abundance of waterfowl broods along shorelines of the HCC reservoirs, and Technical Report E.3.2-40 examines the effects of both modeled proposed and full pool run-of-river operations on the mallard.

Important waterfowl brooding areas and habitat are largely restricted to shoreline zones of the Powder River arm and upper Brownlee Reservoir, including both the mainland and the islands (Technical Report E.3.2-11). Concentrations of waterfowl broods were also identified along the Snake River shorelines and islands between Brownlee Reservoir and Weiser (Technical Report E.3.2-11), though this stretch is unaffected by HCC operations. The low river gradient and shoreline sediments in all these areas support concentrations of perennial riparian vegetation (Technical Report E.3.3-1) that provide suitable habitat for waterfowl brooding (Technical Report E.3.2-40). However, the Applicant concludes that waterfowl would benefit from additional brooding habitat (riparian vegetation) in these areas.

Modeled proposed operations would affect the establishment and extent of riparian habitats more so than full pool run-of-river operations would. Therefore, proposed operations would impact waterfowl nesting habitat (Technical Report E.3.2-40). In addition, drafting of Brownlee

Reservoir during the waterfowl nesting period would cause riparian habitat in shoreline zones to become unavailable to waterfowl (Books 1985). Enhancing riparian habitats in 1) upper Brownlee Reservoir, 2) the Powder River arm, and 3) islands between Weiser and Brownlee Reservoir would benefit waterfowl associated with the HCC.

E.3.2.4.1.1.5. Threatened, Endangered, Candidate, and Special Status Species in Reservoir Shoreline Zones

One hundred five threatened, endangered, candidate, or special status species are potentially associated with the HCC reservoirs (Table E.3.2-1). From this extensive set of species, the TRWG identified 37 species to be evaluated for potential impacts from HCC operations: 18 bird species, 11 mammal species, 4 amphibian species, and 4 insect species (Table E.3.2-1) (see the Consultation Appendix). The Canada lynx and yellow-billed cuckoo were were not considered when the TRWG compiled the evaluation list because they were not listed as threatened or endangered at that time. These species were later added to the list, raising the number of bird species to 19 and the mammal species to 12.

The Applicant conducted 16 studies to evaluate special status species. Technical Reports E.3.2-1, E.3.2-3, E.3.2-6, E.3.2-8, E.3.2-10, E.3.2-12, E.3.2-15, E.3.2-16, E.3.2-17, and E.3.2-18 evaluate birds, including waterfowl, upland game birds, and birds of prey. Technical Reports E.3.2-26, E.3.2-27, E.3.2-29, E.3.2-30, and E.3.2-34 consider mammals, including bats, carnivores, and big game. Technical Report E.3.2-36 reviews amphibians and reptiles. The Applicant did not specifically study the four insect species, but reviewed available literature and information provided by the Entomological Laboratory of the University of Idaho. Technical Report E.3.2-38 synthesizes information about threatened, endangered, candidate, and special status species.

In this section, the Applicant qualitatively discusses potential impacts to special status species from the proposed operations of the HCC by evaluating assessments of wildlife habitat (Technical Reports E.3.2-40 and E.3.2-44) and species life history characteristics, distributions, and habitat relationships (Technical Report E.3.2-38). The Applicant evaluates 5 species that are federally listed as threatened or endangered under the ESA (the bald eagle, peregrine falcon, gray wolf, northern Idaho ground squirrel, and Canada lynx), 3 candidate species (the southern Idaho ground squirrel, Columbia spotted frog, and yellow-billed cuckoo), and 29 special status species.

However, 7 of the 29 special status species are associated with only upland habitat (for example, *Grassland*, *Shrubland*, and *Forested Upland* habitats) that is not impacted by hydroelectric operations. Special status upland species (the greater sage grouse, Columbian sharp-tailed grouse, loggerhead shrike, sage sparrow, and Brewer's sparrow) are not discussed in this section. Technical Reports E.3.2-38 and E.3.2-45 present more detail about special status species.

Threatened, Endangered, and Candidate Species

Bald Eagles—Bald eagles have nested successfully along Oxbow and Hells Canyon reservoirs since 1998 and 1999, respectively (Technical Report E.3.2-15). The Hells Canyon Study Area appears to provide adequate resources for nesting bald eagles, with the possible exception of suitable nesting trees. Resources for bald eagles would probably not change under either the proposed or full pool run-of-river operations for the HCC. Therefore, the Applicant did not identify impacts to nesting bald eagles for these operational scenarios.

Populations of wintering bald eagles in Oregon and Idaho have approximately doubled over the past two decades (USFWS 1986; Isaacs et al. 1993, 1996; Beals and Melquist 2001). About 11% of the total wintering bald eagle population in Idaho and Oregon concentrate along the Snake River reservoirs (Isaacs et al. 1993). Bald eagles are opportunistic foragers and quickly respond to changing and favorable conditions (Technical Reports E.3.2-16 and E.3.2-17); this behavior influences the distribution of eagles in the study area (Technical Report E.3.2-16). Also, other key factors, such as the amount of human disturbance and the availability of perch sites and night roosts, affect the species' distribution. Conditions for bald eagles are adequate in the study area and would be unlikely to change under either of the operational scenarios for the complex. Therefore, no impacts to wintering bald eagles were identified for either scenario.

Peregrine Falcon—Since at least 1995, one peregrine falcon territory has been present in the study area near Hells Canyon Dam (Technical Reports E.3.2-14, E.3.2-15, and E.3.2-18). Eyries were located on remote cliff faces that are protected by the steep topography from disturbance. Foraging areas for the peregrine include upland habitat on the bench above the cliffs and riparian habitat along tributaries to the Snake River. Neither operational scenario would affect peregrine falcon habitat; therefore, no impacts to the peregrine falcon are identified for either scenario.

Gray Wolf—The gray wolf was observed incidentally on the Idaho side of Hells Canyon Reservoir. Gray wolves probably use Hells Canyon as a travel corridor for movement into Oregon (Technical Report E.3.2-38). Potential habitat for the gray wolf exists at higher elevations within the study area. In 2002, an Applicant biologist observed a radio-collared wolf within the canyon rim near the headwaters of the Wildhorse River, a tributary to Oxbow Reservoir. This habitat is not affected by operations of the HCC. Wolves radio-marked in Idaho have been reported in Oregon, so dispersing wolves are probably not impeded by the reservoirs. Since differences in reservoir widths would be similar for the two operational scenarios and since the reservoirs do not affect the wolves' ability to cross to Oregon, no impacts to the gray wolf were identified for either operational scenario.

Idaho Ground Squirrel—The northern Idaho ground squirrel was found on the Applicant's property at Barber Flat, near the border of the Hells Canyon Study Area (Technical Report E.3.2-38). No current threats were identified at this site, but developing a habitat conservation plan could enhance the population.

In 1980, three southern Idaho ground squirrel sites were located in the vicinity of Cobb Rapids (Technical Report E.3.2-38). In 2000, two of these sites still existed, while the remaining site was unconfirmed. The Applicant also discovered two additional sites in 1998. Factors potentially threatening southern Idaho ground squirrel populations include land-use changes, recreational shooting, poisoning, and naturally occurring events (such as floods and droughts). Neither the northern nor southern Idaho ground squirrel would be affected by the proposed operations scenario or the full pool run-of-river operation scenario for the HCC.

Canada Lynx—Canada lynx are present in the Seven Devils Mountains of Idaho and the Wallowa Mountains of Oregon. The species may be using the Hells Canyon Study Area as a travel corridor between suitable habitat in Idaho and Oregon. Suitable habitat for the Canada lynx is only found at higher elevations that would not be affected by HCC operations. Therefore, no impacts to the Canada lynx were identified for either the proposed or full pool run-of-river operation scenarios.

Yellow-Billed Cuckoo—Historically, the yellow-billed cuckoo bred commonly along the Columbia River west of the Cascade Range and in southern Idaho (Stephens and Sturts 1998). The cuckoo requires a dense willow understory for nesting, a cottonwood overstory for foraging, and large patches of habitat in excess of 50 acres (20 ha) (Laymon and Halterman 1989). Proposed operations impact an estimated 343 acres of riparian shoreline habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, *and Emergent Herbaceous Wetland*) (Technical Report E.3.2-40). However, the patch size of shoreline riparian habitat is too small (Technical Report E.3.2-41) for the nesting requirements of the yellow-billed cuckoo. Therefore, the yellow-billed cuckoo is unlikely to occur in Hells Canyon or be impacted by proposed or full pool run-of-river operations.

Columbia Spotted Frog—The Columbia spotted frog was found at one location near the confluence of Eagle Creek and the Powder River (Technical Report E.3.2-36). Breeding habitat, however, is above the reservoir full pool. Therefore, proposed operations of the HCC would not be expected to impact this species.

Special Status Species

Species That Use Open Water Habitat—During at least part of the year, species associated with open water, such as the trumpeter swan, harlequin duck, and black tern, are probably positively affected by the creation of the HCC reservoirs. Therefore, no impacts to species associated with open water are identified for the proposed or full pool run-of-river operation scenarios.

Species That Use Riparian Shoreline Habitat—Riparian shoreline vegetation along the reservoirs provides important habitat for a variety of birds, many of which are special status species. Special status species using riparian habitat for some or most of their life requirements include the mountain quail, willow flycatcher, yellow warbler, MacGillivray's warbler, Townsend's warbler, Wilson's warbler, solitary vireo, yellow-headed blackbird, and northern river otter. In general, the Applicant found no difference between proposed and full pool run-of-river operations for the amount of riparian habitat in the unimpounded reach above Brownlee Reservoir or for Oxbow and Hells Canyon reservoirs (Technical Report E.3.2-40). When compared with the full pool run-of-river operation scenario, the proposed operation scenario would affect an estimated 343 acres of riparian habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland* cover types) in the shoreline zone of Brownlee Reservoir (Technical Report E.3.2-40). Therefore, all species that potentially occur along Brownlee Reservoir and that need riparian habitat for their life requirements would be impacted by proposed operations.

Amphibians—The northern leopard frog was not observed in the study area (Technical Report E.3.2-36), though the southern portion of the study area near Farewell Bend lies within the predicted distribution of the species (Groves et al. 1997). The northern leopard frog uses the *Emergent Herbaceous Wetland* cover type for breeding. When compared with the full pool run-of-river operations scenario, the proposed operations scenario would potentially impact *Emergent Herbaceous Wetlands* (although very sparsely available) and, therefore, could affect the northern leopard frog.

The inland tailed frog is found in cold, fast-flowing, permanent streams in forested areas at higher elevations. The species was observed in five tributaries to the Snake River, generally at higher elevations (Technical Report E.3.2-36). Because the HCC is at lower elevations, proposed operations would not impact the inland tailed frog.

The western toad was found throughout the Hells Canyon Study Area and was considered common (Technical Report E.3.2-36). Asherin and Claar (1976) found western toad eggs in Hells Canyon Reservoir and reported that reservoir operations caused eggs to become stranded and desiccated. Extensive field work during 1995 through 2000 failed to show evidence of breeding at the reservoirs (Technical Report E.3.2-36). Generally, habitat conditions in the reservoir shoreline zones along the three reservoirs appear unsuitable for breeding toads. Nonetheless, proposed operations of the complex would more negatively affect breeding western toads in the fluctuation zones and shoreline zones than full pool run-of-river operations would.

Bats—Within the Columbia River basin, the Snake River corridor in Hells Canyon and the surrounding terrain may be among the most pristine bat habitats available (Technical Report E.3.2-27). Status of the bat community, however, is unknown (Technical Report E.3.2-27). It is unknown whether operations of the HCC impact bat species that are present in the Hells Canyon Study Area, including the Townsend's western big-eared bat, spotted bat, fringed myotis, and western pipistrelle.

Big Game—In 1987, 15 California bighorn sheep were released along the Burnt River on BLM lands; by 1997, the number of sheep in the area increased to at least 73 individuals. Though proposed operations would impact riparian habitat in the shoreline zone along Brownlee Reservoir more than full pool run-of-river operations would (Technical Report E.3.2-40), no literature was found to suggest that riparian habitats were critical to bighorn sheep (Technical Report E.3.2-34). In addition, California bighorn sheep do not occur along the portion of the Burnt River near Brownlee Reservoir. Therefore, proposed operations of the HCC would not affect California bighorn sheep in the Hells Canyon Study Area.

Forest Carnivores—Fishers prefer forests dominated by conifers with extensive and continuous canopies (for example, 70 to 80%) (Spahr et al. 1991). Because preferred habitat of the fisher occurs at higher elevations than the HCC, proposed operations would not impact this species.

Wolverine sightings have been reported for Wallowa and Baker counties in Oregon and for Adams (Schommer 1994) and Idaho counties in Idaho (Technical Report E.3.2-29). During winter, low-elevation areas, such as big game winter range, are important wolverine habitat (Schommer 1994), as evidenced by a sighting at Eagle Bar. However, wolverine presence is probably very rare near the HCC reservoirs. Though the effects of operationally regulated flows on wolverine movement are unknown, the wolverine is known to range widely in northern latitudes across large areas that are intersected by large lakes and rivers (for example, Alaska and Canada) (Technical Report E.3.2-29). Therefore, the wolverine is probably adapted to navigating large water bodies, and the Applicant concludes that wolverines are unlikely to be impeded by the HCC reservoirs (Technical Report E.3.2-45). Because differences in width for the reservoirs would be similar for both the proposed and full pool run-of-river operation scenarios, the Applicant expects that the wolverine would not be affected by either scenario (Technical Report E.3.2-45).

Insects—The Johnson's hairstreak, silver-bordered fritillary, and Yuma skipper have not been reported in Hells Canyon (Frank Merickel, Idaho State University, personal communication). No potentially special status butterfly species were detected during a butterfly survey of the Cecil D. Andrus Wildlife Management Area (Stephens and Ferris 1999). Therefore, HCC operations would not affect the Johnson's hairstreak, silver-bordered fritillary, or Yuma skipper.

Historical populations of the Columbia River tiger beetle were reported to be locally abundant on sandbars of the Columbia and Snake rivers between The Dalles, Oregon, and Lewiston, Idaho (Hatch 1938). More recently, the Columbia River tiger beetle was found along the lower Salmon River between Slate and Eagle creeks (Shook 1981), but the species was not reported along the Snake River. Therefore, the Columbia River tiger beetle is not expected to occur in the Hells Canyon Study Area and would not be affected by HCC operations.

E.3.2.4.1.1.6. Mule Deer Winter Range Zone

A native game species, the mule deer is highly valued by the public, and natural resource agencies strive to optimize mule deer habitat and populations (ODFW 1990, Scott 1991). Because the HCC bisects important mule deer winter range in eastern Oregon and western Idaho, the Applicant initiated five studies (2 information review, 1 modeling, and 2 field studies) to comprehensively investigate potential impacts to mule deer from HCC operations. Studies were integrated and designed first to identify potential impacts from operations and then to specifically address those potential impacts (Technical Report E.3.2-45).

Two studies conducted by the Applicant identified several issues and potential impacts. One study reviewed the status of big game populations in Hells Canyon; its authors recommended that the Applicant investigate potential impacts to mule deer habitat and barriers to migration from hydroelectric operations (Technical Report E.3.2-34). The other study sought to map big game winter range in Hells Canyon and, using expert opinion surveys, concluded that the operation of the complex (especially Brownlee Reservoir) could potentially impact mule deer winter habitat, migration routes, and survival (Technical Report E.3.2-31). An additional issue identified during consultation was that ice formation on Brownlee Reservoir causes mule deer mortality (IPC 1997, Technical Report E.3.2-35).

A modeling study and two field studies investigated potential impacts to mule deer. Because conditions causing significant reservoir ice are uncommon and unpredictable, reservoir-icing events were modeled, and potential influences to mule deer wintering adjacent to Brownlee Reservoir were explored (Technical Report E.3.2-35). Technical Report E.3.2-30 describes relationships between mule deer and the HCC by estimating late-winter population abundance and distribution on winter range adjacent to the reservoirs (HCC winter range). Mule deer movements, habitat selection, and mortality were investigated to identify mule deer interactions with Brownlee and Oxbow reservoirs (Technical Report E.3.2-32). Impacts to mule deer were quantified and summarized (Technical Report E.3.2-45).

By synthesizing the information and data in Technical Reports E.3.2-30, E.3.2-32, and E.3.2-35, the Applicant identified and quantified HCC impacts to mule deer within the winter range zone and fluctuation zone (primarily Brownlee Reservoir) (Technical Report E.3.2-45). Potential impacts assessed were of three types: inhibited movements, limited opportunities for winter habitat selection, and directly and indirectly caused mortality. For each impact type, the Applicant estimated and standardized measures of impacts as habitat coefficients. A habitat coefficient of an impact from HCC operations was defined as the decrease in the capability of the HCC winter range to support mule deer (Technical Report E.3.2-45).

Movements—Uninhibited movement within and among seasonal range is essential for resource selection by mule deer (Wallmo 1981). Fifty-four radio-collared deer (21% of the sample of 255 radio-collared deer) made 153 reservoir crossings. The relatively large winter population on the HCC winter range (Technical Report E.3.2-30) is primarily composed of migratory (74%) deer. Sixty-two percent of reservoir crossings (primarily across the Powder River arm) were associated with migration and occurred independently of Brownlee Reservoir's water surface elevation (or HCC operations). In addition, radio-collared deer crossed Brownlee Reservoir (not including the Powder River arm) at least 30 times. These crossings included those made by two does that crossed and recrossed Brownlee Reservoir while migrating between winter range in Oregon and summer range in Idaho. Although some deer die while crossing, many more successfully cross HCC reservoirs. Reservoir-related mortalities associated with reservoir crossing are addressed below. Brownlee Reservoir, even when at full pool, does not appear to prevent deer from successfully swimming between Idaho and Oregon (Technical Report E.3.2-32).

Considering research findings reported in Technical Report E.3.2-32 and elsewhere (Robinette 1966, Boroski 1998), the Applicant believes that the HCC does not appear to significantly inhibit mule deer movements. Deer successfully swim across the reservoirs during all seasons and at all water surface elevations; these conditions include those that could occur for both proposed and full pool run-of-river operations. The Applicant concludes that the complex currently does not impact habitat capability, nor would proposed operations impact the capability (habitat coefficient = 0.0), of the HCC winter range by inhibiting mule deer movements (Technical Report E.3.2-45).

Habitat Selection—Winter range is a critical component of mule deer ecology (Wallmo 1981). Mule deer wintering adjacent to the HCC select habitats on southerly aspects, at relatively low elevations, and with a diversity of vegetation communities and forage (Technical Report E.3.2-32). During late winter, deer concentrate at low elevations on winter range adjacent to Brownlee Reservoir (Technical Report E.3.2-30). Although deer were distributed from the Brownlee Reservoir full-pool shoreline (2,077 ft msl rounded to 2,100 ft msl for analysis) to 4,700 ft msl (Brownlee Reservoir winter range zone of the HCC winter range) (Technical Report E.3.2-32), deer were disproportionately concentrated (50% of wintering population) within 600 ft elevation (2,677 ft msl rounded to 2,700 ft msl) above full pool (Technical Reports E.3.2-30 and E.3.2-45). Therefore, the Applicant vertically subdivided lands within the winter range zone of Brownlee Reservoir into crucial winter range (86,408 acres between full pool and 2,700 ft msl) and general winter range (2,700 ft to 4,700 ft msl) (Technical Report E.3.2-45).

Because population abundance above Brownlee Reservoir increased with decreasing elevation, the Applicant concluded that the capability of winter habitat in Hells Canyon to support mule deer increases with decreasing elevation (Technical Report E.3.2-45). The Applicant therefore concludes that the fluctuation zone of Brownlee Reservoir impacts the availability of low-elevation winter range beyond the simple amount of land within the zone. Water-level fluctuations prevent establishment of the vegetation that provides deer with forage and, therefore, permanently reduce the capability of the fluctuation zone to support quality mule deer habitat. In addition, the Applicant concludes that the loss of habitat in the fluctuation zone of Brownlee Reservoir would impact mule deer habitat capability for both modeled proposed and full pool run-of-river operations of the HCC (Technical Report E.3.2-40).

The Applicant calculated a habitat coefficient to quantify the impact of HCC operations for the low-elevation habitat that is prevented from establishing in the fluctuation zone of Brownlee Reservoir (5,820 acres) (Technical Reports E.3.2-40 and E.3.2-45). Low-elevation winter range that is unavailable in the fluctuation zone probably had a greater habitat capability and would potentially support 10% more deer than habitats at higher elevations would. The Applicant estimated that 582 acres (0.10 × 5,820 acres) of winter habitat at higher elevations, in addition to the 5,820 acres identified in Technical Report E.3.2-40, would be required to mitigate for impacts to low-elevation winter range that is unavailable in the reservoir fluctuation zone of Brownlee Reservoir (Technical Report E.3.2-45).

Reservoir-Related Mortality—Much of the annual mortality of mule deer populations in the Intermountain West occurs while deer are concentrated on winter range (Wallmo 1981, Bartmann and Bowden 1984, White et al. 1996). To identify HCC impacts, the Applicant quantified three components of mortality on the HCC winter range: 1) mortality unrelated to the reservoirs during years with mild to moderate winter conditions, 2) reservoir-related mortality during years with mild to moderate winter conditions, and 3) reservoir-related mortality during years with harsh winter conditions (see Technical Reports E.3.2-30, E.3.2-32, and E.3.2-45). In addition, Technical Report E.3.2-35 reports on the likelihood of significant ice formation on Brownlee Reservoir during harsh winters and the implications for reservoir-related mule deer mortality.

To quantify HCC impacts to the capability of the winter range to support mule deer, the Applicant estimated reservoir-related mortality directly from drowning and indirectly from reservoir crossing, reservoir ice, and shoreline use (Technical Reports E.3.2-32 and E.3.2-45). The Applicant estimated that deer, while on the HCC winter range, had a 10% annual probability ($\bar{x}$ = 0.099, range = 0.086–0.123, n = 3 years) of succumbing to reservoir-related mortality during years with mild to moderate winter conditions (Technical Report E.3.2-32). Using historic data reported in Technical Report E.3.2-30, the Applicant also estimated that, during winters with harsh conditions (for example, winters with cold temperatures, deep snow, and extensive reservoir icing), the deer had an additional 9% probability of reservoir-related mortality (Technical Report E.3.2-45).

Presumably because of the benefit of increased winter survival, large numbers of the deer on the HCC winter range concentrated adjacent to the reservoirs (Technical Report E.3.2-30) and selected home ranges at the lowest elevations available where nutritious forage was more readily available (Technical Report E.3.2-32). However, spending time near shorelines of Brownlee Reservoir apparently makes deer more vulnerable to mortality from predators. Specifically, deer presence at Brownlee Reservoir appeared to increase predator (primarily coyote) efficiency and decrease overall deer survival. Because proposed operations would cause reservoir conditions similar to those occurring during the Applicant's mule deer study (Technical Report E.3.2-32), the Applicant concludes that the estimated levels of reservoir-related mortality during proposed operations would also be similar to those of the study (Technical Report E.3.2-45).

Therefore, the Applicant concludes that proposed operations of Brownlee Reservoir would negatively affect the capability of the HCC winter range to support mule deer (as measured by deer mortality) by the cumulative effects of 0.10 and 0.09 habitat coefficients (Technical Report E.3.2-45). Applying these habitat coefficients to the 86,408 acres of crucial winter range, the Applicant estimates that 8,641 acres (0.10 × 86,408 acres) and 7,777 acres (0.09 × 86,408 acres) of habitat would be required to mitigate for impacts to the habitat capability of crucial winter range (Technical Report E.3.2-45).

E.3.2.4.1.2. Land Management

The Applicant owns about 3,450 acres of land in fee in Hells Canyon (nonflooded) from which it operates the HCC within the FERC project boundary (encompassing 16,580 acres) (Technical Report E.6-2). All of these lands occur upstream of Hells Canyon Dam. The Applicant-owned land constitutes approximately 21% of the project area. The Applicant also owns approximately 1,850 acres of land outside the project area in Hells Canyon. Combined, these 5,300 acres constitute approximately 0.6% of the approximately 848,000 acres that the Applicant studied to assess its land management influences on terrestrial resources (Technical Report E.6-2). The study area stretched from canyon rim to canyon rim, from just downstream of Weiser to the confluence of the Snake and Salmon rivers.

Potential impacts of the Applicant's land management actions on wildlife habitat are addressed in section E.3.3.4.1.6. and section E.3.3.4.2.5. Detailed information about the Applicant's land management practices on Applicant-owned land is in Technical Report E.6-2. In short, no negative impacts to listed threatened or endangered wildlife species or to other special status species are known to occur on Applicant lands from land management activities (Technical Report E.6-2). Generally, the Applicant recommends that more frequent monitoring of project leases and other properties be conducted to identify corrective actions needed for negative impacts to wildlife resources. Specific policy revisions and land management actions proposed for implementation are summarized in Technical Reports E.3.2-45, E.6-1, and E.6-2.

E.3.2.4.1.3. Impacts of Human Activities on Wildlife Resources

The Applicant's personnel must perform many activities for O&M of the HCC, which includes developed parks, dispersed (or undeveloped) recreation sites, roads, and trails. During relicensing consultation, some state and federal agencies and nongovernmental organizations expressed concern that human activities within the HCC may impact wildlife resources. Accordingly, the Applicant conducted numerous relicensing studies to characterize O&M activities, recreational activities, and wildlife resources associated with the HCC. For Technical Report E.3.2-46, the Applicant then integrated data from the studies and comprehensively investigated potential impacts of human activities upon natural resources at the HCC reservoir shorelines to 0.5 mi upslope of those shorelines.

For Technical Reports E.3.2-45 and E.3.2-46, the Applicant and its contractors assessed potential impacts to wildlife from human activities associated with 29 of the Applicant's facilities (116 acres: dams, residential areas, and small substations), 4 developed parks operated by the Applicant (114 acres), 7 developed parks that are not operated by the Applicant (136 acres), and 167 dispersed sites (77 acres) (Technical Report E.5-2). The Applicant also assessed 26 roads (140 mi) and numerous trails (for example, hiking trails, ATV trails, and dispersed recreation trails) that are associated with its facilities or that are used by recreationists (Technical Report E.3.2-46). The Applicant summarized findings about potential impacts to big game while on winter range and to selected threatened, endangered, candidate, and special status wildlife species (Technical Reports E.3.2-45 and E.3.2-46).

Big Game Winter Range—Elk, mule deer, mountain goat, and Rocky Mountain bighorn sheep are important big game species in Hells Canyon, and the winter range adjacent to the HCC is crucial for big game populations (Technical Report E.3.2-31). Human activities on crucial winter range that cause unacceptable levels of disturbance can decrease habitat suitability and impact big game populations (Technical Reports E.3.2-34 and E.3.2-46).

High levels of human activity are associated with the O&M of many of the Applicant's facilities (for example, Hells Canyon and Oxbow dams, Brownlee Powerhouse, Brownlee Village, and a trailer park near Brownlee Reservoir) during winter (Technical Report E.3.2-46). Consequently, human activity could displace big game from winter range adjacent to the facilities; however, most of the Applicant's activities during winter are concentrated inside the facilities. Relatively heavy road use also occurs among the Applicant's facilities during winter. Although a potential source of high disturbance, these roads are concentrated near portions of reservoir shorelines (40 mi of Applicant-managed access roads versus approximately 200 or more miles of reservoir shorelines) and are not distributed throughout the winter range. However, because severe winter weather may cause big game to become more concentrated in the lowest-elevation portions of the winter range, facility- and road-related impacts might become locally significant during harsh winters. Nonetheless, the Applicant concludes that, in most years, wintering big game would not be significantly affected by human activities at the Applicant's facilities or by Applicant road use.

The Applicant also identified potential impacts to big game and their winter range from recreational activities (Technical Reports E.3.2-45 and E.3.2-46). Several areas of the winter range, primarily near developed parks (for example, McCormick, Woodhead, and Hells Canyon parks), were predicted to have high potential for recreational disturbance. However, most of the winter range in Hells Canyon is relatively free of disturbance from recreation because human activities associated with recreation during winter are largely concentrated immediately within developed parks. As with Applicant-owned facilities, the likelihood for disturbance from recreation probably increases during harsh winters when big game is concentrated at the lowest elevations and near parks. However, recreational use would probably be much reduced during harsh winters (Technical Reports E.3.2-45 and E.3.2-46). The Applicant concludes that during most years, winter recreational activities would not significantly impact big game or winter range. Nevertheless, the Applicant recommends developing a program for educating the public about minimizing disturbance to big game and winter range during critical periods.

Threatened, Endangered, Candidate, and Special Status Species—Threatened, endangered, candidate, and special status species receive special protection under state and federal legislation and regulations. Many of these species occur in Hells Canyon and are associated with the HCC during various periods of the year. These species are often especially sensitive to disturbance from human activities in critical habitats. Therefore, the Applicant evaluated potential impacts from human activities that disturb or degrade habitats of selected threatened, endangered, candidate, and special status species: the mountain quail, bald eagle, and neotropical passerines (Technical Reports E.3.2-38, E.3.2-45, and E.3.2-46).

Mountain quail were historically found in large numbers in west-central Idaho, but populations have declined significantly (Technical Reports E.3.2-4 and E.3.2-6). The declines prompted a petition for the species' protection under the ESA, protection that was subsequently not considered to be warranted (*Federal Register* [January 22, 2003] 68[14]:2000–2003). Small and isolated populations are believed to occur adjacent to the HCC. In Hells Canyon, the majority of suitable winter habitat for mountain quail is composed of low-elevation riparian areas (Technical Report E.3.2-6), which are especially prone to disturbance from human activities associated with recreation, roads, and the Applicant's O&M activities. The Applicant concludes, however, that the species' rarity makes disturbance improbable (Technical Reports E.3.2-45 and E.3.2-46). However, because all Applicant-owned parks, the Brownlee and Oxbow residential areas, and seven dispersed recreation sites intersect potential mountain quail habitat (Technical Reports E.3.2-6, E.3.2-45, and E.3.2-46), the Applicant concludes that O&M and recreational activities, especially those occurring in low-elevation riparian habitat, might reduce opportunities for mountain quail recovery. Mitigation efforts that cooperatively enhance low-elevation riparian habitat would facilitate mountain quail restoration efforts in Hells Canyon.

The bald eagle is currently listed as threatened under the ESA. Substantial numbers of bald eagles winter in Hells Canyon and use several communal night roosts and many day perches (Technical

Reports E.3.2-16 and E.3.2-17). Two bald eagle nests were also discovered in 1998 and 1999 (Technical Report E.3.2-15). Although effects vary, bald eagles can be prone to many forms of disturbance (McGarigal et al. 1991, Stalmaster and Kaiser 1998). Using established criteria (400-m-radius buffer) (Knight and Knight 1984, McGarigal et al. 1991, Anthony et al. 1995, Hamann et al. 1999), the Applicant evaluated potential impacts from disturbance around nests, roosts, and perches (Technical Reports E.3.2-45 and E.3.2-46).

Activities associated with Applicant-owned facilities posed major disturbance risks to only two perches and one roost. Roads had the highest disturbance potential: both bald eagle nests were located within 125 m of Applicant roads. However, despite nearby road use, both nests have produced fledglings each year since bald eagles started nesting at these sites. Eight perches and six roosts were also vulnerable to road disturbance (Technical Report E.3.2-46). Recreation sites were of relatively little concern, with only one roost affected by an Applicant-owned park (McCormick Park) (Technical Report E.3.2-46). Despite high levels of human activity, numbers of wintering bald eagles have been relatively stable in Hells Canyon (Technical Report E.3.2-16). Therefore, the Applicant concludes that current levels of human activities do not displace bald eagles in Hells Canyon. However, an adaptive strategy for managing bald eagles in Hells Canyon, one that includes annual monitoring, would help negate future impacts to nesting bald eagles from increased levels of human activities.

Many passerine bird species that nest in riparian habitats associated with the HCC are classified by state and federal agencies as neotropical migrants with special status: the yellow, Townsend's, MacGillivray's, and Wilson's warblers; willow flycatcher; and plumbeus vireo (Pitocchelli 1995, Curson and Goguen 1998, Wright et al. 1998, Ammon and Gilbert 1999, Lowther et al. 1999, Technical Report E.3.2-1). Because riparian habitat is limited in Hells Canyon (Technical Reports E.3.3-1 and E.3.3-3), human activities within these habitats can especially impact special status passerine birds. Therefore, the Applicant evaluated potential impacts to passerine birds that nest in riparian habitats where human activities occur (Technical Reports E.3.2-45 and E.3.2-46).

The Applicant's residential facilities (for example, Oxbow Village) are often associated with riparian habitat, and human activities in residential areas potentially displace passerine species (for example, the yellow warbler) that do not habituate well to continual disturbance (Technical

Report E.3.2-46). Most potential impacts to special status passerines were in riparian habitat associated with parks and dispersed recreation sites. Parks can provide suitable nesting habitat for many species (for example, the yellow warbler) (Lowther et al. 1999), but only species that are tolerant of concentrated human activity are likely to be present. Therefore, the Applicant concludes that special status passerines are probably affected by human use of riparian habitats associated with the Applicant's facilities and recreation sites (Technical Report E.3.2-46). Special status passerines would benefit from management programs that enhance riparian habitat distanced from areas of human activity (Technical Report E.3.2-45).

E.3.2.4.2. Downstream of the Hells Canyon Complex

E.3.2.4.2.1. River Operations

In the western United States, the loss and fragmentation of riparian habitat are major factors contributing to the decline of many wildlife species (Harris 1984, Saunders et al. 1991). Riparian habitats are limited in the West, comprising only 0.5% of the landscape (Ohmart and Anderson 1986), but they support disproportionately large diversity and abundance of wildlife (Thomas et al. 1979, Szaro 1980, Brinson et al. 1981, Knopf et al. 1988, Saab et al. 1995). Hydroelectric development has impacted much riparian habitat in the West, especially where dam operations have caused divergences from natural river processes and seasonal flow patterns (Bradley and Smith 1986, Akashi 1988, Rood and Heinz-Milne 1989).

Considering the value of riparian habitat for wildlife, the Applicant and state and federal resource agencies identified concerns and issues about potential impacts of HCC operations on the availability and composition of riparian wildlife habitat in Hells Canyon (IPC 1997). Primary issues were that daily flow fluctuations from HCC operations limit the establishment of riparian habitat and fragment riparian habitat along the Snake River shoreline (the river shoreline zone) downstream of Hells Canyon Dam (IPC 1997).

To assess impacts to riparian wildlife habitat from proposed operations of the HCC reservoirs, the Applicant conducted three integrated studies (Technical Reports E.3.2-40, E.3.2-41, and E.3.2-44) (Technical Report E.1-4). These studies were designed and integrated to 1) identify historic conditions of wildlife habitat along the Snake River in Hells Canyon (Technical

Report E.3.2-44), 2) describe existing conditions (such as fragmentation) of riparian wildlife habitat (Technical Report E.3.2-41), and 3) estimate impacts to riparian habitat in shoreline zones that would occur from modeled proposed operation of the HCC (Technical Report E.3.2-40). In addition, the Applicant evaluated effects on threatened, endangered, candidate, and special status species from impacts to riparian habitat downstream of Hells Canyon Dam (Technical Report E.3.2-38).

E.3.2.4.2.1.1. Riparian Habitat in the River Shoreline Zone

Shorelines of the Snake River downstream of Hells Canyon Dam are steep, confined by bedrock, and typically covered by talus, rock debris flows, and alluvial terraces (Technical Report E.1-2). This geomorphologic condition severely limits the extent of riparian vegetation both along the river shoreline and in the tributaries. Before construction of the HCC, the extent of perennial riparian habitat along the Snake River shoreline was sparse because of scouring during large annual spring runoff flows and the rapid recession of water levels during summer (Technical Reports E.3.2-44 and E.3.3-3). The confined canyon and static riverbed does not support the extensive recruitment and survival of woody riparian vegetation (Technical Reports E.3.3-1 and E.3.3-3). The timing and magnitude of peak runoff flows and summer base flows further determine the extent and floristic characteristics of riparian habitat along river shorelines in Hells Canyon.

The daily and seasonal storage capabilities of the HCC have permitted short-term deviations between flows entering and exiting the HCC (flow/stage fluctuations for load following). Although water levels fluctuated only where shorelines were scoured by spring runoff flows (Technical Reports E.1-4 and E.3.3-3), historical load-following operations during summer have been described as an “irrigation effect” (Technical Reports E.3.2-44 and E.3.3-3). The irrigation effect (in addition to changes in land-use practices) probably contributed to the increased upslope extent and robustness of facultative riparian vegetation (that is, vegetation that can both survive under varying hydrologic conditions and benefit from temporary wet conditions), especially hackberry, that currently fringes the river downstream of Hells Canyon Dam (Technical Reports E.3.2-44 and E.3.3-3). Periodically, large runoff flows probably limit the lower extent of permanent vegetation on the shoreline slope by detaching intermittently established plants (Technical Reports E.1-4, E.3.3-1, and E.3.3-3).

The Applicant's contractors modeled flow stage–inundation relationships and characteristic flows for historical operations, modeled proposed operations, and full pool run-of-river operations and estimated the extent of riparian habitat that would be expected in the river shoreline zone (Technical Report E.3.2-40). The shoreline zone (3,435 total acres) is currently comprised of 7.6% riparian habitat (262 acres of perennially vegetated riparian habitat). However, proposed operations are defined to have daily summer flows of lower average maximums than they did under historic operations, and so proposed flows have less shoreline irrigation effect (restricted load-following operations) than under historical operations. Therefore, under proposed operations, riparian habitat would occupy slightly less area (7.4%, 255 acres) of the shoreline zone than it would under historic operations. Because no irrigation effect would occur with full pool run-of-river operations, riparian habitat would occupy even less of the shoreline zone (7.2%, 246 acres) under that operational scenario (Technical Report E.3.2-40).

Impacts of riparian habitat fragmentation are complex and often unique for individual wildlife species (McGarigal and Marks 1995, Donovan et al. 1997, Tewksbury et al. 1998). Nonetheless, the overriding impact of riparian fragmentation is the simple loss or unavailability of this important habitat (Skagen et al. 1998). Because of the linear nature of riparian zones in semiarid regions of the West (Ohmart and Anderson 1986), fragmentation increases with a decrease in the spatial extent of riparian habitat (Technical Report E.3.2-45). Therefore, the Applicant concludes that both the reduced summer water-level fluctuations of proposed operations and the decreased summer base flows of full pool run-of-river operations (Technical Report E.1-4) would, over time, potentially increase the current level of riparian fragmentation by decreasing the extent of woody riparian vegetation (Technical Reports E.3.2-40 and E.3.2-45).

The Applicant concludes, however, that modeled proposed operations for the HCC would provide slightly more riparian wildlife habitat in the river shoreline zone downstream of Hells Canyon Dam than full pool run-of-river operations would (Technical Report E.3.2-45). Full pool run-of-river operations would also probably increase riparian fragmentation more than proposed operations would (Technical Report E.3.2-45).

E.3.2.4.2.1.2. Threatened, Endangered, Candidate, and Special Status Species in the River Shoreline Zone

Two threatened and endangered species, the bald eagle and peregrine falcon, were observed downstream of the HCC. Canada lynx may be present in the Seven Devils Mountains of Idaho and the Wallowa Mountains of Oregon. Because several gray wolves radio-collared in Idaho were reported in Oregon, wolves are likely to pass through the HCC area. The historical distributions of the northern and southern Idaho ground squirrels do not extend below Hells Canyon Dam, and therefore those species are not discussed. Of the two remaining candidate species, the yellow-billed cuckoo and Columbia spotted frog, only the yellow-billed cuckoo could potentially be present downstream of Hells Canyon Dam (Technical Reports E.3.2-38 and E.3.2-45).

The distributions of 9 of the 29 special status species do not extend downstream of Hells Canyon Dam, or the species are only associated with upland habitat (for example, *Grassland*, *Shrubland*, and *Forested Upland* habitats), which is not affected by HCC hydroelectric operations. These 9 species are therefore not discussed here: the greater sage grouse, Columbian sharp-tailed grouse, loggerhead shrike, sage sparrow, Brewer’s sparrow, MacGillivray’s warbler, Wilson’s warbler, northern leopard frog, and California bighorn sheep. A more detailed discussion of threatened, endangered, candidate, and special status species can be found in Technical Reports E.3.2-38 and E.3.2-45.

Threatened, Endangered, and Candidate Species

Bald Eagle—Bald eagles are not known to nest downstream of Hells Canyon Dam, and no historical nest sites are documented (Technical Report E.3.2-38). Bald eagles winter in small numbers downstream of Hells Canyon Dam (0.4 bald eagles/river mile) (Technical Report E.3.2-16). Key parameters influencing concentration of wintering bald eagles are the availability of food, perch sites, and night roosts and the level of human disturbance. Adequate conditions are met in the downstream reach and are unlikely to change, regardless of operational scenario. Therefore, the Applicant concludes that bald eagles would not be impacted by operation of the HCC (Technical Report E.3.2-45).

Peregrine Falcon—Since at least 1995, one peregrine falcon territory has been present in Hells Canyon near Hells Canyon Dam (Technical Reports E.3.2-14 and E.3.2-15). This territory was occupied from 1997 to 2001. Eyries are located on remote cliff faces that are protected from disturbance by the steep topography. Foraging areas for the peregrine include upland habitats on the bench above the cliffs and riparian habitat along tributaries to the Snake River. Neither proposed operations nor full pool run-of-river operations would affect nesting and foraging habitats of peregrine falcons downstream of Hells Canyon Dam. Therefore, the Applicant concludes that peregrine falcons would not be affected by operation of the HCC (Technical Report E.3.2-45).

Gray Wolf—The gray wolf has not been observed in the reach downstream of Hells Canyon Dam. However, since a number of wolf sightings in Oregon were of wolves radio-collared in Idaho, gray wolves probably use Hells Canyon as a travel corridor for movement into Oregon (Technical Report E.3.2-38). Potential habitat for the gray wolf exists in Hells Canyon, but this habitat would not be impacted by operation of the HCC. Gray wolves passing through the canyon below Hells Canyon Dam would encounter crossing conditions similar to those encountered before construction of the HCC. However, during fall and winter, river flows are artificially higher than the long-term average. The effect of somewhat higher flows is unknown. Gray wolves attempting to cross the Snake River below Hells Canyon Dam would encounter flow conditions similar to each other under both proposed or full pool run-of-river operations. Therefore, the Applicant concludes that gray wolves would not be affected by either operational scenario (Technical Report E.3.2-45).

Canada Lynx—Canada lynx are present in the Seven Devils Mountains of Idaho and the Wallowa Mountains of Oregon (Technical Report E.3.2-38). The species may be using the Hells Canyon Study Area as a travel corridor between suitable habitat in Idaho and Oregon. Operations of the HCC are not expected to impact Canada lynx habitat, which is found only at higher elevations that would not be impacted by hydroelectric operations. Therefore, the Applicant concludes that Canada lynx would not be impacted by either proposed or full pool run-of-river operations (Technical Report E.3.2-45).

Yellow-Billed Cuckoo—Historic operations of the HCC elevated summer base flows, resulting in increased vigor of riparian hackberry stands (Technical Report E.3.2-45). Hackberry canopies are currently larger and more robust than they appear to be in historical photos (Technical

Report E.3.2-44). Sandbar willow, however, has decreased (Technical Reports E.1-4, E.3.2-45, and E.3.3-3). Therefore, although cover and extent has increased, the structural and floristic characteristics (species composition) of riparian habitat have changed since construction of the HCC.

The riparian habitat available downstream of Hells Canyon Dam appears to be unsuitable for the yellow-billed cuckoo (Technical Report E.3.2-38); only the tributaries to the Snake River have the mature cottonwoods and dense understory needed for the species' nesting habitat. However, these patches of adequate habitat may be too small to allow successful nesting. Currently, the Snake River shoreline downstream of Hells Canyon Dam has a fragmented riparian zone with very few cottonwoods. This fragmentation and lack of cottonwood stands would probably change little under either the proposed or full pool run-of-river operations (Technical Reports E.3.2-40 and E.3.3-3). Therefore, the Applicant concludes that proposed operations of the HCC would not impact the yellow-billed cuckoo (Technical Report E.3.2-45).

*Columbia Spotted Frog—*The Columbia spotted frog was not found downstream of Hells Canyon Dam. Habitat conditions along the Snake River are unsuitable for the species. Therefore, the Applicant concludes that proposed operations of the HCC would not impact the Columbia spotted frog (Technical Report E.3.2-45).

Special Status Species

*Species That Use Open Water Habitat—*Lacustrine conditions are not present in the unimpounded river downstream of Hells Canyon Dam. Therefore, species associated with open water are unlikely to be found in this reach and would not be impacted by HCC operations.

*Species That Use Riparian Shoreline Habitat—*Riparian shoreline vegetation provides important habitat to a variety of birds, many of which are special status species. Riparian wildlife species present in downstream of Hells Canyon Dam include the mountain quail; willow flycatcher; yellow, MacGillivray's, Townsend's, and Wilson's warblers; plumbeus vireo; yellow-headed blackbird; and northern river otter. Compared with full pool run-of-river operations, proposed operations would slightly favor riparian habitat, mainly through the elevated summer base flow that increases soil moisture for facultative riparian plant species (Technical Reports E.3.2-40 and E.3.3-3), although the difference in riparian habitat is small (about 1 acre of *Forested Wetland* and 8 acres of *Scrub-Shrub Wetland*). Sandbar willow has declined, while hackberry has increased (Technical Report E.3.3-3). Further decline in the remaining sandbar willow populations is unlikely because this species occurs above the river scour zone and is not directly affected by HCC operations (Technical Report E.3.3-3). Therefore, the Applicant concludes that species depending on riparian shoreline vegetation for their life requirements would benefit marginally more from proposed operations than from full pool run-of-river operations.

Amphibians—The inland tailed frog is found in cold, fast-flowing permanent streams in forested areas. The inland tailed frog was observed in five tributaries to the Snake River and is likely to occur more commonly at higher elevations (Technical Report E.3.2-36). Because inland tailed frogs occur in small tributaries rather than in the Snake River, HCC operations would not impact this species.

Below Hells Canyon Dam, backwater ponds along the Snake River provide important breeding sites for amphibians, including western toads (Technical Report E.3.2-36). The presence of western toad tadpoles in backwater ponds surveyed below Hells Canyon Dam demonstrates that western toads breed effectively in relatively permanent backwater ponds. According to photographs, the size and shape of the backwater ponds were fairly similar between 1955 and 1964, but vegetation had encroached at some sites over the period of time that the photographs were taken, while other sites had eroded (Technical Report E.3.2-36). High spring flows typically fill backwater ponds below Hells Canyon Dam. The HCC does not regulate spring floods (Technical Report E.1-4). Therefore, proposed operations for the HCC would not affect the availability of breeding ponds or the western toad's ability to breed in the reach downstream of Hells Canyon Dam. Also, the western toad was found throughout the downstream reach and was considered common (Technical Report E.3.2-36). Therefore, the Applicant identifies no impacts to the western toad for either the proposed or full pool run-of-river operations.

Bats—Within the Columbia River basin, the Snake River corridor in Hells Canyon and its surrounding terrain may be among the most pristine bat habitats available (Technical Report E.3.2-27). Operations of the HCC do not impact bat species present in the Hells Canyon

Study Area, including the Townsend's western big-eared bat, spotted bat, fringed myotis, and western pipistrelle.

Forest Carnivores—Fishers potentially occur adjacent to Hells Canyon in the Wallowa Mountains of Oregon and the Seven Devils Mountains of Idaho (Spahr et al. 1991, Marshall et al. 1996, Technical Report E.3.2-38). No studies of fisher habitat have been conducted in Oregon (Marshall et al. 1996) or Idaho in the Hells Canyon Study Area. Fishers prefer forests dominated by conifers with extensive and continuous canopies (70 to 80%). Because preferred habitat of the fisher occurs at higher elevations, HCC operations would not impact this species.

Wolverine sightings have been reported for Wallowa and Baker counties in Oregon and Adams and Idaho counties in Idaho (Schommer 1994, Technical Reports E.3.2-28 and E.3.2-29). Big game winter range is important wolverine habitat during winter (Schommer 1994). The wolverine has been sighted in Hells Canyon (for example, at Eagle Bar; see Technical Report E.3.2-38), but probably occurs very rarely. Wolverines may also cross the Snake River downstream of the Hells Canyon Dam when traveling between suitable habitats in the Seven Devils and Wallowa mountains (Technical Report E.3.2-28). Wolverines traveling downstream of Hells Canyon Dam could seasonally encounter river flows potentially elevated by operation of the HCC. The effects of operationally regulated flows on wolverine movement are unknown. However, the wolverine ranges widely in northern latitudes across large areas that are intersected by large lakes and rivers (for example, Alaska and Canada) (Technical Report E.3.2-28). Therefore, the Applicant concludes that the wolverine is adapted to navigating large water bodies and that the Snake River is unlikely to affect wolverine movements within the range of the HCC's operational flows. The Applicant expects that the wolverine would not be impacted by either proposed or full pool run-of-river operations (Technical Report E.3.2-45).

Insects—The Johnson's hairstreak, silver-bordered fritillary, and Yuma skipper have not been reported in Hells Canyon (Frank Merickel, Idaho State University, personal communication). None of the potentially special status butterfly species were detected in a butterfly survey of the Cecil D. Andrus Wildlife Management Area (Stephens and Ferris 1999). Therefore, the Applicant believes that HCC operations would not affect the Johnson's hairstreak, silver-bordered fritillary, or Yuma skipper.

Historic populations of the Columbia River tiger beetle were reported to be locally abundant on sandbars of the Columbia and Snake rivers from The Dalles, Oregon, eastward to just west of Lewiston, Idaho (Hatch 1938). More recently, the Columbia River tiger beetle was found along the lower Salmon River between Slate and Eagle creeks (Shook 1981), but the species was not reported along the Snake River. Because the Columbia River tiger beetle does not occur in the Hells Canyon Study Area, it would not be affected by HCC operations.

E.3.2.4.2.2. Recreation

Integrating data collected in numerous Hells Canyon relicensing studies, the Applicant comprehensively studied the interaction of human activities and natural resources in Hells Canyon, including downstream of Hells Canyon Dam (see section 4.1.1.4. of Technical Report E.3.2-46 for details). Although the Applicant identified interactions between wildlife and human activities downstream of Hells Canyon Dam, these potential impacts are not within the Applicant's jurisdiction or responsibilities associated with the HCC. Therefore, there are no identified recreation impacts on wildlife associated with the Applicant's activities.

E.3.2.4.3. Maintenance of Transmission Lines and Service Roads

The HCC includes one transmission line, the Pine Creek–Hells Canyon 69-kV line (Line 945). This line has 22 mi (35.6 km) of rights-of-way (ROW) and less than 1 mi of associated service roads. These ROW are 50 ft (15 m) wide and extend along the Idaho side of the Hells Canyon Reservoir. Approximately 20.5 mi (93 %) of the line is on public lands. The Applicant conducts operation and maintenance (O&M) activities (for example, line patrolling, vegetation clearing, structure repair, and road maintenance) that might disturb wildlife and degrade habitat. In addition, transmission lines and structures potentially displace and kill wildlife. Therefore, state and federal agencies and nongovernmental organizations expressed concern that O&M activities might impact highly valued wildlife resources.

O&M activities on the Pine Creek–Hells Canyon line (Line 945) can occur year-round. Typically, there is a ground patrol of the line in the fall and an air patrol once every three years, and required maintenance is done as needed. Once every ten years the wood poles are inspected and replaced as required. Once every five years vegetation management occurs on a limited basis because of the lack of tall shrubs or trees in the ROW. In 1998, when the line was last cleared, about 240 m of the ROW were affected by vegetation removal, over eight pole spans, where selected ponderosa pine and elm trees were trimmed. The line has about eight short spur service roads (30–130 m). Grading or vegetation removal along these spurs might be necessary for equipment to access the poles during replacement or other servicing.

The Applicant assessed impacts to wildlife from the HCC and other Applicant transmission lines, service roads, and O&M activities (Technical Report E.3.2-37). Potential impacts near the Pine Creek–Hells Canyon line (Line 945) could occur for three big game species, one threatened species, and nine special status species (section E.3.2.1.5.2.).

E.3.2.4.3.1. Big Game

The Pine Creek–Hells Canyon line (Line 945) intersects big game winter range (Technical Report E.3.2-37). A common concern for big game is that transmission lines and their associated O&M activities may degrade big game habitat and disturb big game populations (Thompson 1977). O&M activities, by disturbing ground during vegetation, road, and structure maintenance, potentially degrade habitat by facilitating noxious weed establishment. However, little ground is disturbed during the infrequent road and structure maintenance for the Pine Creek–Hells Canyon line (Line 945). The majority of the line (93%) is alongside a paved, well-used road. Most of the Applicant's vegetation management consists of trimming overstory trees over a very small (approximately 240 m) portion of the line. Individual habitat impacts are small, and localized.

The Pine Creek-Hells Canyon line (Line 945) and its O&M activities may also directly disturb big game (Rost and Bailey 1979, Unsworth et al. 1998, Rowland et al. 2000). However, big game species habituate well to transmission structures and conductor noises (Goodwin 1975, Thompson 1977). Typically, annual O&M activities last less than half a day at a location, and activities scheduled at 5- to 10-year intervals last only one day in a small area (Technical Report E.3.2-37). Scheduled O&M activities probably only temporarily and locally displace big game.

E.3.2.4.3.2. Threatened, Endangered, Candidate, and Special Status Species

Bald Eagle—A federally protected species, the bald eagle is classified as threatened under the Endangered Species Act (Technical Report E.3.2-37). Bald eagles are most numerous along the Hells Canyon Reservoir during winter (Technical Reports E.3.2-16 and E.3.2-17). In addition to wintering use, a bald eagle nest was discovered along Hells Canyon Reservoir in 1998 and another one was established in 2003. At least one of the nesting areas is also used as a winter roost, and both are probably occupied year-round. Both nests are within 135 m of the paved road and the Pine Creek–Hells Canyon line (Line 945). Although responses to disturbance vary, bald eagles can be prone to disturbance during roosting and nesting (Harmata and Oakleaf 1992, Anthony et al. 1995). The Applicant evaluated potential disturbances to bald eagles from O&M activities along the Pine Creek–Hells Canyon line (Line 945) as well as other Applicant transmission lines (Technical Report E.3.2-37). Because roosts are used from late afternoon until early morning, O&M activities are unlikely to disturb roosting bald eagles, except late in the afternoon or before dawn. Despite its nearness to a well-used road, dispersed recreation sites, and an infrequently used landing strip, the 1998 territory produced fledglings from 1998–2002.

Northern Goshawk—The northern goshawk is considered a special status species by state and federal resource agencies. There are three records within 1 km of the Pine Creek–Hells Canyon line (Line 945) for occurrences between fall and spring. There are no large stands of coniferous forest near the line, so the area is unsuitable for nesting. It may provide wintering or migration habitat. O&M activities associated with the line are not likely to significantly disturb goshawks. If a goshawk nest is found near the line, the Applicant recommends developing a management program to avoid O&M activities, except for patrols, within 0.4 mi (700 m) of an occupied goshawk nest (Squires and Reynolds 1997) from April through July (Richardson and Miller 1997) (Technical Reports E.3.2-37 and E.3.2-45).

Lewis' Woodpecker—The Lewis' woodpecker utilizes ponderosa pine, cottonwood, and other trees species near the ROW of the Pine Creek–Hells Canyon line (Line 945) for nesting. Nests are created in dead or decaying trees. This species is relatively tolerant of human activities (Tobalske 1997). ROW vegetation trimming would affect only a small portion of potential future nest trees. In addition, trees are typically topped, not removed, and can continue to provide foraging habitat.

Riparian Area Dwellers—The western toad, mountain quail, and five species of passerines that dwell in riparian areas (the willow flycatcher; plumbeus vireo; and Wilson's, MacGillivray's, and yellow warblers) are riparian dependant and could, therefore, potentially be affected by O&M activities in a few locations along the ROW of the Pine Creek–Hells Canyon line (Line 945). The western toad would be affected by any degradation in stream water quality due to O&M activities, and the birds would be affected by loss of habitat removed during vegetation clearing. However, for the Pine Creek–Hells Canyon line (Line 945), removal or trimming of riparian vegetation occurs in very small, isolated patches and, therefore, affects a small fraction of available habitat.

E.3.2.4.3.3. Electrocution and Collision

Transmission lines can cause bird mortality by electrocuting perching birds, many of which are birds-of-prey, and by being objects with which birds collide (APLIC 1996). During relicensing consultation, state and federal agencies and nongovernmental organizations expressed concern that transmission lines impact birds, including threatened, endangered, candidate, and special status species, through electrocution and collision. The Applicant therefore conducted two studies (Technical Reports E.3.2-19 and E.3.2-20) identifying potential collision and electrocution risks and impacts to bird species along the Pine Creek–Hells Canyon line (Line 945) and other Applicant transmission lines.

Bird Electrocution—The Pine Creek–Hells Canyon line (Line 945) presents a potential risk for electrocuting perching raptors, especially bald eagles (Technical Report E.3.2-19). Other special status bird species (for example, passerines) that occur in the vicinity are much smaller than bald eagles and, therefore, not at risk, or are unlikely to perch on the transmission-line structures (APLIC 1996). Locations of raptor nests and bald eagle winter roosts indicate that up to 26% of the line is a risk to perching raptors (Technical Report E.3.2-19). However, the Applicant considered the line to be of low risk because of 1) limited use of structures by perching raptors, 2) abundant alternate perching sites, and 3) few reported electrocutions from this line (Technical Report E.3.2-19). Therefore, the Applicant concludes that electrocution risk for bald eagles and other raptors is low on the Pine Creek–Hells Canyon line (Line 945). However, bald eagle nesting in the canyon has increased in recent years, from 0 to 3 nests, and may continue to increase in the future. As a precautionary measure for protecting raptors, pole modifications were made in 1999 to the line near one of the nests (Technical Report E.3.2-19).

Bird–Transmission Line Collisions—The Pine Creek–Hells Canyon line (Line 945) was evaluated for risks of bird collision (Technical Report E.3.2-20). It was determined that the line does not pose a risk to birds due to its parallel alignment with the Hells Canyon Reservoir. An insignificant risk may occur where the line crosses the reservoir from the substation. This crossing is not located within a major flyway. No collisions have been reported.

E.3.2.5. Materials and Information on Measures and Facilities

All materials and information regarding existing measures and facilities to be continued by the Applicant are included in section E.3.2.3.1. All materials and information regarding measures and facilities proposed by the Applicant are included in section E.3.2.3.2.

E.3.2.6. Consultation

For a summary of consultation efforts to date for the HCC, see the Consultation Appendix.

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Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Amphibians								
Tiger salamander *Ambystoma tigrinum*							S4	SU
Columbia spotted frog[f] *Rana luteiventris*	G5/S2S3	SC	S	S	S	CE	S2?	SU
Inland tailed frog[f] *Ascaphus montanus*						W	S3	SV
Woodhouse's toad *Bufo woodhousii*	G5/S3					W	S2	SP
Northern leopard frog[f] *Rana pipiens*	G4/S3	SC			S	SC	S2?	SC
Western toad[f] *Bufo boreas*	G4/S4	SC			S	W/SC	S4	SV
Reptiles								
Western ground snake *Sonora semiannulata*	G5/S3	SC			S	W	S2	SP
Ringneck snake *Diadophis punctatus*	G5/S1?	SC			S	W		
Mojave black-collared lizard *Crotaphytus bicinctores*	G5/S2	SC			S	W	S2	SV
Longnose snake *Rhinocheilus lecontei*	G5/S3	SC			S	W		

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Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Desert horned lizard *Phrynosoma platyrhinos*							S3	SV
Northern sagebrush lizard *Sceloporus graciosus*						W	S5?	SV
Birds								
Common loon *Gavia immer*	G5/S1	SC	S	S		W		
Horned grebe *Podiceps auritus*	G5/S1?	P					S2	SP
Trumpeter swan[f] *Cygnus buccinator*	G4/S1B	SC	S		S	SC		
Harlequin duck[f] *Histrionicus histrionicus*	G5/S1	SC	S	S	S	W	S2	SU
American white pelican *Pelecanus erythrorhynchos*	G3/S1	SC		S			S1	SV
Franklin's gull *Larus pipixcan*	G4/S2	P					S1	SP
Black tern[f] *Chlidonias niger*	G4/S2	SC					S3	
Great egret *Casmerodius albus*	G5/S1	SC					S3	
Snowy egret *Egretta thula*	G5/S2	P					S2	SV

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
White-faced ibis *Plegadis chihi*	G5/S2	P				SC	S3	
Greater sandhill crane *Grus canadensis tabida*				S			S3	SV
Upland sandpiper *Bartramia longicauda*	G5/S1	SC		S	S	W		
Long-billed curlew *Numenius americanus*	G5/S3	P		S	S	SC		
Greater sage-grouse[f] *Centrocercus urophasianus*				S	S	SC	S3	SV
Columbian sharp-tailed grouse[f] *Tympanuchus phasianellus*	G4/S3	GSC	S		S	SC	S1	
Spruce grouse *Dendragapus canadensis*							S3	SU
Mountain quail[f] *Oreortyx pictus*	G5/S2	SC	S		S	SC	S4?	SU
Northern harrier *Circus cyaneus*					S			
Northern goshawk *Accipiter gentilis*	G5/S4	SC	S		S	W	S3	SC
Ferruginous hawk *Buteo regalis*	G4/S3	P		S	S	W	S3	SC

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Swainson's hawk *Buteo swainsoni*	G4/S4				S		S3	SV
Merlin *Falco columbarius*	G4/S1	P			S	W	S1	
Prairie falcon *Falco mexicanus*					S			
Peregrine falcon[f] *Falco peregrinus*	G4/S1	E	S	S		DM	S1	LE
Bald eagle[f] *Haliaeetus leucocephalus*	G3/S3	E	T	T		LT	S3	LT
Boreal owl *Aegolius funereus*	G5/S2	SC	S		S	W	S3?	SU
Burrowing owl *Athene cunicularia*	G4/S3	P			S	SC	S2?	SC
Northern pygmy owl *Glaucidium gnoma*	G5/S4	SC			W	W	S4	SC
Flammulated owl *Otus flammeolus*	G4/S3	SC	S		S	W	S4B	SC
Great gray owl *Strix nebulosa*	G5/S2	SC	S		S	W	S3	SV
Yellow-billed cuckoo[f] *Coccyzus americanus*	G5/S1	SC			S	CE	S1	SC
Pileated woodpecker *Dryocopus pileatus*							S4?	SV

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Lewis' woodpecker *Melanerpes lewis*					S		S3	SC
White-headed woodpecker *Picoides albolarvatus*	G4/S2	SC	S		S	W	S3	SC
Black-backed woodpecker *Picoides arcticus*	G5/S3	SC			S	W	S3	SC
Three-toed woodpecker *Picoides tridactylus*	G5/S3	SC	S		S	W	S3	SC
Red-naped sapsucker *Sphyrapicus nuchalis*					S			
Williamson's sapsucker *Sphyrapicus thyroideus*					S		S4	SU
Bank swallow *Riparia riparia*							S4	SU
Pygmy nuthatch *Sitta pygmaea*	G5/S2S3	SC			S	W	S4?	SC
Loggerhead shrike[f] *Lanius ludovicianus*	G4/S3	SC			S	SC	S4	SV
Vaux's swift *Chaetura vauxi*					S			
Olive-sided flycatcher *Contopus cooperi*					S	SC	S4	SV

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Dusky flycatcher *Empidonax oberholseri*					S			
Cordilleran flycatcher *Empidonax occidentalis*					S			
Hammond's flycatcher *Empidonax hammondii*					S			
Willow flycatcher[f] *Empidonax traillii*					S		SU	SU
Townsend's warbler[f] *Dendroica townsendi*					S			
Yellow warbler[f] *Dendroica petechia*					S			
MacGillivray's warbler[f] *Oporornis tolmiei*					S			
Wilson's warbler[f] *Wilsonia pusilla*					S			
Plumbeus vireo[f] *Vireo plumbeus*					S			
Swainson's thrush *Catharus ustulatus*					S			
Veery *Catharus fuscescens*					S			

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Calliope hummingbird *Stellula calliope*					S			
Rufous hummingbird *Selasphorus rufus*					S			
Yellow-headed blackbird[f] *Xanthocephalus xanthocephalus*					S			
Grasshopper sparrow *Ammodramus savannarum*					S		S2?	SV/SP
Brewer's sparrow[f] *Spizella breweri*					S			
Sage sparrow[f] *Amphispiza belli*					S		S4	SC
Black-throated sparrow *Amphispiza bilineata*							S2?	SP
Green-tailed towhee *Pipilo chlorurus*					S			
Black rosy-finch *Leucosticte atrata*	G4/S?			S	S		S4	SP
Bobolink *Dolichonyx oryzivorus*					S		S2	SV
Mammals								
Preble's shrew *Sorex preblei*				S	S		S3	

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Coast mole *Scapanus orarius*	G5/S1?	SC				W		
Pallid bat *Antrozous pallidus*	G5/S1?						S3	SV
Townsend's western big-eared bat[f] *Corynorhinus townsendii townsendii*	G4/S2?	SC	S	S		SC	S2?	SC
Spotted bat[f] *Euderma maculatum*	G4/S4	SC	S		S	W	S1	
Yuma myotis *Myotis yumanensis*	G5/S3?				S	W	S3	
Long-eared myotis *Myotis evotis*	G5/S3?				S	W	S3	SU
Fringed myotis[f] *Myotis thysanodes*	G5/S1?	SC			S	W		
Long-legged myotis *Myotis volans*	G5/S3?				S	W	S3	SU
California myotis *Myotis californicus*	G5/S1?	SC				W		
Western small-footed myotis *Myotis ciliolabrum*	G5/S4?				S	W	S3	SU
Western pipistrelle[f] *Pipistrellus hesperus*	G5/S1?	SC				W		

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Northern Idaho ground squirrel[f] *Spermophilus brunneus brunneus*	G2/S2	SC	T		S	LT		
Southern Idaho ground squirrel[f] *Spermophilus brunneus endemicus*	G2/S2	SC	S		S	CE		
Northern flying squirrel *Glaucomys sabrinus*	G3/S3				W			
Pygmy rabbit *Brachylagus idahoensis*	G4/S3	GSC		S	S	W	S2?	SV
White-tailed jackrabbit *Lepus townsendii*							S4?	SU
Gray wolf[f] *Canis lupus*	G4/S1	E	E	E		LE/XN	SH	LE
American marten *Martes americana*							S3	SV
Fisher[f] *Martes pennanti*	G5/S1	SC	S		S	W	S2	SC
Kit fox *Vulpes macrotis*	G4/S1	SC			S	W	S1	LT
Northern river otter[f] *Lutra canadensis*	G5/S4				W			
Wolverine[f] *Gulo gulo*	G4/S2	SC	S	S	S	W	S2	LT

Table E.3.2-1 State and federal listed, proposed, candidate, and sensitive species known, or suspected to occur, in the Hells Canyon Study Area.

Taxon	IDCDC[a] Rank	IDFG[b] Status	USFS[c] Region4	USFS[c] Region6	USBLM[c] Status	USFWS[d] Status	ORNHP[a] Rank	ODFW[e] Status
Canada lynx[f] *Lynx canadensis*	G4/S1	GSC	T	T	S	LT	S1	
California bighorn sheep[f] *Ovis canadensis californiana*	G4/S3	G		S	S	SC	S2?	
Invertebrates								
Columbia River tiger beetle[f] *Cicindela columbica*	G2/SH						SH	
Silver-bordered fritillary[f] *Boloria selene*	G5/S1						S2	
Johnson's hairstreak[f] *Mitoura johnsoni*	G2G3/						S2?	
Yuma skipper[f] *Ochlodes yuma*	G5/S1						S1?	

a. Natural Heritage Network ranks: G = global rank indicator, T = trinomial rank indicator, and S = state rank indicator; 1 = critically imperiled, 2 = imperiled because of rarity, 3 = very rare and local throughout its range or found locally, 4 = apparently secure, 5 = demonstrably secure, and H = historical occurrence

b. IDFG ranks: T = threatened, E = endangered, SC = species of special concern, P = protected nongame, G = game species

c. USFS and BLM ranks: S = sensitive

d. USFWS (federal) status: LE = listed endangered, LT = listed threatened, XN = experimental nonessential population, CE = candidate endangered, CT = candidate threatened; Snake River Field Office: SC = species of concern, W = watch species, and DM = delisted monitoring

e. ODFW status (all sensitive): LT = threatened, LE = endangered, SC = critical, SV = vulnerable, SP = peripheral (or naturally rare), and SU = undetermined status

f. Threatened and endangered species and species of special concern to be evaluated for impacts related to the Hells Canyon Complex and associated transmission-line corridors as recommended by the TRWG

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Created: April 14, 2003

Plotting Scale: 90000
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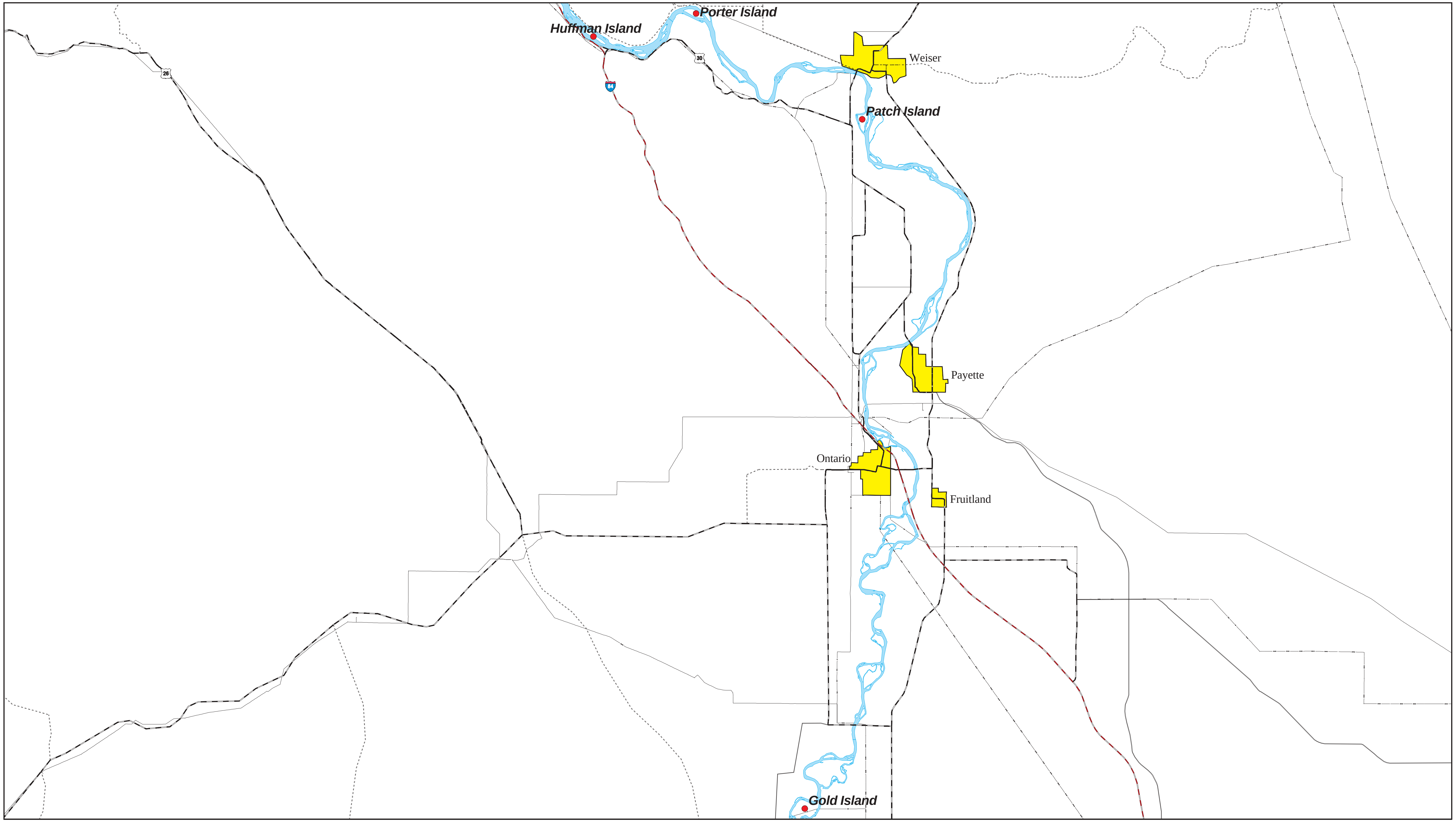
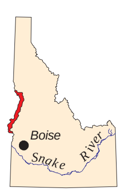
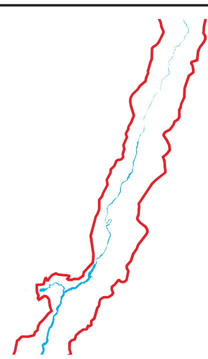




Vicinity Map

IDAHO POWER
Geographic Information Services

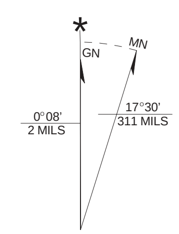


Base Features Legend

- Railroad
- Transmission Line

Thematic Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Islands



UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.3.2 - 1

Agency-Owned Islands Proposed for PM&E Measures

1.5 .75 0 1.5 3 4.5 MILES

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E.3.3. Botanical Resources

E.3.3.1. Description of Botanical Resources

The Applicant conducted studies of botanical resources considered to be of greatest concern to resource managers and the public. These studies were based on discussions of the Terrestrial Resources Work Group that started in 1996 and continued into 2002. Early discussions resulted in a set of final study plans presented to the Terrestrial Resources Work Group in February 2000. Studies were categorized into two groups: descriptive studies and impact studies. The descriptive studies provide information on the current conditions of resources, while the impact studies address the effects of operation and maintenance (O&M) of the Hells Canyon Complex (HCC),[1] including the associated transmission-line system, on botanical resources.

E.3.3.1.1. Botanical Resources of Upstream, Reservoir, and Downstream Reaches

E.3.3.1.1.1. General Vegetation Resources

Technical Report E.3.3-1 provides the primary description of vegetation resources along the Snake River corridor through Hells Canyon. In addition, the results of inventories for noxious weeds and rare plant resources (Technical Report E.3.3-2) (see section E.3.3.1.1.2. and section E.3.3.1.1.3., respectively) and sampling of Snake River riparian vegetation resources (Technical Report E.3.3-3) provide insight on the distribution and abundance of vegetation resources through Hells Canyon.

The Applicant assessed vegetation resources of the study area at two scales (Technical Report E.3.3-1) along 163 river miles of the Snake River and associated reservoirs—from Weiser, Idaho (at river mile [RM] 351.2), downriver to the confluence of the Snake and Salmon rivers (RM 188.2) south of Lewiston, Idaho—and for 9.6 miles (mi) along the Powder River arm of Brownlee Reservoir. For the first scale, the Applicant developed a map of cover types for general vegetation, natural features, and land uses. All lands upstream of Hells Canyon Dam within 0.5 mi of the shorelines and downstream of Hells Canyon Dam within 0.25 mi of shorelines were included. Efforts to map vegetation below Hells Canyon Dam were restricted because of logistical

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

constraints arising from the area's remoteness and steep topography. For the second scale, the Applicant conducted field inventories to sample sites within vegetation cover types that had been mapped. The structural and botanical characteristics, as well as soil and other site characteristics, were described for each vegetation cover type. In addition, the different plant assemblages, or communities, occurring in each type were described. Descriptions were based on actual, current vegetation, rather than theoretical climax (potential natural) vegetation.

For analysis and discussion purposes, the study area for botanical resources was divided into five reaches: 1) the upstream Weiser reach, 2) Brownlee Reservoir, 3) Oxbow Reservoir, 4) Hells Canyon Reservoir, and 5) the reach below Hells Canyon Dam, often called the downstream reach. Reach boundaries were based on distinct geomorphic features, river characteristics, and legal project boundaries (section 2.1. and Table 1 in Technical Report E.3.3-1).

Approximately 48,354 hectares (ha) of habitat in the study area were classified into 26 vegetation, natural-feature, and land use cover types (Table 4 and Figure 3 in Technical Report E.3.3-1). These cover types included 9 upland vegetation types, 4 riparian vegetation types, 4 natural-feature types, and 9 land use types. Table 6 in Technical Report E.3.3-1 identifies cover types and their abundance in each study reach. A summary of the most abundant cover types in each of the 4 major cover classes (land use, upland vegetation, riparian vegetation, and natural feature) is given here in descending order of abundance (percentage of each reach) for each reach:

Upstream Weiser reach (12 mi[2] of river)

Land use: *Agriculture* (45.5%)
Upland vegetation: *Grassland* (18.2%)
Natural feature: *Lotic* (moving water) (12.6%)
Riparian vegetation: *Scrub-Shrub Wetland* (2.0%)

2. For botanical studies, lengths of river reaches were based on river miles printed on U.S. Geological Survey topographical maps. Lengths for the same reaches that are listed in Exhibit E.1. are based on corrected river miles, so reach lengths in that exhibit are slightly different from those shown here.

Brownlee Reservoir (55.5 mi)

Upland vegetation: *Grassland* (33.6%)
Natural feature: *Lotic* (21.9%)
Riparian vegetation: *Shore & Bottomland Wetland* (2.8%)
Land use: *Agriculture* (2.2%)

Oxbow Reservoir (14.2 mi)

Upland vegetation: *Grassland* (34.4%)
Natural feature: *Lotic* (13.4%)
Riparian vegetation: *Scrub-Shrub Wetland* (3.3%)
Land use: *Industrial* (1.1%).

Hells Canyon Reservoir (22.0 mi)

Upland vegetation: *Grassland* (29.0%)
Natural feature: *Cliff/Talus Slope* (15.0%)
Riparian vegetation: *Scrub-Shrub Wetland* (1.5%)
Land use: *Parks/Recreation* (0.4%)

Reach downstream of Hells Canyon Dam (59.3 mi)

Upland vegetation: *Grassland* (50.4%)
Natural feature: *Cliff/Talus Slope* (14.3%)
Riparian vegetation: *Scrub-Shrub Wetland* (2.1%)
Land use: *Grazing Land Pasture* (0.4%)

Because relatively little was known in the study area about the riparian resources, compared with upland resources, the Applicant focused more sampling effort on riparian habitats. More than twice the number of transects were placed in riparian vegetation than were placed in upland vegetation. Botanists sampled a total of 1,245 vegetation transects—386 upland and 859 riparian transects—using systematic-random protocols in the field. Because a systematic sampling design was used, the Applicant could make inferences about the relative abundance of cover types, plant assemblages, and species throughout the study reach.

To sample different components of the system, the Applicant used two approaches to sample upland vegetation. For the first sampling effort (river corridor upland sampling), botanists investigated upland habitat occurring in close proximity to the Snake River. During this effort, approximately 20% of the upland habitats within 0.5 mi of the shoreline were sampled upstream of Hells Canyon Dam, and approximately 10% of the upland habitats within 0.25 mi of the shoreline were sampled downstream of Hells Canyon Dam. Efforts to sample upland vegetation below Hells Canyon Dam were restricted because of logistical constraints arising from the area's steep topography and remoteness. For the second effort (general upland sampling), data were obtained from a broader area within the canyon. This sampling focused on large homogenous stands of upland habitat throughout the study area within about 2 mi of the Snake River.

The Applicant also sampled riparian vegetation resources by using two approaches. For the river corridor riparian sampling, botanists investigated general riparian habitat that was directly influenced by the HCC, specifically, those habitats occurring along the reservoir and river shorelines associated with the water-level fluctuation zone. A systematic random-sampling approach was used to sample approximately 10% of the shoreline habitat throughout the study area. For general riparian sampling, data were obtained from a broader area within the canyon. Sampling focused on large stands of riparian habitat that occurred in the study area, often at or above the confluence of smaller tributary drainages, within about 2 mi of the Snake River.

Based on plant cover of four physiognomic groups (trees, shrubs, forbs, and grasses), vegetation transects were classified into 9 upland vegetation cover types and 4 riparian vegetation cover types (Table 3 in and Appendix 1 to Technical Report E.3.3-1). Ordination analyses were used to classify the transects within each cover type according to 122 plant assemblages (50 upland and 72 riparian) (Table 9 in and Appendices 2 and 3 to Technical Report E.3.3-1).

Most of the plant assemblages identified in this study had not been previously described, especially those assemblages occurring in riparian habitats. This lack of description is probably explained by the limited sampling efforts of previous investigations in both riparian and upland habitats of the canyon and by a previous focus on particular species of interest or on mid- to late seral native vegetation. A brief summary of the plant assemblages encountered in the various vegetation cover types is provided at the end of this section.

Distinct distribution patterns are evident for both cover types and plant assemblages throughout the study area. The distributions of the most common upland and riparian vegetation cover types are illustrated in Figures 5 and 6 in Technical Report E.3.3-1. Distributions of plant assemblages are presented with each assemblage description in Appendices 2 and 3 to Technical Report E.3.3-1. Unique site factors, such as hydrology, geomorphology, and climate, as well as influences from human activity (for example, disturbance from grazing, homesteading, mining, and farming), create environmental gradients that probably explain these distribution patterns across the landscape (see section 4.4. in Technical Report E.3.3-1).

The Applicant found that, in the study area, several riparian plant assemblages were unique to the tributary drainages of the Snake River rather than to the canyon bottom. Assemblages found almost exclusively in tributaries of the Snake River included those dominated by *Betula occidentalis* (water birch), *Alnus rhombifolia* (white alder), *Philadelphus lewisii* (syringa), *Populus trichocarpa* (black cottonwood), *Salix alba* (white willow), and *Typha latifolia* (broadleaf cattail). Common in riparian zones of both the tributaries and the Snake River were sites dominated by *Prunus virginiana* (chokecherry), *Celtis reticulata* (netleaf hackberry), *Scirpus maritimus* (bulrush), and *Dipsacus sylvestris* (teasel). Table 9 in Technical Report E.3.3-1 shows the number of transects placed in each type of plant assemblage that was sampled in tributary drainages and along shorelines of the Snake River (and associated reservoirs). Generally, all other riparian plant assemblages described in Appendix 3 to Technical Report E.3.3-1 are characteristic of the Snake River riparian zone in the study area.

Many plant assemblages in the canyon are dominated by introduced weeds, including many species designated as noxious weeds by Idaho and Oregon state agencies. In upland habitats, common dominant weedy species include *Bromus tectorum* (cheatgrass), *Taeniatherum caput-medusae* (medusahead wildrye), and *Poa bulbosa* (bulbous bluegrass). In some of the most common plant assemblages in many cover types within riparian habitats, *Amorpha fruticosa* (false indigo), *Tamarix parviflora* (tamarisk), *Lepidium latifolium* (broad-leaved pepperweed), *Lythrum salicaria* (purple loosestrife), and *Conium maculatum* (poison hemlock) are common dominant or codominant weeds.

Most of these weedy riparian assemblages occur in the upstream Weiser reach and along the headwaters of the Brownlee Reservoir reach. The reach below Hells Canyon Dam had relatively few weedy riparian assemblages or riparian noxious weed populations (section E.3.3.1.1.2.). Based on the distribution, abundance, and life history characteristics of many riparian weedy species in the study area, it appears that the large fluctuations in water levels on Brownlee Reservoir from historic operations may have helped restrict downstream infestation of several weedy riparian species through riverine processes (section 4.2.1.1.2. in Technical Report E.3.2-45, section 4.4. in Technical Report E.3.3-1, Chapter 4 of Technical Report E.3.3-3).

The following sections briefly discuss the cover types associated with upland vegetation and riparian vegetation, identifying some characteristics of the cover types and corresponding plant assemblages and indicating where these resources occur throughout the study area.

E.3.3.1.1.1.1. Upland Vegetation

Forested Upland

Twenty-four transects were classified into the *Forested Upland* cover type. Although uncommon, this cover type was encountered in all reaches except the Weiser reach, with most occurrences located along Hells Canyon Reservoir (Tables 7 and 8 in Technical Report E.3.3-1). Six plant assemblages were found, mostly dominated by coniferous trees. Occasional fingers of *Pseudotsuga menziesii* (Douglas-fir) and *Abies grandis* (grand fir) extended down to the river's edge in the central and lower reaches of the canyon. Stands of *Pinus ponderosa* (ponderosa pine) were also found along the river in these reaches. *Symphoricarpos albus* (common snowberry) was a common understory species in the coniferous assemblages. Deciduous trees that dominated other assemblages included *Robinia pseudoacacia* (black locust), *Populus tremuloides* (quaking aspen), and *Morus alba* (white mulberry). Most *Forested Upland* plant assemblages were scattered throughout the central reaches of the study area: the lower portion of the Brownlee Reservoir reach, the Oxbow Reservoir and Hells Canyon Reservoir reaches, and the upper portions of the reach below Hells Canyon Dam. A few transects in several of the plant assemblages in this cover type were sampled in tributary drainages to the Snake River; however, none of these *Forested Upland* plant assemblages were unique to tributary drainage systems.

Several introduced and noxious weeds were found in the *Forested Upland* plant assemblages. The most common listed noxious weeds included *Taeniatherum caput-medusae* and *Cynoglossum officinale* (common houndstongue).

Tree Savanna

Ten transects were classified into the *Tree Savanna* cover type. This cover type is uncommon and occurred in the three reaches below Brownlee Reservoir, with the highest relative frequency occurring on Hells Canyon Reservoir (Tables 7 and 8 in Technical Report E.3.3-1). Four plant assemblages were found; *Pinus ponderosa* dominated one of the assemblages, while *Celtis reticulata* and *Amelanchier alnifolia* (serviceberry), which grew tall enough (> 5 meters [m]) to be considered trees, dominated the others. Like the *Forested Upland* plant assemblages, the *Tree Savanna* plant assemblages were encountered only in the central reaches of the study area, except for the *Celtis reticulata* assemblage, which was encountered only in the reach below Hells Canyon Dam. Most of the transects dominated by *Amelanchier alnifolia* were located only in tributary drainages to the Snake River. One noxious weed (*Cynoglossum officinale*) and one rare plant (*Carex backii* [Back's sedge]) were found in the *Tree Savanna* plant assemblages.

Shrubland

Eighty-six transects were classified into the *Shrubland* cover type. This cover type was encountered in all reaches of the study area, with the highest relative frequency occurring in the Hells Canyon Reservoir reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified eight plant assemblages within the *Shrubland* cover type. The most commonly encountered assemblages were dominated by *Celtis reticulata*, *Artemisia tridentata* (big sagebrush), or *Purshia tridentata* (antelope bitterbrush). *Celtis*-dominated sites were more abundant in the downstream study reaches, *Purshia*-dominated sites were encountered most often along Oxbow and Hells Canyon reservoirs, and *Artemisia*-dominated sites were most frequent along Brownlee Reservoir reaches. A few of the transects sampled in the *Celtis reticulata*-dominated assemblage (3 of 24) were located in tributary drainages to the Snake River, but this assemblage is not considered unique to tributary drainages in the study area. However, the majority of *Symphoricarpos albus*-dominated transects (7 of 10) were located in tributaries to the Snake River.

Most *Shrubland* plant assemblages appeared fairly healthy, although the herbaceous layer was typically dominated by introduced grasses, including *Taeniatherum caput-medusae*, which is designated as a noxious weed in Oregon. Other noxious weeds found in these assemblages included *Convolvulus arvensis* (field bindweed), *Cynoglossum officinale*, and *Lepidium latifolia*. The rare plant *Carex backii* was also found in one assemblage.

Shrub Savanna

One hundred ten transects were classified into the *Shrub Savanna* cover type. This cover type was the most frequently encountered of the upland vegetation types. It occurred in all reaches of the study area, but was most frequently encountered in the Brownlee Reservoir reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified eight plant assemblages for the *Shrub Savanna* cover type. The most common assemblages were dominated by *Ericameria nauseosa* (rubber rabbitbrush, formerly *Chrysothamnus nauseosus* [gray rabbitbrush]), *Purshia tridentata*, *Celtis reticulata*, and *Artemisia tridentata*. *Celtis*-dominated sites were more abundant in the lower study reaches, while sites dominated by *Ericameria, Purshia,* and *Artemisia* species were encountered most often in the Oxbow Reservoir and Brownlee Reservoir reaches.

Some *Shrub Savanna* assemblages appeared healthy and were codominated by the native bunchgrasses *Pseudoroegneria spicata* (bluebunch wheatgrass, formerly *Agropyron spicatum*) and *Poa secunda* (Sandberg bluegrass). More often, the assemblages were deteriorated in health, and the herbaceous layer was dominated by introduced annual grasses such as *Bromus tectorum*, *Poa bulbosa*, and *Taeniatherum caput-medusae*. Most noxious weeds occurred in the *Celtis*-dominated assemblage. No rare plants were found in these assemblages.

Desertic Shrubland

Only five transects were classified into the *Desertic Shrubland* cover type. This cover type is very uncommon but was encountered in the Weiser reach and along Brownlee and Hells Canyon reservoirs (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified two plant assemblages dominated by *Purshia tridentata* or *Artemisia tridentata*, and these sampled plant assemblages were encountered only in the Oxbow and Brownlee reservoir reaches. The herbaceous layer of both assemblages was dominated by annual grasses. No noxious weeds or rare plants were found.

Forbland

Forty-eight transects were classified into the *Forbland* cover type. Though encountered throughout the study area, this cover type was most frequent in the Brownlee Reservoir reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified eight plant assemblages for the *Forbland* cover type. The most commonly encountered assemblages were dominated by *Balsamorhiza sagittata* (arrowleaf balsamroot), *Eriogonum compositum* (arrowleaf buckwheat), and *Lomatium grayi* (Gray's biscuitroot). These assemblages consisted mostly of native species and contained few noxious weeds. Several other weedy *Forbland* plant assemblages were also encountered; these assemblages were dominated by species such as *Cardaria draba* (whitetop), *Amaranthus retroflexus* (amaranth), *Centaurea repens* (Russian knapweed), *Melilotus alba* (white sweetclover), and *Tribulus terrestris* (puncturevine), several of which are designated noxious weeds.

A distribution gradient was evident for several assemblages belonging to this cover type. The *Balsamorhiza sagittata*-dominated assemblage was encountered over most of the study area, whereas other assemblages occurred only in the central reaches or in the very upper reach of the study area (Appendix 2 to Technical Report E.3.3-1). No rare plants were found in these assemblages.

Grassland

Eighty transects were classified into the *Grassland* cover type. Though this cover type was encountered throughout the study area, it occurred most frequently in the Brownlee Reservoir reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified eight plant assemblages for the *Grassland* cover type. The plant assemblages included several dominated by native perennials and also several dominated by introduced annual grasses. The two most common assemblages were dominated by *Pseudoroegneria spicata* and/or *Bromus tectorum*. Many of the assemblages in this cover type were distributed throughout the study area, except for the Weiser reach, which had very little grassland habitat. The assemblage dominated by *Taeniatherum caput-medusa* was encountered only in the Oxbow and Brownlee reservoir reaches. Two assemblages dominated by weedy grass species were encountered only near the headwaters of Brownlee Reservoir and in the Powder River arm of Brownlee Reservoir.

Designated noxious weeds occurring in these assemblages included (in decreasing order of abundance) *Taeniatherum caput-medusae*, *Cardaria draba*, *Onopordum acanthium* (Scotch thistle), *Dipsacus sylvestris*, and *Centaurea repens*. No rare plants were found.

Desertic Herbland

Twenty-three transects were classified into the *Desertic Herbland* cover type. This cover type was most often encountered in the Brownlee Reservoir reach, but it occurred occasionally throughout the study area, except above Brownlee Reservoir (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified six plant assemblages for the *Desertic Herbland* cover type. Dominant forbs in these assemblages included *Lomatium grayi*, *Eriogonum compositum*, *Eriogonum strictum* (Blue Mountain buckwheat), and *Alyssum desertorum* (desert madwort). Most assemblages are codominated by *Bromus tectorum* and were encountered primarily in the Brownlee Reservoir reach. No noxious weeds or rare plants were found in these assemblages.

E.3.3.1.1.1.2. Riparian Vegetation

Forested Wetland

Two hundred seven transects were classified into the *Forested Wetland* cover type. This cover type was most frequently encountered in the Weiser reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified 18 plant assemblages for the *Forested Wetland* cover type. Though this type contains a diverse group of plant assemblages, most sites were dominated by *Betula occidentalis*, *Alnus rhombifolia*, *Populus trichocarpa*, *Acer saccharinum* (silver maple), or *Salix amygdaloides* (peachleaf willow) (Table 9 in Technical Report E.3.3-1). *Philadelphus lewisii* is by far the most common understory species and is a codominant member of several assemblages. Several less common assemblages are dominated by introduced species, such as *Ulmus pumila* (Siberian elm), *Salix alba*, *Elaeagnus angustifolia* (Russian olive), *Acer negundo* (box elder), and *Tamarix parviflora*.

Several plant assemblages in the *Forested Wetland* cover type showed distinct distribution gradients across the study area. *Betula occidentalis*- and *Alnus rhombifolia*-dominated assemblages were encountered throughout the central and lower reaches, but occurred nearly exclusively in tributary riparian areas, rather than along shorelines of the Snake River. Likewise, *Populus trichocarpa*-dominated sites were principally encountered only in the central reaches (along Oxbow and Brownlee reservoirs) of the study area and in the riparian zones of tributary drainages (34 of 36 sites) to the Snake River. Most of the assemblages dominated by introduced species were found in the Weiser reach and the headwaters of the Brownlee Reservoir reach.

All assemblages contained at least one designated species of noxious weed. Twelve noxious weed species were found. The most abundant and widespread included (in decreasing order) *Lepidium latifolium*, *Dipsacus sylvestris*, *Conium maculatum*, *Onopordum acanthium*, and *Cirsium arvense* (Canada thistle). The rare plant *Rubus bartonianus* (bartonberry) was found in two assemblages.

Scrub-Shrub Wetland

Two hundred ninety-eight transects were classified into the *Scrub-Shrub Wetland* cover type. This cover type was encountered with the highest relative frequency in the Weiser reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified 26 plant assemblages for the *Scrub-Shrub Wetland* cover type, which had the most diverse group of plant assemblages. The most commonly encountered assemblages were dominated by *Celtis reticulata*, *Amorpha fruticosa*, *Salix exigua* (coyote willow), *Prunus virginiana*, *Toxicodendron rydbergii* (western poison ivy, formerly *T. radicans*), *Salix amygdaloides*, *Philadelphus lewisii*, *Tamarix parviflora*, *Rubus discolor* (Himalayan blackberry), or *Rosa woodsii* (Wood’s rose).

A distinct distribution gradient is evident for many assemblages in this cover type. Generally, most native shrub-dominated assemblages were encountered throughout the study area or in just the central and lower study reaches. Introduced shrub-dominated assemblages were principally found near the headwaters of Brownlee Reservoir and in the Weiser reach. The *Amorpha fruticosa*-dominated assemblage is the most widespread assemblage of introduced species, with sites occurring throughout the Weiser reach and along the Brownlee and Oxbow reservoir reaches. A few assemblages were found principally in tributaries to the Snake River. Most *Prunus virginiana*- and *Philadelphus lewisii*-dominated sites were found in the riparian zones of the tributaries.

All but one assemblage contained at least one designated noxious weed species. Thirteen noxious weed species were found; the most abundant and widespread noxious weeds included (in decreasing order) *Lepidium latifolium*, *Conium maculatum*, *Lythrum salicaria*, *Cirsium arvense*, and *Cardaria draba*. Several rare plants were found: *Rubus bartonianus* (two assemblages), *Cyperus rivularis* (shining flatsedge, one assemblage), and *Carex backii* (one assemblage).

Emergent Herbaceous Wetland

Two hundred ninety-nine transects were classified into the *Emergent Herbaceous Wetland* cover type. By far, this cover type was encountered with the highest relative frequency in the Weiser reach, followed by the Brownlee Reservoir reach (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified 19 plant assemblages for the *Emergent Herbaceous Wetland* cover type. This cover type contains a diverse group of plant assemblages, but most sites are dominated by *Lepidium latifolium*, *Heleochloa alopecuroides* (marsh grass), *Lythrum salicaria*, *Xanthium strumarium* (common cocklebur), *Apocynum cannabinum* (hemp dogbane), *Conium maculatum*, or *Distichlis spicata* (alkali saltgrass). Several of these dominant species are designated as noxious weeds in Idaho and Oregon. Most of these assemblages were found in the Weiser reach and the headwaters of the Brownlee Reservoir reach. Many of the assemblages are not unique to the riverbanks, but occur within the riparian zones of tributary drainages. However, the *Typha latifolia*-dominated assemblage was found only in tributaries to the Snake River (6 of 6 sites).

All but three assemblages contained at least one species of designated noxious weed. Fourteen noxious weeds were found; the most abundant and widespread weeds included (in decreasing order) *Lythrum salicaria*, *Lepidium latifolium*, *Cirsium arvense*, *Rumex crispus* (curly dock), and *Dipsacus sylvestris*. One rare plant was found: *Cyperus rivularis* (one assemblage).

Shore & Bottomland Wetland

Fifty-five transects were classified into the *Shore & Bottomland Wetland* cover type. This cover type was encountered most frequently in the Brownlee Reservoir reach and the reach below Hells Canyon Dam (Tables 7 and 8 in Technical Report E.3.3-1). Ordination analyses identified nine plant assemblages for this cover type. The most abundant plant assemblage was dominated by *Portulaca oleracea* (purslane), an introduced weedy forb. Two assemblages were dominated by shrub species: *Celtis reticulata* and *Salix exigua*. Most of the remaining assemblages were dominated by various native forbs.

Five of the nine assemblages contained at least one designated noxious weed species. Five noxious weed species were found: *Convolvulus arvensis*, *Rumex crispus*, *Lepidium latifolium*, *Lythrum salicaria*, and *Euphorbia esula* (leafy spurge). All noxious weeds occurred infrequently in this cover type, with an average cover of less than 1%. One rare plant was found: *Cyperus rivularis* (one assemblage).

E.3.3.1.1.2. Noxious Weeds

Section 2 in Technical Report E.3.3-2 provides the primary description of noxious weed occurrences along the Snake River corridor (within 50 m of shorelines). In addition, results from sampling vegetation cover types and identifying plant assemblages (Technical Report E.3.3-1) (briefly presented above in section E.3.3.1.1.1.1. and section E.3.3.1.1.1.2.) and sampling for vegetation resources (see especially Chapter 4 of Technical Report E.3.3-3) provide insight on the distribution and abundance of noxious weed species along the Snake River through Hells Canyon.

In consultation with personnel from state and federal government agencies, the Applicant developed a list of species to be considered during inventories of noxious weeds (section 2.1.1. in Technical Report E.3.3-2). For this investigation, noxious weeds were defined as those plant species on either Idaho or Oregon's state noxious weed list. In addition, the Applicant included four invasive riparian species that were not considered noxious weeds by either Idaho or Oregon: *Amorpha fruticosa*, *Elaeagnus angustifolia*, *Phalaris arundinacea* (reed canarygrass), and *Tamarix* species (known as salt cedar or tamarisk) (Table 1 in Technical Report E.3.3-2). After the Applicant's studies were completed, biologists learned that *Tamarix ramosissima* was listed as a noxious weed in Oregon and that *Tamarix* species will be proposed for listing in 2003 in Idaho. From the list of 101 species, 41 species were known or highly suspected to occur in the study area. The Applicant's botanists focused on these species, though data were collected on any of the 101 noxious weed species if encountered. Although some of these species are considered noxious weeds in only Oregon or only Idaho, data were collected for all occurrences of these species encountered in both states. Botanists collected data on noxious weeds while also conducting rare plant surveys; they collected data for each type of plant using similar methods (sections 2.1. and 3.1. in Technical Report E.3.3-2). For this project, the Applicant inventoried a relatively large portion of the area (approximately 25% of the shoreline miles) using a systematic random-sampling protocol. The findings from this inventory should indicate the extent, distribution, and abundance of noxious weeds in the study area.

In total, 1,905 discrete weed populations were recorded in the 405 units surveyed (Tables 2 and 3 in Technical Report E.3.3-2). A survey unit consisted of a 0.25-mi-long section that was randomly selected within each river mile on each side of the river. Surveys were conducted to at least 50 m upslope of the river. Although this study refers to isolated stands of plants as *populations*, this term is used loosely and does not represent actual population boundaries. Of the 405 surveyed units, 397 (98%) contained at least one population of a noxious weed species. The average number of populations per unit was 4.8 (standard deviation [STD] = 3.3), but some units had as many as 16 populations. The average number of weed species per unit was 4.4 (STD = 2.9), and the actual number of species per unit ranged from 0 to 14.

The distributions of upland and riparian noxious weeds vary by study reach. Using data from Table 2 in Technical Report E.3.3-2, biologists classified each species as a riparian or upland weed and summed the number of occurrences by reach (Table E.3.3-1). Species considered to be riparian weeds included *Amorpha fruticosa*, *Lepidium latifolium*, *Phalaris arundinacea*, *Conium maculatum*, *Cirsium arvense*, *Tamarix* species, *Elaeagnus angustifolia*, *Lythrum salicaria*, *Equisetum arvense* (common horsetail), *Cyperus esculentus* (yellow nut sedge), and *Euphorbia esula*. Results of systematic-random surveys indicate that the downstream reach had relatively few riparian weed populations: 10% of the total sites, or about 0.5 populations per river mile. This percentage can be compared with about 30% (4.9 populations per river mile) on Hells Canyon Reservoir, about 30% (4.4 populations per river mile) on Oxbow Reservoir, about 45% (6.4 populations per river mile) on Brownlee Reservoir, and about 70% (13.9 populations per river mile) in the upstream Weiser reach. Most of the riparian weed populations on Brownlee Reservoir occurred along the headwaters of the reservoir (see Figures 3–21 of Technical Report E.3.3-2 for weed distribution maps).

In the following reach descriptions, all species are listed in decreasing order of abundance (Table 2 in Technical Report E.3.3-2). The downstream reach had the lowest average number of weed species per unit (*n* = 2.4, range = 0–8, STD = 1.5). The most common weeds included *Hypericum perforatum* (common St. Johnswort), *Cynoglossum officinale*, *Onopordum acanthium*, and *Convolvulus arvensis*. Few riparian noxious weeds were found in this reach. The Hells Canyon Reservoir reach averaged 5.7 species per unit (range = 0–13, STD = 3.5), with the most common weeds being *Amorpha fruticosa*, *Cynoglossum officinale*, *Tribulus terrestris*, and *Lepidium latifolium*. In this reach and the Oxbow Reservoir reach upland weeds were more common. The Oxbow Reservoir reach had the highest average species per unit (*n* = 8.4, range = 2–14, STD = 2.6). Common species included *Cynoglossum officinale*, *Amorpha fruticosa*, *Taeniatherum caput-medusae*, *Onopordum acanthium*, and *Lepidium latifolium*. Of the reservoir reaches, the Brownlee Reservoir reach had the lowest average number of species per unit (*n* = 4.4, range = 0–11, STD = 2.2). The most common species included *Amorpha fruticosa*, *Onopordum acanthium*, *Convolvulus arvensis*, and *Lepidium latifolium*. The upstream Weiser reach had the second highest average number of species per unit (*n* = 6.7, range = 2–12, STD = 2.4). In this upstream reach, most noxious weed populations consisted of riparian species and relatively few upland weeds. The most common species included *Conium maculatum*, *Lepidium latifolium*, *Onopordum acanthium*, and *Cirsium arvense*.

In terms of average canopy coverage per survey unit (0.25 shoreline mile × 50 m upslope), the most abundant upland weed species in the study area were *Taeniatherum caput-medusae* (300 square meters [m^2]), followed by *Hypericum perforatum* (80 m^2), *Onopordum acanthium* (80 m^2), and *Cardaria draba* (70 m^2). The most abundant riparian weed species were *Lepidium latifolium* (200 m^2), *Conium maculatum* (90 m^2), *Tamarix* species (80 m^2), and *Phalaris arundinacea* (60 m^2) (Table 4 in Technical Report E.3.3-2).

No methodology for botanical field surveys that are suitable for large study areas can guarantee that 100% of the target populations will be found. For this study area, undiscovered weed populations probably exist in unsurveyed areas and in some of the units that were surveyed, even though the units were thoroughly searched. Such inadvertent exclusions are more likely to affect data for the less visible species, such as *Taeniatherum caput-medusae*, than for the larger, more visible species, such as *Onopordum acanthium*.

E.3.3.1.1.3. Threatened, Endangered, and Special Status Species

Section 3 in Technical Report E.3.3-2 provides the primary description of rare plant occurrences along the Snake River corridor (within 50 m of shorelines). In addition, results from sampling vegetation cover types and identifying plant assemblages (Technical Report E.3.3-1) (briefly presented in section E.3.3.1.1.1.1. and section E.3.3.1.1.1.2.) and sampling for vegetation resources (see especially Chapter 5 of Technical Report E.3.3-3) provide insight into the distribution and abundance of rare plant species along the Snake River through Hells Canyon.

In consultation with natural resource agencies, non-government organizations, and other interested parties during Collaborative Team and Terrestrial Resources Work Group meetings, the Applicant developed three lists of rare plant species to be targeted by rare plant surveys for 1) river corridor studies, 2) general vegetation inventories, and 3) transmission-line corridor studies. In late 1997, a subcommittee was selected to convene and identify the rare plant species to be considered. On November 19–20, 1997, Applicant botanists met with botanists from the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) (see section V in the Consultation Appendix).

Rare species were included on the river corridor list if they met any of three criteria: they were known to be associated with the river or reservoirs, they could be affected by the Applicant's operations in the area, or they were of special cultural significance. After several follow-up investigations and correspondence by the subcommittee regarding particular species in question, a final list was developed for study along the river corridor (see Table 8 in Technical Report E.3.3-2). Only one federally listed species is known to occur in the Hells Canyon vicinity: *Mirabilis macfarlanei* (Macfarlane's four-o'clock), listed as threatened. Although *Mirabilis macfarlanei* was not included on the search list for the riverine corridor based on agency consultation, botanists looked for the plant during surveys (Randy Krichbaum, Eagle Cap Consulting, Inc., Beaverton, OR, personal communication). This species was included on the list for the transmission-line corridor studies (see section E.3.3.1.2.3.).

The river corridor study included both shores of the Snake River and the reservoir complex, from the confluence of the Salmon River upstream to Weiser (a distance of approximately 163 river miles). The lateral extent included 50 m from the mean high-water mark. A subsampling scheme was used to randomly survey a 0.25-mi segment in every shoreline mile, for a total of 405 survey units (approximately 25% of the total corridor).

Forty-seven previously unreported populations of 6 rare plant species of concern were located during the investigation: *Cyperus schweinitzii* (Schweinitz flatsedge)—21 sites; *Carex hystricina* (porcupine sedge)—10 sites; *Bolandra oregana* (Oregon bolandra)—8 sites; *Leptodactylon pungens* ssp. *hazeliae* (Hazel's prickly phlox)—6 sites; *Mimulus patulus* (stalk-leaved monkey flower)—1 site; and *Teucrium canadense* var. *occidentale* (American wood sage)—1 site (see Table 9 in Technical Report E.3.3-2 for summary of populations). No rare plant populations were found in the Brownlee Reservoir reach or in the upstream Weiser reach (Figures 29–32 in Technical Report E.3.3-2).

No federally listed endangered or threatened species were found, although three populations of federally threatened *Mirabilis macfarlanei* are known to occur in the reach below Hells Canyon Dam. Two of these populations occur on the Oregon side downstream of Pittsburg Landing (USFWS 1999), and one population occurs on the Idaho side near Pittsburg Landing (Idaho Conservation Data Center, Element Occurrence Record database, Boise, ID). All populations are upslope and away from influence of the HCC.

In addition, botanists located nine populations of three other rare plant species (*Carex backii* [3 sites], *Rubus bartonianus* [3 sites], and *Cyperus rivularis* [3 sites]) during surveys for the general vegetation study (Technical Report E.3.3-1). This study included any special status species with potential to be encountered in the study area vicinity. The rare plant populations occurred upslope in tributary drainages to the Snake River, outside the influence of project operations. Botanists completed a database form for each population of rare plant found and sent it to the appropriate state Natural Heritage Program/Conservation Data Center office.

No methodology for botanical field surveys suitable for large study areas can guarantee that 100% of the target populations will be found. In this study area, undiscovered rare plant populations probably exist in unsurveyed areas and in some of the units surveyed, even though the units were thoroughly searched. For this project, the Applicant inventoried a relatively large proportion of the area (approximately 25% of the river corridor) using a systematic random-sampling protocol. Findings should be indicative of the extent, distribution, and abundance of rare plants along the Snake River through Hells Canyon.

E.3.3.1.1.4. Summary Characterization of Botanical Resources in Each Reach

E.3.3.1.1.4.1. Upstream Weiser Reach

The most upstream reach was studied from Cobb Rapids (RM 339.2), at the upper end of Brownlee Reservoir, to the bridge near Weiser (RM 351.2), just below the confluence of the Weiser River. This 12.0-mi-long unimpounded reach, which occurs in a relatively broad floodplain and includes several island complexes, has a low gradient (0.2–0.4 meters per kilometer [m/km]). Compared with downstream reaches, this environment supports relatively extensive riparian habitats (Table 6 in Technical Report E.3.3-1). Using cover type data in a geographic information system (GIS) from mapping efforts reported in Technical Report E.3.3-1, the Applicant determined that existing riparian habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland* cover types) within a 20-m planimetric band above the high-water mark constitutes 62.3% of the total area (190.9 of 306.7 acres). This percentage of riparian habitat can be compared with 8.4% (111.5 of 1,332.6 acres) along Brownlee Reservoir, 21.2% (51.3 of 242.3 acres) along Oxbow Reservoir, 21.1% (82.0 of 388.2 acres) along Hells Canyon Reservoir, and 17.6% (178.4 of 1,015.3 acres) in the reach below Hells Canyon Dam. In the Weiser reach, the percentage of riparian habitat in the 20-m band converts to approximately 15.9 acres per river mile. Acreage of riparian habitat per river mile in the other reaches is as follows: 2.0 acres per river mile on Brownlee Reservoir, 3.6 on Oxbow Reservoir, 3.7 on Hells Canyon Reservoir, and 3.0 in the reach below Hells Canyon Dam.

Most upland habitats in this reach have been converted to cultivated fields. Widespread agriculture and urbanization have negatively influenced botanical resources, and most plant assemblages are dominated by introduced and/or noxious species (Appendix 2 to Technical Report E.3.3-1).

Tree- and shrub-dominated riparian cover types are generally dominated by introduced species such as *Acer negundo*, *Acer saccharinum*, *Elmus americana* (American elm), *Fraxinus* *pennsylvanica* (green ash), *Elaeagnus angustifolia*, *Salix alba*, *Amorpha fruticosa*, and *Tamarix* species. Some stands are dominated by native species, such as *Salix amygdaloides*, *Salix exigua*, and *Rosa woodsii*. Herbaceous components of woody riparian cover types, and those species dominating herbaceous cover types, are primarily *Lepidium latifolium*, *Conium maculatum*, *Lythrum salicaria*, *Heleochloa alopecuroides*, *Apocynum cannabinum*, and *Portulaca oleracea*; many of these species are listed as noxious weeds (Appendix 3 to Technical Report E.3.3-1). Approximately 70% (162 populations) of the 234 weed populations found in the 12-mile-long Weiser reach consist of riparian weed species (section E.3.3.1.1.2.).

No rare plant populations were found in this reach. No federally listed endangered or threatened species are known to occur in the vicinity of the Weiser reach.

E.3.3.1.1.4.2. Brownlee Reservoir

The Brownlee Reservoir reach is 55.5 mi long, extending from Cobb Rapids (RM 339.2) to Brownlee Dam (RM 283.7[3]). Due to geomorphic characteristics and influences from human activities, this reservoir reach can be viewed as three distinct subreaches with respect to the type and extent of riparian botanical resources: headwaters, main pool, and Powder River arm. The most upstream subreach occurs at the headwaters of Brownlee Reservoir from Cobb Rapids downstream to about RM 325, or about 14 mi of the reservoir. This subreach is a transitional zone: the topography changes from that of a broad alluvial floodplain to a steep-sided reservoir. Riparian botanical resources in the headwaters subreach are more similar to those in the upstream Weiser reach than to those farther downstream along the second subreach, or the main-pool subreach of Brownlee Reservoir. Riparian habitat development in the headwaters subreach is relatively high, and most assemblages are dominated by the same introduced and noxious weed species as in the upstream Weiser reach (Appendix 3 to Technical Report E.3.3-1). Approximately 45% (355 populations) of the 785 weed populations found in the entire 55.5-mile long Brownlee Reservoir reach consists of riparian weed species. Most of these populations occur in this headwaters subreach (section E.3.3.1.1.2.).

3. Because river miles for dam locations for botanical studies were based on U.S. Geological Survey topographical maps, they differ from the corrected river mile locations that appear in the other exhibits of this application.

The second subreach is the main-pool subreach, which extends from about RM 325 downstream approximately 41.5 miles to Brownlee Dam. Riparian botanical resources in the main-pool subreach primarily occur near the mouths of tributary streams or in areas influenced by groundwater (for example, springs and seeps). Large annual fluctuations of Brownlee Reservoir expose a barren shoreline zone between the water levels of full pool (2,077 feet [ft] elevation) and low pool, a possible difference of 101 vertical feet. In some locations, a thin band of facultative perennial species, those that can both survive under varying hydrologic conditions and benefit from temporary wet conditions, exists at the full-pool elevation of the reservoir. At most locations along the shoreline, upland vegetation abruptly ends at a barren drawdown zone. Native species are more prominent in the riparian assemblages of the main-pool subreach. Tree- and shrub-dominated riparian cover types are often dominated by species such as *Betula occidentalis*, *Alnus rhombifolia*, *Philadelphus lewisii*, *Populus trichocarpa*, *Celtis reticulata*, and *Toxicodendron rydbergii*. However, an introduced species, *Amorpha fruticosa*, is also quite common in this subreach, occurring in thin linear bands along the high-water mark. Relatively few noxious weed species occur in the main-pool subreach.

The third subreach on Brownlee Reservoir is a 2.5-mi-long section at the Powder River arm of the reservoir (Figure 3, Panel 6 in Technical Report E.3.3-1). This subreach occurs in a broad alluvial floodplain, beginning at the confluence of Powder River and Eagle Creek and continuing downstream to near Hewitt and Holcomb parks, where the river enters a steep-walled canyon. Gentle topography in the Powder River arm subreach and numerous springs on the north side of the pool favor relatively extensive stands of riparian habitats. Woody native riparian species comprise most of the dominant members of plant assemblages, and this area is noteworthy because it contains the largest stand of *Populus trichocarpa* in the study area. Dominant woody riparian species include *Salix exigua*, *Rosa woodsii*, and *Salix alba*. As in the Weiser reach, negative influences from agriculture and urbanization are evident in the Powder River pool subreach, and several weedy and listed noxious weed species occur in the riparian zone, including *Lythrum salicaria*, *Lepidium latifolium*, *Heleochloa alopecuroides*, and *Phalaris arundinacea*. In this subreach, during periods of drawdown of Brownlee Reservoir, expansive areas of mudflats are exposed and colonized by annual species, such as *Xanthium strumarium*, *Portulaca oleracea*, *Amaranthus* species (pigweed), and *Echinochloa crus-galli* (barnyard grass). This annual colonization also occurs in other subreaches of Brownlee Reservoir where fine sediments are exposed during periods of drawdown.

Upland habitats along Brownlee Reservoir are primarily dominated by grassland and shrubland cover types (Technical Report E.3.3-1). Dominant grasses in this reach include *Pseudoroegneria spicata*, *Bromus tectorum*, *Taeniatherum caput-medusae*, and *Poa bulbosa*. *Bromus tectorum* is probably more abundant in this reach than in other downstream reaches, although *Taeniatherum caput-medusae* dominates most of the understory shrubland and grassland habitats, especially along the main-pool subreach. Shrubland habitats along Brownlee Reservoir are dominated by *Artemisia tridentata* and *Ericameria nauseosa* plant assemblages. These assemblages are nearly always found only along Brownlee Reservoir. Other shrubs, such as *Celtis reticulata* and *Purshia tridentata*, also occur but are more common along the Oxbow and Hells Canyon reservoir reaches. This regional distribution pattern is thought to occur because of differences in precipitation, soil depth, and disturbance factors (for example, livestock grazing) throughout the study area (section 4.4. in Technical Report E.3.3-1). In the headwaters subreach, occasional stands of *Sarcobatus vermiculatus* (greasewood) are found.

No rare plant populations were found in this reach. No federally listed endangered or threatened species are known to occur in the vicinity of Brownlee Reservoir.

E.3.3.1.1.4.3. Oxbow Reservoir and Hells Canyon Reservoir Reaches

Because botanical resources along the Oxbow and Hells Canyon reservoir reaches are very similar, these reaches are combined here for descriptive purposes. The Oxbow Reservoir reach is 14.2 mi long and extends below Brownlee Dam (RM 283.7) to the Oxbow Dam (RM 269.5). The Hells Canyon Reservoir reach extends 22.0 mi below Oxbow Dam to Hells Canyon Dam (RM 247.5). Reservoir shorelines are generally very steep, with substrates primarily of basalt outcrops and talus, except for alluvial fans created by small tributaries. Oxbow and Hells Canyon reservoirs are re-regulating reservoirs. Ninety percent of the time, Oxbow Reservoir has historically fluctuated on a daily basis within 5.6 ft of the normal maximum elevation, and Hells Canyon Reservoir has operated within 3.8 ft of the normal maximum elevation (Technical Report E.1-4).

These historic, relatively stable pool levels at both Oxbow and Hells Canyon reservoirs have probably enhanced establishment of riparian habitats compared with what would exist if the reservoirs were not held relatively stable. Where suitable substrate and topography occur, a relatively wide band of riparian habitat is promoted by the combination of small daily water fluctuations that irrigate riparian vegetation during the growing season and no large seasonal drafting (section 2.3.2.2. in Technical Report E.3.3-3, Technical Report E.3.2-44). In contrast to Brownlee Reservoir, both Oxbow and Hells Canyon Reservoirs have relatively abundant trees, shrubs, and other perennial species along them (section 4.4. in Technical Report E.3.3-1, section 2.3.2.2. in Technical Report E.3.3-3). Soil and substrate affinities for vegetation occurrence ranged from fine to coarse substrates, similar to patterns observed for Brownlee Reservoir (section 2.3.2.2. in Technical Report E.3.3-3). Using GIS cover type data from mapping efforts reported in Technical Report E.3.3-1, the Applicant determined that existing riparian habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland* cover types) within a 20-m planimetric band above the high-water mark constitutes 21.2% riparian habitat (51.3 of 242.3 acres) along Oxbow Reservoir and 21.1% riparian habitat (82.0 of 388.2 acres) along Hells Canyon Reservoir. These percentages of riparian habitat can be compared with 8.4% (111.5 of 1,332.6 acres) along Brownlee Reservoir, 62.3% (190.9 of 306.7 acres) in the Weiser reach, and 17.6% (178.4 of 1,015.3 acres) in the reach below Hells Canyon Dam. On Oxbow and Hells Canyon reservoirs, percentages of riparian habitat convert to about 3.6 and 3.7 acres per river mile, respectively, in the 20-m band. Acres per river mile of riparian habitat in the other reaches are as follows: 2.0 on Brownlee Reservoir, 15.9 in the Weiser reach, and 3.0 in the reach below Hells Canyon Dam.

Most of the riparian plant assemblages occurring along these reservoirs are dominated by native species, such as *Betula occidentalis*, *Philadelphis lewisii*, *Alnus rhombifolia*, *Toxicodendron rydbergii*, *Populus trichocarpa*, *Celtis reticulata*, and *Crataegus douglasii* (black hawthorn). Ruderal annual species (annual plant species that can establish and grow in degraded or disturbed areas) constitute a relatively minor botanical component along the shorelines of Oxbow and Hells Canyon Reservoirs (Appendix 3 to Technical Report E.3.3-1).

Several undesirable riparian species, including listed noxious weeds, occur along the shores of both reservoirs (Technical Report E.3.3-2); these species include *Cynoglossum officinale*, *Lepidium latifolium*, *Phalaris arundinacea*, and *Conium maculatum*. About 30% of the weed occurrences are from riparian species: 63 of the 209 populations on Oxbow Reservoir and 109 of the 356 populations on Hells Canyon Reservoir (section E.3.3.1.1.2.). Many upland weedy species have probably been introduced to the Oxbow and Hells Canyon reservoir reaches by means not related to riverine processes (for example, recreational activities, vehicles, livestock, and homesteading) prior to and during HCC operations. Historically and today, these reaches have been readily accessible by vehicle traffic.

Upland habitats along Oxbow and Hells Canyon reservoirs are primarily dominated by grassland and shrubland cover types, but occasional fingers of forested upland reach down to the canyon bottom (Appendix 2 to Technical Report E.3.3-1). Dominant grasses in this reach include *Pseudoroegneria spicata*, *Bromus tectorum*, *Taeniatherum caput-medusae*, and *Poa bulbosa*. *Taeniatherum caput-medusae* is more abundant in the Oxbow Reservoir reach, while *Pseudoroegneria spicata* becomes more dominant on Hells Canyon Reservoir. Contrary to the shrubland habitats along Brownlee Reservoir that are dominated by *Artemisia tridentata* and/or *Ericameria nauseosa* plant assemblages, shrublands along these two reservoirs are principally dominated by *Celtis reticulata* at lower elevations or *Purshia tridentata* at both lower and upper elevations. Other upland shrubs are also locally common, such as *Amelanchier alnifolia* and *Prunus emarginata* (bitter cherry). Where forested uplands occur, they are dominated by *Pseudotsuga menziesii* or *Pinus ponderosa*, usually with an understory of *Symphoricarpos albus*, *Physocarpus malvaceus* (mallow ninebark), or both.

Populations (occurrences) of four species of special status plants were found in the Oxbow and Hells Canyon reservoir reaches: *Leptodactylon pungens* ssp. *hazeliae* (5 sites on Hells Canyon Reservoir), *Mimulus patulus* (1 site on Oxbow Reservoir), *Bolandra oregana* (1 site on Hells Canyon Reservoir, 3 sites on Oxbow Reservoir), and *Carex hystricina* (7 sites on Oxbow Reservoir) (Technical Report E.3.3-2). No federally listed endangered or threatened species are known to occur in the vicinity of these reservoirs.

E.3.3.1.1.4.4. Reach Downstream of Hells Canyon Dam

The downstream reach was studied for 59.3 mi from Hells Canyon Dam (RM 247.5) to the confluence of the Salmon River (RM 188.2). In this reach, the river environment is characterized by a deep, narrow valley that is confined by bedrock walls, talus slopes, debris flows, landslides, and alluvial terraces (Bonneville Flood deposits, landslide backwater deposits, relict alluvial fans, or relict bars) (Technical Report E.1-2). This confinement has prevented the development of an alluvial floodplain that is typical of other rivers of comparable discharge area and gradient. The Snake River in this reach has a high gradient (1.8 m/km) and a wide diversity of aquatic habitat, including numerous large rapids, shallow riffles, and deep pools. Shoreline substrates are diverse, but are comprised almost entirely of large basalt outcrops (bedrock) or large boulders and cobbles, with few sands or gravels (Technical Report E.1-2). Substrate affinities of riparian vegetation in this reach range from fine soils to coarser cobbles with interstitial fines (section 2.3.5.2. in Technical Report E.3.3-3). Substantial quantities of fine sediment occur in the interstitial spaces between larger rocks and also underlying the coarser armor layers (section 6.2. in Technical Report E.3.3-3).

The riparian zone is limited in this reach by the prevalence of steep canyon walls, rocky shorelines, and a high-gradient river slope. Nevertheless, there is a relatively substantial amount of riparian habitat in this reach. Using GIS cover type data from mapping efforts reported in Technical Report E.3.3-1, the Applicant determined that existing riparian habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland* cover types) within a 20-m planimetric band above the high-water mark constitute 17.6% of the total area (178.4 of 1,015.3 acres) along this reach. This percentage of riparian habitat can be compared with 21.1% (82.0 of 388.2 acres) along Hells Canyon Reservoir, 21.2% (51.3 of 242.3 acres) along Oxbow Reservoir, 8.4% (111.5 of 1,332.6 acres) along Brownlee Reservoir, and 62.3% (190.9 of 306.7 acres) in the Weiser reach. For the downstream reach, the percentage of riparian habitat converts to approximately 3.0 acres per river mile in the 20-m band. Acres of riparian habitat per river mile for the other reaches are as follows: 3.7 on Hells Canyon Reservoir, 3.6 on Oxbow Reservoir, 2.0 on Brownlee Reservoir, and 15.9 in the upstream Weiser reach.

Tree- and shrub-dominated riparian cover types are primarily dominated by species such as *Celtis reticulata*, *Betula occidentalis*, *Alnus rhombifolia*, *Philadelphus lewisii*, *Salix exigua*, and *Toxicodendron rydbergii* (Appendix 3 to Technical Report E.3.3-1, Chapter 2 of Technical Report E.3.3-3). Common herbaceous riparian species include *Glycyrrhiza lepidota* (American licorice), *Physalis longifolia* (long-leaved ground cherry), *Artemisia ludoviciana* (western mugwort), *A. lindleyana* (Columbia River mugwort), *Anthriscus scandicina* (chervil), *Galium aparine* (bedstraw), and *Solidago canadensis* (Canada goldenrod). Detailed descriptions of riparian plant assemblages occurring in this study reach and all others are in Appendix 3 to Technical Report E.3.3-1 and Chapter 2 of Technical Report E.3.3-3.

Upland plant communities consist mostly of grassland habitats with fingers of forest extending downslope to the water's edge and occasional stands of *Pinus ponderosa* occurring in the canyon bottom. Few of the shrubland habitats are similar to those in upstream reaches. Grasslands are dominated primarily by *Pseudoroegneria spicata* and secondarily by *Bromus tectorum*, *Taeniatherum caput-medusae*, and *Poa bulbosa*. Other grasses, such as *Sporobolus cryptandrus* (sand dropseed) and *Aristida longiseta* (red threeawn), are locally common. Detailed descriptions of upland plant assemblages occurring in this study reach and all others are in Appendix 2 to Technical Report E.3.3-1 and Chapter 2 of Technical Report E.3.3-3.

Few riparian noxious weed species occur below Hells Canyon Dam (Technical Reports E.3.3-1, E.3.3-2, E.3.3-3). Nearly all weeds are upland species, such as *Hypericum perforatum*, *Cynoglossum officinale*, *Onopordum acanthium*, and *Convolvulus arvensis*. Approximately 10% (32 populations) of the 289 weed populations found in the 59.3-mile-long downstream reach consist of riparian weed species (section E.3.3.1.1.2.).

Populations (occurrences) of five species of special status plants were found below the dam: *Cyperus schweinitzii* (21 sites), *Teucrium canadense* var. *occidentale* (1 site), *Bolandra oregana* (4 sites), *Carex hystricina* (3 sites), and *Leptodactylon pungens* ssp. *hazeliae* (1 site) (Technical Report E.3.3-2). No federally listed threatened or endangered species were found, although three populations of one federally threatened species, *Mirabilis macfarlanei*, are known to occur in the project vicinity, outside of the 50-m survey area along each shoreline. These populations occur upslope of the river corridor near Pittsburg Landing.

E.3.3.1.2. Botanical Resources along Transmission Lines and Associated Service Roads

One transmission line is associated with FERC Project No. 1971. The Applicant operates and maintains the Pine Creek–Hells Canyon 69-kV line (Line 945) on 22 mi (36.5 km) of rights-of-way (ROW) associated with the HCC and less than 1 mi of service roads. The 50-ft-wide ROW extends from the Pine Creek Substation at Oxbow, Oregon, to Hells Canyon Dam and runs alongside a paved road on the Idaho side of Hells Canyon Reservoir (Figure E.1-2). The study area for the transmission line is limited to public land under the jurisdiction of state or federal authorities. About 93% of the line is located on public land.

The botanical resource components considered here include general vegetation cover and plant communities, noxious weeds, and rare plants (see also Technical Report E.3.3-4, which describes a suite of integrated studies addressing botanical resource concerns along the transmission-line corridor).

E.3.3.1.2.1. General Vegetation Resources

The 22-mi-long the Pine Creek–Hells Canyon line (Line 945) is entirely within Hells Canyon. The terrain is steep, with a mosaic of grasslands, shrub savanna, and shrublands. The line runs along the eastern shore of Hells Canyon Reservoir from Oxbow Dam to Hells Canyon Dam adjacent to a paved road and over land that is mostly (93.3%) classified as disturbed habitat. However, in a few locations the line leaves the road shoulder for short distances and travels over grasslands (2%), reservoir (2%), rock (2.3%), big sagebrush (0.2%), shrub riparian vegetation (0.1%), and ponderosa pine (0.1%) (Technical Report E.3.3-4). Small amounts of riparian vegetation occur throughout numerous drainages that bisect the line. Forest riparian vegetation is most prominent near Big Bar along Allison Creek and at Eckels and Kinney creeks. The major landscape-changing processes in this region include livestock grazing and wildfire (Quigley and Arbelbide 1997).

E.3.3.1.2.2. Noxious Weeds

Prior to field research, the Applicant, in consultation with appropriate agencies and the Terrestrial Resources Work Group, compiled lists of noxious weeds: 35 species for Idaho and 26 for Oregon. Botanists conducted surveys for these weeds on public lands along the Pine Creek-Hells Canyon line (Line 945) (Technical Report E.3.3-4). Fifty-seven survey units, consisting of short segments of Hells Canyon Road, were delineated. Units were about 0.25 mi long and were typically demarcated by tower structures along the line. For each survey unit, botanists recorded the relative abundance of each species within the following three zones: 1) immediately on the roadbed or tower pad location, 2) within 50 m of the roadbed or pad location, and 3) in the area farther than 50 m (164 ft) from the roadbed or pad location.

Botanists recorded 144 occurrences of 8 noxious weed species along the Pine Creek-Hells Canyon line (Line 945). At least one noxious weed was located on 50 of 57 units surveyed (88%). *Tribulus terrestris* was most commonly recorded, occurring on 41 of 57 survey units (72%). *Onopordum acanthium* was present on 31 units, *Linaria dalmatica* (dalmatian toadflax) on 22, *Cardaria draba* on 15, *Conium maculatum* on 13, *Convolvulus arvensis* on 11, *Centaurea diffusa* (diffuse knapweed) on 9, and *Cirsium arvense* on 2.

E.3.3.1.2.3. Threatened, Endangered, and Special Status Species

Prior to field research, the Applicant, in consultation with the Terrestrial Resources Work Group, developed lists of special status plant species to be considered during transmission-line surveys. Twenty-seven target species and 43 incidental species were designated for Idaho, while 25 target species and 37 incidental species were designated for Oregon. Surveys for rare plants were conducted in conjunction with surveys for noxious weeds using similar methods and protocols (Technical Report E.3.3-4). The frequencies of rare plant occurrences within the road/pad location, within the 50-m buffer zone, and beyond the buffer zone appear in Table 7 in Technical Report E.3.3-4.

Ten occurrences of one rare plant, *Rubus bartonianus*, were recorded along the Pine Creek–Hells Canyon line (Line 945). No other target or incidental search species or any federally listed threatened or endangered plant species were found.

E.3.3.2. Measures or Facilities Recommended by the Agencies

To consolidate measures, the Applicant has included measures or facilities recommended by the agencies in section E.3.3.3.3. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.3.3.3. Applicant's Existing and Proposed Measures or Facilities

E.3.3.3.1. Existing Measures or Facilities to Be Continued or Maintained

No formal measures or facilities specifically associated with botanical resources in the HCC have been previously adopted. In section E.3.3.3.2., the proposed protection, mitigation, and enhancement (PM&E) measures include some measures (for example, cooperative weed control) for which the Applicant has initiated prelicensing efforts to begin implementation.

For cooperative weed control, the Applicant has initiated activities in support of the measure proposed in section E.3.3.3.2.1.2. The Applicant has participated in projects from several county-based Cooperative Weed Management Areas (CWMAs) and other weed control groups in the Hells Canyon area to gain and share knowledge and build working relationships. The Applicant's participation in the cooperative projects has included one or more of the following: 1) funding, 2) technical expertise, 3) logistical involvement, 4) in-kind support, and 5) materials. Cooperative projects have occurred reasonably near, but usually outside, Applicant-owned lands. The Applicant's participation began in 1999, with support of the public affairs project of the Columbia-Blue Mountain Resource Conservation and Development Area, Baker County's weed control and revegetation program (Wessinger Foundation Grant), and three newly formed CWMAs (Lower Payette CWMA [Payette, Gem, and Washington Counties, Idaho], Snake River Breaks CWMA [Washington County, Idaho], and Weiser River CWMA [Washington County, Idaho]). In 2000, annual support was expanded to other cooperative projects with entities such as the Adams County CWMA (Adams County, Idaho) and the Oregon Trail CWMA (Twin Falls County, Idaho). The Applicant's efforts have been recognized in four letters of commendation by County Commissioners from Washington, Payette, and Gem Counties and from the Weed Control District Supervisor of Baker County (see section V in the Consultation Appendix).

The Applicant has also initiated weed control and habitat improvement projects in support of the measure proposed in section E.3.2.3.2.1.2. Meetings were held with technical staff from the Oregon Department of Fish and Wildlife (ODFW) and the Idaho Department of Fish and Game

(IDFG), and field work began in June 2002. On February 13, 2003, the Applicant met with representatives of IDFG and ODFW to review results of past field work and to further refine goals and objectives for 2003 field work on two pilot weed control and reseeding projects on Patch Island (owned by the ODFW) and Gold Island (owned by the IDFG). Discussions with technical staff confirmed the challenges of controlling current levels of noxious weeds and establishing desirable perennial vegetation on these islands. Results of these pilot projects will be valuable to identify useful revegetation techniques and realistic management objectives to incorporate in future management plans for the four Snake River islands, as proposed in section E.3.2.3.2.1.2. Representatives from several county weed control associations have committed to participate in these cooperative pilot projects including Malheur County (Oregon), Washington County (Idaho), and Canyon County (Idaho).

The Applicant plans to continue with these cooperative efforts until formal measures are developed and defined in new license articles identified by the FERC. These efforts are expected to greatly facilitate developing and implementing numerous actions regarding weed control and habitat enhancement, activities that are applicable to all the Applicant's proposed PM&E measures for wildlife and botanical resources.

E.3.3.3.2. New Measures or Facilities Proposed by the Applicant

The Applicant proposes four categories of PM&E measures for botanical resources. These measures are organized according to the spatial impacts of operation of the HCC on botanical resources. The Applicant proposes three measures for the area including the HCC reservoirs and the river reach downstream of Hells Canyon Dam and one measure for the transmission-line ROW. PM&E measures are implemented to address specific types of issues and impacts identified in section E.3.3.4.

For each PM&E measure, at least one type of action is noted: acquisition, cooperative project, or management program. These three action categories were identified and defined by the Terrestrial Resources Work Group (TRWG). Acquisition was defined as acquiring lands and managing and operating them to mitigate for future operational impacts that have been identified (Technical Report E.3.2-45). Acquisition would include the following actions by the Applicant: 1) acquiring properties in fee title, including water rights and federal and state grazing permits; 2) acquiring conservation easements; and 3) providing funds for operation and maintenance (O&M) of the property. Cooperative project was defined as participating with partners (such as state and federal agencies and nongovernmental organizations) to address impacts on lands other than those owned or acquired by the Applicant. The Applicant's participation in cooperative projects would include one or more of the following: 1) funding, 2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials. Finally, management program was defined as developing and implementing a program to address impacts and resource stewardship needs on Applicant-owned lands or Applicant-held ROW. This program would include the Applicant's developing and implementing best management practices and resource management plans.

E.3.3.3.2.1. HCC Reservoirs and the Reach Downstream of Hells Canyon Dam

Three PM&E measures for botanical resources focus on the HCC reservoirs and the reach downstream of Hells Canyon Dam:

Acquisition—Acquisition of upland and riparian habitat (same PM&E measure as in section E.3.2.3.2.1.1.)

Cooperative Projects—1) Noxious weed control and site monitoring and reseeding and 2) protection and monitoring of sensitive plant sites

The Applicant proposes no management program actions for botanical resources for the HCC or the reach downstream of the Hells Canyon Dam.

E.3.3.3.2.1.1. Acquisition of Upland and Riparian Habitat

This PM&E measure is the same as that explained in section E.3.2.3.2.1.1. The justification for this measure is presented in this section as it reflects botanical resources in Hells Canyon.

Continued operation of the HCC would primarily affect botanical resources associated with the three reservoirs (section E.3.3.4.1.1.). Impacts are related to processes in the fluctuation and shoreline zones and to loss of terrestrial habitat by shoreline bank erosion along the reservoirs and downstream reach. The Applicant summarizes impacts in this section. The extent of these impacts has been described in relation to wildlife habitat in section E.3.2.3. These same impacts and acreage figures apply directly to botanical resources. This acreage is not additive to that stated in section E.3.2.3.

Reservoir Fluctuation Zone—The Applicant estimated that modeled proposed operations would prevent the fluctuation zone of 1) Brownlee Reservoir from supporting 372 acres of riparian and 5,448 acres of upland habitats, 2) Oxbow Reservoir from supporting 7 acres of riparian and 82 acres of upland habitats, and 3) Hells Canyon Reservoir from supporting 9 acres of riparian and 231 acres of upland habitats (Technical Report E.3.2-40). Therefore, the Applicant concludes that proposed operations of the HCC would impact 6,149 acres (388 acres riparian and 5,761 acres upland) of terrestrial habitat in the reservoir fluctuation zones (section E.3.3.4.1.1.1.).

Reservoir Shoreline Zone—The Applicant determined that neither modeled proposed operations nor full pool run-of-river operations would significantly alter the current composition of riparian and upland habitats within shoreline zones of Oxbow and Hells Canyon reservoirs (section E.3.3.4.1.1.2.). After investigating current conditions, the Applicant estimated that modeled proposed operations would not alter habitat within the shoreline zone of Brownlee Reservoir, but that full pool run-of-river operations would convert 343 acres of upland habitat into riparian habitat (section E.3.3.4.1.1.2.). Investigators indicate, however, that newly established riparian plant communities along Brownlee Reservoir's shorelines would more closely resemble the characteristics (for example, species cover, composition, density) of the abundant weed-dominated communities found upstream in the Weiser reach (Technical Reports E.3.2-40, E.3.3-1, E.3.3-3). This conclusion does not override recognition of the benefits that could occur with the establishment of riparian habitat along many miles of shoreline on Brownlee Reservoir. The invasion of weedy introduced riparian species would be expected to negatively influence native riparian communities located downstream of Brownlee Reservoir (Technical Report E.3.2-45, Chapter 4 of Technical Report E.3.3-3). See also section E.3.3.4.1.2. for a discussion regarding the dispersal barrier effect on Brownlee Reservoir with modeled proposed operations.

The Applicant concludes that modeled proposed operations would prevent (that is, negatively impact) 343 acres of riparian habitat from establishing in areas of Brownlee Reservoir's shoreline zone that are currently occupied by upland habitat, and so the Applicant proposes to add this acreage to the 388 acres of riparian habitat (372 + 7 + 9 acres mentioned previously for the three reservoirs) that would be impacted within the fluctuation zone. It should be understood that the shoreline environment in the reservoir reaches of the Snake River is realistically only capable of supporting about 350 to 400 acres of riparian habitat under any scenario. Under one operational scenario, this riparian vegetation could establish at one elevational level, or under a different operational scenario, at another elevational level; but riparian vegetation could not establish at both elevational levels at any one time. Therefore, combining acreages of riparian habitats negatively affected by 1) the *fluctuation zone* and 2) the *shoreline zone* (by comparing modeled proposed operations to full pool run-of-river operations) essentially doubles the amount of riparian habitat that could actually be influenced or impacted at any time. However, the Applicant recognizes the importance and value of riparian habitat in the project area and, therefore, believes that the cumulative acreage is appropriate.

Erosion of Shoreline Banks—For the reservoir reaches, the Applicant concludes that, compared with full pool run-of-river operations, modeled proposed operations would result in a greater amount of shoreline bank erosion (section E.3.3.4.1.4.). Because the Applicant cannot predict a quantitative difference in shoreline erosion between scenarios on the reservoirs (for example, acreage or number of sites), it assumes that the amount of bank erosion under proposed operations would not be greater than the current amount of bank erosion. Therefore, the Applicant concludes that habitat management actions designed to protect 84 acres of terrestrial habitat (the total extent of shoreline erosion in all reservoir reaches) would constitute appropriate mitigation for proposed operational impacts to shoreline erosion along reservoir reaches. This protection would be accomplished through acquisition and enhancement actions (for example, additive to other acquisition/enhancement measures), by specific management actions to eliminate causes of erosion, and, where feasible, by limited site stabilization/revegetation actions (section E.3.3.4.1.4.).

For the downstream reach, the Applicant concludes that, compared to full pool run-of-river operations, modeled proposed operations would result in a greater amount of shoreline erosion on the downstream reach, especially those sites impacted below the 30,000 cfs stage level (section E.3.3.4.2.4.). Because the Applicant cannot predict a quantitative difference in shoreline erosion between scenarios on the river reach (for example, acreage or number of sites), it assumes that the amount of bank erosion under proposed operations would not be greater than the amount of current bank erosion. Therefore, the Applicant concludes that habitat management actions designed to protect about 6 acres of terrestrial habitat (the total extent of shoreline erosion in the river reach) would constitute appropriate mitigation for proposed operational impacts to shoreline erosion of botanical resources along the downstream reach. This protection would be accomplished through acquisition and enhancement actions (for example, additive to other acquisition/enhancement measures), by specific management actions to eliminate anthropogenic causes of erosion, and, where feasible, by some limited site stabilization/revegetation actions (section E.3.3.4.2.4.).

Summarizing shoreline erosion influences, the Applicant concludes that habitat management actions designed to protect 90 acres of terrestrial habitat (the total extent of shoreline bank erosion in the study area) would constitute appropriate mitigation for proposed operational impacts to shoreline erosion of botanical resources.

By proposing to mitigate for the total extent of shoreline bank erosion along the reservoir and downstream reaches, the Applicant has not limited its actions solely to its contribution to shoreline bank erosion. Other influences outside of the Applicant's control also impact shoreline bank erosion. Such factors include recreation activities (boat-driven waves, camping, trails, and dispersed recreation); livestock grazing; road or other construction or maintenance activities under the management actions of federal, state, or county agencies; public interest groups; or other private landowners. These factors would continue to influence shoreline bank erosion under either proposed or full pool run-of-river operations.

Management actions would be implemented to control human-caused factors that negatively affect shoreline banks. These actions should focus on controlling recreation influences (for example, boat-driven waves, camping, trails, and vehicle use), minimizing effects of roads and construction or maintenance activities, and reducing the livestock grazing that has negative effects (Technical Report E.3.2-42). Because these management actions largely fall under the jurisdiction of state and federal land managers in the reservoir reaches, and specifically the USFS below Hells Canyon Dam, the Applicant has little management authority. Because water fluctuations are necessary if the HCC is used for flood control, anadromous fish spawning and protection, downstream navigation, and hydroelectric generation, eliminating all negative impacts from human activity is not possible.

Stabilizing and revegetating most of the shoreline erosion sites in the study area would not be practical, feasible, or even desirable (Technical Report E.3.2-42). The subsoil remaining at these sites is probably hard, rocky, infertile, and droughty, making it difficult to reestablish vegetation cover. Without soil amendments, the remaining soil probably could not support adequate growth and, therefore, would not adequately stabilize the banks. The steep topography and remoteness of the canyon make it difficult to access and work on most sites. Improper design or implementation often results in problems more severe than those that were to be avoided. However, proper stabilization and revegetation techniques possibly could be employed at specific sites if analysis indicated that such techniques were appropriate. Because natural resources below Hells Canyon Dam are highly valued by many people for recreation, cultural, and aesthetic resources (Technical Reports E.4-1, E.5-4, E.5-9), the Applicant proposes additional stewardship measures for cooperative projects to stabilize and enhance specific sites below Hells Canyon Dam (section E.4.2.5.1.6.).

For an explanation of this PM&E measure and its goals, associated benefits, implementation and construction schedule, cost estimate, and location, see section E.3.2.3.2.1.1.

E.3.3.3.2.1.2. Cooperative Noxious Weed Control, Site Monitoring, and Reseeding

Justification

Riparian zones are generally vulnerable to invasion by exotic species because riverine environments are dynamic and have recurrent disturbances (for example, flooding, scour, and sediment movement and deposition), water is available year-round, and rivers form a natural network for propagule dispersal (Planty-Tabacchi et al. 1995). Prior to and since construction of the HCC, residential, industrial, recreational, and agricultural influences both upstream and within Hells Canyon likely introduced many weedy species to the Hells Canyon ecosystem. Most of the weedy species identified in Technical Report E.3.3-2 appear to have been present within the study corridor prior to the HCC (Table 13 in Technical Report E.3.2-44). With these weed introductions and the capacity of these species to proliferate, the current abundance of weeds in Hells Canyon (section E.3.3.1.1.2.) is not surprising. Weedy exotic species would occur along the Snake River in Hells Canyon without the influence of HCC operations. Nonetheless, historic operation of the HCC reservoirs has probably contributed to the spread of noxious weeds.

The Applicant concludes that modeled proposed operations would contribute to the spread of noxious weeds along the reservoir reaches in Hells Canyon and along the river reach below Hells Canyon Dam, but to a much lesser extent than with full pool run-of-river operations (section E.3.3.4.1.2. and section E.3.3.4.2.2.). The Applicant cannot quantitatively identify the extent (for example, acreage or number of populations) of operational impacts of either future scenario on the potential spread of noxious weeds. Under proposed operations, the combination of drought stress and inundation stress on Brownlee Reservoir would eliminate the vast majority of many weedy species encroaching from upstream sources (reduction of seeds and plant propagules), controlling downstream infestation especially in the 41.5-mi-long main-pool subreach of Brownlee Reservoir. Proposed operations may also deter the invasion of some species currently not found below Hells Canyon Dam, especially *Tamarix* species (Technical Reports E.3.3-1 and E.3.3-3).

The Applicant acknowledges that it may be just a matter of time before riparian habitats along the reservoir and downstream reaches are negatively influenced by riparian weed sources above the HCC, regardless of the dispersal barrier imposed by drawdown operations on Brownlee Reservoir. Occasionally, individuals of these invasive riparian weeds would become established at locations where they could survive, such as near tributary inflows, and although some plants would be impeded, eventually these species would probably extend downstream beyond Brownlee Reservoir. In addition, there are alternate propagule sources beyond the inputs from the Weiser reach and the Powder River, and these would also enable expansion of invasive plants (section 4.3. in Technical Report E.3.3-3). On Oxbow and Hells Canyon reservoirs, both proposed and full pool run-of-river operations would contribute similarly to the spread of existing levels of noxious weeds.

Other factors that influence the spread of noxious weeds along the Snake River corridor through Hells Canyon include management actions of federal and state agencies and other private landowners. Because of the high percentage of federally owned lands in the canyon, actions of the USFS and BLM probably play a significant role in the spread of noxious weeds. Federal land managers oversee grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area, all of which can contribute to the spread of noxious weeds. These influences can affect the spread of weeds 1) directly through spreading of weed seed and plant parts and 2) indirectly by creating disturbance to soil and vegetation that create conditions more conducive to weed invasion. Recreationists, livestock operators, subcontractors, federal personnel, and members of the public visiting this area can unknowingly spread weeds when passing through areas of noxious weeds. Weed propagules are picked up on equipment, clothing, and animals and can be spread along roadways or travel corridors, including water-based recreation sites (Loney and Hobbs 1991). Weeds can be transported within the canyon or brought in from outside sources by visitors. Once present, these weeds can invade adjacent native habitats (MacLellan and Stewart 1986). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make weed control necessary.

Because many factors influence the spread of noxious weeds along the reservoir and downstream reach, the Applicant proposes that it take the lead role in developing and participating in cooperative agreements with federal and state natural resource agencies and other private landowners to control establishment and spread of noxious weeds in the project area. Such cooperative efforts support the goals and actions of the Idaho State Department of Agriculture as outlined in its strategic plan for managing noxious weeds (ISDA 1999), the Oregon Department of Agriculture's Noxious Weed Control Program (ODA 2003), and weed management strategies identified in the BLM's *Partners Against Weeds* (1996) and the USFS's *Stemming the Invasive Tide* (1998).

The Applicant would focus on efforts with local, usually county-based, organizations called Cooperative Weed Management Areas (CWMAs) or with similar groups that are involved in weed control activities in areas bordering the Snake River in Hells Canyon. CWMAs have been successful in building cooperative relationships among agencies, landowners, land managers, and other interested individuals and organizations—relationships that are needed to effectively manage noxious weeds (ISDA 1999). To the extent possible, the Applicant's efforts would be focused along the Snake River corridor through Hells Canyon rather than on a political or jurisdictional basis. Increased focus would be given to the control of *Tamarix* species.

Efforts in Hells Canyon would be conducted in consultation with the Idaho Noxious Weed Coordinating Committee and Oregon's Noxious Weed Control Program. These groups coordinate state-level weed management programs of organizations and agencies with responsibility or interest in noxious weed management. Other vital coordination would also occur as identified in the following sections. As the noxious weed problem becomes more widespread and acute, the need for effective coordination is critical. Scarce resources cannot be wasted with duplicated effort or failure to apply measures across ownership and jurisdictional boundaries (ISDA 1999).

The Applicant's participation in the cooperative projects would include one or more of the following items: 1) funding, 2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials. The Applicant has proposed an annual level of commitment in section E.3.3.3.2.1.2. This estimate was based on past experience with costs involved with cooperative projects, an estimate of the scope of efforts, and an estimate of other participants' funding of cooperative projects and is intended to be capped at an annual level. The actual level of the Applicant's annual commitment cannot reliably be specified until after the planning phase is initiated. It is anticipated that all participants will contribute funds, personnel, and other support to assist with cooperative weed control activities along the Snake River corridor. Because of the high percentage of federally owned lands in the canyon, the USFS and BLM will be encouraged to serve as catalysts for participation in cooperative efforts. The level of commitment from participants cannot be specified until after the planning phase is initiated. Nonetheless, the Applicant anticipates that federal and state natural resource agencies will be involved with implementing the measure at levels recommended by the FERC.

Goal

The primary goal of this measure is to formalize cooperative relationships between the Applicant, agencies, landowners, land managers, and other interested individuals and organizations needed to effectively manage nonnative invasive plants and noxious weeds along the Snake River corridor from Weiser downstream to the confluence of the Salmon River. This measure would include developing a cooperative integrated management plan to coordinate priorities and actions for preventing, eradicating, containing, and controlling nonnative invasive plants and noxious weeds. The plan would define the land area for these cooperative efforts, which would focus on the health of riparian species and habitats. While specific weed control activities on Applicant-owned lands are also addressed in other proposed PM&E measures (for example, section E.3.2.3.2.1.1. and section E.3.2.3.2.1.2.), the focus of this measure is on cooperation at a broader scale along the Snake River in Hells Canyon.

This measure would allow for participation with existing or forthcoming CWMAs in both Idaho and Oregon in the Hells Canyon vicinity or would define and implement new actions (for example, a Hells Canyon CWMA) in areas where no formal cooperative efforts exist. Such a strategy is consistent with and implements many of the actions identified by Idaho (ISDA 1999) and Oregon (ODA 2003). This strategy is consistent with the intent of federal and state laws and regulations on managing nonnative invasive plants and noxious weeds as those laws and regulations apply to local needs and conditions in surrounding areas with CWMAs.

The cooperative relationships sought by this measure would result in grass-roots efforts. Local landowners, land managers, and other interested individuals and organizations would pool their resources and capabilities to protect the natural and economic resources that are impacted by the spread of nonnative invasive plants and noxious weeds.

Description

To ensure that activities are accomplished, the Applicant would take the lead in developing and organizing cooperative efforts. The Applicant would establish a Noxious Weed Advisory Board with members representing the Applicant, agencies, landowners, land managers, and other interested individuals and organizations. The Noxious Weed Advisory Board would perform the following duties:

- Establish specific objectives for weed management

- Establish priorities for weed management
- Coordinate with the Idaho Noxious Weed Coordinating Committee
- Coordinate with Oregon's Noxious Weed Control Program staff
- Coordinate with the USFS and BLM regarding weed control, monitoring, and reseeding policies
- Identify opportunities for participating with existing CWMAs
- Create zones within the larger management area to more effectively use resources or treatments
- Coordinate treatment of individual weed species and infestations
- Identify common inventory and mapping protocols
- Manage designated noxious weeds by using an integrated approach
- Coordinate cooperative use of resources and staff
- Determine board meeting and reporting frequency

Suggested weed management goals for the Snake River corridor through Hells Canyon include the following:

- Prevent the introduction, reproduction, and spread of designated noxious weeds (those on Idaho and Oregon state lists) and invasive exotic plants into and within the Snake River corridor

- Reduce the extent and density of established noxious weeds so that natural resource damage is within some acceptable limits

- Rehabilitate areas that have been infested to reduce reinvasive potential in those areas

- Implement the most effective, economical, and appropriate control methods for each specifically targeted weed or infestation

- Implement an integrated management system that uses all appropriate, available methods or combination of methods

- Complete annual end-of-year reports to document cooperator activities and contributions, project work, estimated total expenditures (for labor, materials, equipment), overall successes observed and monitored from previous years, and projected plans for future years

General management objectives and treatment priorities would be established for specific species and infestations to provide direction for the control of these weeds and to coordinate management efforts of the cooperative. Suggested management objectives would be as follows:

Early Detection/Prevention—Identify potential invaders and prevent their establishment through regular monitoring and control treatments.

Eradicate—Attempt to totally eliminate a noxious weed species from the area.

Control—Prevent seed production throughout the target patch and reduce the coverage of the weed; prevent the weed species from dominating the vegetation of the area but accept low levels of the weed.

Contain/Confine—Prevent the spread of the weed beyond the perimeter of patches or infestation areas.

Tolerate—Accept the presence of the weed when 1) the species is not inherently invasive, 2) environmental or biological elements keep the populations within acceptable limits, or 3) control is not economically feasible under current technologies.

The Applicant suggests the following management priorities:

- Prevent the establishment of potential invaders
- Eradicate new invaders when possible and economically feasible
- Treat new satellite infestations of established invaders
- Treat centers of established invaders

Associated Benefits

Increasing the health and integrity of native plant communities through cooperative and integrated weed management is expected to enhance conditions for multiple resources and purposes, including wildlife, fisheries, aesthetic values, recreation, livestock grazing, and protection of cultural resources.

Implementation or Construction Schedule

Implementation of cooperative efforts would include the following elements:

Time Frame	Action
Within 1 year after license is issued	• Continue ongoing cooperative efforts with CWMAs in the HCC vicinity • Establish the Noxious Weed Advisory Board • Determine opportunities for participating with existing CWMAs • Determine need for additional subregional cooperative efforts • Identify initial cooperators • Begin cooperative integrated weed management plan
Within 2 years after license is issued	• Complete cooperative integrated weed management plan • Implement first cooperative projects
Beginning 3 years after license is issued and continuing for the life of the license	• Implement cooperative integrated weed management plan through adaptive management

Cost Estimate

The Applicant estimates the costs associated with cooperative weed management as follows:

Action	Cost
Cooperative weed control projects along the Snake River corridor in Hells Canyon	
Costs for tasks (for example, planning, reporting, materials purchase, project labor) would vary annually	~$50,000
Total for annual operation budget	$50,000
Total budget for assumed license period (30 years)[a]	$1,500,000

a. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC's discretion for setting a new license term.

Location Map

The Noxious Weed Advisory Board would determine the locations for the weed control and reseeding projects. However, the Applicant anticipates that locations would include both Applicant-owned and other lands within about a 1-mi corridor along the Snake River through Hells Canyon, from Weiser downstream to the confluence of the Salmon River.

E.3.3.3.2.1.3. Cooperative Protection and Monitoring of Sensitive Plant Sites

Justification

Many factors negatively impact rare plant populations along the Snake River corridor through Hells Canyon (confidential Technical Report E.3.2-46 and Technical Reports E.3.3-2 and E.3.3-4), including disturbance from off-road vehicle use, camping, hiking, boating, livestock grazing, agriculture, residential activities, industrial activities, fire, road maintenance, and water-level fluctuations (both natural and river regulation). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make protection of rare plant populations necessary.

The Applicant concludes that, compared with full pool run-of-river operations, modeled proposed operations may negatively influence some rare plant populations. Specifically for the reservoir reaches, the Applicant concludes that, compared with full pool run-of-river operations, proposed operations may limit expansion of some hydrophytic rare plant populations (that is, *Carex hystricina*) along Hells Canyon and Oxbow reservoirs (section E.3.3.4.1.3.). For the downstream reach, the Applicant concludes that both operational scenarios may negatively affect populations of *Cyperus schweinitzii*, *Teucrium canadense* var. *occidentale*, and *Carex hystricina*. Such an effect would be due to an expected decrease in 7 acres of riparian habitat under proposed operations and a decrease of 19 acres of riparian habitat under full pool run-of-river operations from existing levels (section E.3.3.4.2.3.).

Because many factors negatively impact rare plant populations along the reservoir and downstream reach, the Applicant proposes working cooperatively with public land management agencies and other interested conservation groups to protect rare plant sites impacted by disturbance activities (both related and unrelated to HCC operations) in the Hells Canyon area. The Applicant's participation in the cooperative projects would include one or more of the following: 1) funding, 2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials. The Applicant has proposed an annual level of commitment in section E.3.3.3.2.1.3. This estimate was based on past experience with costs involved with rare plant monitoring and protection projects, an estimate of the scope of efforts, an estimate of other participants' funding of cooperative projects and was intended to be capped at an annual level. The actual level of the Applicant's annual commitment cannot be reliably specified until after the planning phase is initiated. It is anticipated that all participants will contribute funds, personnel, and other support to assist with cooperative rare plant protection activities. Because of the high percentage of federally owned lands in the canyon, the USFS and BLM will be encouraged to serve as catalysts for participation in cooperative efforts. The level of commitment from participants cannot be specified until after the planning phase is initiated. Nonetheless, the Applicant anticipates that federal and state natural resource agencies will be involved with implementating the measure at levels recommended by the FERC.

Goal

The primary goal of this measure is to formalize cooperative relationships between the Applicant, agencies, landowners, land managers, and other interested individuals and organizations (such as The Nature Conservancy) needed to protect rare plant species from negative effects of disturbance along the Snake River corridor from the headwaters of Brownlee Reservoir downstream to the confluence of the Salmon River. This measure would include forming a Rare Plant Advisory Board and coordinating with that board on priorities and actions for preventing disturbance to rare plant populations. The board would define the land area for cooperative efforts, which would focus primarily on the health of riparian species and habitats and secondarily on upland species and habitats.

The cooperative relationships sought by this measure would result in grass-roots efforts. Local landowners, land managers, and other interested individuals and organizations would pool their resources and capabilities to protect rare plant sites. The Applicant anticipates that activities initiated by the Rare Plant Advisory Board would be closely coordinated with those of the

Noxious Weed Advisory Board because the spread of nonnative invasive plants and noxious weeds often threatens rare plant sites.

Description

To ensure that activities are accomplished, the Applicant would take the lead in developing and organizing cooperative efforts. The Applicant would establish a Rare Plant Advisory Board with members representing the Applicant, agencies, landowners, land managers, and other interested individuals and organizations. The Rare Plant Advisory Board would perform the following duties:

- Establish priorities
- Establish specific objectives for rare plant protection and monitoring
- Identify opportunities for participating with other interested groups
- Create zones within the larger management area to more effectively use resources or treatments
- Coordinate protection activities for individual rare plant sites or populations
- Identify common inventory and mapping protocols
- Coordinate cooperative uses of resources and manpower
- Determine meeting and reporting frequency
- Identify the opportunities and feasibility for introducing new rare plant populations
- Consider the goals and objectives of state, private, and federal land management directives and plans regarding rare plant species

Suggested rare plant management goals for the Snake River corridor through Hells Canyon include the following:

- Prevent or minimize disturbance to special status plant occurrences and populations associated with the Snake River corridor
- Use noxious weed control, reseeding techniques, grazing management strategies, and other management tools, where applicable, to enhance and minimize disturbance
- Implement the most effective, economical, and appropriate protection measures for each specifically targeted population
- Complete regular reporting to document cooperator activities and contributions, project work, estimated total expenditures (for labor, materials, equipment), overall successes observed and monitored from previous years, and projected plans for future years

Associated Benefits

Increasing the health and integrity of special status plant populations through cooperative efforts is expected to benefit native plant communities and other resources that depend on those communities.

Implementation or Construction Schedule

Implementation of cooperative efforts would include the following elements:

Time Frame	Action
Within 1 year after license is issued	• Establish the Rare Plant Advisory Board • Determine opportunities for participating with existing agency and organization efforts • Determine need for additional subregional cooperative efforts • Identify initial cooperators

Time Frame	Action
Within 2 years after license is issued	• Implement first cooperative projects
Beginning 3 years after license is issued and continuing for the life of the project	• Implement cooperative projects through adaptive management

Cost Estimate

The Applicant estimates the costs associated with cooperative protection and monitoring of rare plant sites as follows:

Action	Cost
Cooperative rare plant projects along the Snake River Corridor in Hells Canyon	
Costs for tasks (for example, planning, reporting, materials purchase, project labor) would vary annually	$6,000
Total for annual operation budget	$6,000
Total budget for assumed license period (30 years)	$180,000

Location Map

The Rare Plant Advisory Board would determine project locations. However, the Applicant anticipates that locations would be within approximately a 1-mi corridor along the Snake River through Hells Canyon, from Weiser downstream to the confluence of the Salmon River.

E.3.3.3.2.2. Transmission Lines and Associated Service Roads

One new measure for botanical resources is associated with the single HCC transmission line—the Pine Creek–Hells Canyon 69-kV line (Line 945): development and implementation of a transmission-line O&M plan. This measure is primarily a management program action with cooperative project components; it requires no acquisition of land.

E.3.3.3.2.2.1. Development and Implementation of Transmission-Line Operation and Maintenance Plan

Justification

The Applicant performs O&M activities to ensure the structural and engineering integrity of the transmission-line system and thereby the safety and reliability of the lines (Technical Reports E.3.2-45 and E.3.3-4). Some of these activities may impact botanical resources.

The Applicant identified threats to special status plant species and the proliferation of noxious weeds as potential impacts of O&M activities on the Pine Creek–Hells Canyon line (Line 945) (Technical Reports E.3.2-45 and E.3.3-4). Small-scale, localized impacts associated with service roads are sparsely scattered throughout the transmission-line corridor. The Applicant's impacts to botanical resources are summarized here.

Special Status Plant Species—The Applicant located 10 occurrences of 1 rare plant species in the HCC transmission-line corridor (Technical Report E.3.3-4). No federally listed threatened or endangered plant species were found. Seven of 10 *Rubus bartonianus* occurrences were assoicated with the Hells Canyon Road. Populations of *Rubus bartonianus* in Hells Canyon are considered secure, with no major threats (Technical Report E.3.3-4).

Noxious Weeds—The Applicant concluded that noxious weeds are common throughout the transmission-line corridors and throughout the surrounding regions (Technical Report E.3.3-4). The Applicant's botanists recorded 114 occurrences of 8 noxious weed species (species designated by Oregon or Idaho state agencies) on survey units along the Pine Creek–Hells Canyon line (Line 945). At least 1 noxious weed was located on 50 of 57 units surveyed (88%) (Technical Report E.3.3-4). The Applicant recognized that O&M activities contribute to the spread of noxious weeds along transmission-line service roads and at tower locations. However, because most disturbance factors are interrelated, attributing the cause of noxious weed occurrence and spread to any single factor is difficult, if not impossible. Other factors potentially contribute to the spread of noxious weeds along transmission lines, such as recreational activity, livestock grazing, wildlife use, and use of the associated Hells Canyon Road.

Goal

The overall goal of the proposed measure is for the Applicant to adaptively manage O&M activities within transmission-line and service-road ROW so that the timing, extent, and location of O&M activities would minimize impacts. A primary objective of the plan is to manage noxious weeds by working cooperatively with federal, state, county, and private entities. By pooling resources, cooperators can protect the natural and economic resources that are impacted by the spread of nonnative invasive plants and noxious weeds.

Description

The Applicant's proposed transmission-line O&M plan would protect botanical resources through three mechanisms:

- Constraints on O&M activities based on type of activity and the spatial and temporal nature of botanical resources being managed
- Site rehabilitation requirements following ground disturbance to protect habitat conditions
- Integration of monitoring results with adaptive management of botanical resources to ensure adequate protection and enhancement

The Applicant defines these measures more fully for each identified potential impact:

Constraints on O&M Activities—The Applicant proposes to restrict the timing and location of O&M activities that may impact identified botanical resources (for example, rare plants) during critical periods. The Applicant has identified time periods when specific plant species are particularly sensitive to disturbance (Technical Report E.3.3-4). In addition, during O&M activities, the Applicant would employ best management practices to minimize impacts to plant species and communities, where applicable.

Site Rehabilitation—The Applicant proposes to repair measurable damage to resources and roads caused by O&M activities. To improve resource conditions, reduce erosion, and minimize the spread of noxious weeds, the Applicant would revegetate roads, structure sites, and other areas measurably affected by ground-disturbing O&M activities. The seed mix and techniques used for any restoration and revegetation project would be determined in consultation with an appropriate land management agency.

Integration of Monitoring with Management of Botanical Resources—The Applicant proposes to integrate monitoring and management activities into an adaptive management program to reduce impacts to botanical resources and improve habitat conditions. Information from monitoring programs would be used in formulating O&M constraints and implementing best management practices (abbreviated as BMPs in tables).

- Special Status Plant Species. The Applicant recognizes that conservation of rare plants in the study area may involve several measures, depending on current knowledge of the natural history of the species, dynamics of the occurrences, and threats to species occurrences. Primary conservation and enhancement measures could include protecting rare plants from physical disturbance, monitoring rare plant occurrences, and controlling encroaching weed species.

  The Applicant proposes to work cooperatively with appropriate state and federal agencies to protect rare plant sites that are threatened by O&M activities. Specific actions to minimize impacts from O&M activities would include the following:

  – Reduce the potential spread of noxious weeds, which can displace rare plants

  – Protect existing rare plant occurrences from O&M disturbances by using timing restrictions and avoidance measures, using best management practices for road maintenance, and educating and communicating with the Applicant's personnel and contractors

  – Survey for new rare plant sites when implementing major O&M activities

  – Monitor impacts following major O&M activities

- Implement best management practices for road maintenance

- Noxious Weeds. The Applicant proposes to work cooperatively with state and federal agencies, counties, and other private landowners to control the establishment and spread of noxious weeds. Specifically, the Applicant proposes taking the lead in forming a Noxious Weed Advisory Board, which would function similarly to County Weed Management Areas (see section E.3.3.3.2.1.2.). Specific actions to minimize impacts from Applicant-related O&M activities would include the following:

  - Clean vehicles that travel off-road or disturb soil and that are likely to spread noxious weed seeds

  - Promptly reseed areas following disturbance to reduce the potential for weed invasion

  - Educate and communicate with the Applicant's personnel and contractors about noxious weed control

  - Implement best management practices for road maintenance

Associated Benefits

Managing the timing of O&M activities, habitat rehabilitation, weed management projects, and best management practices for road maintenance would benefit many botanical, wildlife, and aquatic resources, as well as environmental conditions in general. Increasing the health and integrity of native plant communities through cooperative and integrated weed management is expected to enhance conditions for multiple resources and land-use activities, including wildlife, fisheries, recreation, livestock grazing, aesthetic values, and protection of cultural resources.

In addition to protecting botanical resources, the O&M plan would also have measures for protecting cultural, wildlife, aesthetic, and aquatic resources; controlling erosion; reducing fire hazards; and managing travel and access.

Implementation or Construction Schedule

Management actions associated with the transmission-line O&M plan would follow the schedule below:

Time Frame	Action
Within 1 year after license is issued	• Develop transmission-line O&M plan, including guidelines for site rehabilitation, rare plants, and noxious weeds • Develop monitoring plans for rare plants at risk from O&M activities
Beginning 2 years after license is issued and continuing for the life of the project	• Implement O&M plan, including adaptive management response to monitoring feedback • Implement monitoring plans for rare plants at risk from O&M activities • Implement rehabilitation plans for existing service roads and associated sites

Cost Estimate

The Applicant estimates the costs associated with the transmission-line O&M plan as follows:

Action	Time Frame (years)	Annual Cost	Total Cost (30 years)
Development and implementation of transmission-line O&M plan	1–30	$1200	$36,000
Site rehabilitation—reseeding for ongoing O&M activities	1–30	$800	$24,000
Monitoring and management			
Rare plants	1–30	$1,500	$45,000
Noxious weeds (see section E.3.3.3.2.1.2.)			
Service road BMPs			
Maintenance	1–30	$500	$15,000
Access control	as needed		$5,000
Total			$125,000

Location Map

See Figure E.1-2 for a map of the transmission lines associated with the HCC.

E.3.3.3.2.2.2. Cooperative Project Associated with Transmission-Line Operation and Management Plan

Cooperative project components are incorporated within the transmission-line O&M plans described fully in section E.3.3.3.2.2.1.

E.3.3.3.3. Measures or Facilities Recommended by the Agencies

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.3.3.3.3.1. Accepted or Conditionally Accepted Measures or Facilities

Bureau of Land Management comment letter, dated January 9, 2003.

BLM1-195

> The BLM notes that there are already national standards for noxious weed inventory and mapping protocols that would need to be employed on BLM lands.

Response

The Applicant notes the existence of national standards for noxious weed control. These standards would be considered during implementation of the proposed measure (section E.3.3.3.2.1.2.).

BLM1-196

> The BLM suggests that noxious weed spread prevention would include best management practices (BMPs) for all equipment operating in the permit area, such as cleaning them prior to entering BLM lands, if they have been operating in an area of known noxious weeds.

Response

The Applicant notes the BMPs referenced by the BLM. These BMPs would be considered during implementation of the proposed measure (section E.3.3.3.2.1.2.).

BLM1-199

> The BLM suggests that IPC add a fifth goal, of working cooperatively to introduce or reintroduce rare plant species where habitat is appropriate, in order to address conservation plans or recovery plans.

Response

The Applicant agrees with the BLM's suggestion as long as reintroduction of rare plant species supports documented conservation/recovery plans and has been demonstrated to be successful or strong evidence suggests that such reintroductions would be successful, as proposed, for any cooperative project in the Applicant's proposed PM&E measure in section E.3.3.3.2.1.3.

BLM2-247

> Riparian habitat is an important feature for erosion control, wildlife food and cover. Efforts to restore riparian habitat should first be made on reservoir tributaries and the Powder River Arm. Riparian habitat along Hells Canyon and Oxbow reservoirs needs protection from dispersed recreation. All riparian areas need protection from grazing, vehicles and noxious weed spread. Vehicles can reduce habitat effectiveness by destroying and fragmenting habitat. Brownlee Reservoir lacks adequate riparian habitat. IPC should work cooperatively with other owners to re-establish cottonwood and other important riparian species as well as to protect and enhance all riparian communities in the HCC.

Response

The Applicant notes BLM's suggestions for improving riparian habitat on reservoir tributaries and the Powder River arm; protecting riparian habitat along Oxbow and Hells Canyon reservoirs from dispersed recreation; protecting riparian areas from grazing, vehicles, and noxious weed spread; and establishing cottonwood in the Hells Canyon area. Such goals and objectives are largely already incorporated into proposed PM&E measures in section E.3.2.3. and E.3.3.3. Other management actions would be considered by the Applicant as BLM participated in consultation for these measures. The Applicant notes the BLM's management responsibility on many lands surrounding the HCC and hopes that the BLM takes similar actions to improve management of dispersed recreation and protect riparian areas from grazing, vehicle use, and spread of noxious weeds.

BLM2-261

> Noxious weeds can have serious impacts on Idaho ground squirrel, big game habitats, upland bird habitats and riparian vegetation. All land management agencies, counties and private landowners face serious problems and consequences if noxious weeds are not controlled. It is incumbent upon IPC and land management agencies to work together to prevent and control infestations. As the county governments work with private landowners for weed control, IPC and land management agencies should attempt further cooperative efforts with the counties.

Response

The Applicant appreciates support of its proposed PM&E measure as outlined in section E.3.3.3.2.1.2. With regard to the control of noxious weeds, the Applicant notes the BLM's statement, "It is incumbent upon IPC and land management agencies to work together to prevent and control infestations." This statement is inconsistent with other BLM recommendations to the Applicant regarding weed control where the BLM fails to acknowledge the significant role that its actions play in the spread of noxious weeds in the canyon and implies that the Applicant is responsible for all noxious weed control in the canyon (for example, see comments BLM1-275 and BLM2-264 in section VII of the Consultation Appendix).

BLM2-262

> Upland habitats have been seriously impacted by medusa head wild rye and other exotic weeds reducing the productivity of big game winter range and upland bird habitat. Range rehabilitation efforts would require control of medusa head and other weeds. A key method for weed spread is motor vehicles (pickups, cars, OHV's etc.). Restricting off road vehicle would aid in reducing the spread of noxious weeds. Also, regular control of weeds on roadways would reduce weed spread. IPC should employ these methods in their preparation of a Noxious Weed Management Plan.

Response

The Applicant notes that degradation of upland habitats in the Hells Canyon area has largely resulted from past land management actions, largely under the jurisdiction of the BLM and USFS. The Applicant has little management authority over road or off-highway vehicle (OHV) use on the vast majority of lands in the canyon. The BLM could play a large role in improving upland habitats, especially along Brownlee Reservoir, by managing its lands to control OHV impacts and other human activities. These influences degrade upland and riparian habitats by disturbing the soil, trampling/removing perennial vegetation, and assisting the spread of noxious weeds.

The Applicant is willing to incorporate the BLM's suggestions to control *Taeniatherum caput-medusae* (medusahead wildrye) and other specific noxious weeds in upland habitats, as proposed in its PM&E measure for cooperative noxious weed control, monitoring, and reseeding (section E.3.3.3.2.1.2.). For this measure, projects would be coordinated and prioritized by the Noxious Weed Advisory Board, a board on which the BLM would be represented. The Applicant rejects the BLM's suggestions to mandate specific road restrictions and control weeds in upland habitats as these areas are largely unaffected by HCC operations (Technical Reports E.3.2-45, E.3.3-2, and E.3.3-3 and confidential Technical Report E.3.2-46).

U.S. Forest Service comment letter, dated January 8, 2003.
USFS2-154

- Noxious weed control and site monitoring and reseeding
- Protection and monitoring of sensitive plant sites

The Forest Service by law, requires that any weed control, monitoring, and reseeding on NFS lands will be coordinated with, and conducted according to Forest Service standards and guidelines.

IPC should develop cooperative programs to produce employee and public education programs regarding to the threat of noxious weeds, their identification, mechanisms of spread, and methods of controlling.

IPC should develop cooperative programs to re-vegetate degraded habitats with local native plant materials.

IPC should develop cooperative programs to develop species management guides for rare plants impacted by IPC operations.

IPC should develop cooperative programs to restore rare plant habitat and reintroduce or introduce rare plants to appropriate habitats in accordance with species management guides.

IPC should develop cooperative programs to construct exclosures around rare plant populations threatened by livestock use associated with trailing avenues provided by construction and maintenance of transmission line ROWs.

IPC should develop cooperative programs to construct exclosures around select small noxious weed populations during treatment actions to reduce their chance of spreading via livestock and recreational actions associated with transmission line ROWs.

Response

The Applicant anticipates that the Noxious Weed Advisory Board would consider USFS-stated objectives for noxious weed control while prioritizing cooperative noxious weed control activities in the canyon, as proposed in section E.3.3.3.2.1.2. The Applicant also anticipates that the Rare Plant Advisory Board would consider USFS-stated objectives for rare plant protection while prioritizing cooperative rare plant protection actions in the canyon, as proposed in section E.3.3.3.2.1.3. The USFS would be represented on these boards.

USFS2-155

> IPC should develop a management program for noxious weeds on lands they own, as state law requires landowners treat noxious weeds. Weed sites on private land provide a seed source for neighboring public lands, and IPC should treat occurrences on land they own, as well as establish BMPs for equipment working in known weeds sites on IPC lands.

Response

The Applicant refers the USFS to Technical Report E.6-1 (*Hells Canyon Resource Management Plan*), which indicates current policies and planned activities regarding noxious weed control on Applicant lands.

USFS2-165

> The Forest Service notes that there are already national standards for noxious weed inventory and mapping protocols that would need to be employed on NFS lands.

Response

The Applicant notes the existence of national standards for noxious weed control. These would be considered during implementation of the proposed measure (section E.3.3.3.2.1.2.).

USFS2-166

> The Forest Service suggests that noxious weed spread prevention would include BMPs for all equipment operating in the permit area, such as cleaning them prior to entering NFS lands, if they have been operating in an area of known noxious weeds.

Response

The Applicant notes the BMPs referenced by the USFS. These BMPs would be considered during implementation of the proposed measure (section E.3.3.3.2.1.2.).

USFS2-167

> The Forest Service suggests a 5th management priority: Re-vegetate treated noxious weed sites with native species approved by the appropriate land management agency.

Response

The Applicant notes USFS suggestions. These would be considered during implementation of the proposed measure (section E.3.3.3.2.1.2.). The USFS neglects to mention the use of desired nonnative species in revegetation efforts as stated in its objectives for relicensing the HCC (see the Applicant's response to comment USFS1-22 in section VII of the Consultation Appendix).

USFS2-168

> The Forest Service suggests that IPC add a fifth goal of working cooperatively to introduce or reintroduce rare plant species were habitat is appropriate, in order to address conservation plans or recovery plans.

Response

The Applicant agrees with the USFS suggestion as long as reintroduction of rare plants species supports documented conservation/recovery plans and has been demonstrated to be successful or strong evidence suggests that such reintroductions would be successful, as proposed, for any cooperative project in the Applicant's proposed PM&E measure in section E.3.3.3.2.1.3.

Idaho Fish and Game Department comment letter, dated January 10, 2003

IDFG1-153

> The IDFG believes that IPC should propose PM&E measures that restore nativegrassland communities instead of small and discrete sites containing rare and/or sensitive plant species. This will provide more measurable benefits on a landscape level basis for plant community viability as well as wildlife species dependent on these communities.

Response

The Applicant agrees with the IDFG's suggestion to implement measures that restore native grassland communities instead of small and discrete sites containing rare and/or sensitive plant species. As stated in the mitigation measure described in section E.3.2.3.2.1.1., the Applicant identifies certain characteristics that are desirable in land acquisition and management actions: "Generally, the Applicant would prefer properties that consist of large, contiguous parcels having potential for maximum habitat diversity. Such properties would simultaneously benefit many natural and cultural resources." One of the specific cover types that was identified to be desirable on acquired lands was *Grassland*.

As stated in the mitigation measure described in section E.3.2.3.2.1.4., the Applicant would develop an integrated wildlife habitat program for Applicant-owned lands in three phases: planning, implementation, and adaptive monitoring. Specific parcels of land and their acreages would be evaluated during the planning phase and included as appropriate for protecting and enhancing botanical and wildlife resources.

IDFG1-157

> E.3.3.3.2.1.2 Cooperative Noxious Weed Control, Site Monitoring, and Reseeding
>
> This measure focuses on the Hells Canyon project area from Weiser downstream to the Salmon River. The wide-scale spread of noxious weeds is a major concern of the IDFG and

other resource agencies. This is a measure we support due to the significant adverse consequences of invasive noxious weeds in Hells Canyon, especially for wildlife. IPC believes this measure would be consistent with the Idaho state strategy and consistent with state and federal laws and regulations.

IPC proposes to take the lead in developing and organizing cooperative efforts by establishing a Noxious Weed Advisory Board with a diverse membership including agencies. This is a positive measure and one that the IDFG supports. The IDFG encourages IPC to adequately fund this proposed measure.

Response

The Applicant appreciates the IDFG's support for its proposed program for cooperative noxious weed control, site monitoring, and reseeding.

The Applicant appreciates the IDFG's concern regarding the adequacy of annual funding for its proposed cooperative noxious weed control, site monitoring, and reseeding program. The basis for the estimated annual cost was that the Applicant would develop and participate in "cooperative" agreements with federal and state natural resource agencies and other private landowners to control establishment and spread of noxious weeds in the project area. The Applicant is not proposing to subsidize all weed control efforts in the canyon. The proposed $50,000 represents an estimate of the Applicant's annual participation in the cooperative projects, which would include one or more of the following items: 1) funding, 2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials. This estimate was based on past experience with costs involved in cooperative projects, an estimate of the scope of efforts, and an estimate of other participants' funding of cooperative projects, and it was intended to be capped at an annual level. The actual level of the Applicant's annual commitment cannot reliably be specified until after the planning phase is initiated. It is anticipated that all participants would contribute funds, personnel, and other support to assist with cooperative projects. The level of commitment from participants cannot be specified until after the planning phase is initiated. The Applicant intends to cap the annual cost of its participation in these efforts for budget forecasting and other planning purposes.

IDFG1-158

E.3.3.3.2.1.3 Cooperative Protection and Monitoring of Sensitive Plant Sites

This proposed measure should offer some protection to sensitive plant sites if implemented in conjunction with the noxious weed control and re-seeding measures described above. IPC intends to foster cooperative relationships with other parties including agencies, to protect rare plants from negative effects of disturbance along the Snake River corridor from Weiser downstream to the confluence of the Salmon River. IPC proposes forming a Rare Plant Advisory Board and coordinating with this body on priorities and actions to prevent disturbance to rare plant communities. The primary focus would be on riparian species (presumably because project operations adversely impact riparian corridors) and secondarily on upland plant species and habitats.

IPC proposes to take the lead in developing and organizing these cooperative efforts.

The Rare Plant Advisory Board needs to consider the goals and objectives of state, private (such as The Nature Conservancy), and federal land management directives and plans regarding rare plant species. IDFG and the Idaho Conservation Data Center (CDC) request representation on the advisory board. The IDFG and Idaho CDC combined have expertise in land management and rare plant ecology and management.

Response

The Applicant appreciates the IDFG's support for its proposed program for cooperative protection and monitoring of sensitive plant sites. The Applicant agrees with the IDFG that the "Rare Plant Advisory Board needs to consider the goals and objectives of state, private (such as The Nature Conservancy), and federal land management directives and plans regarding rare plant species." This is incorporated into section E.3.3.3.2.1.2. The IDFG and Idaho Conservation Data Center would have representation on this board.

E.3.3.3.3.2. Rejected Measures or Facilities and Explanations for Rejection

Bureau of Land Management comment letter, dated January 9, 2003

BLM1-275 (repeated in BLM2-263 to BLM2-265)

> The BLM concurs with the conclusion that ongoing continued operations can still contribute to the spread of noxious weeds along the reservoir and downriver reaches. As such, the BLM will require IPC to participate in the prevention, suppression and containment of noxious weed plants. IPC shall at a minimum identify and implement the following activities on BLM lands associated with project-related roads, campgrounds and trails:
>
> - Inventory and map noxious weed presence, distribution, and density. The initial inventory will be completed within one year of issuance of the new license, and annually throughout the length of the license or as defined by the agencies.
> - Develop and implement a monitoring program for noxious weeds that includes evaluating the effectiveness of prevention, control, and eradication measures.
> - Annually detect and eradicate small existing populations and new introductions of noxious weeds.
> - Control, suppress, and contain large-scale infestations of noxious weeds, especially those that overlap different ownerships or responsibilities.
> - Maintain native plant composition and re-vegetate weed infested and disturbed sites with native species.
> - Prevent invasion of new weeds by limiting their dispersal, minimizing soil disturbances, and properly managing desirable vegetation.
> - Complete all necessary NEPA environmental analyses and comply with existing NEPA. Prior to any noxious weed control activities on BLM lands, the licensee shall obtain approval from the BLM.

Coordinate with the BLM to ensure that exotic and invasive vegetation objectives are met across administrative boundaries.

Response

The Applicant notes the BLM's agreement that HCC operations "contribute" to the spread of riparian noxious weeds along the reservoir and downriver reaches. The Applicant is disappointed that the BLM fails to acknowledge the significant role its actions play in the spread of noxious weeds in the canyon. The BLM manages a high percentage of lands in the canyon and oversees grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area, all of which have contributed to the spread of noxious weeds, erosion of shoreline banks, and degradation of rare plant populations in both upland and riparian habitats along the river corridor through Hells Canyon (Technical Reports E.3.3-2, E.3.2-42, and E.3.2-45).

The Applicant notes the BLM's statement that "the BLM will require IPC to *participate* [italics added] in the prevention, suppression and containment of noxious weed plants," but this statement fails to suggest that the BLM would also participate in these efforts. This recommendation is inconsistent with the BLM's recognition that "it is incumbent upon IPC and land management agencies to work together to prevent and control infestations" (see BLM1-172 in section VII of the Consultation Appendix). Rather, the BLM goes on to identify the measures that the Applicant should do to accomplish BLM-mandated work. Therefore, the BLM fails to contribute to *cooperative* efforts.

In general, the Applicant rejects the BLM's bulleted items, listed above, which indicate the "minimum" activities that the Applicant should implement on BLM lands associated with project-related roads, campgrounds, and trails. Because many factors influence the spread of noxious weeds along the reservoirs and downstream reach, the Applicant is willing to work cooperatively on related activities as outlined in the proposed PM&E measure in section E.3.3.3.2.1.2. Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make weed control necessary (see section E.3.3.4. and Technical Reports E.3.3-2 and E.3.2-45). Similar activities as those suggested in the BLM's bulleted items would be conducted *cooperatively* in the Hells Canyon area, based on ecological prioritized needs determined by the Noxious Weed Advisory Board. Prioritized locations for cooperative weed control, revegetation, and monitoring would be determined by the board. The BLM would be represented on this board.

BLM2-248

> Bank erosion has greatly diminished the possibility of growing riparian vegetation along much of Brownlee Reservoir. The alluvial soil deposits below tributaries are potential sites for establishment of riparian vegetation. Roads and soil disturbance in the adjacent uplands contribute to soil erosion making re-vegetation and weed control necessary. Revegetating eroded areas will be difficult because of site conditions and require the attention of vegetation specialists. Road closures or restrictive road OHV management most likely will be necessary to control road and trail erosion and the spread of noxious weeds. IPC should describe how they will fund these analysis and rehabilitation efforts.

Response

Bank erosion is occurring along 27% of the available shoreline (49.6 of 182.3 mi) (79 acres) along Brownlee Reservoir (Technical Report E.3.2-42), resulting from project operations and other factors outside the Applicant's control (such as camping, hiking, boat-generated waves, roads, and livestock grazing) (see section E.3.3.4.2.4.). The Applicant estimated that no more than this amount of erosion would occur under modeled proposed operations and has proposed mitigation by acquiring an equivalent amount of riparian habitat and conducting site stabilization efforts as described in E.3.3.3.2.1.1. and E.4.2.5.1.6. The Applicant notes the BLM's concern regarding revegetation of erosion areas.

The Applicant notes the BLM's management responsibility regarding disturbance of roads and upland habitats from management actions along Brownlee Reservoir. BLM managers oversee grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area, all of which have contributed to the degraded condition of uplands, riparian habitats and the spread of noxious weeds (Technical Reports E.3.2-42, E.3.2-45, and E.3.3-2).

Recreationists, livestock operators, subcontractors, BLM personnel, and the public who visit this area can disturb upland and riparian habitats and unknowingly spread noxious weeds. Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make habitat enhancement and weed control necessary.

The Applicant rejects the BLM's suggestion to fund additional analyses regarding road closures and OHV management. Because of the large percentage of federally owned lands in the canyon, actions of the BLM play a significant role in the degradation of riparian and upland habitats. As the Applicant has limited jurisdiction regarding road closures and OHV management, these activities fall largely under the BLM's responsibility.

BLM2-256

> IPC should join other agencies in developing a road management plan for the canyon. IPC should contribute to operation and maintenance (O&M) costs for all main access roads into the canyon including the Snake River road and the Homestead Canyon road in Oregon, and the Steck road in Idaho because their use is directly related to use of the project.

Response

In its comments, the BLM implies that the Applicant should be responsible for all road-related impacts and thus corresponding mitigation. The TRWG agreed (November 19, 1997; see the "Roads and Access Impacts" statement in the meeting documentation found in section VI of the Consultation Appendix) that the Applicant would study all project-related roads and 1) make recommendations regarding Applicant-owned or maintained roads and 2) propose recommendations applicable to agency road management planning. Specifically, the TRWG statement reads, "...agencies will evaluate the recommendation of the [road management] plan and incorporate those that conform with their needs." It was neither the intent of the TRWG, nor described in the Applicant's study plans, that the Applicant would assume management responsibility for all roads within the project area. See the Applicant's response to comment

BLM1-160 in section VII of the Consultation Appendix for further information on the BLM's contradictions in its positions on wildlife, recreation, and public access issues.

BLM2-257

> Dispersed recreation can have negative impacts on terrestrial resources by causing erosion, damaging riparian habitat and harassment of wildlife. The primary problem is unrestricted camping and recreational uses that damage vegetation. Vegetation removal occurs when vehicles drive off roadways, or humans dig holes for toilets or fire pits, cut trees or shrubs for various reasons and create pathways by foot traffic. Riparian vegetation is limited by soil compaction, vehicles, foot traffic and by cutting and removal. By reducing vegetation densities, erosion can increase from wind or water. Recreational use in or near riparian vegetation limits or displaces wildlife use. Uncontrolled camping along Hells Canyon reservoir has reduced mountain quail habitat effectiveness. IPC operations are directly responsible for this use therefore IPC should assist BLM in the management and operation of this recreation use. See the Recreation section for details.

Response

The Applicant agrees with the BLM that dispersed recreation may potentially impact habitat and wildlife. The Applicant evaluated potential impacts of dispersed recreational activities and other human use activities in confidential Technical Report E.3.2-46. That report made several recommendations to address potential impacts on lands over which the Applicant has jurisdiction; these recommendations, including riparian habitat protection and enhancement, were carried over to the PM&E measure described in section E.3.2.3.2.1.4.

While the BLM is concerned about recreational impacts to wildlife and habitat, it has also commented that the Applicant should improve access for recreationists and further develop both dispersed and developed recreational sites. The Applicant opposes providing increased recreational access at the BLM's request and then being required to mitigate for the potential negative effects to wildlife resulting from the increased access.

The Applicant proposes measures to protect, mitigate for, or enhance wildlife habitat, as appropriate, on dispersed sites on Applicant-owned lands. Recreation site plans developed by the Applicant for dispersed recreation sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (that is, hardening sites, restricting access, using native plant materials). The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, or cultural), nor would it actively enhance habitat at sites not covered by an agreed-upon site plan.

The Applicant requests that the BLM 1) recognize the inherent trade-offs between recreational access and wildlife resources, 2) establish site-specific prioritizations between protecting wildlife and providing recreational access, and 3) provide the Applicant with nonconflicting recommendations for proposed mitigation measures.

BLM2-279

> Conduct a study and inventory of submergent and emergent vegetation and its value to wildlife. Determine the continuing impacts of the loss of this vegetation.

Response

The Applicant disagrees with the BLM that more research is necessary to determine the value of submergent and emergent vegetation to wildlife. The BLM's statements are simply conjecture without supporting evidence.

Emergent vegetation was inventoried and mapped in Technical Report E.3.3-1. The *Emergent Herbaceous Wetland* cover type is extensively described in the text of Technical Report E.3.3-1 (pages 338 through 392).

The need to study submergent vegetation was never identified as an issue in comments on the Applicant's *Formal Consultation Package for Relicensing: Hells Canyon Project* (January 1997) or comments on detailed study plans in April 1999 (Phase I) and July 1999 (Phase II) (see section II of the Consultation Appendix).

In requesting a need to "determine the continuing impacts of the loss of this vegetation," the BLM references the pre-project issue regarding the effects of changing from a free-flowing river to a large slackwater reservoir. The Applicant disagrees. FERC has determined that where project works already exist and are part of the existing environment, it is not reasonable to analyze the effects of relicensing using a pre-project environmental baseline. The proper baseline for environmental analysis is existing conditions. These arguments do not affect the Applicant's analysis of modeled proposed or full pool run-of-river operational effects on natural resources based on current conditions with the HCC in place.

U.S. Forest Service comment letter, dated January 8, 2003
USFS2-160

> In their PM&Es, IPC needs to address actions that relate to their contribution to shoreline erosion.

Response

The USFS has misinterpreted data and not adequately reviewed conclusions in Technical Report E.3.2-42. The Applicant concludes that, because many of the erosional influences are interrelated, attributing the cause of erosion at each site to any single factor is impossible. The number and severity of influences affecting each erosion site are identified in Appendix 2 of Technical Report E.3.2-42. Discussions regarding the influence of individual factors on erosion sites, summarized by reach, are presented in sections 5.3. and 6 of Technical Report E.3.2-42.

The Applicant has adequately addressed PM&E needs for erosion of shoreline banks and loss of terrestrial habitats by proposing mitigation to acquire and manage an area equal to the total extent of shoreline bank erosion in the reservoir and downstream river reaches (90 acres). Impacts of modeled proposed operations on shoreline bank erosion are not expected to be greater than impacts currently found in the study area. Also, by proposing to mitigate for 90 acres, the Applicant has not limited its actions solely to its contribution to shoreline bank erosion. Other influences on bank erosion outside the Applicant's control would include recreational activities (boat-driven waves, camping, trails, and dispersed recreation), livestock grazing, and road or other construction or maintenance activities. These activities largely occur on federal lands under the jurisdiction of BLM and USFS. These factors would continue to influence shoreline bank erosion under either proposed or full pool run-of-river operations.

USFS2-164 (repeated in USFS2-192)

> The Forest Service intends that IPC work cooperatively with weed management entities and implements weed control measures in accordance with the Standards and Guidelines of the governing landowner. However, in their following discussion of goals, objectives, and management prioritization, IPC neglects to emphasize the treatment and eradication of existing noxious weed species or select weed populations. Treating existing weed occurrences needs to be priority. IPC needs to focus on more than just addressing new invaders. Simply proposing to Treat centers of established invaders. is not adequate. Likewise, managing to reduce the extent and density of established noxious weeds to a point that natural resource damage is within some acceptable limits is too vague. In the HCNRA, that limit will *be zero tolerance for many weed species*.

Response

The Applicant notes the USFS statement that "the Forest Service intends that IPC work cooperatively with weed management entities," but this statement fails to suggest that the USFS would participate in these cooperative efforts. In the following comments by the USFS, and those expressed elsewhere in response to the Applicant's DLA, the USFS implies that the Applicant is responsible for all of the noxious weed control in the canyon. The USFS repeatedly suggests that the Applicant do USFS-mandated work. The USFS fails to recognize the significant role its actions play in the spread of noxious weeds in the canyon and the need to contribute to *cooperative* efforts. The USFS and BLM manage a high percentage of lands in the canyon and oversee grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area, all of which have contributed to the spread of noxious weeds, erosion of shoreline banks, and degradation of rare plant populations in both upland and riparian habitats along the river corridor through Hells Canyon (Technical Reports E.3.3-2, E.3.2-42, and E.3.2?45).

With regard to the Applicant's proposed PM&E measure, the USFS has made incorrect assumptions regarding the Applicant's statements. The Applicant questions the USFS review of this proposed PM&E measure (section E.3.3.3.2.1.2.) and the validity of USFS comments, based on existing USFS standards and guidelines for noxious weed control activities.

In the Applicant's proposed goals, objectives, and management prioritization, the USFS states that the Applicant 'neglects to emphasize the treatment and eradication of existing noxious weed species or select weed populations." The Applicant refers the USFS to the list of tasks suggested for the Noxious Weed Advisory Board, suggested management objectives, and suggested management goals in section E.3.3.3.2.1.2. Numerous references are made to existing populations of noxious weeds.

The USFS states that the Applicant "needs to focus on more than just addressing new invaders." The USFS has not considered other actions proposed in this measure (section E.3.3.3.2.1.2.). The Applicant's suggested management priorities are consistent with applicable USFS plans for the Hells Canyon area, such as the *Wallowa–Whitman Integrated Noxious Weed Management Plan* (USFS 1990) that states "prioritize species and sites to treat infestations with the most potential for control, or to eliminate new invaders that are still isolated."

The Applicant notes the USFS's suggested "zero tolerance" for many weed species. The Applicant is not aware that USFS has published or practiced this policy. The Applicant is not aware that this policy is part of any forest plan or stated in any of its standards and guidelines for noxious weed control activities. The USFS has a history of demanding that others follow more stringent practices than it requires of its own staff.

The Applicant's proposed PM&E measure is well within established guidelines for noxious weed control activities and supports the goals and actions of the Idaho State Department of Agriculture as outlined in its strategic plan for managing noxious weeds (ISDA 1999), the Oregon Department of Agriculture's Noxious Weed Control Program (ODA 2003), and weed management strategies identified in the BLM's January 1996 *Partners Against Weeds* and the USFS's September 1998 *Stemming the Invasive Tide* documents. The Applicant has found its proposed measure to be consistent with the *Wallowa–Whitman Integrated Noxious Weed Management Plan* (USFS 1990) and other forest plans reviewed by the Applicant. Nevertheless, all goals, objectives, and management priorities would be established by members of the Noxious Weed Advisory Board. The USFS would be represented on this board.

USFS2-192

> The Forest Service concurs with the conclusion that ongoing continued operations can still contribute to the spread of noxious weeds along the reservoir and downriver reaches. As such, the Forest Service recommends IPC participate in the prevention, suppression and containment of noxious weed plants. IPC should at a minimum identify and implement the following activities on NFS lands associated with river margin, project-related roads, campgrounds and trails:
>
> - Inventory and map noxious weed presence, distribution, and density. The initial inventory will be completed within one year of issuance of the new license, and annually through out the length of the license or as defined by the agencies.
> - Inventory and map noxious weed response to major landscape events, such as wild fire and large scale floods.
> - Develop and implement a monitoring program for noxious weeds that includes evaluating the effectiveness of prevention, control, and eradication measures.
> - Annually inventory, map changes and eradicate small existing populations and new introductions of noxious weeds.

- Control, suppress, and contain large-scale infestations of noxious weeds, especially those that overlap different ownerships or responsibilities.

- Maintain native plant composition and re-vegetate weed infested and disturbed sites with native species.

- Prevent invasion of new invaders by limiting weed dispersal, minimizing soil disturbances, and properly managing desirable vegetation.

- Complete all necessary NEPA environmental analyses and comply with existing NEPA and the Record of Decision for Managing Competing and Unwanted Vegetation ([USFS] 1988, as amended in 1992a). Prior to any noxious weed control activities on NFS lands, the licensee should obtain approval from the Forest Service.

- Collaborate with the Forest Service to ensure that exotic and invasive vegetation objectives are met across administrative boundaries.

Response

The Applicant notes the USFS's agreement that HCC operations "contribute" to the spread of riparian noxious weeds along the reservoir and downriver reaches. The Applicant is disappointed that the USFS fails to acknowledge the significant role its actions play in the spread of noxious weeds in the canyon. The USFS manages a high percentage of lands in the canyon and oversees grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area, all of which have contributed to the spread of noxious weeds in both upland and riparian habitats along the river corridor through Hells Canyon (Technical Reports E.3.3-2 and E.3.2-45).

The Applicant notes the USFS's statement that "the Forest Service recommends IPC *participate* [italics added] in the prevention, suppression, and containment of noxious weed plants," but this statement fails to suggest that the USFS would also participate in these efforts. Rather, the USFS goes on to identify measures that the Applicant should do to accomplish USFS-mandated work. Therefore, the USFS fails to contribute to *cooperative* efforts.

In general, the Applicant rejects the USFS's bulleted items, which indicate the "minimum" activities that the Applicant should implement on USFS lands associated with river margin, project-related roads, campgrounds, and trails. Because many factors influence the spread of noxious weeds along the reservoirs and downstream reach, the Applicant is willing to work cooperatively on related activities as outlined in its proposed PM&E measure (section E.3.3.3.2.1.2.). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make weed control necessary (see section E.3.3.4. and Technical Reports E.3.3-2 and E.3.2-45). Similar activities as those suggested in the USFS's bulleted items would be conducted cooperatively in the Hells Canyon area, based on prioritized ecological needs determined by the Noxious Weed Advisory Board. Prioritized locations for cooperative weed control, revegetation, and monitoring would be determined by the board. The USFS would be represented on this board.

E.3.3.3.3.2.1. Oregon Department of Fish and Wildlife comment letter, dated January 10, 2003

ODFW3-14

> IPC should immediately begin development and implementation of the Noxious Weed Advisory Board and the cooperative weed management plan, rather than waiting until issuance of the new license. The cooperative weed management plan should be drafted and included in the FLA.

Response

The Applicant appreciates the ODFW's support for its proposed program for cooperative noxious weed control, site monitoring, and reseeding. The Applicant has initiated work for the measure proposed in section E.3.3.3.2.1.2., as outlined below, and plans to continue with these cooperative efforts until new license articles are received for the HCC. These efforts will accomplish much toward building cooperative relationships with interested parties, identifying successful strategies for noxious weed control, and implementing monitoring and revegetation actions; they will also form the basis for developing a realistic cooperative weed management plan when a new license is received. The Applicant rejects the recommendation to draft the cooperative weed management plan and begin formal cooperative measures before the issuance of a new license.

With regards to cooperative weed control, the Applicant has been involved in many projects from several county-based CWMAs and other weed control groups in the Hells Canyon area to gain/share knowledge and build working relationships. The Applicant's participation in the cooperative projects has included one or more of the following items: 1) funding, 2) technical expertise, 3) logistical involvement, 4) in-kind support, and 5) materials. Cooperative projects have occurred reasonably near, but usually outside, Applicant-owned lands. The Applicant's participation began in 1999 with support of the Columbia-Blue Mountain RC&D Public Affairs Project; with support of Baker County's weed control and revegetation program (Wessinger Foundation Grant); and with the newly formed Lower Payette CWMA (Payette, Gem and Washington counties, Idaho), Snake River Breaks CWMA (Washington County, Idaho), and the Weiser River CWMA (Washington County, Idaho). Since then, annual support has expanded to other cooperative project with entities such as the Adams County CWMA (Adams County, Idaho) and the Oregon Trail CWMA (Twin Falls County, Idaho). The Applicant's efforts have been recognized in four letters of commendation by county commissioners from Washington, Payette, and Gem counties and from the Weed Control District Supervisor of Baker County (see section V of the Consultation Appendix).

The Applicant has also initiated weed control and habitat improvement projects in support of the measure proposed in section E.3.2.3.2.1. Meetings with ODFW and IDFG technical staff and field work began in June 2002. The Applicant recently met with representatives of the IDFG and ODFW on February 13, 2003, to further identify and refine two pilot weed control and reseeding projects on Patch Island (owned by the ODFW) and Gold Island (owned by the IDFG). Discussions with technical staff confirmed the challenge to control current levels of noxious weeds and to establish desirable perennial vegetation on these islands. These pilot projects will be conducted during 2003–2004 to help identify useful revegetation techniques and realistic management objectives to incorporate into future management plans for these islands.

Representatives from several county weed control associations have committed to participate in these cooperative pilot projects, including Malheur County (Oregon), Washington County (Idaho) and Canyon County (Idaho).

ODFW3-16

> IPC needs to provide a detailed plan for protecting rare and sensitive plant sites in the FLA. Specific sites for protection and specific measures and funding levels necessary need to be included.

Response

The Applicant appreciates the ODFW's support for its proposed program for cooperative protection and monitoring of sensitive plant sites. The Applicant rejects the recommendation to draft specific measures for protection of rare plant sites before the issuance of a new license. Many factors negatively impact rare plant populations along the Snake River corridor through Hells Canyon (section E.3.3.4.1.3. and E.3.3.4.2.3. and Technical Reports E.3.3-2 and E.3.2-45). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make protection of rare plant populations necessary. The Applicant proposes to work cooperatively with public land management agencies and other interested conservation groups to protect rare plant sites impacted by disturbance activities, both related and unrelated to HCC operations. The Applicant would coordinate with these groups to prioritize sites and protection measures, as proposed in section E.3.3.3.2.1.3.

The Applicant appreciates the ODFW's concern regarding the adequacy of annual funding for its proposed program for cooperative protection and monitoring of sensitive plant sites. The basis for the estimated annual cost was that the Applicant would develop and participate in *cooperative* agreements. The Applicant is not proposing to subsidize all rare plant protection efforts in the canyon. The proposed $6,000 represents an estimate of the Applicant's annual participation in the cooperative projects, which would include one or more of the following items: 1) funding,

2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials. This estimate was based on past experience with costs involved with rare plant monitoring and protection projects, an estimate of the scope of efforts, an estimate of other participants' funding of cooperative projects, and it was intended to be capped at an annual level. The actual level of the Applicant's annual commitment cannot reliably be specified until after the planning phase is initiated. It is anticipated that all participants would contribute funds, personnel, and other support to assist with cooperative projects. The level of commitment from participants cannot be specified until after the planning phase is initiated. The Applicant intends to cap the annual cost of its participation in these efforts for budget forecasting and other planning purposes.

E.3.3.4. Anticipated Impacts on Botanical Resources

Identifying impacts to botanical resources is a specific concern for relicensing the HCC (FERC 1990, IPC 1997). During the Applicant's relicensing consultation, state and federal resource agencies identified several issues and expressed concerns about potential impacts to botanical resources (IPC 1997). Primary issues were that operations of the HCC 1) prevent perennial habitats from becoming established between reservoir maximum operational drafting depths and full-pool shorelines (referred to as reservoir fluctuation zones); 2) prevent the establishment of perennial riparian habitat along full-pool reservoir shorelines (reservoir shoreline zones); 3) negatively affect botanical resources downstream of Hells Canyon Dam (river shoreline zone); 4) decrease habitat for threatened, endangered, or other special status plant species; 5) contribute to the spread of listed noxious weeds and other undesirable plants; and 6) accelerate erosion of shoreline banks and botanical habitats. See section V in the Consultation Appendix for all other botanical resource issues presented by agencies and other cooperators in the consultation process that are tracked through study development, impact assessment, and Applicant-proposed PM&E measures.

The Applicant conducted several studies to investigate issues about potential impacts to botanical resources. The Applicant evaluated and compared operational impacts to botanical resources for two potential operational scenarios: 1) modeled proposed operations for the complex and 2) full pool run-of-river operations wherein hydroelectric operations would not influence reservoir water surface elevations or outflows from Hells Canyon Dam (see Technical Report E.1-4 and

Exhibit B for a description of operational scenarios). For individual botanical issues, studies were designed to 1) describe current resource conditions, 2) identify potential impacts from modeled proposed operations of the complex, and 3) estimate magnitudes of operational impacts.

E.3.3.4.1. HCC Reservoirs and Vicinity

E.3.3.4.1.1. Reservoir Operations and General Vegetation

E.3.3.4.1.1.1. General Riparian and Upland Habitats in Fluctuation Zones

The HCC reservoirs formed fluctuation zones when water levels were manipulated during historical operations (Technical Report E.1-4). Although drafting of Brownlee Reservoir has historically varied within and among years, relatively large seasonal fluctuations were common. But during years with a large spring runoff, fluctuations rarely extended to the 101-ft level (2,077 ft msl) allowed in the license for flood control (Technical Report E.1-4). The fluctuation zones of Oxbow and Hells Canyon reservoirs were relatively small (typically less than 5 ft rather than the 10-ft maximum allowed) (Technical Report E.1-4).

Large annual fluctuations on Brownlee Reservoir expose a barren zone and, where fine sediments are available, can be annually colonized by species such as *Xanthium strumarium*, *Portulaca oleracea*, *Amaranthus* species, and *Echinochloa crus-galli* before being inundated when Brownlee Reservoir is refilled (Technical Reports E.3.3-1 and E.3.3-3). In this fluctuation zone, these species are able to germinate, grow, and set seed during periods of drawdown, whereas most native and exotic perennial species cannot survive to propagate. In contrast, the smaller fluctuations of Oxbow and Hells Canyon Reservoirs largely prevent the establishment of annual species in the fluctuation zones, and shoreline habitats predominantly consist of perennial herbaceous and woody species (section 2.3.2.2. in Technical Report E.3.3-3).

The Applicant concluded that the current lack of vegetation in the fluctuation zones would persist into the future, regardless of the operational scenario used (Technical Report E.3.2-40). That is, under either modeled proposed operations or full pool run-of-river operations, the reservoir fluctuation zones would be at least seasonally inundated. Therefore, the Applicant concludes that proposed operations would permanently and completely eliminate the capability of the fluctuation zones to support perennial vegetation habitats (Technical Reports E.3.2-40 and E.3.2-45).

The Applicant estimated that 5,820 acres in the 101-ft fluctuation zone of Brownlee Reservoir, 89 acres in the 10-ft fluctuation zone of Oxbow Reservoir, and 240 acres in the 10-ft fluctuation zone of Hells Canyon Reservoir are affected by operations and therefore impact botanical habitat (Technical Reports E.3.2-40 and E.3.2-45). To further evaluate impacts to botanical habitats (wildlife habitats), the Applicant estimated theoretical amounts of perennial riparian and upland habitats that modeled proposed operations would prevent from establishing in the fluctuation zones. The Applicant estimated that proposed operations would prevent 1) Brownlee Reservoir from supporting 372 acres of riparian and 5,448 acres of upland habitats, 2) Oxbow Reservoir from supporting 7 acres of riparian and 82 acres of upland habitats, and 3) Hells Canyon Reservoir from supporting 9 acres of riparian and 231 acres of upland habitats (Technical Reports E.3.2-40 and E.3.2-45).

The Applicant concludes that modeled proposed operations would impact 6,149 acres (388 acres riparian habitat and 5,761 acres upland habitat) of botanical habitat within the fluctuation zones of the three HCC reservoirs. Protecting (for example, through acquisition) and enhancing riparian and upland wildlife habitat would constitute appropriate mitigation for operational impacts to the reservoir fluctuation zones (see section E.3.3.3.2.1.1.). This acreage is not additive to that identified in section E.3.2.4.1.1.2.

E.3.3.4.1.1.2. General Riparian and Upland Habitats in Shoreline Zones

Reservoir operations often affect riparian habitats, especially where large seasonal water-level fluctuations occur. Such fluctuation, while creating new full-pool reservoir shorelines, inhibits riparian vegetation from establishing in the fluctuation zone (Lewke and Buss 1977).

Comparing reservoir and lake ecology provides a reference point for understanding the environmental impacts associated with reservoir operation. Lakes are relatively stable ecological systems. Decades, if not centuries, are often required for lake shorelines to achieve equilibrium. Easily erodable shoreline substrates are leveled, creating shallow, low-gradient landscapes, while more durable substrates such as rock outcrops remain as cliffs or steep-gradient shorelines.

The degree to which reservoirs function as natural lakes depends largely on the magnitude of water-level fluctuations. Reservoirs that closely mimic the water-level fluctuations of natural lakes tend to have richer shoreline communities, although generally not as rich as natural lakes. Reservoir shorelines are not as stable or complex as lake shorelines (GANDA 1996).

Large seasonal drafting of Brownlee Reservoir has historically limited the extent of riparian habitat in the shoreline zone of this reservoir (Technical Reports E.3.3-1 and E.3.3-3). Most existing riparian habitat in the shoreline zone of Brownlee Reservoir occurs near the mouths of tributary streams or springs where the shoreline soil moisture is not dependent on reservoir water surface elevation. In some locations, a narrow linear band of facultative perennial riparian species (that is, adapted to benefit from temporary mesic conditions) exists along the full-pool shoreline (Technical Reports E.3.3-1 and E.3.3-3). During periods of drawdown, where fine sediments occur, expansive areas can be colonized by ruderal annual species, such as *Xanthium strumarium*, *Portulaca oleracea*, *Amaranthus* species, and *Echinochloa crus-galli*. Otherwise, upland vegetation composes most of the shoreline zone, extending to the reservoir full-pool shoreline (Technical Report E.3.3-1).

In contrast to Brownlee Reservoir, both Oxbow and Hells Canyon reservoirs have relatively abundant trees, shrubs, and other perennial riparian species along them (section 4.4. in Technical Report E.3.3-1, section 2.3.2.2. in Technical Report E.3.3-3). Historic, relatively stable pool levels at both Oxbow and Hells Canyon reservoirs likely enhanced establishment of riparian habitats compared with what would exist if the reservoirs were not held relatively stable (Technical Report E.3.2-44). Where suitable substrate and topography occur, a relatively wide band of perennial riparian habitat is promoted by the combination of small daily water fluctuations that “irrigate” riparian vegetation during the growing season and conditions of no large seasonal drafting (section 2.3.2.2. in Technical Report E.3.3-3, Technical Report E.3.2-44).

An “irrigation effect” refers to the promotion of vegetation growth and vigor through supplemental water. The Applicant considers that the phrase may be somewhat new relative to discussion of riparian hydraulics, but the recognition that an increase in summer stream flow (stage) can promote riparian vegetation is fully consistent with numerous reports (Nilsson and Keddy 1988, Hill et al. 1998, Springer et al. 1999, Jansson et al. 2000). Along Oxbow and Hells

Canyon reservoirs, the obvious proliferation of trees and shrubs above the full-pool elevation provides further demonstration of an irrigation effect.

Soil resources along Oxbow and Hells Canyon reservoirs are favorable for riparian vegetation establishment. Soil and substrate affinities for riparian vegetation occurrence on these reservoirs ranged from fine to coarse substrates, similar to patterns observed for Brownlee Reservoir (section 2.3.2.2. in Technical Report E.3.3-3). Using GIS cover type data from mapping efforts reported in Technical Report E.3.3-1, existing riparian habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland* cover types) within a 20-m planimetric band above the high-water mark constitute 21.5% and 20.0% of the total area along Oxbow and Hells Canyon reservoirs, respectively. These percentages can be compared with 9.8% along Brownlee Reservoir, 39.8% in the Weiser reach, and 17.7% in the reach below Hells Canyon Dam.

To estimate impacts of potential future operation of the HCC on the shoreline botanical resources, studies reported in Technical Report E.3.3-3 modeled the effects of two hypothetical scenarios: modeled proposed operations and full pool run-of-river operations (see Exhibit B for an explanation of the operational scenarios). Investigators predicted modest differences along shoreline riparian habitats of Oxbow and Hells Canyon reservoirs for the two scenarios, indicating that there is no real advantage from a general vegetation perspective for either scenario over the other because of the lack of dramatic or significant differences in timing and magnitude of water-level variations between the scenarios (section 3.6.2.2. and Table 6.1 in Technical Report E.3.3-3). For Brownlee Reservoir, the riparian corridor would probably migrate upslope and would be expected to be denser (that is, more plant cover and higher plant density) under full pool run-of-river operations than under proposed operations (section 3.6.2.1. in Technical Report E.3.3-3). A distinct difference between the two scenarios was in relation to the dispersal and proliferation of noxious weed species, which is discussed later in section E.3.3.4.1.2.

For Oxbow and Hells Canyon reservoirs, investigators predicted a slight reduction in the extent of perennial riparian vegetation with modeled proposed operations compared with full pool run-of-river operations (Table 6.1 in Technical Report E.3.3-3). With modeled proposed operations, riparian perennials would extend further downward along the elevational profile, but those at the upper end of the riparian zone would be less favored. With full pool run-of-river operations, the riparian zone would be expected to become more densely vegetated and migrate slightly upslope.

Generally, because perennial vegetation persists in the riparian zone of Oxbow and Hells Canyon reservoirs, opportunities for recruitment of annuals, which are ecological pioneers and often shade intolerant, would be diminished. Modeling efforts predicted a slight downward extension of ruderal annuals with the proposed scenario but decreased occurrence from full pool up to about 2.5 m (Figure 3.14 in Technical Report E.3.3-3). The ruderal annuals would probably not complete their life cycles under the daily/hourly fluctuation zone influence and would not effectively compete with the perennial vegetation in the dense vegetation zone near full pool (section 3.6.2.2. in Technical Report E.3.3-3). Evidence for this predicted lack of annual species is demonstrated by the current composition of riparian plant assemblages along Oxbow and Hells Canyon reservoirs in which annual species are an insignificant component of the assemblages (Appendix 3 to Technical Report E.3.3-1, section 2.3.2.2. in Technical Report E.3.3-3).

Overall, investigators predicted rather modest differences between the two scenarios along these reservoirs, indicating that there is no real advantage from a general vegetation perspective of either scenario over the other (section 3.6.2. and Table 6.1 in Technical Report E.3.3-3).

In attempts to quantify impacts (for example, acres) to botanical habitats in the shoreline zones, the Applicant's contractors estimated impacts to the establishment and extent of riparian habitat (Technical Report E.3.2-40). They compared the projected future composition and extent of cover types in the reservoir shoreline zones for modeled proposed and full pool run-of-river operational scenarios.

They determined that neither scenario would change the relative composition and extent of riparian and upland cover types from current conditions within shoreline zones of Oxbow and Hells Canyon reservoirs. Modeled proposed operations nearly mimic patterns of water surface elevations that historically occurred during the vegetation growing season (Technical Report E.1-4). It was concluded that if proposed operations occurred for 30 years or more, the relative composition of riparian and upland cover types within all three reservoir shoreline zones would remain unchanged from current conditions (Technical Report E.3.2-40). Similarly, full pool run-of-river operations would not alter the relative composition of riparian and upland cover types from current conditions within shoreline zones of Oxbow and Hells Canyon reservoirs (Technical Reports E.3.2-40 and E.3.2-45). Therefore, the extent and composition of riparian cover types in the shoreline zones of Oxbow and Hells Canyon reservoirs would remain essentially unchanged regardless of operation scenario. However, some negative influences of increased noxious weed dispersal could result from full pool run-of-river operations and, therefore, decrease the quality of riparian cover types on Oxbow and Hells Canyon reservoirs, as discussed in section E.3.3.4.1.2.

Current riparian and upland cover type conditions within the shoreline zone of Brownlee Reservoir would change under full pool run-of-river operations. Under these operations, reservoir water surface elevations would be held constantly at full pool, a level that would promote establishment of an estimated 343 additional acres of riparian cover types (Technical Reports E.3.2-40 and E.3.2-45). Investigators indicate, however, that newly established riparian plant communities along Brownlee Reservoir's shorelines would more closely resemble the characteristics (for example, species cover, composition, density) of the abundant weed-dominated communities found upstream in the Weiser reach (Technical Reports E.3.2-40, E.3.3-1, E.3.3-3). This invasion of weedy introduced riparian species would be expected to negatively influence native riparian communities located downstream of Brownlee Reservoir (Technical Report E.3.2-45, Chapter 4 of Technical Report E.3.3-3). See also section E.3.3.4.1.2. regarding this dispersal barrier.

The Applicant concludes that modeled proposed operations would prevent 343 acres of riparian habitat from establishing along the Brownlee Reservoir shoreline zone that is currently occupied by upland habitat and that neither scenario would significantly alter vegetation cover types along Oxbow and Hells Canyon Reservoirs. Habitat management actions designed to protect (for example, through acquisition) and enhance 343 acres of riparian habitat would constitute appropriate mitigation for operational impacts to the establishment of riparian habitat along the reservoir shoreline zones (see section E.3.3.3.2.1.1.). This acreage is not additive to that stated in section E.3.2.4.1.1.3.

E.3.3.4.1.2. Reservoir Operations and Noxious Weeds

Riparian zones are generally vulnerable to invasion by exotic species because riverine environments are dynamic and have recurrent disturbances (for example, flooding, scour, and sediment movement and deposition), water is available year-round, and rivers form a natural network for propagule dispersal (Planty-Tabacchi et al. 1995). Weed invasions can be pronounced where natural communities are further disturbed by river regulation (Nilsson and Berggren 2000).

Prior to and since construction of the HCC, residential, industrial, recreational, and agricultural influences both upstream and within Hells Canyon likely introduced many weedy species to the Hells Canyon ecosystem. Most of the weedy species identified in Technical Report E.3.3-2 appear to have been present within the study corridor prior to the HCC (Technical Report E.3.2-44). With these weed introductions and the capacity of these species to proliferate, the current abundance of weeds in Hells Canyon (section E.3.3.1.1.2.) is not surprising. Weedy exotic species would occur along the Snake River in Hells Canyon without the influence of HCC operations. Nonetheless, historic operation of the HCC reservoirs has probably contributed to the spread of noxious weeds.

Although regulated water levels from hydroelectric operations can contribute to exotic weed invasion in riparian habitats, the large water-level fluctuations during historical operations on Brownlee Reservoir may have provided a barrier to impede downstream infestation of many perennial weedy species (section 4.4. in Technical Report E.3.3-1, Chapter 4 of Technical Report E.3.3-3). The capacity of reservoirs to hinder hydrochory, or water-based plant propagation, is well established and underlies the concept of fragmentation that is prominent in the current literature (Nilsson et al. 1991, Dynesius and Nilsson 1994, Nilsson and Jansson 1995, Johnson 2002). Essentially, floristic dissimilarities result between upstream, reservoir, and downstream reaches (Jansson et al. 2000). Most riparian plant species, both native and exotic, are unable to establish and survive the successive drying and flooding in reservoir fluctuation zones that experience large, seasonal water level changes (Nilsson and Keddy 1988).

Table 12 in Technical Report E.3.3-1 identifies common and abundant exotic weedy riparian species that are found almost exclusively upstream and in the headwaters of Brownlee Reservoir and that may have been impeded in their downstream spread. These species have appropriate life history traits for potentially increasing in abundance and distribution downstream under natural or regulated river flow conditions. However, these species occur relatively infrequently, if at all, downstream of the headwaters of Brownlee Reservoir (Technical Reports E.3.3-1, E.3.3-2, E.3.3-3). Life history traits for several riparian species, including exotic weedy riparian species, are discussed in Appendix 3.2 to Technical Report E.3.3-3.

Specific evidence suggests that seasonal drafting of Brownlee Reservoir has impeded *Tamarix* species from invading riparian habitats downstream of Brownlee Reservoir. *Tamarix* species are aggressive, woody species that produces massive quantities of small seeds and can propagate from buried or submerged stems or branch fragments. The species often form dense monotypic stands that out-compete other riparian species (de Gouvenain 1996) and replaces native trees (Ellis 1995, Cleverly et al. 1997). *Tamarix* species are listed in many western states as a noxious weed, though not in Idaho; they are, however, currently being proposed for listing in Idaho. It was speculated to be a relatively recent (10–15 years) invader to the headwaters of Brownlee Reservoir (Technical Report E.3.3-1), and the average age of a few cored plants in the study area was 9 years old (Technical Report E.3.3-3). However, the first record of a *Tamarix* species in the vicinity is from 1938 (54 years ago) for an occurrence in an abandoned field northwest of Weiser, Idaho, Washington County (Rice 2002). *Tamarix* species are quite prolific in the headwaters of Brownlee Reservoir and upstream along the Snake River, but were found nowhere else along the Snake River in Hells Canyon (Appendix 3 to Technical Report E.3.3-1 [distribution maps of *Tamarix*-dominated assemblages in the *Forested Wetland* and *Scrub-Shrub Wetland* cover types], Figure 16 in Technical Report E.3.3-2). Suitable habitat for *Tamarix* species occurs all along the Snake River in Hells Canyon (Technical Report E.3.3-3). *Tamarix* species also occur downstream of Hells Canyon on the Snake and Columbia rivers, where it has negatively impacted native flora and fauna.

On the upper reaches of Brownlee Reservoir, young seedlings (or clonal fragments) of *Tamarix* species annually establish in the fluctuation zone but are subsequently killed by refilling of the reservoir (Technical Report E.3.3-1). *Tamarix* species cannot survive more than three months of flooding (Stevens 1990). The young plants that establish in the reservoir shoreline zone are subsequently killed by long periods of drafting. Although not totally depended on permanent groundwater (Turner 1974), mature *Tamarix* species usually occur in areas where the roots can reach the water table (depth to ground water does not exceed 3 to 5 m), such as in floodplains, along irrigation ditches, and on lakeshores. Given the invasive capacity of *Tamarix* species, if water levels were held relatively stable on Brownlee Reservoir (for example, full pool run-of-river operations), *Tamarix* species could spread rapidly downstream to quickly dominate shoreline riparian habitats (Technical Reports E.3.3-1 and E.3.3-3). After investigating potential impacts of proposed and full pool run-of-river operations on riparian habitats, investigators concluded, "Of all of the probable impacts addressed in the present report, the prevention of encroachment of salt cedar into the natural riparian zone along the Snake River downstream from the Hells Canyon Dam may be the most ecologically significant" (Technical Report E.3.3-3).

Although historical operations on Brownlee Reservoir may have been effective in controlling downstream infestation of many weedy riparian species, especially in the 41.5-mi-long main-pool subreach of Brownlee Reservoir, several other weedy species occur along Oxbow and Hells Canyon reservoirs. These have probably been introduced by other vectors (for example, recreation activities, vehicles, livestock, homesteading) coincident with, and prior to, construction and operation of the HCC (Technical Reports E.3.3-1 and E.3.3-3). The Oxbow and Hells Canyon reservoir reaches historically, and today, are readily accessible by vehicle traffic. However, in contrast to the headwaters of Brownlee Reservoir and the Weiser reach, the most abundant and common riparian plant assemblages along Oxbow and Hells Canyon reservoirs are dominated by native woody species such as *Betula occidentalis*, *Alnus rhombifolia*, *Philadelphus lewisii*, *Toxicodendron rydbergii*, and *Populus trichocarpa*. Relatively few riparian plant assemblages along Oxbow and Hells Canyon reservoirs are dominated by nonnative vegetation (Technical Reports E.3.3-1 and E.3.3-3). Along Oxbow and Hells Canyon reservoirs, about 30% of the weed populations consist of riparian weeds, compared with over 45% on Brownlee Reservoir and over 70% in the Weiser reach (see section E.3.3.1.1.2.) (Table 2 in Technical Report E.3.3-2).

The Applicant conducted three integrated studies (Technical Reports E.3.3-1, E.3.3-2, E.3.3-3) to assess the influence of modeled proposed and full pool run-of-river operations on the spread of noxious weeds. The first two studies (Technical Reports E.3.3-1 and E.3.3-2) were designed to provide descriptive and predictive data on the occurrence of target weed species.

Results of Technical Report E.3.3-1 helped to identify and quantify the relative distribution and abundance of noxious weed-dominated plant assemblages throughout the study area using systematic random-sampling protocols. Two important findings were identified regarding noxious weed occurrence: 1) distribution gradients exist for the occurrence of noxious weed-dominated upland and riparian plant communities, and 2) historic operations of the HCC may have imposed a dispersal barrier to the downstream spread of noxious riparian weeds by the drawdown pattern of Brownlee Reservoir (section 4.4. in Technical Report E.3.3-1). Riparian noxious weed-dominated plant assemblages were more abundant and widespread in the upstream reaches (headwaters of Brownlee Reservoir and the Weiser Reach) than they were in the areas along Oxbow and Hells Canyon reservoirs and along the downstream reach.

Results of studies for Technical Report E.3.3-2 further identified and quantified the relative distribution and abundance of riparian and upland noxious weed populations and provided predictive data on the occurrence of weed populations. Investigators confirmed that riparian noxious weed populations were more abundant and widespread in the upstream reaches (headwaters of Brownlee Reservoir and the Weiser Reach) than they were in downstream reaches. About 70% of the weed populations were riparian species in the Weiser reach (or about 13.6 populations per river mile). This percentage can be compared with about 45% (6.4 populations per river mile) on Brownlee Reservoir, about 30% (4.4 populations per river mile) on Oxbow Reservoir, about 30% (4.9 populations per river mile) on Hells Canyon Reservoir, and 10% (0.5 populations per river mile) in the reach below Hells Canyon Dam (see section E.3.3.1.1.2.).

Often, several factors influenced the occurrence of each noxious weed population. The types of disturbance present at each population and the level of disturbance (for example, extreme, high, moderate, or slight; defined in section 3.1.3. in Technical Report E.3.3-2) at each population are summarized by species in Appendix 6 to Technical Report E.3.3-2. Generally, at least one disturbance factor (alluvial, flow zone [water-level fluctuations], livestock grazing, mining, fire, road maintenance, recreation [camping, boating facilities], trail use, industry, agriculture, and off-road vehicle use) was significantly ($P < 0.001$) correlated with populations of one or more noxious weed species. In the reservoir reaches, 2,664 disturbance types were recorded at

1,350 weed populations. The most frequent disturbance factors were flow zone, recreation, road maintenance, and livestock grazing (Appendix 5 to Technical Report E.3.3-2).

Investigators identified two noxious weed species (*Lepidium latifolium* and *Phalaris arundinacea*) and one special interest weed (*Amorpha fruticosa*) to be significantly and positively associated with water fluctuations (Table 5 in Technical Report E.3.3-2). These species benefit from recurrent water-level fluctuations that create sites for weeds to establish and persist in riparian habitats. Other species, specifically *Cyperus esculentus*, *Equisetum arvense*, *Euphorbia esula*, *Lythrum salicaria*, and *Tamarix* species were also positively associated with water-level fluctuations (Table 5 in Technical Report E.3.3-2).

To specifically assess the potential effects of future operations, a modeling study was conducted (Technical Report E.3.3-3). Investigators' results, based on a combination of the modeling analysis and life history consideration, predicted that 15 weedy species would be similarly affected across the two operational scenarios. One ruderal annual species, *Tribulus terrestris*, was predicted to increase in abundance with the proposed versus the full pool run-of-river scenario. Four perennial species, including *Cardaria draba*, *Euphorbia esula*, *Tamarix* species, and possibly *Elaeagnus angustifolia*, would be substantially reduced with the proposed scenario because the drawdown of Brownlee Reservoir would continue to impede their downstream expansion. Investigators also recognized the occurrence of a dispersal barrier imposed by the drawdown pattern of Brownlee Reservoir and anticipated a substantial ecological benefit of the proposed scenario relative to the full pool run-of-river scenario (Technical Report E.3.2-45, section 4.3. in Technical Report E.3.3-3) by retarding the downstream spread of undesirable plant species.

In summary, the Applicant concludes that modeled proposed operations would contribute to the spread of noxious weeds along the reservoir reaches in Hells Canyon, but to a much lesser extent than with full pool run-of-river operations. The Applicant cannot quantitatively identify the extent (for example, acreage or number of populations) of operational impacts of either future scenario on the potential spread of noxious weeds along the reservoir reaches. Under proposed operations, the combination of drought stress and inundation stress on Brownlee Reservoir would eliminate the vast majority of many weedy species encroaching from upstream sources (reduction of seeds and plant propagules), controlling downstream infestation especially in the 41.5-mi-long main-pool subreach of Brownlee Reservoir.

The Applicant acknowledges that it may be just a matter of time before riparian habitats along the reservoir reaches are negatively influenced by upstream riparian weed sources, regardless of the dispersal barrier imposed by drawdown operations on Brownlee Reservoir. Occasionally, individuals of these invasive riparian weeds would become established at locations where they could survive, such as near tributary inflows, and although some plants would be impeded, eventually these species would probably extend downstream beyond Brownlee Reservoir. In addition, there are alternate propagule sources beyond the inputs from the Weiser reach and the Powder River, and these would also enable expansion of invasive plants (section 4.3. in Technical Report E.3.3-3). On Oxbow and Hells Canyon reservoirs, both modeled proposed and full pool run-of-river operations would contribute similarly to the spread of existing levels of noxious weeds.

Other factors that influence the spread of noxious weeds along the Snake River corridor through Hells Canyon include management actions of federal and state agencies and other private landowners. Because of the high percentage of federally owned lands in the reservoir reaches that are largely under BLM or USFS ownership, actions of the these agencies probably play a significant role in the spread of noxious weeds. Federal and state land managers oversee grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area, all of which can contribute to the spread of noxious weeds. These influences can affect the spread of weeds 1) directly through spreading of weed seed and plant parts and 2) indirectly by creating disturbance to soil and vegetation that create conditions more conducive to weed invasion. Recreationists, livestock operators, subcontractors, federal personnel, and members of the public visiting this area can unknowingly spread weeds when passing through areas of noxious weeds. Weed propagules are picked up on equipment, clothing, and animals and can be spread along roadways or travel corridors, including water-based recreation sites (Loney and Hobbs 1991). Weeds can be transported within the canyon or brought in from outside sources by visitors. Once present, these weeds can invade adjacent native habitats (MacLellan and Stewart 1986). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make weed control necessary.

Because many factors influence the spread of noxious weeds along the reservoir reaches, the Applicant recommends that it take the lead role in developing and participating in cooperative agreements with federal land management agencies and other private landowners to control establishment and spread of noxious weeds in the project area (see the proposed PM&E measure in section E.3.3.3.2.1.2.). All land owners would be expected to contribute one or more of the following: 1) funding, 2) management, 3) technical expertise, 4) logistical involvement, 5) in-kind support, and 6) materials to assist in weed control activities. Specifically, the Applicant recommends that it participate with local organizations called CWMAs, or with similar organizations, that are involved with areas bordering the Snake River in Hells Canyon and with increasing focus on the control of *Tamarix* species. CWMAs build cooperative relationships among agencies, landowners, land managers, and other interested individuals and organizations—relationships that are needed to effectively manage noxious weeds (ISDA 1999).

E.3.3.4.1.3. Reservoir Operations and Threatened and Endangered Plant Species

Many factors negatively impact rare plant populations along the Snake River corridor through Hells Canyon (confidential Technical Report E.3.2-46 and Technical Reports E.3.3-2 and E.3.3-3), including disturbance from off-road vehicle use, camping, hiking, boating, livestock grazing, agriculture, residential activities, industrial activities, fire, road maintenance, and water-level fluctuations (both natural and river regulation). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make protection of rare plant populations necessary.

The Applicant conducted two integrated studies (Technical Reports E.3.3-2 and E.3.3-3) to assess the influence of modeled proposed and full pool run-of-river operations on rare plants. In the first study, populations of four species of special status plants were found in the reservoir reaches: *Mimulus patulus*, *Leptodactylon pungens* ssp. *hazeliae*, *Bolandra oregana*, and *Carex hystricina* (Chapter 3 of Technical Report E.3.3-2). *Mimulus patulus* occurred only in the reservoir reaches, while the latter three species also occurred in the reach below Hells Canyon Dam.

No federally listed endangered or threatened species are known to occur in the shoreline zones of the HCC reservoir reaches. Therefore, no negative impacts to federally listed species are expected to occur from either proposed or full pool run-of-river operations.

In the second study, investigators predicted the potential influence of modeled proposed and full pool run-of-river operations based on knowledge of life history traits and distributional patterns of the species (Chapter 5 of Technical Report E.3.3-3). A modeling study was originally intended so that the potential influence of future scenarios could be predicted, but due to lack of sampling data (too few observations), a modeling approach was deemed infeasible. For most species considered to be rare, there is a lack of clear documentation of their geographic distribution and ecological properties. Investigators did not observe rare plants along reservoir shorelines during sampling for Technical Report E.3.3-3 (185 transects; 1.15 transects per river mile), but they did encounter several populations of *Cyperus schweinitzii* within the riparian zone of the Hells Canyon reach of the Snake River (see section E.3.3.4.2.3.). Investigators used results of rare plant observations from Technical Report E.3.3-2 and professional judgment to assess potential influences to populations of these special status species from proposed or full pool run-of-river operations on the reservoirs as identified below.

One population of *Mimulus patulus* was found along Oxbow Reservoir. The population was found growing on gently sloping, damp, rocky ground in a road cut adjacent to State Route 71. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. The site is located well above the full-pool shoreline and approximately 20 m laterally from Oxbow Reservoir. Disturbance from the road corridor was recorded as extreme for this site (although a retaining wall does separate the population from the road) (for definitions of ratings such as extreme, high, moderate, or slight used in rare plant surveys, see section 3.1.3. in Technical Report E.3.3-2). Disturbance from recreation, livestock, and alluvial erosion and/or deposition was recorded as slight. The site is not affected by water-level fluctuations under either proposed operations or full pool run-of-river operations (Technical Reports E.3.3-2 and E.3.3-3).

Six populations of *Leptodactylon pungens* ssp. *hazeliae* were found: one downstream of Hells Canyon Dam and five along Hells Canyon Reservoir. There are seven previously known populations in the vicinity of the HCC. Status of this species is reviewed in section 3.2.2. in

Technical Report E.3.3-2. The five newly located populations were found growing on dry, steep to vertical cliffs above the reservoir's full-pool shoreline. Neither proposed operations nor full pool run-of-river operations would negatively affect the populations as they are outside the influence of water-level fluctuations (Technical Reports E.3.3-2 and E.3.3-3). No other disturbance factors were noted, such as disturbance from recreation activities, road maintenance, livestock grazing, fire, or off-road vehicle use.

Four populations of *Bolandra oregana* were found: one along Hells Canyon Reservoir and three along Oxbow Reservoir. There are also two previously known populations of this species on the Oregon side of the Snake River, just north of Brownlee Dam. These two populations were outside the 50-m-wide survey area. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. All populations were found growing near seeps or streams in cliffs, surrounded mostly by bare rock. The four sites on Hells Canyon and Oxbow reservoirs were subject to a variety of disturbances including alluvial action, recreation, road corridor disturbance, livestock grazing, fire, and off-road vehicle use. The sites are not affected by water-level fluctuations under either proposed operations or full pool run-of-river operations (Technical Reports E.3.3-2 and E.3.3-3).

Seven populations of *Carex hystricina* were found along Oxbow Reservoir. There are two previously known occurrences of this species in the vicinity of the HCC: one along Hells Canyon Reservoir and one along Oxbow Reservoir. These two sites are located outside the 50-m survey corridor of the reservoir shorelines. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. Populations were found growing in either relatively bare shoreline areas or relatively lush riparian communities. Disturbance from many sources was evident at most of the sites. Because modeled proposed conditions nearly mimic patterns of water surface elevations that historically occurred during the vegetation growing season, proposed operations should not negatively affected these populations. However, full pool run-of-river operations may further benefit populations by providing more stable hydrologic conditions on the reservoirs for this obligate riparian species (Technical Report E.3.3-3).

The Applicant concludes that compared with full pool run-of-river operations, modeled proposed operations may limit expansion of some hydrophytic rare plant populations, specifically *Carex hystricina*, along Hells Canyon and Oxbow reservoir reaches.

Because many factors negatively impact rare plant populations along the reservoirs and because much of the area surrounding the reservoir reaches is under BLM and USFS jurisdiction, the Applicant recommends working cooperatively with federal land management agencies and other conservation groups to protect rare plant sites impacted by disturbance activities (activities both related and unrelated to HCC operations) (see proposed PM&E measure in section E.3.3.3.2.1.3.). Cooperative efforts could include protection (for example, land acquisition or management actions) and site enhancement activities (including reintroduction projects when determined to be viable and consistent with agency management plans).

E.3.3.4.1.4. Reservoir Operations and Shoreline Erosion of Terrestrial Habitat

The comparison between reservoir and lake ecology again provides a useful reference point for understanding environmental impacts associated with reservoir operation, specifically shoreline bank erosion. Lakes are relatively stable ecological systems. The state of equilibrium that lakes have achieved with their shorelines is generally the result of decades, if not centuries, of interaction. Easily erodable shoreline substrates are leveled, creating shallow, low-gradient landscapes, while more durable substrates such as rock outcrops remain as cliffs or steep-gradient shorelines. Generally, reservoir shorelines are young, still moving toward a more stable state. As a result, many reservoirs are beset by shoreline erosion problems (Allen and Wade 1991). Erosion problems are particularly severe along reservoir shorelines that are steep and friable. Shoreline erosion can be the most severe in reservoirs with large fluctuations (O'Neil and McDonnell 1995).

Historic operations of the HCC have contributed to the current extent of shoreline erosion along the reservoir reaches. The total area of shoreline erosion sites in the study area (from Weiser to the confluence of the Salmon River) was estimated to be 100.7 acres (Technical Report E.3.2-42). Detailed information on the location, extent, and other inventory data for each site are provided in Figure 3 in and Appendix 2 to Technical Report E.3.2-42. Excluding sites in the Weiser reach (10.6 acres), 90 acres of erosion sites occurred along reaches potentially influenced by historic

HCC operations; of these, about 84 acres were in the reservoir reaches, and 6 acres were below Hells Canyon Dam.

The Brownlee Reservoir reach had the highest rate of bank erosion: 261 sites (69% of all sites) occurring along about 27.2% of the available shoreline (49.6 mi of 182.3 total shoreline miles). Total area of erosion was estimated at 79.07 acres on Brownlee Reservoir. The Oxbow Reservoir reach had relatively little bank erosion: 9 sites along 2.0% of the available shoreline (0.51 mi of 25.0 total miles). Total area of erosion was estimated at 1.34 acres. Similarly, the Hells Canyon Reservoir reach had relatively little bank erosion: 39 sites along 2.7% of the available shoreline (1.45 mi of 53.9 total miles). Total area of erosion was estimated at 3.45 acres.

Shorelines along the reservoirs are susceptible to many natural and human influences, including wind-driven waves, boat-generated waves, water-level fluctuations, groundwater seepage, livestock grazing, roads, alluvial flooding, channel flow, and recreation (for example, bank fishing and camping in undeveloped sites, sometimes called dispersed or impromptu camping). Usually, several factors influence erosion at each site. The types and severity of influences (for example, extreme, high, moderate, or slight) affecting each erosion site are identified in Appendix 2 to Technical Report E.3.2-42. On Brownlee Reservoir, 1,263 disturbance types were recorded at 261 erosion sites. Oxbow and Hells Canyon reservoirs had 41 factors at 9 sites and 162 factors at 39 sites, respectively. Generally, the most frequent disturbance factors in the reservoir reaches were water-level fluctuations, wind-generated waves, excessive slope, boat-generated waves, highly erosive soil, and recreation (Table 3 in Technical Report E.3.2-42). Because many of these influences are interrelated, attributing the cause of erosion at each site to any single factor is difficult. Because the reservoirs in the HCC are relatively recent features, some level of erosion is expected to occur under any operational scenario until the new shorelines reach equilibrium with the ecological and human influences.

Predicting quantitative differences between the effects of the modeled proposed and the full pool run-of-river scenarios on shoreline erosion is difficult (for example, acreage or number of sites). It is believed that full pool run-of-river operations on Brownlee Reservoir would reduce shoreline erosion (Technical Report E.3.2-45). This reduction would be due to an absence of large drawdowns and therefore decreased potential for slumping during periods of drawdown, when slopes are often susceptible to failure because of rapid soil moisture movements. Stable water levels on Brownlee Reservoir would also be expected to result in an additional 343 acres of riparian vegetation (section E.3.3.4.1.1.2.), which would afford some degree of protection to shorelines from erosional influences. However, under full pool run-of-river operations, slopes along the full-pool shoreline would be more susceptible to erosion from wind-driven waves, especially in areas that face into prevailing winds and in areas where wind and waves travel over large distances. During periods of drawdown, the erosional force of wind-driven waves would not be directed at the full-pool shoreline. Other erosional influences (for example, recreation traffic, livestock grazing) would also be more concentrated at the full-pool elevation under full pool run-of-river conditions, rather than focused on areas in the drawdown zone during periods of lower pool levels.

On Oxbow and Hells Canyon reservoirs, few differences would be expected between the two proposed scenarios. Because modeled proposed operations nearly mimic patterns of water surface elevations that occurred historically and because relatively little erosion has occurred on these reservoirs, little erosion would be expected in the future. Shorelines along these reservoirs appear to be more in equilibrium with past ecological and human influences on these reservoirs. Because of the minimal differences in water surface elevations between proposed and full pool run-of-river operations, little difference in the occurrence and extent of future shoreline erosion would be expected.

Other factors that influence the erosion of shoreline banks along the reservoir reaches include management actions of federal, state, and county agencies; public interest groups; and other private landowners. Federal and state land managers oversee grazing allotments, road maintenance activities, recreation facilities, and other public uses in the study area. County agencies likewise oversee road maintenance activities and recreation facilities. These activities can contribute to factors such as livestock grazing, boat-generated waves, roads, recreation, and industrial disturbance types, which were documented to influence erosion of shoreline banks along the reservoirs (Table 3 in and Appendix 2 to Technical Report E.3.2-42).

The Applicant concludes that, compared with full pool run-of-river operations, modeled proposed operations would result in a greater amount of shoreline bank erosion on Brownlee Reservoir.

Because the Applicant cannot predict a quantitative difference in shoreline erosion between scenarios on the reservoirs (for example, acreage or number of sites), it assumes that the amount of bank erosion under proposed operations would not be greater than the current amount of bank erosion. Therefore, the Applicant recommends that habitat management actions designed to protect 84 acres of terrestrial habitat (the total extent of shoreline erosion in all reservoir reaches) would constitute appropriate mitigation for proposed operational impacts to shoreline erosion along reservoir reaches (see section E.3.3.3.2.1.1.).

By proposing to mitigate for the total extent of shoreline bank erosion along the reservoir reaches, the Applicant has not limited its actions solely to its contribution to shoreline bank erosion. Other influences outside of the Applicant's control also impact shoreline bank erosion. Such factors include recreation activities (boat-driven waves, camping, trails, and dispersed recreation), livestock grazing, and road or other construction or maintenance activities under the management actions of federal, state, or county agencies; public interest groups; or other private landowners. These factors would continue to influence shoreline bank erosion under either proposed or full pool run-of-river operations.

Mitigation for 84 acres of existing shoreline erosion could be accomplished through acquisition and enhancement actions (for example, additive to other acquisition/enhancement measures), by specific management actions to eliminate causes of erosion, and, where feasible, by limited site stabilization/revegetation actions.

Management actions could be implemented to control human-caused factors that negatively affect shoreline banks. These actions should focus on controlling recreation influences (for example, boat-driven waves, camping, trails, and vehicle use), minimizing effects of roads and construction or maintenance activities, and reducing the livestock grazing that has negative effects (Technical Report E.3.2-42). Because these management actions largely fall under the control of state and federal land managers in the reservoir reaches, the Applicant has little management authority. Because water fluctuations are necessary if the HCC is used for flood control, anadromous fish spawning and protection, downstream navigation, and hydroelectric generation, it is not possible to eliminate all negative impacts from human activity.

Stabilizing and revegetating most of the shoreline erosion sites in the study area may not be practical, feasible, or even desirable (Technical Report E.3.2-42). The subsoil remaining at these sites would likely be hard, rocky, infertile, and droughty, making it difficult to reestablish vegetation cover. Without soil amendments, the remaining soil probably could not support adequate growth and, therefore, would not adequately stabilize the banks. The steep topography and remoteness of the canyon make it difficult to access and work on most sites. However, proper stabilization and revegetation techniques possibly could be employed at specific sites if analysis indicated that such techniques were appropriate.

E.3.3.4.1.5. Applicant Land Management Activities and Botanical Resources

The Applicant owns about 2,990 acres of land in fee in Hells Canyon (nonflooded), from which it operates the HCC within the proposed project boundary (encompassing 20,680 acres) (Technical Report E.6-2). All of these lands occur upstream of Hells Canyon Dam. The Applicant-owned land constitutes approximately 14.5% of the federal project area. The Applicant also owns approximately 1,850 acres of land outside the project area in Hells Canyon. Combined, these 4,840 acres constitute approximately 0.6% of the approximately 848,000 acres that the Applicant studied to assess HCC land management influences on terrestrial resources. The study area stretched from canyon rim to canyon rim, from just downstream of Weiser to the confluence of the Snake and Salmon rivers.

In addition to the activities associated with operations of the HCC, the land receives other use. The Applicant 1) allows residents of its lands (primarily employees) to conduct secondary activities, mainly livestock grazing; 2) allows the public to access most of its undeveloped lands for recreation (undeveloped, or dispersed, recreation sites); 3) issues various permits for private recreational use (for example, cabins and docks); and 4) issues permits and leases for a variety of other activities and purposes, including grazing, agricultural cultivation, communication lines, and utilities. The Applicant's lands are also subject to trespass and open-range grazing uses.

The small amount of "accessory use" grazing that occurs on parcels of residential land, totaling less than 12 acres, has no appreciable impact on vegetation where lands are irrigated (most of these lands) (Technical Report E.6-2). However, pastures can at times be overgrazed, a practice that can promote weed invasion and soil erosion. Where irrigation does not occur, overgrazing negatively impacts vegetation and soil resources.

Leases and permits issued by the Applicant for activities such as grazing, agricultural cultivation, and communications are quite limited, affecting only about 118 acres. Leases are monitored irregularly. Generally, current leases have been found to have little impact on terrestrial resources (Technical Report E.6-2), primarily because leases have specific authorization and conditions relevant to their use, the Applicant monitors the leases, and the Applicant controls noxious weeds on the properties.

Recreation activities at undeveloped sites result in damage to vegetation and soils, primarily because of indiscriminate use of motor vehicles on these lands and because of trash and sanitation problems. Of the 169 sites in the project area (Technical Report E.5-9), 55 were fully or partially on the Applicant's land and showed definite signs of past use. Together, the 55 sites totaled just under 50 acres; the obviously used portion of these sites (usually where vegetation had been wholly or mostly destroyed) totaled about 37 acres. People and vehicles have trampled and compacted these lands, increasing their susceptibility to soil erosion and weed invasion.

Some unauthorized uses occur on Applicant-owned lands: trespass grazing, construction of private residential structures, and gatherings for special events (such as parties and community events). In addition, lands that are not fenced are subject to open-range grazing. No estimate is available on the number of parcels or acres affected by unauthorized uses or open-range grazing.

Cattle grazing is the primary unauthorized use, and much of this grazing occurs because of open-range laws. This unauthorized use is the most difficult to eliminate because of its transitory nature and because property boundaries are extensive and remote (Technical Report E.6-2). During reservoir drawdowns when water recedes from reservoir arms, animals can pass easily from one owner's land to another's, even though lands are otherwise fenced. Most grazing encroachments occur where the Applicant's land abuts extensive private holdings that are grazed.

Temporary short-term uses such as for parties or trailer parking occur occasionally, some without permission and some after permission has been denied. Such uses are difficult to monitor and usually pass before action can be taken.

No negative impacts to listed threatened or endangered plant species, or to other special status plant species, are known to occur on the Applicant's lands because of land management activities (Technical Report E.6-2).

Generally, the Applicant recommends more frequent monitoring of project leases and other properties to identify corrective actions needed for negative impacts to botanical resources. Specific policy revisions and proposed land management actions are summarized in Technical Report E.6-2. Ongoing actions to control noxious weeds and enhance native plant communities should be continued.

E.3.3.4.1.6. Human Activities and Botanical Resources

The Applicant's personnel must perform many activities for O&M of the HCC. In addition, developed parks, dispersed recreation sites, roads, and trails associated with the HCC facilitate numerous recreational activities in Hells Canyon. During relicensing consultation, state and federal agencies and nongovernmental organizations expressed concern that human activities may impact highly valued botanical resources. So the Applicant conducted numerous relicensing studies to characterize O&M activities, recreational activities, and botanical resources associated with the HCC. The Applicant integrated data from the studies and comprehensively investigated potential impacts of human activities upon natural resources within the area from the HCC reservoir shorelines to 0.5 mi upslope (confidential Technical Report E.3.2-46).

The Applicant assessed potential impacts to botanical resources from human activities associated with 29 of the Applicant's facilities (dams, residential areas, and small substations; 116 acres), 4 Applicant-developed parks (114 acres), 7 non-Applicant-developed parks (136 acres), and 167 dispersed sites (77 acres) (Technical Reports E.3.2-45 and E.5-2 and confidential Technical Report E.3.2-46). Twenty-six roads (140 mi) and numerous trails (for example, hiking trails, ATV trails, and dispersed recreation trails) that are associated with the Applicant's facilities or that are used by recreationists were also assessed (confidential Technical Report E.3.2-46). The Applicant summarized findings regarding potential impacts to botanical resources (Technical Report E.3.2-45 and confidential Technical Report E.3.2-46).

E.3.3.4.1.6.1. Rare Plants

The Applicant evaluated occurrences of 23 species of rare plants in Hells Canyon (confidential Technical Report E.3.2-46). No federally listed plant species were found in the study area (Technical Report E.3.3-2). Sixty-seven occurrences of 12 rare plant species were near sites of human activities (Technical Report E.3.3-4). Of these occurrences, 3 at locations where the Applicant has management responsibility or authority were considered to be at risk of disturbance. These three occurrences are located in riparian areas along reservoir margins near dispersed recreation sites. Two occurrences of *Carex hystricina* are located along Oxbow Reservoir, and one occurrence of *Cyperus rivularis* occurs along Brownlee Reservoir. The Applicant recommends continued monitoring of occurrences that are at risk from its facilities or maintenance activities and also recommends developing protection measures in coordination with appropriate state or federal agencies, if warranted.

E.3.3.4.1.6.2. Riparian Habitat

Riparian habitat is limited in Hells Canyon (Technical Report E.3.3-1). Human activities associated with recreation or project operations can be especially detrimental to habitat when they occur within riparian habitats. Therefore, the Applicant evaluated potential impacts to riparian habitats having human activities present or nearby (Technical Report E.3.2-45 and confidential Technical Report E.3.2-46).

Thirty-five riparian patches, totaling 6.5 ha, had a high risk of impact from human activities (confidential Technical Report E.3.2-46). When areas at risk from human activities were mapped against vegetation, the high risk areas corresponded with riparian areas having the most abundant vegetation—Oxbow and Hells Canyon reservoirs and the headwaters of Brownlee Reservoir between Weiser and Farewell Bend. Potential impacts to riparian habitat were primarily associated with roads, parks, and dispersed recreation sites. Impacts from roads and parks have probably stabilized. Unless amount of use increases or spatial patterns of use in parks change, impacts are not expected to increase. In some cases, planting trees in parks has increased the amount of riparian habitat available. However, because dispersed recreation sites are often not contained, impacts from use of such sites can expand as amount of use increases.

The Applicant recommends identifying locations where managing human activities in relation to riparian habitat can be improved. In addition, the Applicant suggests that areas of high-quality riparian habitat be enhanced and protected to provide for a diversity of riparian habitat types and conditions in Hells Canyon.

E.3.3.4.2. Downstream of the HCC

E.3.3.4.2.1. Downstream Operations and General Vegetation

In the reach below Hells Canyon Dam, the riparian zone is limited by the prevalence of steep canyon walls, rocky shorelines, and a high-gradient river slope (section E.3.3.1.1.4.) Nevertheless, there is a relatively substantial amount of riparian habitat in this reach. Using GIS cover type data from mapping efforts reported in Technical Report E.3.3-1, the Applicant determined that existing riparian habitat (*Forested Wetland*, *Scrub-Shrub Wetland*, and *Emergent Herbaceous Wetland* cover types) within a 20-m planimetric band above the high-water mark constitute 17.6% of the total area (178.4 of 1,015.3 acres) along this reach. This percentage can be compared with 21.1% riparian habitat (82.0 of 388.2 acres) along Hells Canyon Reservoir, 21.2% riparian habitat (51.3 of 242.3 acres) along Oxbow Reservoir, 8.4% riparian habitat (111.5 of 1,332.6 acres) along Brownlee Reservoir, and 62.3% riparian habitat (190.9 of 306.7 acres) in the Weiser reach. For the downstream reach, the percentage of riparian habitat converts to approximately 3.0 acres per river mile in the 20-m band. Acres of riparian habitat per river mile in the other reaches are as follows: 3.7 on Hells Canyon Reservoir, 3.6 on Oxbow Reservoir, 2.0 on Brownlee Reservoir, and 15.9 in the upstream Weiser reach.

Riparian cover types in the downstream reach are primarily dominated by native perennial species. Dominant tree and shrub species include *Celtis reticulata*, *Betula occidentalis*, *Alnus rhombifolia*, *Philadelphus lewisii*, *Salix exigua*, and *Toxicodendron rydbergii*. Common herbaceous riparian species include *Glycyrrhiza lepidota*, *Physalis longifolia*, *Artemisia ludoviciana*, *A. lindleyana*, *Anthriscus scandicina*, *Galium aparine*, and *Solidago canadensis* (Appendix 3 to Technical Report E.3.3-1, Chapter 2 of Technical Report E.3.3-3).

Historical photographs taken during the early part of the 1900s and photographs taken recently clearly show an increase in size and extent of riparian communities both above and below the river's high water mark (section 5.4., photos SR-1–SR-12, and Table 20 in Technical Report E.3.2-44). Following damming and flow regulation, the band of perennial riparian vegetation became more dense and continuous along the reach (section 3.6.3. in Technical Report E.3.3-3). This expansion is probably related to both historic HCC operations and changes in land-use practices.

Most of the increase in riparian extent and cover occurred in native *Celtis reticulata* communities. Botanical characteristics of the dominant *Celtis* plant assemblage in this reach are described in Appendix 3 to Technical Report E.3.3-1. In some instances today, the margin of the river is entirely bordered by riparian *Celtis* communities, while scattered individuals were found there 60 to 80 years ago (Technical Report E.3.2-44).

There are three main hydrologic reasons for the observed increase in riparian habitat. First, base flows from the HCC were higher during summer, and more stable, than they were before the HCC was constructed (Technical Report E.1-4). Second, the load-following flows in late spring and summer (following spring runoff), below 30,000 cfs stage levels, repeatedly irrigated portions of the riverbed. Daily water levels often fluctuated several feet in the riverbed zone that was previously annually scoured and then left dry as river stage decreased after spring runoff. Analyses of historic HCC operations indicate that between June 1 and September 30, daily fluctuations below Hells Canyon were 10,000 cfs or below, 80% of the time (Technical Report E.1-4). Third, scouring of the roots of *Celtis reticulata* growing near the high-water mark stimulated the growth and suckering of the root systems, which benefited from higher base flows and repeated irrigation events (Technical Reports E.3.2-44 and E.3.3-3). All combined, these conditions enabled *Celtis reticulata* communities to occupy a broader zone that was previously not available.

An irrigation effect refers to the promotion of vegetation growth and vigor through supplemental water. This phrase may be somewhat new relative to discussions of riparian hydraulics, but the recognition that an increase in summer stream flow (stage) can promote riparian vegetation is fully consistent with numerous reports (Nilsson and Keddy 1988, Hill et al. 1998, Springer et al.

1999, Jansson et al. 2000). In the Hells Canyon corridor, the obvious proliferation of trees and shrubs above the full-pool elevation along Oxbow and Hells Canyon reservoirs provides further demonstration of an irrigation effect.

Data on new *Celtis* plants regenerating or establishing along the river are provided in various technical reports (for example, Technical Reports E.3.2-40, E.3.3-1, and E.3.3-3). Specifically, Appendix 3 to Technical Report E.3.3-1 identifies vegetation characteristics for the *Celtis reticulata–Toxicodendron rydbergii* plant assemblage, the dominant *Celtis* community in this reach. These data indicate an average density of 6,044 seedlings per hectare (plants less than 0.5 m tall) of *Celtis reticulata* growing in this community along the river. No distinction is made between plants establishing from seed versus those establishing from root suckers.

Another reason for the observed increase in riparian habitat may also be from changes in land use: cessation of grazing, particularly of domestic sheep, and reduction in homesteading, ranching, and mining in the canyon. Reduction in these activities could have positively affected the survival and growth of *Celtis reticulata*. Stem coring of a limited number of *Celtis reticulata* plants indicated that most hackberry stands probably established during the past 60 to 80 years (Technical Report E.3.3-3). A similar increase in the *Forested Wetlands* cover type in the reach between Swan Falls Dam and Farewell Bend was reported by Dixon and Johnson (1999), who hypothesized a similar mechanism (reduced consumptive use of riparian areas) for the increase of the acreage and cover of these *Forested Wetlands*.

Some plant communities may have declined in abundance due to historic operations. HCC operations likely contributed to the decline of some obligate riparian plants, especially *Salix exigua*, because the dams trap incoming sediment of the sizes useful for building rooting substrate (Technical Report E.1-1). Although quantification is difficult due to the lack of riparian inventories before dam construction, it is probable that the loss of sand and sandbars has produced a proportional loss of *Salix* species, as well as the loss of some other obligate riparian species that similarly require fine sediments for colonization.

While sands and other fine sediments have been depleted from the surfaces of the riparian zones through Hells Canyon, fine sediments occur in the interstitial spaces between the coarser materials, as well as in subsurface substrates. The Applicant found that substrate affinities of riparian vegetation in this reach ranged from fine soils to coarser cobbles with interstitial fines (section 2.3.5.2. in Technical Report E.3.3-3). Although shoreline substrates are typically comprised of large basalt outcrops (bedrock) or large boulders and cobbles, this composition does not preclude fine substrates from occurring in the interstitial spaces or underneath an armored layer, a sediment layer covered with boulders or cobbles (section E.3.3.4.2.4.) (Appendix C to Technical Report E.1-2). The existing fine sediment provides some of the substrate that supports the current riparian vegetation and would be expected to continue to support vegetation in the future (section 6.2. in Technical Report E.3.3-3). All sediments, even coarse materials, influence the processes of water infiltration, retention, and drainage, and capillarity is substantial, with many sediments coarser than silt (Mahoney and Rood 1991, 1992, 1998; Richter and Richter 2000).

Outside of land uses (for example, grazing, homesteading, mining, and agricultural activities), the extent and characteristics of riparian communities downstream of Hells Canyon Dam have been historically, and under HCC operations, largely determined by the timing and magnitude of peak flows and summer base flows. In this reach, a deep, narrow valley that is confined by bedrock walls, talus slopes, debris flows, landslides, and alluvial terraces characterizes the river environment (for example, Bonneville Flood deposits, landslide backwater deposits, relict alluvial fans, or relict bars) (Technical Report E.1-2). This confinement has precluded the development of an alluvial floodplain that is typical of other rivers of comparable discharge, area, and gradient (10.5 to 3.7 feet per mile) (Technical Report E.1-2). Historically, annual runoff events scoured the canyon walls and created a barren shoreline between the high-water mark and summer base flows. Riparian vegetation, therefore, was sparse in this reach as evidenced by photographs and General Land Office records from 1900 to the late 1950s (Technical Report E.3.2-44). Current conditions are even less suitable for establishment and growth of *Salix* species in the Hells Canyon reach.

To estimate impacts of potential future operation of the HCC on shoreline botanical resources, the Applicant conducted two integrated studies (Technical Reports E.3.3-3 and E.3.2-40) to model the effects of two hypothetical scenarios: modeled proposed operations and full pool run-of-river operations. Technical Report E.3.3-3 provided more qualitative comparisons of plant species response to the two scenarios, while Technical Report E.3.2-40 predicted quantitative differences in extent of riparian habitats.

In the first study, investigators predicted that overall differences across the two operational scenarios for the Snake River reach below Hells Canyon Dam would be intermediate in magnitude between the substantial changes along the Brownlee Reservoir reach and the slight differences along Oxbow and Hells Canyon reservoir reaches (Table 6.1 in Technical Report E.3.3-3). Both current and projected riparian vegetation zones along the Snake River are somewhat different from the riparian zones along the reservoir shorelines. In terms of spatial pattern, the greatest difference involves the elevational extent of riparian vegetation. Obligate riparian vegetation extends up to about 10 m above the mean annual water level along the Snake River but is limited to about 4 m above full pool along the reservoirs (Technical Report E.3.3-3). This reflects the elevational dynamics of water surface as the river stage varies substantially within and across years. In contrast, the reservoir elevations have a defined lower limit imposed by the full-pool elevation.

To predict differences in species response across the scenarios, plant responses were modeled by life form and species' hydrologic indicator status. Species were classified into six groups: ruderal annuals, facultative riparian annuals and perennials, obligate riparian annuals and perennials, and hydrophytes (section 3.3. in Technical Report E.3.3-3). Overall, ruderal annuals would not substantially change under the two operational scenarios, while a slight increase would occur in the facultative riparian annuals and perennials (0.4% and 2.2%, respectively) under the modeled proposed scenario (Table 6.1 in Technical Report E.3.3-3). A slight increase in the obligate riparian annuals and perennials (2.2% and 9.0%, respectively), particularly in the zone immediately above the mean annual water level, was also predicted with the modeled proposed scenario. In addition, an increase of 24.7% in hydrophytes was predicted with the modeled proposed scenario, although the magnitude of this increase was questioned. Currently, hydrophytes have a limited distribution at higher elevations due to localized water retention from fine sediment lenses. Investigators anticipated that hydrophyte distribution would remain sparse under the proposed scenario, with some moderate increases in abundance and distribution under the full pool run-of-river scenario. Species classified into each of the six groups are listed in

Table 3.1.E in Technical Report E.3.3-3. A summary of the predicted vegetation responses for each reach and under both operational scenarios is presented in Table 6.1 in Technical Report E.3.3-3.

In the second study, investigators modeled flow-stage-inundation relationships and characteristic flows for historical operations, modeled proposed operations, and full pool run-of-river operations to project the extent of riparian habitat that would be expected along the river shorelines (Technical Report E.3.2-40). Historical operations were characterized on average by relatively large daily changes in water surface elevation and stage during summer (Exhibit B) (Technical Report E.1-4). Modeled proposed operations also specified load following, but projected daily-maximum flows were constrained to be lower than historical operations. However, proposed operations were defined to have lower average-maximum daily summer flows and, therefore, less shoreline irrigation effect (that is, restricted load-following operations) than historical operations had. Full pool run-of-river operations had no load following, so projected daily flows from Hells Canyon Dam reflect projected daily inflows to the HCC. It was estimated that 7.6% of the shoreline zone (262 of 3,435 acres) was composed of riparian habitat (polygons coded as perennially vegetated riparian area). The shoreline zone included all lands within 11 m vertically above the 20,595 cfs water surface elevation (Technical Report E.3.2-40). Investigators projected that riparian habitat would occupy slightly less area (7.4%, 255 acres) of the shoreline zone under modeled proposed operations (Technical Report E.3.2-40). Because no irrigation effect would occur, riparian habitat was projected to occupy even less of the shoreline zone (7.2%, 246 acres) with full pool run-of-river operations (Technical Report E.3.2-40).

The Applicant concludes that slightly less riparian habitat would occur along the shorelines under both of the modeled scenarios: about 7 acres less with modeled proposed operations and 16 acres less with full pool run-of-river operations. Modeled proposed operations for the HCC would provide slightly more (about 9 acres) riparian habitat in the river shoreline zone downstream of Hells Canyon Dam than would occur with full pool run-of-river operations.

E.3.3.4.2.2. Downstream Operations and Noxious Weeds

Riparian zones are generally vulnerable to invasion by exotic species because riverine environments are dynamic and have recurrent disturbances (for example, flooding, scour, and sediment movement and deposition), water is available year-round, and rivers form a natural network for propagule dispersal (Planty-Tabacchi et al. 1995). Weed invasions can be pronounced where natural communities are further disturbed by river regulation (Nilsson and Berggren 2000). Historic operation of the HCC reservoirs has likely contributed to the spread of noxious weeds.

Yet relatively few occurrences of riparian noxious weeds occur below Hells Canyon Dam (see section E.3.3.1.1.2.). Botanists located three occurrences of *Phalaris arundinacea*, eight of *Equisetum arvense*, and six of *Cyperus esculentus* that could have been spread by historic water-level fluctuations (Technical Report E.3.3-2). A few occurrences of other riparian noxious weeds were found in the riparian zone (within 50 m of the shoreline) (*Amorpha fruticosa* [11 sites] and *Conium maculatum* [1 site]), but these species were not found to have positive association with water fluctuations (Technical Report E.3.3-2); they were just as likely to occur in upland settings and to be associated with other forms of disturbance. Ninety percent all noxious weed populations found below Hells Canyon Dam (289 of 321 sites) were upland species (see section E.3.3.1.1.2.) that appeared to have been influenced by factors other than historic flow fluctuations (Technical Report E.3.3-2).

Results of USFS noxious weed surveys along the Snake River in the HCNRA also provide insight on weed occurrence below Hells Canyon Dam. Reports identified and described occurrences of 10 species of noxious plants (Burton 1993a, 1993b). Three of these species are considered to be riparian noxious weeds (*Lythrum salicaria*, *Euphorbia esula*, and *Cirsium arvense*); and the rest, upland weed species (*Chondrilla juncea* [rush skeletonweed], *Linaria dalmatica*, *Centaurea diffusa*, *Centaurea maculosa* [spotted knapweed], *Cardaria draba*, *Onopordum acanthium*, and *Tribulus terrestris*). Burton (1993a) reported that most of the occurrences were associated with recreation sites (for example, campgrounds and trails) and that he was surprised that some of the weed species such as *Centaurea diffusa*, *Euphorbia esula*, *Lythrum salicaria*, and *Cardaria draba* were not more widespread than found. The investigators suspected that the one site of *Euphorbia esula* came in by boat or trailer from Pittsburg Landing. It was believed that "the drawdown of the river levels during the summer months when seed from up river sources is available limits establishment" (Burton 1993a). He further reported, "…we were also amazed purple loosestrife was established on only spring sources away from the river itself. It is almost like the seeds came in with birds dependant of [*sic*] cattail sites" (Burton 1993a).

The Applicant conducted three integrated studies (Technical Reports E.3.3-1, E.3.3-2, and E.3.3-3) to assess the influence of modeled proposed and full pool run-of-river operations on the spread of noxious weeds. The first two studies (Technical Reports E.3.3-1 and E.3.3-2) were designed to provide descriptive and predictive data on the occurrence of target weed species.

Surveys for Technical Report E.3.3-1 identified the relative distribution and abundance of noxious weed-dominated plant assemblages throughout the study area using systematic random-sampling protocols. Two important findings were identified regarding noxious weed occurrence: 1) distribution gradients exist for the occurrence of noxious weed-dominated upland and riparian plant communities, and 2) historic operations of the HCC may have imposed a dispersal barrier to the downstream spread of noxious riparian weeds by the drawdown pattern of Brownlee Reservoir (section 4.4. in Technical Report E.3.3-1). Riparian noxious weed-dominated plant assemblages were more abundant and widespread in the upstream reaches (headwaters of Brownlee Reservoir and the Weiser Reach) than they were along Oxbow and Hells Canyon reservoirs and the downstream reach.

Studies for Technical Report E.3.3-2 further identified the relative distribution and abundance of riparian and upland noxious weed populations and provided predictive data on the occurrence of weed populations. Investigators confirmed that riparian noxious weed populations were more abundant and widespread in the upstream reaches (headwaters of Brownlee Reservoir and the Weiser Reach) than they were downstream. About 10% of the weed populations were riparian species in the reach below Hells Canyon Dam (32 of 321 sites). This percentage converts to about 0.5 populations of riparian noxious weeds per river mile. Percentages of weed populations that were riparian species along the other reaches are as follows: about 30% (4.9 populations per river mile) on Hells Canyon Reservoir (109 of 356 sites), about 30% (4.4 populations per river mile) on Oxbow Reservoir (63 of 209 sites), about 45% (6.4 populations per river mile) on Brownlee Reservoir (356 of 785 sites), and about 70% (13.6 populations per river mile) in the Weiser reach (164 of 234 sites) (see section E.3.3.1.1.2.).

Often, several factors influenced the occurrence of each noxious weed population. The types of disturbance present at each population and the level of disturbance (for example, extreme, high, moderate, or slight; defined in section 3.1.3. in Technical Report E.3.3-2) at each population are summarized by species in Appendix 6 to Technical Report E.3.3-2. Generally, at least one disturbance factor (alluvial, flow zone [water-level fluctuations], livestock grazing, mining, fire, road maintenance, recreation [camping, boating facilities], trail use, industry, agriculture, and off-road vehicle use) was significantly ($P < 0.001$) correlated with populations of one or more noxious weed species. In the downstream river reach, 488 disturbance types were recorded at 321 weed populations. The most frequent disturbance factors were recreation (40%; 129 sites), livestock (38%; 121 sites), flow zone (21%; 67 sites), alluvial (15%; 47 sites), and trail use (14%; 46 sites) (Appendix 5 to Technical Report E.3.3-2).

Investigators identified two noxious weed species (*Lepidium latifolium* and *Phalaris arundinacea*) and one special interest weed (*Amorpha fruticosa*) to be significantly and positively associated with water fluctuations (Table 5 in Technical Report E.3.3-2). These species benefit from recurrent water-level fluctuations that create sites for weeds to establish and persist in riparian habitats. Other species, specifically *Cyperus esculentus*, *Equisetum arvense*, *Euphorbia esula*, *Lythrum salicaria*, and *Tamarix* species were also positively associated with water-level fluctuations (Table 5 in Technical Report E.3.3-2).

To specifically assess the potential effects of future operations, a modeling study was conducted (Technical Report E.3.3-3). Investigators' results, based on a combination of the modeling analysis and life history consideration, predicted that 15 weedy species would be similarly affected across the two operational scenarios. One ruderal annual species, *Tribulus terrestris*, was predicted to increase in abundance with the proposed versus full pool run-of-river scenario. Four perennial species, including *Cardaria draba*, *Euphorbia esula*, *Tamarix* species, and possibly *Elaeagnus angustifolia*, would be substantially reduced with the proposed scenario because the drawdown of Brownlee Reservoir would continue to impede their downstream expansion. Investigators also recognized the occurrence of a dispersal barrier imposed by the drawdown pattern of Brownlee Reservoir and anticipated a substantial ecological benefit of the proposed scenario relative to the full pool run-of-river scenario (Technical Report E.3.2-45, section 4.3. in

Technical Report E.3.3-3) by retarding the downstream spread of undesirable plant species (see section E.3.3.4.1.2.).

The capacity of reservoirs to hinder hydrochory, or water-based plant propagation, is well established and underlies the concept of fragmentation that is prominent in the current literature (Nilsson et al. 1991, Dynesius and Nilsson 1994, Nilsson and Jansson 1995, Johnson 2002). Essentially, floristic dissimilarities result between upstream, reservoir, and downstream reaches (Jansson et al. 2000). Most riparian plant species, both native and exotic, are unable to establish and survive the successive drying and flooding in reservoir fluctuation zones that experience large, seasonal water level changes (Nilsson and Keddy 1988). Potential inputs of weed seed and propagules from upstream sources must be considered in comparing conditions for weed spread under future operational scenarios in the downstream reach.

After investigating potential impacts of modeled proposed and full pool run-of-river operations on riparian habitats, investigators concluded, “Of all of the probable impacts addressed in the present report, the prevention of encroachment of salt cedar into the natural riparian zone along the Snake River downstream from the Hells Canyon Dam may be the most ecologically significant” (Technical Report E.3.3-3). With respect to populations of native *Salix* species in the downstream reach, observations of Dudley and Collins (1995) are noteworthy. They state that *Tamarix* species have been able to out-compete willow and other riparian plants in many locations, greatly diminishing the quantity and quality of riparian habitat for migrant songbirds and vegetation-dependent birds. In addition, results of Stohlgren et al. (2003) and others (Levine and D-Antonio 1999, Stohlgren et al. 1999, Levine 2000) indicate that highly invasive plant species, such as *Tamarix* species, *Elaeagnus angustifolia*, and *Lythrum salicaria*, can become more widely established in native species-rich riparian zones than they can in habitats of low plant diversity, habitats that were thought to be more vulnerable to plant invasions through the process of competitive exclusion (Grime 1973). The Applicant considers the native downstream communities to be particularly at risk to invasion of *Tamarix* species under full pool run-of-river operations.

Compared with full pool run-of-river operations, modeled proposed operations would lead to limited increases in distribution and abundance of riparian noxious weeds in the downstream reach. On the upstream reservoirs, proposed operations nearly mimic patterns of water surface elevations that historically occurred in the reservoir reaches. If these conditions occurred for another 30 years or more, the abundant weed sources in the upstream reach would be impeded in their downstream movement. The spread of weeds in the downstream reach would be restricted to 1) the capacity of limited existing populations to spread and 2) the capacity of populations on Oxbow and Hells Canyon Reservoirs to spread into the reach. Differences in downstream flows between the two future scenarios are expected to have minimal difference on the spread of noxious weeds.

Under full pool run-of-river operations, new sources of noxious weeds delivered to the canyon from above the HCC would 1) introduce previously unknown species to this reach (for example, *Tamarix* species), 2) significantly augment noxious weed populations in the Oxbow and Hells Canyon reservoirs (thereby increasing their capacity to influence the downstream reach), and 3) add to existing populations of weedy species in the downstream reach. Combined, these influences would result in comparatively greater negative impacts to existing native perennial communities than would occur under proposed operations (Technical Reports E.3.3-1 and E.3.3-3).

In summary, the Applicant concludes that modeled proposed operations would contribute to the spread of noxious weeds along the river reach below Hells Canyon Dam, but to a much lesser extent than full pool run-of-river operations would. The Applicant cannot quantitatively identify the extent (for example, acreage or number of populations) of operational impacts of either future scenario on the potential spread of noxious weeds in the downstream reach. Under proposed operations, the combination of drought stress and inundation stress on Brownlee Reservoir would eliminate the vast majority of many weedy species encroaching from upstream sources (reduction of seeds and plant propagules), controlling downstream infestation especially in the 41.5-mi-long main-pool subreach of Brownlee Reservoir (see section E.3.3.4.1.2.). Proposed operations may also deter the invasion of some species currently not found below Hells Canyon Dam, especially *Tamarix* species (Technical Reports E.3.3-1 and E.3.3-3).

The Applicant acknowledges that it may be just a matter of time before downstream riparian habitats are negatively influenced by upstream riparian weed sources, regardless of the dispersal barrier imposed by drawdown operations on Brownlee Reservoir. Occasionally, individuals of these invasive riparian weeds would become established at locations where they could survive, such as near tributary inflows, and although some plants would be impeded, eventually these species would probably extend downstream beyond Brownlee Reservoir. In addition, there are alternate propagule sources beyond the inputs from the Weiser reach and the Powder River, and these would also enable expansion of invasive plants (section 4.3. in Technical Report E.3.3-3).

Other factors that influence the spread of noxious weeds along the Snake River corridor through Hells Canyon include management actions of federal and state agencies and other private landowners. Because of the high percentage of federally owned lands, largely under USFS ownership in the downstream reach, management actions of the USFS probably play a significant role in the spread of noxious weeds. USFS land managers oversee grazing allotments, road maintenance activities, residential/field camp facilities, historic visitor sites, camping and boating recreation facilities, and other public uses in the downstream reach, all of which can contribute to the spread of noxious weeds. These influences can affect the spread of weeds 1) directly through spreading of weed seed and plant parts and 2) indirectly by creating disturbance to soil and vegetation that create conditions more conducive to weed invasion. Recreationists, livestock operators, subcontractors, federal personnel, and members of the public visiting this area can unknowingly spread weeds when passing through areas of noxious weeds. Weed propagules are picked up on equipment, clothing, and animals and can be spread along roadways or travel corridors, including water-based recreation sites (Loney and Hobbs 1991). Weeds can be transported within the canyon or brought in from outside sources by visitors. Once present, these weeds can invade adjacent native habitats (MacLellan and Stewart 1986). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make weed control necessary.

Because many factors influence the spread of noxious weeds along the downstream reach and because this reach is largely under the management jurisdiction of the USFS, the Applicant recommends that it take the lead role in developing and participating in cooperative agreements with the USFS and other interested agencies and groups to control establishment and spread of noxious weeds (see proposed PM&E measure in section E.3.3.3.2.1.2.). All landowners and participants would be expected to contribute personnel and funds to assist in weed control activities. Specifically, the Applicant recommends that it participate with local organizations called CWMAs, or with similar organizations, that are involved with areas bordering the Snake River in Hells Canyon and with increasing focus on the control of *Tamarix* species. CWMAs build cooperative relationships among agencies, landowners, land managers, and other interested individuals and organizations—relationships that are needed to effectively manage noxious weeds (ISDA 1999).

E.3.3.4.2.3. Downstream Operations and Threatened and Endangered Plant Species

Many factors negatively impact rare plant populations along the Snake River corridor through Hells Canyon (confidential Technical Report E.3.2-46 and Technical Reports E.3.3-2 and E.3.3-3), including disturbance from off-road vehicle use, camping, hiking, boating, livestock grazing, agriculture, residential activities, industrial activities, fire, road maintenance, and water-level fluctuations (both natural and river regulation). Actions by natural resource agencies, state and county governments, nongovernmental organizations, private landowners, and the public contribute to disturbance of upland and riparian habitats and make protection of rare plant populations necessary.

The Applicant conducted two integrated studies (Technical Reports E.3.3-2 and E.3.3-3) to assess the influence of modeled proposed and full pool run-of-river operations on rare plants. In the first study, (Technical Report E.3.3-2) populations of five species of special status plants were found to be potentially impacted by historic operations in the reach below Hells Canyon Dam: *Cyperus schweinitzii*, *Teucrium canadense* var. *occidentale*, *Bolandra oregana*, *Carex hystricina*, and *Leptodactylon pungens* ssp. *hazeliae* (section 3 in Technical Report E.3.3-2). The first two species were found only in the downstream reach, while the latter three species were found in the downstream reach and in Oxbow or Hells Canyon reservoirs.

No federally listed endangered or threatened species are known to occur in the 50-m survey areas along shorelines in the downstream reach. However, three populations of the federally threatened *Mirabilis macfarlanei* occur upslope of the river corridor near Pittsburg Landing. No negative impacts to listed species are expected to occur from either proposed or full pool run-of-river operations.

In the second study, investigators predicted the potential influence of modeled proposed and full pool run-of-river operations based on knowledge of life history traits and distributional patterns of the species (Chapter 5 of Technical Report E.3.3-3). A modeling study was originally intended so that the potential influence of future scenarios could be predicted, but due to lack of sampling data (too few observations), a modeling approach was deemed infeasible. Investigators did not observe rare plants along reservoir shorelines, but did encounter several populations of *Cyperus schweinitzii* within the riparian zone in the downstream reach. Investigators used results of rare plant observations from Technical Report E.3.3-2 and professional judgment to assess potential influences to populations of these special status species from operational scenarios. In addition, based on the relative distribution and abundance of *Cyperus schweinitzii* in the downstream reach, six populations of the species were randomly selected from the 21 populations recorded in Technical Report E.3.3-2 for more intensive study (section 5.3. in Technical Report E.3.3-3). Potential influences to populations of the five special status species from proposed or full pool run-of-river operations in the downstream reach are identified below.

Twenty-one populations of *Cyperus schweinitzii* were found downstream of Hells Canyon Dam. All the populations were situated near the Snake River on dry, coarse, sandy loam soils on gentle to moderate slopes. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. The majority of the sites (17 of 21, or 81%) did not extend downslope of the mean high-water mark. Recreation, fire, and livestock were the major disturbance types reported for the *Cyperus schweinitzii* populations. Because proposed operations are defined to have daily summer flow of lower average maximums than under historic operations, riparian habitat would occupy slightly less area (7 acres less, Technical Report E.3.2-40). This reduced area may negatively affect the populations. Because no permanent water would be available to the upper riparian zone during the growing season with full pool run-of-river operations, riparian habitat would occupy even less (16 acres less) of the shoreline zone (Technical Report E.3.2-40). This situation may negatively affect the populations (Technical Report E.3.3-3).

More intensive study of six randomly selected populations of *Cyperus schweinitzii* identified additional conclusions. Investigators found that the elevational distribution ranged from 2.57 m to 6.6 m above the mean annual water level (Table 5.2 and Figure 5.2 in Technical Report E.3.3-3). These populations occurred well above mean annual peak flows (2.10 m above), yet were subject to inundation during relatively infrequent historic peak-flow events. Their relative abundance was low to moderate, ranging from 1 to 27% cover per sample plot (mean = 9.8% cover). This pattern of distribution indicates that populations of *Cyperus schweinitzii* were located toward the upper end of the facultative riparian zone, an area only rarely inundated by scouring peak flows. Situated at these high elevations, these plants would be minimally influenced by the differences in flow patterns across the two scenarios (Technical Reports E.3.3-2 and E.3.3-3).

One population of *Teucrium canadense* var. *occidentale* was found, and two other populations were previously known to occur downstream of Hells Canyon Dam. Only one of the three populations was within 50 m of the Snake River. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. The population found during this survey was growing on gently sloping, moist, rocky ground along the shoreline of the Snake River. Plants spanned about 15 centimeters (cm) above to 75 cm below the mean high-water mark. Horizontal distance ranged from 10 cm above to 2 m below the mean high-water mark. Recreational activity was noted to provide slight disturbance to the site. Because proposed operations are defined to have daily summer flow of lower average maximums than under historic operations, riparian habitat would occupy slightly less area (7 acres less, Technical Report E.3.2-40). This reduction in area may negatively affect the population. Because no permanent water would be available to the upper riparian zone during the growing season with full pool run-of-river operations, riparian habitat would occupy even less (16 acres less) of the shoreline zone (Technical Report E.3.2-40). This situation may negatively affect the population (Technical Report E.3.3-3).

Four populations of *Bolandra oregana* were found downstream of Hells Canyon Dam. In addition, there are two previously known populations of this species downstream of Hells Canyon Dam: one is near Hells Canyon Dam, and the other is near the confluence of Cow Creek and the Imnaha River. However, neither was within the 50-m-wide survey area. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. All populations were growing near seeps or streams in cliffs, surrounded mostly by bare rock. No observable disturbances were recorded for the four new populations. Because populations occur outside the influence of water-level fluctuations, no negative impacts are expected from either proposed or full pool run-of-river operations (Technical Reports E.3.3-2 and E.3.3-3).

Three populations of *Carex hystricina* were found downstream of Hells Canyon Dam. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. Populations were found growing in either relatively bare flow zone areas or relatively lush riparian communities. Disturbance from many sources was evident at most of the sites. Hydrologic disturbance was heavy at one site and extreme at four sites. Because proposed operations are defined to have daily summer flow of lower average maximums than under historic operations, riparian habitat would occupy slightly less area (7 acres less, Technical Report E.3.2-40). This reduction in area may negatively affect the populations. Because no permanent water would be available to the upper riparian zone during the growing season with full pool run-of-river operations, riparian habitat would occupy even less of the shoreline zone (16 acres less, Technical Report E.3.2-40). This situation may negatively affect the populations (Technical Report E.3.3-3).

Six populations of *Leptodactylon pungens* ssp. *hazeliae* were found: one downstream of Hells Canyon Dam and five along Hells Canyon Reservoir. There are 7 previously known populations in the vicinity of the HCC. Status of this species is reviewed in section 3.2.2. in Technical Report E.3.3-2. The five newly located populations were found growing on dry, steep to vertical cliffs above the shoreline. Neither proposed operations nor full pool run-of-river operations would negatively affect the populations as they are outside the influence of water-level fluctuations (Technical Reports E.3.3-2 and E.3.3-3). No other disturbance factors were noted, such as disturbance from recreation activities, road maintenance, livestock grazing, fire, or off-road vehicle use.

The Applicant concludes that both operational scenarios may negatively affect populations of three of the five special status plant species located in the downstream reach: *Cyperus schweinitzii*, *Teucrium canadense* var. *occidentale*, and *Carex hystricina*. This conclusion is due to an expected decrease in 7 acres of riparian habitat under modeled proposed operations and a decrease of 19 acres of riparian habitat under full pool run-of-river operations from existing levels. Populations of *Leptodactylon pungens* ssp. *hazeliae* were found growing outside of riparian areas on dry, steep to vertical cliffs above the shoreline outside the influence of water-level fluctuations. Populations of *Bolandra oregana* were found near seeps or streams in cliffs, outside the influence of water-level fluctuations.

Because many factors negatively impact rare plant populations along the downstream reach and because this reach is largely under the management jurisdiction of the USFS, the Applicant recommends working cooperatively with USFS and other interested agencies and groups to protect rare plant sites that are threatened by flow levels and other disturbance activities below Hells Canyon Dam (see proposed PM&E measure in section E.3.3.3.2.1.3.).

E.3.3.4.2.4. Downstream Operations and Shoreline Erosion of Terrestrial Habitat

Riverbanks in the reach below Hells Canyon Dam are very stable except at a few locations. This downstream river reach was one of the most stable of the reaches studied (from Weiser above the HCC to the Salmon River). Shoreline bank erosion occurred at 60 sites (6.3 acres) along 2.0% of the available shoreline (2.44 mi of 125 total miles) (Technical Report E.3.2-42). This erosion occurrence can be compared with 9 sites (10.6 acres) along the Weiser reach along 7.5% of the available shoreline (3.45 of 45.8 mi), 261 sites (79.07 acres) along the Brownlee Reservoir reach along 27.2% of the available shoreline (49.58 of 182.3 mi), 9 sites (1.34 acres) along the Oxbow Reservoir reach along 2.0% of the available shoreline (0.51 of 25.0 mi), and 39 sites (3.45 acres) along the Hells Canyon Reservoir reach along 2.7% of the available shoreline (1.45 of 53.9 mi). Slopes are extremely steep in the upper portions of the downstream reach, often greater than 60 degrees, and soils are usually shallow, when present. Mass movements can be expected at any time along the main canyon and in side canyons (Vallier 1998). Many of the canyon walls are precipitous, and rocks are crumbly and severely weathered (Vallier 1998). Shoreline substrates are diverse but are composed almost entirely of large basalt outcrops (bedrock) and large boulders and cobbles, with few sands or gravels. However, fine sediments occur in the interstitial spaces between the coarser materials as well as in subsurface substrates (section 2.3.5.2. in Technical Report E.3.3-3). The coarseness of the shoreline substrates reduces the potential for shoreline erosion.

Appendix C to Technical Report E.1-2 provides details on the geomorphic characteristics of the shorelines below Hells Canyon Dam. Geomorphologists focused on areas affected by recent historic flows (recent defined in this study as the historic record of the past 90 years) and areas that could be affected by future flow scenarios. These areas essentially encompassed a narrow riparian zone, including riparian vegetation and excluding upland habitats. Total lengths of shorelines were classified by substrate class (bedrock, boulder, cobble, gravel, sand), geomorphic feature (for example, hillslope, terrace, fan, island, bar), and material source (for example, alluvium, colluvium). Location data were collected using a sub-meter global positioning system (GPS) unit coupled with a laser range finder. The table below indicates the percentage of total available shoreline (miles) in each substrate class from Hells Canyon Dam to the confluence of the Salmon River. The most prevalent class is dominated by boulders, a class that occurs along about 62% of the available shoreline, while the least frequent are the sand and cobble substrate classes that each occur along little more than 1% of the available shoreline.

Overlaying these data with the GPS locations obtained for the shoreline bank erosion sites (Technical Report E.3.2-42) indicates that most of the erosion (80%, 5.08 acres of the 6.34 acres) occurred in the boulder substrate class (see table below). This amount can be compared with about 7% (0.47 acres) occurring in the sand class, 5% (0.35 acres) in the bedrock class, 5% (0.32 acres) in the cobble class, and 2% (0.13 acres) in the gravel class. There are about 1,015 acres in a 20-m corridor along both shorelines below Hells Canyon Dam to the confluence of the Salmon River.

Substrate Class	Shoreline Bank Erosion (acres)	Amount Available (% of total shoreline miles)
Bedrock	0.35	28.2
Boulder	5.08	61.9
Cobble	0.32	7.2
Gravel	0.13	1.5
Sand	0.47	1.2
Total	6.34	100.0

Combined, the above data indicate the relative amount of shoreline bank erosion occurring along each substrate class compared with the amount of the substrate class available in the reach. For example, approximately 80% of the bank erosion sites (5.08 of 6.34 acres) occurred in the boulder substrate class, which is available along about 62% of the reach. Likewise, about 7% of the bank erosion (0.47 of 6.34 acres) occurred in the sand substrate class, which is available along about 1% of the reach.

Factors that probably influenced past bank erosion include hydroelectric operations, boat-generated waves, disturbance from recreation (for example, camping and hiking), channel flow, flooding of tributary drainages, shoreline substrate and topography, vegetation cover, livestock grazing, and homesteading activities (Technical Report E.3.2-42). Usually, several factors influenced erosion at each site. The types and severity of influences (for example, extreme, high, moderate, or slight) affecting each erosion site are identified in Appendix 2 to Technical Report E.3.2-42. In the downstream reach, 207 disturbance types were recorded at 60 erosion sites. The most common factors were highly erosive soil (60 sites), excessive slope (59 sites), boat-generated waves (58 sites), recreation (12 sites), and water-level fluctuations (8 sites) (Table 3 in Technical Report E.3.2-42). From a hydrologic perspective, most bank erosion sites (52 of 60) are located upslope of the 30,000 cfs stage level, above the typical zone influenced by water fluctuations and summer base flows from past HCC operations. These sites are believed to be primarily impacted during periods of high flows (Technical Report E.3.2-42). Because many of these influences are interrelated, attributing the cause of erosion at each site to any single factor is difficult.

Predicting quantitative differences between the effects of the proposed and the full pool run-of-river scenarios on shoreline erosion is difficult (for example, acreage or number of sites). Although modeled proposed operations are defined to have daily summer flow of lower average maximums than under historic operations, other operational influences (for example, daily ramping rates) and natural flow events (for example, spring runoff flows greater that 30,000 cfs, or the capacity of Hells Canyon Dam) are expected to be similar to historic conditions. Therefore, a similar amount of shoreline bank erosion may be expected over the next 30 years as has occurred during historic operations. Full pool run-of-river operations would eliminate large daily fluctuations from HCC operations and result in smoother stage decline rates and lower summer base flows (Technical Report E.1-4). Compared with proposed operations, this situation may reduce bank erosion below the 30,000 cfs stage. However, a similar rate of bank erosion would be expected on shoreline substrates at and above the 30,000 cfs stage. Other erosional influences (for example, recreation traffic, boat-generated waves) would continue to exert influence on shoreline bank erosion under both operational scenarios.

Other factors that influence the erosion of shoreline banks along the downstream reach include management actions of federal and private landowners. In this reach, which is almost entirely under USFS ownership, USFS oversees grazing allotments, road and recreation facility maintenance, river boating activities, and other public uses. These activities can contribute to erosion factors such as livestock grazing, boat-generated waves, roads, and recreation disturbance types, which were documented to influence erosion of shoreline banks along this reach (Table 3 in and Appendix 2 to Technical Report E.3.2-42).

The Applicant concludes that, compared with full pool run-of-river operations, modeled proposed operations would result in a greater amount of shoreline bank erosion along the downstream reach, especially those sites impacted below the 30,000 cfs stage level. Because the Applicant cannot predict a quantitative difference in shoreline erosion between scenarios on the river reach (for example, acreage or number of sites), it assumes that the amount of bank erosion under proposed operations would not be greater than the amount of current bank erosion.

By proposing to mitigate for the total extent of shoreline bank erosion in this reach, the Applicant has not limited its actions solely to its contribution to shoreline bank erosion. Other influences outside of the Applicant's control also impact shoreline bank erosion. Such factors include recreation activities (boat-driven waves, camping, trails, and dispersed recreation), livestock grazing, and road or other construction or maintenance activities under the actions of federal agencies, public interest groups, or other private landowners. These factors would continue to influence shoreline bank erosion under either proposed or full pool run-of-river operations.

Mitigation for 6 acres of existing shoreline erosion could be accomplished through acquisition and enhancement actions (for example, additive to other acquisition/enhancement measures), by specific management actions to eliminate anthropogenic causes of erosion, and, where feasible, by limited site stabilization/revegetation actions (see section E.3.3.3.2.1.1.).

Management actions could be implemented to control human-caused factors that negatively affect shoreline banks. These actions should focus on controlling recreation influences (for example, boat-driven waves, camping, trails, and vehicle use), minimizing effects of roads and construction or maintenance activities, and reducing the livestock grazing that has negative effects (Technical Report E.3.2-42). Because these management actions fall under the jurisdiction of the USFS in this downstream reach, the Applicant has little management authority. Because water fluctuations are necessary if the HCC is used for flood control, anadromous fish spawning and protection, downstream navigation, and hydroelectric generation, eliminating all negative impacts from human activity is not possible.

Stabilizing and revegetating most of the shoreline erosion sites in the study area may not be practical, feasible, or even desirable (Technical Report E.3.2-42). The subsoil remaining at these sites would likely be hard, rocky, infertile, and droughty, making it difficult to reestablish vegetation cover. Without soil amendments, the remaining soil probably could not support adequate growth and, therefore, would not adequately stabilize the banks. The steep topography and remoteness of the canyon make it difficult to access and work on most sites. Improper design or implementation often results in problems more severe than those that were to be avoided. However, because natural resources below Hells Canyon Dam are highly valued by many people for recreation, cultural, and aesthetic resources (Technical Reports E.4-1, E.5-4, and E.5-9), cooperative efforts to stabilize and enhance priority sites that have shoreline erosion may be appropriate to benefit these values.

E.3.3.4.2.5. Human Activities and Botanical Resources

Integrating data collected in numerous Hells Canyon relicensing studies, the Applicant comprehensively evaluated the interaction of human activities and natural resources in Hells Canyon, including the river reach downstream of Hells Canyon Dam (confidential Technical Report E.3.2-46). Although the Applicant identified potential effects of human activity on botanical resources downstream of Hells Canyon Dam, these effects are not within the Applicant's jurisdiction or responsibilities associated with operation of the HCC. Therefore, no identified impacts are associated with the Applicant's activities.

E.3.3.4.3. Transmission Lines and Service Roads

The Applicant conducts O&M activities (such as line patrolling, vegetation clearing, structure repair, and road maintenance) that potentially impact botanical resources. Therefore, state and federal agencies and nongovernmental organizations expressed concern that O&M activities might impact highly valued botanical resources and facilitate the spread of undesirable weeds. In response to concerns, the Applicant assessed impacts to botanical resources from the Pine Creek–Hells Canyon transmission line (Line 945), its service roads, and O&M activities (Technical Report E.3.3-4).

E.3.3.4.3.1. Operation and Maintenance Activities and General Vegetation

There is no evidence that the transmission-line and service-road ROW affect the composition or pattern of the vegetation communities in the immediate area. O&M activities, including ROW vegetation clearing, have limited, site-specific impacts. In 1998, when the line was last cleared, tree trimming occurred in only 240 m, over eight pole spans.

E.3.3.4.3.2. Operation and Maintenance Activities and Noxious Weeds

The Applicant's botanists recorded 144 occurrences of 8 listed noxious weed species on survey units along the Pine Creek–Hells Canyon line (Line 945). At least 1 noxious weed was located on 50 of 57 units surveyed (88%) (Technical Report E.3.3-4). Noxious weeds are common throughout the transmission-line corridor and the surrounding region.

The Pine Creek–Hells Canyon line (Line 945) runs adjacent to the Hells Canyon Road, a paved road between Oxbow and Hells Canyon dams. The ROW is classified as 93% disturbed habitat (Technical Report E.3.3-4). The disturbed habitat cover type is represented primarily by road verge conditions. The Applicant used an O&M Activity Index to rate the potential of O&M activities being conducted on the Pine Creek–Hells Canyon line (Line 945) to negatively affect botanical resources (Technical Report E.3.3-4). Based on this Activity Index, the transmission line was classified as having moderately low potential impact.

O&M activities probably play a role in the spread of noxious weeds along road corridors. Along the Pine Creek–Hells Canyon line (Line 945), 8 disturbance types were recorded at 144 weed populations. The most frequent disturbance factors were water erosion, wildlife, and livestock (Technical Report E.3.3-4). Because most disturbance factors are interrelated, attributing the potential cause of noxious weed occurrence and spread to any single influence is difficult, if not impossible.

E.3.3.4.3.3. Operation and Maintenance Activities and Threatened and Endangered Plant Species

The Applicant's surveys located 10 occurrences of 1 rare plant species, *Rubus bartonianus*, along the Pine Creek–Hells Canyon line (Line 945) (Technical Report E.3.3-4). No federally listed threatened or endangered plant species were found. Seven of the 10 *Rubus bartonianus* occurrences were near the Hells Canyon Road.

Rubus bartonianus is endemic to the Snake River Canyon, occurring in thickets on canyon sides along the Hells Canyon Reservoir and a few miles below Hells Canyon Dam. Habitats include ravines and talus slopes, often near water seeps. All occurrences located by the Applicant were found on steep, rocky slopes, in areas difficult to access and, therefore, naturally protected from most types of disturbance.

Populations of *Rubus bartonianus* in Hells Canyon are considered secure, with no major threats (Technical Report E.3.3-4). The Applicant's surveys suggest that *Rubus bartonianus* occurrences are stable along the Pine Creek–Hells Canyon line (Line 945).

E.3.3.4.4. Anticipated Incremental Impacts of New Developments

Because the Applicant proposes no new development of project works or changes in operation at the HCC, no incremental impacts of such new development or changes in operation are anticipated.

E.3.3.5. Materials and Information on Measures and Facilities

Because no current mitigation measures or facilities specifically target botanical resources, there are no existing measures or facilities to continue. All materials and information regarding measures and facilities proposed by the Applicant are included in section E.3.3.3.2.

E.3.3.6. Consultation

For a summary of consultation efforts to date for the HCC, see the Consultation Appendix.

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Table E.3.3-1 Number of weed populations and relative percent of upland and riparian weed populations (in parentheses) in each reach

Noxious Weed Type	Downstream Reach	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir	Weiser Reach	All Reaches
Riparian	32	109	63	356	164	724
	(10.0)	(30.6)	(30.1)	(45.4)	(70.1)	(38.0)
Upland	289	247	146	429	70	1,181
	(90.0)	(69.4)	(69.9)	(54.6)	(29.9)	(62.0)
Total	321	356	209	785	234	1,905
Total River Miles	59.3	22.0	14.2	55.5	12.0	163
Acres of riparian vegetation per river mile[a]	3.0	3.7	3.6	2.0	15.9	3.8
Number of riparian weed populations per river mile	0.5	4.9	4.4	6.4	13.6	4.4

a. Acres of riparian vegetation in a 20-m planimetric band along the shoreline per river mile.

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The *Code of Federal Regulations* below—18 CFR § 4.51(f)(4)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(f)(4) *Report on historical and archaeological resources*. The report must discuss the historical and archaeological resources in the project area and the impact of the project on those resources. The report must be prepared in consultation with the State Historic Preservation Officer and the National Park Service. Consultation must be documented by appending to the report a letter from each agency consulted that indicates the nature, extent, and results of the consultation. The report must contain:
>
> (i) Identification of any sites either listed or determined to be eligible for inclusion in the National Register of Historic Places that are located in the project area, or that would be affected by operation of the project or by new development of project facilities (including facilities proposed in this exhibit);
>
> (ii) A description of any measures recommended by the agencies consulted for the purpose of locating, identifying, and salvaging historical or archaeological resources that would be affected by operation of the project, or by new development of project facilities (including facilities proposed in this exhibit), together with a statement of what measures the applicant proposes to implement and an explanation of why the applicant rejects any measures recommended by an agency.
>
> (iii) The following materials and information regarding the survey and salvage activities described under paragraph (f)(4)(ii) of this section:
>
> (A) A schedule for the activities, showing the intervals following issuance of a license when the activities would be commenced and completed; and
>
> (B) An estimate of the costs of the activities, including a statement of the sources and extent of financing.

E.4. Report on Historical and Archaeological Resources

As part of efforts to relicense the Hells Canyon Complex (HCC),[1] the Applicant commissioned intensive archaeological inventories within the area of potential effects (APE). Because the HCC consists of several components—three reservoirs and their associated dams, powerhouses, transmission lines, and appurtenant facilities—three separate APEs were established. The first of these APEs includes the three reservoirs, the second includes the unimpounded reach of the Snake River from Hells Canyon Dam downstream to the confluence with the Salmon River, and the third includes the transmission lines.[2] These three APEs are described in the following paragraphs.

Reservoir APE—Along the reservoirs, the APE consists of the area between the reservoir drawdown zone to a line 0.1 mile upslope from the reservoir high-pool level. The area up to the 0.1-mile line was determined to be within the area affected by relicensing-related activities, such as development or improvement of boat ramps and construction or improvement of campsites. In addition, this area could be affected by land management activities, such as gravel mining and

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.
2. Twelve transmission lines were included in the draft *New License Application: Hells Canyon Hydroelectric Project*. All but one of those lines have been excluded from this final license application.

impromptu camping. Some of these activities might affect historic properties. This 0.1-mile-wide APE along the reservoirs was specified in the *Formal Consultation Package for Relicensing: Hells Canyon Project* (FCP) that the Applicant distributed in January 1997 (IPC 1997:VIII-623). In this exhibit, the reservoir APE is also referred to as the HCC and vicinity.

River APE—Below Hells Canyon Dam, the Snake River flows unimpounded for a distance of 99 river miles to the upper end of Lower Granite Reservoir. Of this distance, the APE for the free-flowing river segment extends downstream of Hells Canyon Dam to the confluence of the Snake and Salmon rivers, a 60-mile reach. It also includes the area 100 meters inland from the river shoreline. It is in this zone that the effects of river flows, land management activities, and recreational improvements are most likely to occur. Downstream of the confluence, Salmon River flows mask the effects of flows from Hells Canyon Dam.

In a meeting held in February 1998, the Applicant discussed the 100-meter width of the APE with the Idaho State Historic Preservation Office (Idaho SHPO), U.S. Forest Service (USFS) staff, and principal investigators from Applied Paleoscience and Rain Shadow Research. The staff of the Oregon SHPO were invited to the meeting, but they could not attend. Dr. Robert Yohe, the Idaho Deputy State Historic Preservation Officer, expressed the Idaho SHPO's approval of the river APE in a letter to the Applicant dated March 13, 1998. The Idaho and Oregon SHPOs and other agencies and tribes were notified of the APE definition. In addition, when the FCP was published and distributed, they were provided the opportunity to comment (IPC 1997:VIII-630). In this exhibit, the river APE is also referred to as downstream areas.

Transmission Line APE—The APE for transmission lines consists of the right-of-way corridor and associated service roads within the right-of-way (IPC 1997:VIII-616). Only one of the 12 transmission lines included in the draft license application remains in this final license application. The Pine Creek–Hells Canyon 69-kV line (Line 945) parallels the Oxbow–Hells Canyon Road (also referred to as the Hells Canyon Road).

As mentioned earlier, the FCP was distributed in January 1997. Although there was an opportunity for comment provided, no comments were received concerning the three APEs.

E.4.1. Identification of Historical and Archaeological Sites

Identification of historical and archaeological sites included sites that were already listed on the National Register of Historic Places (National Register), as well as sites that needed to be evaluated for their National Register eligibility. The sites that were not yet evaluated could be determined to be eligible, potentially eligible, or not eligible for the National Register.

E.4.1.1. Sites Listed on the National Register of Historic Places

HCC and Vicinity—According to an Internet search (http://www.nr.nps.gov) of historical and archaeological sites listed on the National Register, there are no listed sites in the reservoir APE. The Applicant's search included both the Oregon and Idaho sides of the reservoirs. Also, following standard procedure, the Applicant's consulting archaeologists reviewed National Register records at the Oregon and Idaho SHPOs.

Downstream Areas—One historic district listed on the National Register encompasses the project area below Hells Canyon Dam to the confluence with the Salmon River (Torgeson 1983). As originally documented, the Hells Canyon Archaeological District includes 152 historic and 384 prehistoric sites. The historic sites include 63 mining placers and 25 lode-mining properties, while the remainder comprises agricultural and ranching properties. The prehistoric sites include 151 rockshelters, 212 open sites, and 21 sites that include a mix of rockshelters, housepits, and other features.

In this same APE, one archaeological site located between Hells Canyon Dam and the confluence of the Snake and Salmon rivers is listed on the National Register. Site 10IH 538 (IPC-RR0109) is the remains of a historic homestead at Bernard Creek. The USFS restored the McGaffee cabin at this site after boaters dismantled and burned the front porch in 1979.

Transmission Line and Associated Service Roads—None of the archaeological sites recorded along the Pine Creek–Hells Canyon line (Line 945) are listed on the National Register.

E.4.1.2. Sites Eligible for Inclusion in the National Register of Historic Places

E.4.1.2.1. Historical and Archaeological Sites of the HCC and Vicinity

Discussion of sites in the reservoir APE that are eligible, potentially eligible, or not eligible for inclusion in the National Register is provided by reservoir in the following sections.

E.4.1.2.1.1. Brownlee Reservoir

Northwest Archaeological Associates conducted the inventory of the Brownlee Reservoir margin and drawdown areas (confidential Technical Report E.4-3[3]). In evaluating the eligibility of sites for inclusion on the National Register, Northwest Archaeological Associates analyzed prehistoric Native American sites and historic Euro-Asian sites separately, according to different research domains or themes. For prehistoric Native American sites, Northwest Archaeological Associates considered the following domains: chronology, paleoenvironment, technology, settlement, presence of buried deposits, and site integrity (confidential Technical Report E.4-3). Northwest Archaeological Associates' recommendations for the National Register eligibility of prehistoric Native American sites are listed in Appendix E.4-A, which is an excerpt of Table 9 in Technical Report E.4-3.

For historic Euro-Asian sites, Northwest Archaeological Associates considered the potential of the sites to provide information on important historic themes, such as early settlement, the railroad, mining, and transportation (confidential Technical Report E.4-3), according to a criterion about information potential in 36 CFR § 60.4(d). Other sites may be eligible because of their "association with broad patterns of local and regional history," according to 36 CFR § 60.4(a). Northwest Archaeological Associates' recommendations for historic sites along the margins and in the drawdown zone of Brownlee Reservoir are listed in Appendix E.4-B, which is an excerpt of Table 10 in confidential Technical Report E.4-3.

The Applicant agrees with all of Northwest Archaeological Associates' evaluations and recommendations. Within the drawdown zone of Brownlee Reservoir, two prehistoric

3. Some technical reports are confidential because they contain location information about archaeological sites. These reports have been made available to FERC and the appropriate entities.

Native American sites are eligible for inclusion on the National Register, while six prehistoric Native American sites are potentially eligible. One prehistoric/historic Native American site is eligible and one is potentially eligible for inclusion. In addition, four historic sites are potentially eligible (Table E.4-1).

Along Brownlee Reservoir's margin, four prehistoric Native American sites are eligible, while 16 such sites are potentially eligible for inclusion. Four historic sites are potentially eligible for inclusion. Six prehistoric/historic sites are potentially eligible for the National Register (Table E.4-2).

E.4.1.2.1.2. Oxbow Reservoir

Archaeologists from Science Applications International Corporation (SAIC) conducted the inventory of site eligibility for Oxbow Reservoir. They recommended that, of the six archaeological sites recorded, one site is not eligible for listing, four sites are potentially eligible, and one site is eligible (Table E.4-3).

The Applicant agrees with the consulting archaeologists that site 10AM 448 is eligible for inclusion on the National Register. This site, often called the Two Girls site, contained one Native American burial and deep, undisturbed archaeological deposits. The burial was dislodged by reservoir action and has since been reburied in a ceremony, directed by the Nez Perce Tribe, in which the Shoshone–Bannock Tribes and the Applicant participated. In addition, the Applicant has stabilized the shoreline, based on consultation with the Idaho SHPO and the Shoshone–Bannock, Shoshone–Paiute, and Nez Perce tribes (Figure E.4-1 and Figure E.4-2).

The Applicant also agrees with the evaluation by SAIC archaeologists that sites HC-12, HC-15, HC-19, and HC-23 are potentially eligible for inclusion on the National Register. Because the Applicant proposes to treat sites that are potentially eligible as though they were eligible, all protection, mitigation, and enhancement (PM&E) measures associated with eligible sites, including monitoring, would cover these sites as well.

In addition, the Applicant agrees with the evaluation that site HC-17/35BA 894 is not eligible because it lacks integrity. The Applicant's evaluation of the National Register quality of sites recorded on Oxbow Reservoir is summarized in Table E.4-4.

E.4.1.2.1.3. Hells Canyon Reservoir

Archaeologists from SAIC recommended that, of the nine archaeological sites recorded on Hells Canyon Reservoir, five are eligible for nomination to the National Register and four are potentially eligible (Table E.4-5).

The Applicant agrees that sites 35WA 880, 35WA 881, ORBA29, ORBA30, and HC-9/10AM 72 are eligible for inclusion on the National Register and that sites 35WA 882, 35BA 1009, 35BA 1010, and HC-24/10AM 72 are potentially eligible for inclusion. Again, the Applicant would treat all sites that are potentially eligible as if they were eligible (Table E.4-6). Therefore, all PM&E projects associated with eligible sites would cover these sites as well.

E.4.1.2.2. Historic Buildings in the HCC and Vicinity

SAIC also conducted a reconnaissance inventory of 129 structures distributed among 89 properties at Brownlee, Oxbow, and Hells Canyon dams (Technical Report E.4-14). Property types at Brownlee Dam included operators' residences in Brownlee Village, several buildings in the station yard, the Old Brownlee Trailer Court, McCormick Park, and Woodhead Park (Table E.4-7). At Oxbow Dam, SAIC recorded properties in six areas: the Oxbow Dam Village, trailer park/Copperfield Park, fish hatchery, powerhouse and maintenance areas, Oxbow Dam, and reservoir boat launches (Table E.4-8). At Hells Canyon Dam, SAIC recorded structures at the dam and visitors center, reservoir, and park (Table E.4-9).

Based on the field reconnaissance, as well as on archival research, SAIC archaeologists recommended that the HCC be considered eligible for inclusion on the National Register as a historic district, even though the complex is less than 50 years old. According to their evaluation, the HCC has significance as a historic district because of its crucial role in the development of Snake River hydroelectric power, its role in the debate over government versus private development of hydroelectric power in the region, and the overall unity of the three dams and appurtenant structures (Technical Report E.4-14).

The Applicant generally agrees with SAIC conclusions about National Register eligibility:

> Although most of the buildings would not be considered eligible for the National Register based on their individual merits, the complex as a whole comprises a unit of study that can yield important information about the historic processes that shaped development in the Intermountain West during the latter half of the twentieth century. For this reason…[,] it would be useful to develop at least three historic contexts addressing 1) hydroelectric power development on the Snake River; 2) government versus private development of natural resources on the Snake River; and 3) Idaho Power operators village in Hells Canyon for the period 1947 to 1968. Against these contexts, many of the buildings…would contribute to the historic significance of the area under one of the following property types: hydroelectric power plants and associated facilities; and company housing and village facilities in operators villages. (Technical Report E.4-14)

The Applicant agrees with SAIC archaeologists' evaluations of National Register eligibility, except for their evaluation of the Vista House at the Hells Canyon Visitors Center. The Applicant disagrees that the Vista House would be a contributing property to a historic district. The historic district would be related to the development of hydroelectric power and associated themes. The Vista House is not related to these themes.

E.4.1.2.3. Historical and Archaeological Sites of Downstream Areas Affected by the HCC Eligible for Nomination to the National Register

The downstream area is so rich in archaeological sites that two teams were contracted to conduct the inventory. Survey teams from Applied Paleoscience and Rain Shadow Research recorded 868 archaeological sites between Hells Canyon Dam and the confluence with the Salmon River. Many of these sites had already been inventoried as part of the Hells Canyon Archaeological District.

Not all of these sites have been extensively evaluated, but because they are present within and contribute to the historic district themes, most are considered to be eligible as contributing properties (confidential Technical Report E.4-1).

Both consultants evaluated eligibility by determining whether each, or any, component of a site contributed to the archaeological district. As part of evaluating each component, they considered whether the chronological era of the site was prehistoric or whether the site was related to ranching, placer mining, lode mining, or other historic themes.

Of the 868 sites recorded and evaluated by the two teams, 87 were assessed as properties that did not contribute to the archaeological district (Appendix E.4-C[4], Appendix E.4-D, and Appendix E.4-E). The Applicant will review these recommendations with the USFS Wallowa–Whitman National Forest and the Idaho and Oregon SHPOs. In this review, the Applicant will defer to the judgment of the USFS, the land managing agency. Until the final eligibility determination is made, the Applicant will consider all sites to be eligible for nomination to the National Register.

E.4.1.2.4. Historical and Archaeological Sites Affected by Transmission Lines and Associated Service Roads

Twelve transmission lines were included in the draft *New License Application: Hells Canyon Hydroelectric Project*. All but one of those lines have been excluded from this final license application. The remaining transmission line is the Pine Creek–Hells Canyon 69-kV line (Line 945). Northwest Archaeological Associates inventoried this transmission line. This inventory covered 22 miles and 128 acres. Two previously recorded sites include two prehistoric campsites (10AM 77 and 10AM 1/45) and a historic farm and gravesite (10AM 45) (Appendix E.4-F). No new sites were recorded within the APE.

The archaeologists conducting the inventory did not make National Register evaluations for the previously identified sites (Appendix E.4-F). No information was found on the site forms for the

4. For Rain Shadow Research, noncontributing properties, such as site RR0039, have no elements that are contributory.

two previously recorded sites, but the Applicant will treat both sites as eligible for inclusion on the National Register (Appendix E.4-F). The Applicant provides a discussion of impacts to sites located along Line 945 in section E.4.1.3.3.

E.4.1.3. Sites Affected by HCC Operations or New Development

HCC operations provide power to over 400,000 customers. Fisheries, flood control, and other concerns influence operations of the HCC and are often carried out in cooperation with federal and state agencies. However, because the hydraulic capacity of the Hells Canyon Dam is 30,500 cubic feet per second (cfs), flows exceeding this capacity are outside the Applicant's control. A description of HCC operations is included in Exhibit B. Specific effects of various flows observed during the archaeological inventories are discussed in the sections below.

Project-related impacts to sites eligible for inclusion on the National Register constitute *adverse effects*. In this section, the Applicant describes impacts and assesses adverse effects. The Applicant will consult with the Idaho and Oregon SHPOs and with Native American tribes regarding its assessment of adverse effects, pursuant to implementing the regulations of the National Historic Preservation Act (36 CFR § 800.5[a]).

An effect is considered *adverse* "when an undertaking may alter, directly or indirectly, any of the characteristics of the historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR § 800.5[a][1]; see also 36 CFR § 800.16[i]). These adverse effects are only defined for sites that are listed or eligible for listing on the National Register. Under 36 CFR § 800.5(a)(2)(i), physical destruction of or damage to all or part of a property is an adverse effect. Therefore, the listed impacts constitute adverse effects because they have resulted in or could result in partial or total destruction of the sites.

E.4.1.3.1. Operational Impacts to Sites in the Hells Canyon Complex and Vicinity

Impacts from project operations could be related to recreation and access, as well as to pool fluctuations and cutbank erosion. Other impacts that are not related to project operations occur on lands that are not under the Applicant's control. For example, on Hells Canyon and Oxbow reservoirs, these impacts include use of dirt roads, disturbance to archaeological sites by pond or road construction, casual artifact collection on sites located near boat ramps, erosion from natural processes such as runoff, vandalism, and damage to sites as a result of agricultural activities (confidential Technical Report E.4-2:68)

Brownlee Reservoir—The effects of project operations were observable during large drawdowns of Brownlee Reservoir. For the 43 sites along the margins and in the drawdown zone on Brownlee Reservoir, 85 cases of effects were recorded. The most common impact was siltation (36 cases or 42%) (Figure E.4-3). Bank erosion occurred at 27 sites (32%) (Figure E.4-4); deflation (erosion caused by the action of wind over the ground), at 9 sites (11%) (Figure E.4-5); road damage, at 4 sites (5%); and camping impacts, at 3 sites (4%). One case each (or 1%) showed impacts of agricultural activities, off-road vehicle use (Figure E.4-6), a powerline, and an abandoned railroad grade (confidential Technical Report E.4-3). These impacts are listed in Appendix E.4-G.

Oxbow Reservoir—As mentioned in section E.4.1.2.1.2., a Native American burial was dislodged along Oxbow Reservoir as a result of high flows experienced in the spring and early summer of 1998[5]. Other impacts to archaeological sites along Oxbow Reservoir include those from road use, recreational use, and reservoir access during pool fluctuations (Table E.4-10).

Hells Canyon Reservoir—On Hells Canyon Reservoir, recreational use and access impacts are observable at sites 35WA 880, 35WA 881, 35WA 882, 35BA 1009, 35BA 1010, HC-9/10AM 72, ORBA29, ORBA30, and HC-24/10AM 72. Effects related to pool fluctuations and cutbank erosion occur at site 35BA 1009 (Table E.4-11). At that site, the cutbank is low but appears to be eroding, and flakes are visible both in the water and on the beach (confidential Technical Report E.4-2).

E.4.1.3.2. Operational Impacts to Sites in Downstream Areas

Of the many impact categories recorded by the Applicant's consulting archaeologists, only riverine erosion of archaeological sites is potentially related to the operation of the project (specifically Hells Canyon Dam).

5. The average high flows for May and June 1998 were 217% above normal.

Recreational Impacts—The Applicant does not control the amount and types of recreational activities in downstream areas. Recreational activities, including use of the Hells Canyon boat launch, are controlled and managed by the USFS. Therefore, the Applicant does not have an operational effect on archaeological sites located in downstream areas. However, the relationship of project operations to erosional impacts is not so clear cut.

Riverine Erosion—On the basis of currently available evidence, it is not possible to conclusively distinguish the effects of the operation of Hells Canyon Dam from naturally caused erosion. The hydraulic capacity of the Hells Canyon Dam is 30,500 cfs. Therefore, flow-related effects to archaeological sites located outside the reach that lies within the 30,500-cfs level cannot reasonably be assigned to project operations. There are more than 200 archaeological sites located in areas subject to flows through the 30,500-cfs level. More than 600 archaeological sites are located higher up the slope.

As documented in section E.4.1.3.2.3.2., flows below Hells Canyon Dam exceed the 30,000-cfs level, often reaching 60,000 cfs and occasionally reaching 75,000 or 100,000 cfs. These higher flows reach the upslope sites. The same higher flows also intersect sites within the 30,500-cfs level.

The archaeological inventories have noted damage to sites affected by various flow levels. It is evident when sites only reachable by 60,000-cfs flows have been impacted by those flows. Also, beach lines indicating approximately 30,000- and 60,000-cfs shorelines are present at some sites, which show that flows of those levels have intersected the sites, often causing erosion.

But what is not always evident is which flows have damaged the sites located within the simulated 30,000-cfs flow level. Has erosion resulted from operational flows up to 30,500 cfs? Has the erosion been caused by natural flows higher than 30,500 cfs? Has the site been damaged cumulatively by flows of various levels? Has the site been damaged by natural high flows coming down the tributaries in addition to flows along the mainstem? Distinguishing among these possibilities is impossible without direct observation. Observations must be made while the erosion is occurring. Then, in combination with data from other disciplines, distinguishing project-related from nonproject-related flows may be possible.

The distinction of project operations from natural effects is the key to assessing adverse effects. Flows of any level have the potential to damage the archaeological sites they reach by removing artifact-bearing sediments and damaging archaeological features.[6] Therefore, if *project operations* cause the erosion of an archaeological site located within the 30,500-cfs zone, the project operation has an *adverse effect* on historic properties.[7] On the other hand, if natural events such as floods result in the release of a much higher flow from Hells Canyon Dam, any erosion of archaeological sites may not be determined to be adverse effects of project operations.[8]

The following sections include a discussion of the archaeological sites affected by riverine erosion and an assessment of the roles that project operations and natural processes play in the observed impacts. To provide a context, the Applicant discusses the full range of recorded impacts.

E.4.1.3.2.1. Description of Impacts at Affected Sites

At the outset of the process to relicense the HCC, when the study plans were formulated (IPC 1997), the Applicant stated that project operations have the potential to affect cultural resources. Previous archaeological inventories downstream of the HCC had identified impacts to archaeological sites. These known impacts included erosion, grazing, recreational use, and vandalism, among others. The recently completed inventory below Hells Canyon Dam, beginning in 1998, updated information on impacts. Overall site condition was also reevaluated. In addition, the inventory further subdivided impacts from erosion into several categories not provided in the IMACS forms.[9] Although the categories vary somewhat between the two survey teams (Table E.4-12), they can be reconciled (Table E.4-13).

6. Features are immovable artifacts such as hearths, house pits, and cairns.
7. An important goal of the section 106 process is the determination of adverse effects (36 CFR § 800.5).
8. A fuller discussion of this complex issue is outside the scope of this section.
9. IMACS (Intermountain Antiquities Computer System) site forms were the standard SHPO-approved archaeological site forms used in the Intermountain West (see University of Utah et al. 1990) at the time the inventories were conducted.

Proportions of impacts observed during each survey are shown in Figure E.4-7 and Figure E.4-8. Although many impacts were observed, the kinds of effects *potentially* relevant to the relicensing process are those related to river flows/erosion and recreational use. These kinds of impacts were identified as potentially relevant through consultation with the Idaho SHPO and through the Applicant's prior experience in relicensing several hydroelectric projects.[10]

In addition, over the course of several years, the Applicant discussed potential impacts with the tribes and agencies during meetings of the Recreation and Aesthetics Resources Work Group and the Cultural Resources Work Group, on project area tours, and in individual agency or tribal meetings. Throughout the consultation process, concerns were expressed about effects of project operations to cultural resources downstream. Tribal members stated that visitor recreational use of the downstream areas negatively affects the spiritual values of the area. This issue is discussed in section E.4.2.2.4.

E.4.1.3.2.1.1. Applied Paleoscience

Applied Paleoscience recorded 422 archaeological sites in downstream areas. They defined the following impact levels in confidential Technical Report E.4-1:

Impact Level 1—This level indicates that impact is occurring but that it is not yet threatening to diminish a site's integrity or information value. In the case of camping impact, for example, this level indicates that fire hearths and/or areas leveled for tents are present, but they are not yet causing any damage to the archaeological resource. In the case of trails, a trail is passing through the site or one of its features, but it is not causing significant erosion of the archaeological deposit. In the case of looting, this level indicates that pits are less than 1 meter in diameter or less than 10% of the area of a rockshelter floor. Flow impact at level 1 means that the site's bank is eroding, but only a scattering of artifacts has as yet been exposed.

Impact Level 2—This level indicates that impact is starting to diminish site integrity and information value. In the case of looting, this level means that more than level 1 impact has

10. As stated earlier (in section E.4.1.3.2.), the Applicant does not control recreational activities below Hells Canyon Dam. However, recreational impacts are described in order to assist other entities in their management efforts.

occurred, but less than 50% of any one feature of the site has as yet been impacted. In the case of river flow, stream erosion, wind erosion or slope erosion, construction, or mining, this level indicates that intact deposits have been affected, exposing large numbers of artifacts, but much of the archaeological deposit still remains intact.

Impact Level 3—This level indicates that the site or at least one of its major features (rockshelter, housepit, lithic scatter) faces imminent destruction. In the case of looting, at least one feature is damaged to a level greater than 50%. In the case of erosion or construction damage, most of the former site area appears to have been eroded away, leaving a deflated assemblage on the beach or land surface. Artifacts have largely lost their spatial relationships. Despite extensive damage, the site or damaged feature(s) retains at least some information potential.

Impact Level 4—This level indicates that the site has been destroyed. Artifacts have been repositioned and/or features altered to the extent that no information potential remains. The site has lost its integrity.

Of the 422 archaeological sites recorded, 31 were associated with the river (Table E.4-12). Impact levels for these 31 sites varied from minor (level 1) to total destruction (level 4) (Table E.4-14).

Other impacts recorded included 27 cases of slope erosion/deflation, 22 cases of road or trail impact, 27 cases of campground impacts, 40 cases of looting prior to establishment of the Hells Canyon National Recreation Area (HCNRA; based on site records), 10 cases of placer mining impacts to other cultural resources, and 11 cases of grazing impacts (Table E.4-12, Table E.4-15, and Figure E.4-7). Impact levels varied widely for each of these cases.

E.4.1.3.2.1.2. Rain Shadow Research

Rain Shadow Research recorded 446 archaeological sites, 165 of which showed erosion (Table E.4-12). These erosion effects were to multicomponent sites, lithic scatters, homesteads, placer mines, mine adits (or entrances), placed rocks, and cairns (Appendix E.4-H). Rain Shadow Research scored the severity of erosion from 1 through 4 using the same impact score definitions that Applied Paleoscience used.

E.4.1.3.2.2. Recreation and River Erosion Impacts to Archaeological Sites

Of the several recorded impacts mentioned above, only river erosion impacts are potentially related to project operations. The Applicant has no control over recreational activity occurring below Hells Canyon Dam. Therefore, recreation impacts are unrelated to project operations.

The following sections discuss the extent to which these two classes of impacts are related to project operations. Because the hydraulic capacity of Hells Canyon Dam is 30,500 cfs, it is necessary to consider where the affected sites are located with respect to flow. Sites within the zone affected by flows of 30,500 cfs and below are potentially affected by the Applicant's operation of Hells Canyon Dam. Sites located higher above the river (that is, subject to 50,000-; 75,000-; and 100,000-cfs flows) are not within the range of Applicant-controlled flows. The Applicant's hydrologic simulation of river flows at various levels, including 30,000; 50,000; 75,000; and 100,000 cfs in downstream areas, supplements information on river flows and archaeological sites and features.[11]

In summarizing impacts to archaeological sites, the inventory identified several sites of particular concern. These sites need immediate attention because they are subject to ongoing erosion (Volume 4 of confidential Technical Report E.4-1). Some of these sites are within the simulated 30,000-cfs zone, and others are not.

E.4.1.3.2.2.1. Oregon Sites of Particular Concern

IPC-RR0041—This site is site 35WA 286. Significant portions of this large campsite are subject to erosion (located within the simulated 30,000-cfs zone).

IPC-RR0045—This site requires immediate attention before it is destroyed. Artifacts were observed *in situ* in the cutbank wall to a depth of 80 centimeters below surface, as well as along the gravel beach below the cutbank (not located within the simulated 30,000-cfs zone).

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11. The analysis was expressed in geographic information system (GIS) coverages representing various flow ranges including 9,500 to 30,000 cfs; 30,000 to 50,000 cfs; 50,000 to 75,000 cfs; and 75,000 to 100,000 cfs. The 9,500- to 30,000-cfs simulated flow zones will be used to approximate the upper limit of the hydraulic capacity of Hells Canyon Dam (30,500 cfs). The overlap (or *intersection*, in GIS terms) of simulated river flow zones with archaeological sites shows shorelines at various flow levels, as well as the distribution of archaeological sites within the flow zones of 9,500 to 30,000 cfs; 30,000 to 50,000 cfs; and so forth.

IPC-RR0254—This site is similar to IPC-RR0041 in the type of material that is eroding from the exposed edge of a sandy cutbank (located within the simulated 30,000-cfs zone).

IPC-AP0010—The deposit is actively eroding onto the beach and appears to contain buried cultural deposits, possibly including faunal remains and features. The site may soon be completely eliminated (just barely located within the simulated 30,000-cfs zone).

IPC-AP0013—This site is the Tin Shed site, located in the T1 floodplain at the upstream end of Pittsburg Bar. Rapid erosion has created a greater than 2-meter-high cutbank that has receded as much as 2 meters since the site was recorded in 1998 (located within the simulated 30,000-cfs zone).

IPC-AP0023—Characteristics of the bank are indicative of rapid erosion, which has recently exposed roots of a hackberry grove that occupies the site. Like AP0013, this site is likely to disappear within a decade (located within the simulated 30,000-cfs zone).

IPC-AP0030—This site is actively eroding, but consulting archaeologists were unable to determine whether any of the artifacts occur *in situ* or are part of the gravel substrate below the eroding bank (located within the simulated 30,000-cfs zone).

IPC-AP0164—This site, located in the T1 floodplain at the upstream-most edge of Copper Creek Bar, is being impacted by river flows and the action of leaseholders (located within the simulated 30,000-cfs zone).

IPC-AP0206—The feature of concern at this site is a lithic scatter found (apparently) weathering out of the rapidly eroding T1 terrace (not located within the simulated 30,000-cfs zone).

E.4.1.3.2.2.2. Idaho Sites of Particular Concern

IPC-RR0029—This site consists of an extensive lithic scatter and midden eroding from a cutbank along the Snake River downstream of Caribou Creek. This site requires immediate mitigation through excavation before it is destroyed. The most pronounced adverse effect on this site is river erosion. At the time this site was originally recorded (May 22, 1998), the water level of the Snake River was more than 60,000 cfs. The site was revisited on October 25, 1999, when the river level was approximately 13,000 cfs. During the 17 months that elapsed between the first recording and the site revisit, the cutbank with eroding prehistoric material had receded about 1 meter from where it was in May 1998. Even more bone and mussel shell was visible in 1999 than was the case in 1998. Given this accelerated rate of erosion, much of this site may already have eroded into the river (not located within the simulated 30,000-cfs zone).

IPC-AP0111—This site is another concentration of lithic material and shell, found eroding from the T1 terrace. Erosion does not yet appear to have had a severe impact here, but this site may be obliterated if erosion continues for another 20 years (a small portion of the site touches the simulated 30,000-cfs zone).

IPC-AP0113—Lithic material and hopper mortar bases were found eroding from a 1-meter-high cutbank in the T1 terrace behind a large, prominent outcropping. The USFS keeps an outhouse and picnic table at this site, which is popular with boaters because of its sandy beach. The site is at risk from both erosion and casual collection by visitors to the campground (located within the simulated 30,000-cfs zone).

IPC-AP0511—Campers use this site heavily, and portions of it that lie in the T1 terrace have been and are continuing to be severely eroded by the Snake River (located within the simulated 30,000-cfs zone).

IPC-AP0514—This site is one of the only archaeological sites where river erosion is cutting into the T2 terrace, exposing artifacts from a Cascade Phase occupation (located within the simulated 30,000-cfs zone).

IPC-AP0520—The river has also severely eroded the site, and actions need to be taken to minimize future damage of this kind (not located within the simulated 30,000-cfs zone).

These site descriptions indicate that not all sites needing immediate attention fall within the limits of project operations. Therefore, these sites are not adversely affected by project operations.

E.4.1.3.2.3. River Erosion Impacts to Archaeological Features at Flows up to Simulated 30,000 cfs

In the previous section, the degree of riverine erosion to archaeological *sites* was described. This site-level description provides a broad overview of the extent of erosion impacts. However, in general, the sites are often quite large and contain many features. Large portions of sites are not affected by erosion. Therefore, to provide a more precise description of erosion impacts, erosion at the *feature* level is discussed below.

Individual archaeological features were recorded in the field. The Applicant's hydrologic data overlaid on maps of the archaeological features indicate that 208 sites are exposed to simulated river flows up to 30,000 cfs, that is, nearly up to the 30,500-cfs hydraulic capacity of Hells Canyon Dam[12] (Table E.4-16). At a sample of 62 of these archaeological sites within the simulated 9,500- to 30,000-cfs flow, there are 50 placer mining features, including tailings piles and rocker settings, 33 lithic scatters, 13 rock art panels, 6 cairns or rock alignments, and 7 areas where Native American lithic scatters have been disturbed by subsequent placer mining. Several sites encompass multiple features. A discussion of adverse effects at the feature level is included in section E.4.1.3.2.3.3.

E.4.1.3.2.3.1. Erosion and Overall Site Condition

Erosion scores are only one measure of effects and do not indicate the overall condition of the archaeological sites. This overall condition is recorded under a separate IMACS site form category. For example, for one team, most sites (68 of 165) for which major erosion (an erosion score of 3) was recorded are also considered to be in good condition (a condition score of 5) on the site forms (Table E.4-17). Six sites are reported in excellent overall condition but subject to major erosion (an erosion score of 3). On the other hand, sites reported in poor condition are also subject to high levels of erosion. In general, no correlation was found in the data set between overall condition and erosion severity (confidential Technical Report E.4-1).

12. The Applicant's analysis simulated flows at various levels including 30,000 cfs; 50,000 cfs; and so forth. The simulated 30,000-cfs flow approximates the 30,500-cfs hydraulic capacity of Hells Canyon Dam.

E.4.1.3.2.3.2. History of Flooding and Erosion

Previous sections have described riverine erosion impacts to archaeological sites and features. High flows, well above the operational limit of Hells Canyon Dam, occur and have caused erosion at archaeological sites. The relationship between overall site condition and riverine erosion has also been described. To distinguish erosion caused by the project from erosion due to other causes, the history of flooding and erosion is described below.

High[13] flows have occurred in the Hells Canyon area several times over the past several thousand years, long before the HCC was constructed. It should be noted that the evidence for repeated "high flows" discussed here does not contradict the description in Exhibit E.3.0 about the river being essentially stable since the Bonneville Flood. Different scales are used in each section.

Archaeological inventories conducted in support of the license application indicate that high flows have contributed to erosion at archaeological sites. The Applicant expects that high flows related to natural climatic phenomena and resultant erosion of archaeological sites would continue to occur.

The primary information on high flows consists of recent hydrologic data and historic measurements from the U.S. Geological Survey gauge at Weiser.[14]

Recent High Flows (1965–2000)—Data compiled for the Applicant by West Consultants (2002) (Figure E.4-9) indicated that since 1965, maximum annual flows in Hells Canyon were below 30,000 cfs for 8 years, between 30,000 and 60,000 cfs for 16 years, and over 60,000 cfs for 11 years. The documentation of several high flows (above 60,000 cfs) is important: HCNRA staff

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13. High flows are defined as flows of 60,000 cfs because the field archaeologists' professional river guide identified the 60,000-cfs shoreline, among other shorelines (Volumes II and III of confidential Technical Report E.4-1). The shorelines are treated as estimates in this section and will be confirmed by the Applicant. El Niño is a global climatic phenomenon, often accompanied by disastrous floods, hurricanes, tornadoes, and loss of life. El Niño has been recently described as "the main controlling factor of contemporary climate" (Caviedes 2001:xi).
14. There is also information on the relationship between El Niño events, high flows, and damage to archaeological sites and inferential information on historic El Niño flows (namely, Caviedes 2001); a recent geomorphological study of the history of flooding in the immediate project area (Rhodes 2000); regional paleoclimatic data on changes in aridity levels (Volume I of confidential Technical Report E.4-1); and local paleoclimatic data on precipitation cycles (Davis 2001).

noted damage caused by high flows to one important archaeological site during the winter of 1982–1983 (Table E.4-18):

> …The site area was estimated at 150 m^2. Five years later, 35WA286 was revisited by Hells Canyon NRA archaeologist Bruce Womack, who attached a note to the 1978 description:
>
> "As of January, 1983, lateral erosion by the Snake River has cut into this site revealing buried cultural deposits of shell, bone, chipping waste, projectile points, etc. Considerable damage has resulted from unusually high waters in 1982 and 1983." (confidential Technical Report E.4-1)

Historic Readings from the Weiser Gauge (1911–1998)—High flows were also recorded for the period before 1965. The U.S. Geological Survey gauge at Weiser has documented flow conditions above Hells Canyon Dam since 1910. According to measurements taken at the gauge, mean daily flows exceeded 60,000 cfs on 261 days between 1911 and 1998 (Table E.4-19). Given that these measurements were the mean, peak flows were obviously higher than 60,000 cfs for those days. Based on this stream gauge information alone, it is reasonable to predict that high flows will continue.

Implications of Flooding History for Erosion at Archaeological Sites—The foregoing demonstrates that high flows have occurred in the project area for many years. It is reasonable to assume that all archaeological sites for which high flow damage has been recorded were subject to several high-flow episodes. At any given archaeological site, the vast majority of the high flows occurred long before the HCC was constructed. Also, because flooding in Hells Canyon is often correlated with periodic, global climatic changes, flooding will likely continue. The existence of so much natural flooding, both in the past and predicted for the future, has crucial implications for determining whether the observed erosional impacts are adverse effects of HCC operations. An important element in determining project effects is the effect of the HCC in trapping sediment that could have rebuilt beaches damaged by erosion.

"Sediment-Starved Flood" Hypothesis—The prevailing explanation for the absence of beaches below Hells Canyon Dam favored for the last several years by agency staff and others can be summarized as follows:

> Alluvial sands were formerly a significant source of archaeological sediments in Hells Canyon. A study by Grams [and Schmidt] (1991) found that sand bars and alluvial terraces within the [HCNRA] corridor eroded swiftly between 1964 and 1990. The number and size of sand bars decreased by 75% between 1964 and 1973, with channel margin bars most affected. Higher terraces with significant cultural deposits such as Tin Shed and Camp Creek continue to erode. (confidential Technical Report E.4-1)

A more recent study commissioned by the USFS reaffirmed the sediment-starved flood hypothesis (Grams and Schmidt 1999a,b). However, evidence compiled by the Applicant demonstrates that the HCC is not the only cause of sediment starvation, and that Grams and Schmidt's estimates of erosion of sandbars in Hells Canyon are too high. Using the same series of aerial photographs, IPC finds that the loss of sandbars in the Hells Canyon reach is 34% from 1955 (pre-HCC) to 1997 (Technical Report E.1-1). Further, the Brownlee Reservoir does not block sediments of the size needed to build beaches; instead, predominantly silts, clays, and very fine sands are trapped in Brownlee while beaches in the Hells Canyon reach are medium size and larger sands. The origin of the sediments found in these beaches is from 50 to 85% Idaho Batholith, which was cut off as a sediment supply prior to construction of the HCC. Grams and Schmidt failed to acknowledge that other dams had already cut off 87% of the watershed upstream of the HCC by the time the HCC was constructed (Technical Report E.1-2).

Also, the beaches observed to be disappearing by Grams and Schmidt (1991, 1999a,b) were modified in frequency and size by historic anthropogenic activities within and upstream of Hells Canyon prior to the construction of the HCC (Technical Report E.1-1). At the Tin Shed site, pore pressure in the cutbank associated with flood recession rather than project operations may be an important factor contributing to bank failure. Pore pressure is an issue related to the rate at which floodwaters recede.

In addition, IPC finds that there was an increase in sandbars from 1955 to 1964 (Grams and Schmidt's baseline) of 11%, suggesting that conditions in 1964 do not represent pre-HCC, or a condition of equilibrium to base degradation estimates upon, as Grams and Schmidt have done in their 1991 and 1999a reports.

Rate of Recession of Floodwaters—HCNRA staff and management believe that the Applicant controls the rate of recession of water levels after floods. According to this view, bank failure is caused by a rapid recession of the water level after a flood event. This argument acknowledges that pore pressure has a role in bank failure. The Applicant has been unable to empirically study pore pressure dynamics at specific sites in the downstream areas. Therefore, the role of HCC operations in controlling the receding limb of the hydrograph, as well as the role of the receding limb in causing bank failure, is undetermined at this time.

E.4.1.3.2.3.3. Erosion and Adverse Effects to Archaeological Features Subject to Simulated 30,000-cfs Flow

Not all erosional impacts to archaeological features constitute adverse effects. In some cases, the intersection of simulated 30,000-cfs flows with archaeological features does not damage the integrity of the feature and/or the site. The Applicant proposes the following principles for consideration. The final list of sites adversely affected will be determined in consultation with the Idaho and Oregon SHPOs, the land management agency (the USFS for the HCNRA), and the tribes, as appropriate.

River Flows at Placer Mining Features/Tailings Piles—As mentioned above, the river at simulated 30,000-cfs flows intersects 50 placer mining features. This contact occurs at 26 sites. The river cannot move the rocks that constitute the placer mine tailings piles; therefore, portions of the tailings piles are not displaced downstream by the simulated 30,000-cfs flows. In fact, the same sites have been occasionally subject to simulated flows of 100,000 cfs, and even then, the tailings piles were not disturbed. Therefore, river erosion, either natural or related to project operations within the simulated 30,000-cfs range, does not constitute an adverse effect on historic properties.

River Flows at Placer Mining Features/Fine Sediment—The contracting archaeologists have observed that, at some sites, river flows have removed fine, possibly artifact-bearing sediments from among the placer mine tailings piles. The Applicant agrees that the potential displacement of artifacts from placer mining features is a potential adverse effect to historic properties.

River Flows at Lithic Scatter Sites—River flows can damage Native American lithic scatters and historic debris that contain buried cultural materials. For example, site IPC-RR0004 is described as follows:

> The general condition of the site is relatively good, though the portion of the site below the high-water mark has been impacted more than the portion above it. The presence of fine-grained sediments above the high-water mark and their absence below the mark indicate that sediment has been eroded by periodic inundation by the river. Erosion has resulted in a denuded cobble and boulder pavement along the shoreline below the high-water mark. Small artifacts, such as flake debris, are especially susceptible to downstream displacement during periods of inundation. (confidential Technical Report E.4-1)

Approximately one-half of the site is subject to simulated flows up to 30,000 cfs. Therefore, the site is affected by flows within the operational range of Hells Canyon Dam. And if operational flows rather than natural flows displace artifacts, there is an adverse effect on historic properties.

E.4.1.3.2.4. Summary of Operational Adverse Effects from River Erosion and Recreational Activities to Downstream Areas

Adverse Effects from Erosion—Although damage to archaeological sites from river erosion has been recognized, on the basis of current evidence, the role that HCC project operations play cannot be conclusively separated from the role that natural processes play in these impacts. Therefore, it cannot be conclusively stated that project operations have an adverse effect on historic properties.

Evidence from stream gauges indicates that flow levels have varied since 1911 and that several high-flow events occurred during this time. It is reasonable to assume that high flows have occurred for thousands of years and will continue to occur. Therefore, it is also reasonable to assume that each archaeological site has been subjected to several high flows. And observations showed that high flows caused erosion at some archaeological sites. In some cases, artifacts were removed, and in many cases, erosion has removed fine sediments that may have contained artifacts. This erosion process began long before the HCC was constructed. In fact, river erosion continues to occur independently of project operations. Also, the HCC has trapped silt rather than beach-building sediments. However, the role of daily river-level fluctuations occurring within the 30,500-cfs flow range controlled by the Applicant is still undetermined. The monitoring efforts described as PM&E measures in section E.4.2.5. of this application would include data collection techniques designed to distinguish project-related erosion from natural erosion.

Therefore, with the possible exception of effects from daily flow fluctuations related to project operations and occurring below 30,500 cfs, the HCC is not the cause of adverse effects to cultural resources in downstream areas because of riverine erosion.

Adverse Effects from Recreational Activities—Archaeological inventories recorded some damage to sites resulting from recreational activities. However, the Applicant does not control the amount and types of recreational activities in downstream areas. Recreational activities, including use of the Hells Canyon boat launch, are controlled and managed by the USFS.

E.4.1.3.3. Operational Impacts to Sites along Transmission Line and Associated Service Roads

The area at site 10AM 1/45 was highly disturbed historically. A fruit and vegetable farm, as well as irrigation ditches and terraces, associated structures, and road ways, was constructed, disturbing or obliterating known Native American campsites. This area is now an established undeveloped public campground on USFS-administered land, and the gravesites are protected by rail fencing. Transmission-line operations and maintenance activities have no adverse effect on identified cultural resources at this site (confidential Technical Report E.4-5).

Site 10AM 77 occurs at the same undeveloped campground on USFS land. This site was tested by the USFS, and during the survey, some lithic debitage was noted, although campers on site hindered a thorough examination. Transmission-line operations and maintenance activities are not impacting this site (confidential Technical Report E.4-5).

E.4.2. Measures or Facilities Recommended by the Agencies and Tribes

The Applicant distributed the draft *New License Application: Hells Canyon Hydroelectric Project* in September 2002. In response, agencies and tribes submitted recommendations for measures or facilities that they believed were necessary to protect or enhance cultural resources. Those measures are discussed in section E.4.2.6.

Before any studies were conducted or the draft license application developed, the Applicant also consulted with agencies and tribes on measures for locating, assessing, identifying, and salvaging resources. These measures for locating, assessing, identifying, and salvaging resources are discussed in section E.4.2.2., section E.4.2.3., and section E.4.2.4.

E.4.2.1. Measures or Facilities Recommended in Response to the Draft License Application

To consolidate measures, the Applicant has included measures or facilities recommended by the agencies and tribes in section E.4.2.6. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.4.2.2. Recommended Measures for Locating and Assessing Resources

E.4.2.2.1. Archaeological Inventory Methods for Locating Sites

The Idaho Advisory Council of Professional Archaeologists, in consultation with the Idaho SHPO, established that transects spaced no more than 30 meters apart is the standard for intensive archaeological survey in Idaho. This standard was followed along transmission-line corridors and exceeded around reservoir margins and below Hells Canyon Dam. In these areas, a 15-meter transect interval was used for much of the inventory area because of the high density of known and suspected archaeological sites in the survey area.

E.4.2.2.2. Identification and Assessment of Archaeological Sites

Archaeologists conducting the inventories assessed sites using IMACS site forms (University of Utah et al. 1990). The IMACS forms establish a common standard throughout the surveys since they have been the regional standard for a generation. For Oregon sites, information recorded on the IMACS forms was copied to shorter site forms approved by the Oregon SHPO for filing.

E.4.2.2.3. Inventory of Historic Structures

In previous relicensing projects (such as the application for the C.J. Strike Project), the Idaho SHPO recommended that historic properties on the Applicant's land be located through a historic reconnaissance. Reconnaissance methods used by Attebery and Egleston (1990) include on-the-ground surveys to photograph properties and record structures on site forms. The same approach was followed for the HCC. The Applicant's plans for the inventory were published for agency and tribal comment in the FCP (IPC 1997). The completed inventory of historic buildings is included with this application as Technical Report E.4-14.

E.4.2.2.4. Traditional Cultural Properties and Archival and Oral History Studies

The Applicant conducted archival and oral history studies to address the issue of traditional cultural properties in the project area. Several of these studies have involved tribal members.

A traditional cultural property is "a district, site, building, structure, or object that is valued by a human community for the role it plays in sustaining the community's cultural integrity" (King 1998:267). In addition, it is eligible for inclusion in the National Register "because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1994:1).

Methods for identifying traditional cultural properties include consulting with knowledgeable individuals and groups in a culturally sensitive manner (using their native language where possible), conducting extensive background research, and taking knowledgeable individuals into the field to visit important traditional cultural properties (Parker and King 1994:7).

E.4.2.2.4.1. Results of the Archival Study

In conducting the archival study, Myers (Technical Report E.4-12) found that specific information about the location of traditional cultural places in Hells Canyon was largely missing from the anthropological literature. He assessed the quality of the ethnographic literature data he collected by stating:

> …the anthropological literature concerning the region is minimal, and for the study area [Hells Canyon], it is extremely meager and limited in content and context. This being the case, information about the Shoshone and Paiute groups and Nez Perce cultural areas of historical or sacred significance in and around the study area is extremely limited. In fact, there are no specific delineations of areas of historical or sacred significance in or near the study area in the ethnographic literature. (Technical Report E.4-12)

That being the case, the extensive archival study sponsored by the Applicant identified no traditional cultural properties in the project area that were eligible for inclusion on the National Register. On the other hand, the study clearly demonstrated that the project area in general was heavily used by Native Americans, a finding that was confirmed by the archaeological investigations (confidential Technical Reports E.4-1, E.4-2, and E.4-3). This widespread ethnohistoric and prehistoric use of the area is incorporated into the *Historic Properties Management Plan: Hells Canyon Complex*[15] ([HPMP] Technical Report E.4-15).

E.4.2.2.4.2. Results of Native American Oral History Studies

An important aspect of cultural resources in the Hells Canyon area is traditional cultural properties used by Native Americans who inhabited the area before impoundment. Taped

15. This document was called the *Cultural Resources Management Plan: Hells Canyon Complex* (CRMP) in the draft license application. The contents and title of the plan were changed to conform to FERC/Advisory Council on Historic Preservation guidelines released after the CRMP was written.

interviews with area residents have focused on the identification of traditional cultural resources and properties. These oral history studies may help the Applicant identify and evaluate the National Register significance of historic sites in the Hells Canyon area.

Three oral history studies have been completed, and one study is underway. The Burns Paiute (Chapter 1 of confidential Technical Report E.4-13), the Confederated Tribes of the Warm Springs (Chapter 2 of confidential Technical Report E.4-13), and the Confederated Tribes of the Umatilla Indian Reservation (Chapter 3 of confidential Technical Report E.4-13) have completed oral history projects. Due to some unanticipated delays, the completion date for the Nez Perce Tribe's ethnographic study has been extended. The document is currently in the final review phase and will not be submitted with this final license application. The Applicant will notify the appropriate agencies and tribes when the report becomes available.

Jerofke interviewed over 50 Burns Paiute elders to identify tribal use of the Snake River and its tributaries (Chapter 1 of confidential Technical Report E.4-13). No traditional cultural properties were identified; however, Jerofke indicates that the Burns Paiute Tribe uses the Snake River and its tributaries for subsistence and religious purposes.

Whipple interviewed eight elders having knowledge of the Hells Canyon area (Chapter 2 of confidential Technical Report E.4-13). Although no traditional cultural properties were identified, 50 traditional plant resources were recorded.

A study was also contracted with the Confederated Tribes of the Umatilla Indian Reservation (Chapter 3 of confidential Technical Report E.4-13) to assess the traditional cultural properties associated with the Hells Canyon area and vicinity. As a result of their literature search and 22 oral history interviews, 15 geographical areas were identified and 93 locations described. These location descriptions were considered traditional cultural properties by the Confederated Tribes of the Umatilla Indian Reservation because they are viewed as being connected to the beliefs, customs and practices, ways of life, arts, crafts, and social institutions of their people through the generations. Many of these areas are along tributaries of the Snake River, although some occur at confluences of these tributaries with the Snake River and a few are along the

Snake River itself. Almost all of the specific places described lie west of the immediate project area, in Oregon. The position of the tribe's cultural resources protection program is not to nominate these properties to the National Register because of the risk of publicizing culturally sacred areas.

E.4.2.3. Recommended Measures for Identifying Resources

Like the method for assessing sites (see section E.4.2.2.2.), the recommended method for identifying archaeological and historic sites is listed in the manual for the IMACS (University of Utah et al. 1990). The IMACS site forms, artifact definitions, and site-mapping procedures have been the standard for use in defining archaeological sites for the last decade in Idaho. Because the process for identifying sites is so closely tied with the processes for locating and assessing sites, information about site identification is included in section E.4.2.2. Generally, sites were identified through inventories, archival research, and oral history interviews.

E.4.2.4. Recommended Measures for Salvaging Resources

E.4.2.4.1. Measures for Salvaging Resources That Would Be Affected by Operations

Because the Applicant proposes no changes in operations, monitoring efforts described below are designed to reveal whether ongoing operations are damaging archaeological sites (see also the HPMP [Technical Report E.4-15]).

E.4.2.4.2. Measures for Salvaging Resources That Would Be Affected by New Development

Because the Applicant plans no new development of hydroelectric facilities, no salvage measures are proposed. However, several earth-disturbing activities may occur in connection with development of recreational sites. These activities would be monitored by qualified archaeologists, and appropriate actions would be taken if culturally significant materials are encountered (see the HPMP [Technical Report E.4-15]).

E.4.2.5. Measures Proposed by the Applicant

The following site-specific measures are incorporated in the Applicant's HPMP included with this license application as Technical Report E.4-15. PM&E measures are categorized in this section as protection measures, mitigation measures, and enhancement measures.

E.4.2.5.1. Protection Measures

The goal of each of the following Applicant-proposed measures is to protect sites against erosion, road damage, vandalism, and other disturbances. Costs include resources for providing yearly progress reports.

E.4.2.5.1.1. Monitoring of Eligible Sites along Transmission Line 945

Justification

An archaeological inventory along the Pine Creek–Hells Canyon 69-kV transmission line (Line 945) has recorded sites subject to both existing and potential impacts, including erosion and vandalism. Monitoring, in consultation with agencies, tribes, and landowners, is necessary at these sites to determine whether the Applicant's operations are causing impacts and whether such impacts are endangering their National Register qualities.

Goals

The goals of this measure are to protect known archaeological sites eligible for inclusion on the National Register, determine causes of site impacts, and distinguish project-related impacts from other impacts.

Description

Certain archaeological sites are known to be located on public land, Applicant-owned land, and other private land along the Pine Creek–Hells Canyon transmission line (Line 945) or service roads. These sites, which are also listed or eligible for inclusion on the National Register, would be monitored for adverse impacts from erosion, vandalism, and other disturbances, particularly those arising from project operations. Based on the current state of knowledge about resources and conditions, two sites (10AM 77 and 10AM 1/45) are eligible for inclusion on the National

Register and require monitoring. The monitoring plan would be set up for a three-year cycle. Each site would be visited annually over the license period. At the end of the first three-year cycle and before the second cycle, all parties involved (the Applicant, USFS, Bureau of Land Management [BLM], FERC, tribes, and Oregon and Idaho SHPOs, as appropriate) would evaluate the procedures, list of sites, and the monitoring plan for the next six-year cycle. Monitoring methods and the sample of sites examined may be revised to accommodate changes in technology and conditions.

Monitors would be looking for the causes of site impacts, especially those related to erosion. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to recreational or private use of the areas underneath the transmission lines.

Sites would also be monitored for vandalism since looting of archaeological sites is known to occur on public and private lands in the project area. Vandalism not only seriously damages the scientific quality of archaeological sites by removing archaeological evidence, but it also destroys evidence by disturbing the soil matrix that surrounds the artifacts that have been removed. Monitors would also make general observations about cutbank conditions and be looking for other National Register sites that are being affected. Native Americans trained in archaeological site monitoring would be invited to assist in the effort.

As currently envisioned, the monitoring plan would consist of on-site monitoring of impacts to specific cultural resources within the transmission line APE. Techniques, which could include use of monitoring pins for gauging cutbank or roadcut erosion, global positioning system (GPS) point mapping, and/or photographs or videos to record disturbance would provide visual and quantifiable representation of site impacts. The use of standardized recording forms would allow qualitative data to be added. These data would be used to update site records and prepare progress reports.

As mentioned earlier, Native Americans with training in monitoring may perform some of the fieldwork, in coordination with the Applicant and other contractors. Agencies with jurisdiction or private landowners may also be included. The various monitoring programs (see this section through section E.4.2.5.1.5.) would be coordinated to make the most cost- and time-efficient use of personnel. Reports on this monitoring effort may be combined with other PM&E reports.

Associated Benefits

Associated benefits include the monitoring of road conditions.

Implementation or Construction Schedule

Time Frame	Action
Within the first 3 years after license is issued	• Visit sites 10AM 1/45 and 10AM 77annually • Evaluate conditions • Prepare annual progress reports
During year 3 of the license period	• Review site list and monitoring program
During years 4–6 after license is issued	• Monitor sites 10AM 1/45 and 10AM 77 • Prepare annual reports
During years 7–30	• Continue to monitor sites 10AM 1/45 and 10AM 77 • Prepare annual reports

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period[16]:

16. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC's discretion for setting a new license term.

Action	Time Frame (years)	Incremental Cost	Cost (30 years)
Monitor sites 10AM 1/45 and 10AM 77 and prepare annual reports	1–30	$1,500	$45,000
Evaluate program	Every 3 years	$3,000	$30,000
Total			$75,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.1.2. Monitoring of Known Burial Site on Oxbow Reservoir

Justification

Stabilization measures at the Two Girls site (10AM 448) must be monitored to ensure that the site continues to be protected. Also, because site-stabilization methods at this site would serve as a model for other site-stabilization projects (see section E.4.2.5.1.6. and section E.4.2.5.2.1.), the long-term success of the Two Girls site-stabilization project must be tracked.

Goals

The goal of this measure is to continue protecting this known burial site.

Description

During a Sunday outing on Oxbow Reservoir, a power plant operator and two young girls discovered bones eroding from the riverbank. A USFS archaeologist identified the bones as human and consulted with Native Americans. Native American, Idaho State Historical Society, and Applicant personnel conducted limited excavations and collections, followed by a reburial ceremony for all the materials recovered.

Nine months of monitoring and stabilization ensued (Figure E.4-1). Monitoring consisted of "observing the rate of cutbank erosion, establishing fixed reference points for photographing the bank, and continued survey for additional human remains" (Johnson and Deering 2000:2). Monitors took repeated measurements and photographs from fixed points, which were located using GPS and panoramic photographs.

The site now appears to be stable, protected by its covering of riprap and vegetation (Figure E.4-2). However, the Applicant plans to continue monitoring it for stability and protection for the life of the new license; consulting with agencies, tribes, and landowners, as necessary; and visiting the site once every year. Methods comparable to those used on other monitoring programs would measure impacts to the site. In addition, monitoring visits and reporting may be combined with those for other monitoring programs to make the most efficient use of resources and personnel.

Associated Benefits

Associated benefits include those to botanical and wildlife resources, since the placement of plants to prevent erosion would also improve plant and wildlife habitat.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Visit site annually • Evaluate condition • Prepare reports

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Annual Cost	Cost (30 years)
Visit site annually, evaluate condition, and prepare reports	1–30	$750	$22,500

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.1.3. Monitoring of Known Eligible Sites on Oxbow and Hells Canyon Reservoirs

Justification

The Applicant's consulting archaeologists have identified actual and potential impacts to archaeological sites resulting from various causes, including reservoir fluctuations, vandalism, recreational uses, grazing, and road use. Monitoring, in consultation with agencies, tribes, and landowners, is necessary at these sites to determine whether the Applicant's operations are causing impacts and whether such impacts are endangering their National Register qualities.

Goals

The goals of this measure are to protect known archaeological sites eligible for inclusion on the National Register, determine causes of site impacts, and distinguish project-related impacts from other impacts.

Description

Certain known archaeological sites are located on public, Applicant-owned, and other private lands along Oxbow and Hells Canyon reservoirs. These sites that are also listed or eligible for inclusion on the National Register would be monitored, pending permission of land managers, for adverse impacts from erosion, vandalism, and other disturbances, particularly those arising from project operations. Based on the current state of knowledge about resources and their conditions, three sites on Oxbow Reservoir (10AM 516, 10AM 520, and 10AM 514) and nine sites on

Hells Canyon Reservoir (35WA 882, 35WA 881, 35WA 880, 10AM 72/HC-9, 10AM 72/HC-24, OR-BA-29, OR-BA 30, 35BA 1010, and 35BA 1009) would each be visited annually over the license period, using a three-year cycle. General monitoring would occur concurrently with the site-specific monitoring. At the end of the first three-year cycle and before the second cycle, all parties involved (the Applicant, USFS, BLM, FERC, tribes, and Oregon and Idaho SHPOs) would evaluate the procedures, list of sites, and the monitoring plan for the next three-year cycle. Monitoring methods and the sample of sites examined may be revised to accommodate changes in technology and conditions.

Monitors would be looking for the causes of site impacts, especially those related to erosion. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to boat wakes or wind action.

Monitoring techniques and intervals would be designed to serve as data collection for study 8.4.7., which is about the effects of reservoir water-level fluctuations on cultural resources. This study was described in the FCP (IPC 1997:664 ff). In consultation with the Cultural Resources Work Group, the study was deferred until the implementation of archaeological site monitoring efforts.

Sites would also be monitored for vandalism since looting of archaeological sites is known to occur on public and private lands in the project area. Vandalism not only seriously damages the scientific quality of archaeological sites by removing archaeological evidence, but it also destroys evidence by disturbing the soil matrix that surrounds the artifacts that have been removed.

Monitors would also make general observations about cutbank conditions and look for other National Register sites that are being affected. Native Americans trained in archaeological site monitoring would be invited to assist in the effort.

As currently envisioned, the monitoring plan would consist of on-site monitoring of impacts to specific cultural resources within the reservoir APE. Techniques, which could include use of monitoring pins for gauging bank erosion, GPS point mapping, and/or photographs or videos to record disturbance, would provide visual and quantitative representation of site impacts. The use of standardized recording forms would allow qualitative data to be added. These data would be used in updating site records and preparing progress reports. As mentioned earlier, Native Americans with training in monitoring may perform some of the fieldwork, in coordination with the Applicant and other contractors. Agencies with jurisdiction or landowners also may be included. The various monitoring programs (see section E.4.2.5.1.1. through section E.4.2.5.1.5.) would be coordinated to make the most cost- and time-efficient use of personnel. Reports on this monitoring effort may be combined with other PM&E reports.

Associated Benefits

Associated benefits include those to botanical and wildlife resources. Monitoring would make information available for use in maintaining the overall health of biological resources on the reservoirs.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Develop schedule for monitoring sites so that each site is visited annually • Conduct general monitoring of resource conditions
Within the first 3 years after license is issued	• Monitor known sites annually and monitor general condition of the reservoir • Prepare annual progress reports • Develop and implement stabilization program
During year 3 of the license period	• Reevaluate monitoring program
During years 4–6 after license is issued	• Implement reviewed monitoring program • Review program
During years 6–30	• Continue to monitor sites • Continue to review program every 3 years

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Incremental Cost	Cost (30 years)
Monitor sites on Oxbow and Hells Canyon reservoirs, conduct general site monitoring while monitoring specific sites, and prepare annual reports	1–30	$18,000	$540,000
Evaluate monitoring program	Every 3 years	$3,000	$30,000
Develop and implement stabilization program	2–3	—	$27,500
Total			$597,500

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.1.4. Monitoring of Known Eligible Sites on Brownlee Reservoir

Justification

The Applicant's consulting archaeologists have identified actual and potential impacts to archaeological sites resulting from various causes, including reservoir fluctuations, vandalism, recreational uses, grazing, and road use. In addition, cutbanks are incised into archaeological deposits during reservoir drawdowns. Monitoring, in consultation with agencies, tribes, and landowners, is necessary at these sites to determine whether the Applicant's operations are causing impacts and whether such impacts are endangering their National Register qualities. Monitoring is also necessary to determine whether mitigation measures, such as data recovery, are necessary.

Goals

The goals of this measure are to protect known archaeological sites eligible for inclusion on the National Register, determine causes of site impacts, and distinguish project-related impacts from other impacts.

Description

Certain known archaeological sites are located on public, Applicant-owned, and other private lands along Brownlee Reservoir. These sites that are also listed or eligible for inclusion on the National Register would be monitored for adverse impacts from erosion, vandalism, and other disturbances, particularly those arising from project operations. Based on the current state of knowledge about resources and their conditions, 22 sites on Brownlee Reservoir would each be visited annually over the license period, using a three-year cycle: 10WN 451, 35BA 801, IPCBD 97 12, IPCBD 97 13, IPCBD 97 14, IPCBD 97 15, IPCBD 00 37, IPCBD 00 41, IPCBD 00 42, IPCBD 00 43, IPCBD 00 48, IPCBD 00 52, IPCBD 00 53, IPCBD 00 54, IPCBD 00 56, IPCBD 00 63, IPCBD 00 64, IPCBD 00 66, IPCBD 00 68, IPCBD 00 70, IPCBD 00 71, and IPCBD 00 74.

At the end of the first three-year cycle and before the second cycle, all parties involved (the Applicant, USFS, BLM, FERC, tribes, and Oregon and Idaho SHPOs) would evaluate the procedures, list of sites, and the monitoring plan for the next three-year cycle. Monitoring methods and the sample of sites examined may be revised to accommodate changes in technology and conditions.

While conducting site-specific monitoring, monitoring crews would also look for shoreline erosion, particularly where it might affect previously unrecorded sites, and check subjectively for impacts on sites not specifically scheduled for monitoring.

Monitors would be looking for the causes of site impacts, especially those related to erosion. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to boat wakes or wind action.

Monitoring techniques and intervals would be designed to serve as data collection for study 8.4.7., which is about the effects of reservoir water-level fluctuations on cultural resources. This study was described in the FCP (IPC 1997:664 ff). In consultation with the Cultural Resources Work Group, the study was deferred until the implementation of archaeological site-monitoring efforts.

Sites would also be monitored for vandalism since looting of archaeological sites is known to occur on public and private lands in the project area. Vandalism not only seriously damages the scientific quality of archaeological sites by removing archaeological evidence, but it also destroys evidence by disturbing the soil matrix that surrounds the artifacts that have been removed. Monitors would also make general observations about cutbank conditions and look for other National Register sites that are being affected. Native Americans trained in archaeological site monitoring would be invited to assist in the effort.

As currently envisioned, the monitoring plan would consist of on-site monitoring of impacts to specific cultural resources within the reservoir APE. Techniques, which could include use of monitoring pins for gauging bank erosion, GPS point mapping, and/or photographs or videos to record disturbance would provide visual and quantitative representation of site impacts. The use of standardized recording forms would allow qualitative data to be added. These data would be used in updating site records and preparing progress reports. As mentioned earlier, Native Americans with training in monitoring may perform some of the fieldwork, in coordination with the Applicant and other contractors. Landowners or agencies with jurisdiction may also be included. The various monitoring programs (see section E.4.2.5.1.1. through section E.4.2.5.1.5.) would be coordinated to make the most cost- and time-efficient use of personnel. Reports on this monitoring effort may be combined with other PM&E reports.

Associated Benefits

Associated benefits include those to botanical and wildlife resources. Monitoring would make information available for use in maintaining the overall health of biological resources on the reservoirs.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Develop schedule for monitoring sites • Conduct general monitoring of resource conditions
Within the first 3 years after license is issued	• Monitor specific sites and general condition of sites along the reservoir • Prepare annual progress reports (if necessary, including observations on erosion dynamics)
During year 3 of the license period	• Reevaluate monitoring program and schedule monitoring according to priorities
During years 4–6 after license is issued	• Implement revised monitoring program • Monitor Brownlee Reservoir drawdown zone • Conduct study 8.4.7. • Study erosion dynamics and effects of flow
During years 6–30 after license is issued	• Continue to evaluate the program every 3 years and implement revised monitoring program

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Incremental Cost	Cost (30 years)
Monitor 22 sites and prepare annual reports	1–30	$14,850	$445,500
Conduct general monitoring and include information in annual reports	1–30	$2,250	$67,500
Reevaluate monitoring program	Every 3 years	$1,500	$15,000

Action	Time Frame (years)	Incremental Cost	Cost (30 years)
Conduct study 8.4.7., monitor Brownlee Reservoir drawdown zone, and study erosion dynamics and effects of flow	4–6	$35,000	$35,000
Total			$563,000

The Applicant would fund this project.

Location Map

Not included because it contains confidential site-location information.

E.4.2.5.1.5. Monitoring of Known Eligible Sites below Hells Canyon Dam

Justification

Project operations are not causing any demonstrable impacts to archaeological sites downstream. However, as a stewardship measure, the Applicant proposes to assist the agencies in monitoring efforts downstream.

Goals

The goals of this measure are to protect known archaeological sites eligible for inclusion on the National Register, determine causes of site impacts, and distinguish project-related impacts from other impacts.

Description

Known archaeological sites are located on public and private land below Hells Canyon Dam. The sites that are listed or eligible for inclusion in the National Register would be monitored for adverse impacts from erosion, vandalism, and other disturbances, particularly those arising from project operations. The Applicant proposes to partner with the USFS as a way of furthering monitoring.

The monitoring plan would be set up for a three-year cycle. Before beginning the monitoring program, site impacts would be evaluated, and the specific sites requiring monitoring would be determined. The Applicant is developing a GIS-based analysis that would identify features that could be impacted by riverside erosion and those areas where sites eligible for inclusion on the National Register would be adversely affected.

Each site chosen for monitoring would be visited annually over the 30-year license period. At the end of the first three-year cycle and before the second cycle, all parties involved (the Applicant, USFS, BLM, FERC, tribes, and Oregon and Idaho SHPOs, if appropriate) would evaluate the procedures, list of sites, and the monitoring plan for the next six-year cycle. Monitoring methods and the sample of sites examined may be revised to accommodate changes in technology and conditions.

Monitors would be looking for the causes of site impacts, especially those related to erosion. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to boat wakes or wind action. Sites would also be monitored for vandalism since looting of archaeological sites is known to occur on public and private lands in the project area. Monitors would also make general observations about bank conditions and look for other National Register sites that are being affected. Federal agencies may invite Native Americans trained in monitoring archaeological sites to assist in the effort.

As currently envisioned, the monitoring plan would consist of on-site monitoring of impacts to specific cultural resources within the APE. Techniques, which could include use of monitoring pins for gauging bank erosion, GPS point mapping, and/or photographs or videos to record disturbance, would provide visual and quantitative representation of site impacts. The use of standardized recording forms would allow qualitative data to be added. These data would be used in updating site records and preparing progress reports. As mentioned earlier, Native Americans with training in archaeological site-monitoring techniques may perform some of the fieldwork, in coordination with agencies, the Applicant, contracting archaeologists, and landowners, as appropriate. The various monitoring programs (see section E.4.2.5.1.1. through section E.4.2.5.1.5.) would be coordinated to make the most cost- and time-efficient use of personnel. Reports on this monitoring effort may be combined with other PM&E reports.

Associated Benefits

Associated benefits include those to botanical and wildlife resources. Monitoring would make information available for use in maintaining the overall health of biological resources on the reservoirs.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Develop schedule for monitoring sites
Within the first 3 years after license is issued	• Monitor sites • Prepare annual progress reports
During year 3 of the license period	• Reevaluate monitoring program and schedule monitoring according to priorities
During years 4–6 after license is issued	• Implement revised monitoring program
During years 6–30	• Continue to evaluate the program every 3 years and implement revised monitoring program

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Annual Cost	Cost (30 years)
Monitor selected sites	1–3	Up to $65,000	$195,000
Evaluate program and monitor sites	4–30	$65,000	$1,755,000
Total			Up to $1,950,000

The Applicant would fund this project.

Location Map

Not included because it contains confidential site-location information.

E.4.2.5.1.6. Stabilization of Sites below Hells Canyon Dam

Justification

Project operations are not causing any demonstrable impacts to archaeological sites downstream. However, as a stewardship measure, the Applicant proposes to help the USFS stabilize several archaeological sites downstream of Hells Canyon Dam.

Goal

The goal of this measure is to protect archaeological sites eligible for inclusion on the National Register.

Description

Below Hells Canyon Dam, there are an estimated 20 sites that may require stabilization. These sites are eligible for inclusion on the National Register. Possible stabilization measures for erosion include revegetation with native plants or installation of riprap. Exclosures to exclude grazing animals, rerouting of trails and roads, and facility relocation are also possibilities. Because each site presents a unique set of conditions, stabilization plans would be coordinated with the Idaho or Oregon SHPO, federal agencies (if the site lies on public land) or private landowners, and tribes (if the site is Native American).

Associated Benefits

Associated benefits include those to botanical and wildlife resources since preventing erosion would supplement protection measures for rare plants and wildlife habitat.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Identify sites requiring stabilization • Develop site-stabilization program
During the first 10 years after license is issued	• Implement site-stabilization program

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Cost per Site	Cost (30 years)
Develop and implement site-stabilization program for a maximum of 20 sites	1–10	$160,000	$3,200,000

Location Map

Not applicable

E.4.2.5.2. Mitigation Measures

The goal of each of the following Applicant-proposed measures is to mitigate for adverse effects shown to be related to project operations.

E.4.2.5.2.1. Stabilization of Sites on Brownlee Reservoir

Justification

The Applicant's consulting archaeologists have determined that project operations, including reservoir drawdowns, have adversely affected archaeological sites. Site stabilization is necessary to protect those sites from further, irreversible damage.

Goal

The goal of this measure is to protect archaeological sites eligible for inclusion on the National Register.

Description

On Brownlee Reservoir, seven sites eligible for inclusion on the National Register (10WN 451, 35BA 801, IPCBD 0043, IPCBD 0058, IIPCBD 61, IIPCBD 63, and IIPCBD 64) are being destabilized by actions associated with the reservoir.

Continued damage from the Applicant's actions and other impacts may destroy the integrity of the sites, thereby affecting their National Register eligibility. Erosion damages archaeological sites by disturbing the soil matrix that contains artifacts and organic material. This disturbance, in turn, destroys the critical spatial relationships among the artifacts and between the artifacts, geological features, and organic remains used to date artifacts and reconstruct paleoenvironmental relationships.

Possible stabilization measures for erosion include revegetation with native plants or installation of riprap. Exclosures to exclude grazing animals, rerouting of trails and roads, and relocation of facilities are also possibilities. Because each site presents a unique set of conditions, stabilization plans would be coordinated with the Idaho or Oregon SHPO, federal agencies (if the site lies on public land) or private landowners, and tribes (if the site is Native American).

Associated Benefits

Associated benefits include those to botanical and wildlife resources since preventing erosion would supplement protection measures for rare plants and wildlife habitat.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Develop site-stabilization program
During the first 5 years after license is issued	• Implement site-stabilization program

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Annual Cost	Cost (30 years)
Develop and implement site-stabilization program for 7 sites	1–5	$104,000	$520,000

Location Map

Not applicable

E.4.2.5.2.2. Data Recovery at Four Archaeological Sites on Brownlee Reservoir

Justification

Monitoring efforts or engineering design considerations may determine that site stabilization is inappropriate for some sites on Brownlee Reservoir. In these cases, avoidance of continued impacts would be impossible. In such cases, the Applicant proposes data recovery according to methods that are consistent with the Advisory Council on Historic Preservation's recent guidance on data-recovery excavations (1999).

Goal

The goal of this measure is to recover archaeological data from four sites eligible for inclusion on the National Register because they might otherwise be damaged by the operation of Brownlee Reservoir.

Description

This project would involve data-recovery programs at four sites on Brownlee Reservoir: IPC95-09, IPCBD-97-03, IPCBD 0075, and IPCBD 0080 (Connor Creek).

Site IPC95-09 consists of a complex lithic scatter and historic structural remains with associated debris. Lithic debitage is abundant throughout the site area and ranges in density from 1 flake per square meter to more than 100 flakes per square meter. Material noted, in order of abundance, includes basalt, obsidian, and several kinds of chert. Other artifacts present include groundstone, cores, large flaked cobbles, projectile points, a hammer stone, a biface, and unifacially modified and utilized flakes. The historic component consists of a square, rough-concrete structure with stairs descending into it (apparently the remains of a basement), a powerline, and historic debris. The site is partially obscured by reservoir silts, and the potential for buried deposits is high (confidential Technical Report E.4-3).

IPCBD-97-03 is a complex lithic scatter with a historic component consisting of an asphalt road, abandoned railroad grade, and several fragments of amethyst glass. The lithic scatter contains debitage, cores, flaked stone tools, and groundstone. A large, burned mammal bone was also noted, and numerous freshwater mussel shells litter the area, suggesting food-processing activity. Various lithic materials are present, including obsidian, basalt, and several kinds of chert and chalcedony. Numerous tools exhibiting use include pestles and pestle fragments, unifacially flaked tools, a hammer stone, a nearly complete slate pendant, and two burned Shoshone ware potsherds. The site appears to have been partially destroyed by construction of the road and railroad, except possibly for material that may lie beneath the heavily silted-in area above the railroad grade. The area below the road may contain more intact deposits as evidenced by two complete pestles found near the water's edge. Cultural material extended to the drawdown level of the reservoir (confidential Technical Report E.4-3).

The following information is quoted from the site form:

> IPCBD 0075 consists of a portion of a road that originates below reservoir waters and is visible above the high water line of the reservoir. The road segment is visible for approximately 120 feet up the gulch on the north side of the creek. Vegetation has overgrown the road beyond this point and no road is visible. The road may be the Tim Goodell Road built for Brownlee in the 1860s. GLO survey notes 9/9/1911 indicate a wagon road from Brownlee to Pine on the section 2 northern boundary running north and south (Retracement and Resurvey of N. Bdy, T. 9 S., r 47 E., W.M., Oregon page 12/112). Continuing east along the boundary is a wagon road, course north and south and then railroad track course N 15 degrees, continued to the left bank of the Snake River in section 1.

Reservoir waters cover the road from the river up to this point, and the road is being eroded.

The site form for IPCBD 0080 included the following information (confidential Technical Report E.4-3):

IPCBD 0080 consists of segment of a ditch presumed to be the ditch referred to as Connor Ditch. Connor Creek was known for gold deposits and was mined, primarily upstream three miles. Just below the creek was the Cook ranch with a ditch that carried water from Connor Creek for irrigating. It was later to become the Baker Peach Orchard. The Bache (Basche) ranch was also irrigated by a ditch from Connor Creek. The first owners were the Hill (?) Family who had sheep, and it later became the Coats place. [This information is from a manuscript by John Flynn, which has no date but was presumably written in the 1960s, "John Flynn's Stories of Mineral," p. 31–33]. The Sisley ranch, subsequently the Hamilton, the Wan, and then the Flick ranch, became known as Home when the railroad came down river (Flynn:32). Since the ditch is located above the site Home, it is also possible this ditch is associated with Home, Oregon. Flynn also puts Sisley at a ranch at the mouth of Fox Creek (p. 40) as well as the GLO 1881 survey map. The ditch may be the last feature associated with early settlement within the Brownlee Reservoir pool and may be potentially eligible for the NRHP under criterion a.

The road has crossed the ditch, and the ditch is eroding.

All four sites are eligible for inclusion on the National Register and are being severely impacted by the fluctuating reservoir: siltation, wave action, and slumping are affecting the sites' integrity. Because these sites are located partially below the usual reservoir level, site stabilization is not an option. A data-recovery plan would be developed in consultation with the Idaho and Oregon SHPOs, tribes, and federal agencies involved. Broadly stated, the procedure would consist of the following actions:

- Developing a mitigation plan that includes research questions and methods (occurring in the first one or two years)
- Implementing the mitigation plan (which could take from one to eight years)
- Supporting ongoing research (such as archival research or artifact analysis) and monitoring the sites through the remaining period of the license

Associated Benefits

Associated benefits include those to recreation. Information about Native American and more recent inhabitants of the project area would enhance interpretive displays.

Implementation or Construction Schedule

Time Frame	Action
Within the first 2 years after the license is issued	• Develop mitigation plans for each site
During years 3–10 after license is issued	• Implement mitigation plan for each site
During years 11–30 after license is issued	• Support ongoing research and monitor sites

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Annual Cost	Cost (30 years)
Develop mitigation plans	1–2	—	$25,000
Implement mitigation plans	3–10	—	$600,000
Support ongoing research and monitor sites	11–30	$4,250	$85,000
Total			$710,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3. Enhancement Measures

The goal of each of the following Applicant-proposed measures is to enhance the current state of knowledge about Native Americans, as well as Euro- and Asian-American settlers, in the Hells Canyon area.

E.4.2.5.3.1. Native American Interpretive Sites on Brownlee Reservoir

Justification

This measure is proposed as a result of consultation with Native Americans who expressed strong interest in educating the public about Native American presence and land use in the project area. Educational kiosks are a cost-effective means of accomplishing this goal.

Goal

The goal of this measure is to enhance visitors' awareness of cultural resources in the project area.

Description

The Applicant proposes to place four interpretive kiosks along Brownlee Reservoir in areas selected in consultation with the Native American tribes, who consider this region their traditional territory. This effort would enhance cultural resources by educating the public about Native American use of the area. Kiosks would not include site locations, which are considered confidential, but would have information about penalties for vandalism, including looting, of archaeological sites and historic structures.

Associated Benefits

Associated benefits include those to recreation, botanical, and wildlife resources. Interpretation of project area history would add interest to area visits by recreationists. Native American use of local plant and animal resources would also add interest.

Implementation or Construction Schedule

Year	Action
Within 1 year after license is issued	• Design, construct, and install four kiosks
Term of license	• Maintain kiosks

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Cost per Kiosk	Cost (30 years)
Design, construct, and install four kiosks	1	$5,500	$22,000
Maintain kiosks	1–30	$550	$66,000
Total			$88,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.2. Native American Interpretive Sites on Oxbow and Hells Canyon Reservoirs

Justification

This measure is proposed as a result of consultation with Native Americans who expressed strong interest in educating the public about Native American presence and land use in the project area. Educational kiosks are a cost-effective means of accomplishing this goal.

Goal

The goal of this measure is to enhance visitors' awareness of cultural resources in the project area.

Description

The Applicant proposes to place two interpretive kiosks along Oxbow and Hells Canyon reservoirs, in areas selected in consultation with the Native American tribes who consider this region their traditional territory. This effort would enhance cultural resources by educating the public about Native American use of the area. Kiosks would not include site locations, which are considered confidential, but would have information about penalties for vandalism, including looting, of archaeological sites and historic structures.

Associated Benefits

Associated benefits include those to recreation, botanical, and wildlife resources. Interpretation of project area history would add interest to area visits by recreationists. Native American use of local plant and animal resources would also add interest.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Design, construct, and install two kiosks
Term of license	• Maintain kiosks

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Cost per Kiosk	Cost (30 years)
Design, construct, and install two kiosks	1	$5,500	$11,000
Maintain kiosks	1–30	$550	$33,000
Total			$44,000

The Applicant would fund this project.

Location Map

Not applicable; the locations have not yet been determined.

E.4.2.5.3.3. Euro-American Interpretive Sites on Brownlee, Oxbow, and/or Hells Canyon Reservoirs

Justification

This measure was specifically requested by the Idaho SHPO, which expressed strong interest in educating the public about the Euro-American presence and land use in the project area. Educational kiosks are a cost-effective means of accomplishing this goal.

Goal

The goal of this measure is to enhance visitors' awareness of cultural resources in the project area.

Description

This project consists of the placement of four interpretive kiosks along Brownlee, Oxbow, and/or Hells Canyon reservoirs, in areas selected in consultation with the Idaho and Oregon SHPOs and individuals knowledgeable in local Euro-American history. This effort would enhance cultural resources by educating the public about Euro-American use of the area.

Associated Benefits

Associated benefits include those to recreation. Interpretation of project area history would add interest to area visits by recreationists. In addition, a more informed public would likely support other PM&E measures.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Design, construct, and install four kiosks
Term of license	• Maintain kiosks

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Cost per Kiosk	Cost (30 years)
Design, construct, and install four kiosks	1	$5,500	$22,000
Maintain kiosks	1–30	$550	$66,000
Total			$88,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.4. Asian-American Interpretive Sites on Brownlee, Oxbow, and/or Hells Canyon Reservoirs

Justification

This measure was specifically requested by the Idaho SHPO, which expressed strong interest in educating the public about the Asian-American presence and land use in the project area. Educational kiosks are a cost-effective means of accomplishing this goal.

Goal

The goal of this measure is to enhance visitors' awareness of cultural resources in the project area.

Description

This project consists of the placement of four interpretive kiosks along Brownlee, Oxbow, and/or Hells Canyon reservoirs, in areas selected in consultation with the Idaho and Oregon SHPOs and individuals knowledgeable in local Asian-American history. This effort would enhance cultural resources by educating the public about Asian-American use of the area.

Associated Benefits

Associated benefits include those to recreation, botanical, and wildlife resources. Interpretation of project area history adds interest to area visits by recreationists. Information about Asian-American contributions to local history would also add interest.

Implementation or Construction Schedule

Time Frame	Action
Within 1 year after license is issued	• Design, construct, and install four kiosks
Term of license	• Maintain kiosks

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Cost per Kiosk	Cost (30 years)
Design, construct, and install four kiosks	1	$5,500	$22,000
Maintain kiosks	1–30	$550	$66,000
Total			$88,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.5. Euro- and Asian-American Interpretive Projects

Justification

As documented by the Idaho SHPO, there was intensive occupation of the Hells Canyon area by trappers, miners, homesteaders, ranchers, and river runners of European and Asian descent. Local museums are valuable resources for educating the public about the historic contributions of these groups.

Goal

The goal of this measure is to enhance visitors' awareness of cultural resources in the project area.

Description

The Applicant proposes to assist local community museums with collections acquisition, display, and curation, particularly of oral history archives related to Hells Canyon. The Applicant would also maintain a fund to which local communities could apply for specific projects. Funds would be awarded on the basis of merit, but an effort would also be made to distribute funds throughout the region. Although annual amounts dedicated to projects may vary, the total of the grants would average $5,833 annually. Programs to be funded could include design, construction, and maintenance of Euro- and/or Asian-American history kiosks, docent training programs, museum collection acquisition, curation and display, traveling exhibits, and schools programs.

Associated Benefits

Associated benefits would include a more informed public that would more likely support other PM&E measures.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Provide assistance and support to local community museums

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Time Frame (years)	Annual Cost	Cost (30 years)
Provide assistance and support to local community museums	1–30	average of $5,833	$174,990

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.6. Native American Programs: Burns Paiute Tribe

Justification

Since 1997, in an effort to use relicensing proceedings as a vehicle to reach out broadly to the region's tribal constituencies, without regard to the extent that they may be affected by the project, the Applicant invited many tribal groups to become involved with Hells Canyon relicensing projects. As a result of this involvement, the Applicant has learned that the tribes 1) often lack funds to fully participate in relicensing efforts, 2) seek to enhance educational opportunities for their youth, and 3) desire to develop specific programs to enhance their own understanding of and participation in their traditional culture.

Goal

The goal of this measure is to assist the Burns Paiute Tribe in its efforts to 1) obtain funding for participating in and/or administering cultural resources PM&E measures, 2) educate its youth by providing a scholarship/training fund, and 3) provide funds to facilitate several cultural enhancement projects.

Description

The Applicant proposes to develop, in consultation with the Burns Paiute Tribe, programs in the following areas of PM&E development funding, educational development, and cultural enhancement:

- Funding for costs of tribal staff time and travel costs associated with cultural resources PM&E implementation
- Support for educational development programs, including scholarship/training funds
- Support for ongoing and future cultural enhancement projects in consultation with the Burns Paiute Tribe

Associated Benefits

Associated benefits would be to expand the tribe's historical database and enhance opportunities for tribal youth to learn about traditional land use and resources. The measure would also provide opportunities for tribal youth to pursue educational or vocational training, which in turn would enhance economic development opportunities within the tribe.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Fund tribal programs

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Fund tribal programs (for term of license)	$1,000,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.7. Native American Programs: Confederated Tribes of the Warm Springs Indian Reservation (Warm Springs Tribes)

Justification

Since 1997, in an effort to use relicensing proceedings as a vehicle to reach out broadly to the region's tribal constituencies, without regard to the extent that they may be affected by the project, the Applicant invited many tribal groups to become involved with the Hells Canyon relicensing projects. As a result of this involvement, the Applicant has learned that the tribes 1) often lack funds to fully participate in relicensing efforts, 2) seek to enhance educational opportunities for their youth, and 3) desire to develop specific programs to enhance their own understanding of and participation in their traditional culture.

Goal

The goal of this measure is to assist the Warm Springs Tribes in their efforts to 1) obtain funding for participating in and/or administering cultural resources PM&E measures, 2) educate their youth by providing a scholarship/training fund, and 3) provide funds to facilitate several cultural enhancement projects.

Description

The Applicant proposes to develop, in consultation with the Warm Springs Tribes, programs in the following areas of PM&E development funding, educational development, and cultural enhancement:

- Funding for costs of tribal staff time and travel costs associated with cultural resources PM&E implementation
- Support for educational development programs, including scholarship/training funds

- Support for ongoing and future cultural enhancement projects in consultation with the Warm Springs Tribes

Associated Benefits

Associated benefits would be to expand the tribes' historical database and enhance opportunities for tribal youth to learn about traditional land use and resources. The measure would also provide opportunities for tribal youth to pursue educational or vocational training, which in turn would enhance economic development opportunities within the tribes.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Fund tribal programs

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Fund tribal programs (for term of license)	$1,000,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.8. Native American Programs: Nez Perce Tribe

Justification

Since 1997, in an effort to use relicensing proceedings as a vehicle to reach out broadly to the region's tribal constituencies, without regard to the extent that they may be affected by the project, the Applicant invited many tribal groups to become involved with Hells Canyon relicensing projects. As a result of this involvement, the Applicant has learned that the tribes 1) often lack funds to fully participate in relicensing efforts, 2) seek to enhance educational opportunities for their youth, and 3) desire to develop specific programs to enhance their own understanding of and participation in their traditional culture.

Goal

The goal of this measure is to assist the Nez Perce Tribe in its efforts to 1) obtain funding for participating in and/or administering cultural resources PM&E measures, 2) educate its youth by providing a scholarship/training fund, and 3) provide funds to facilitate several cultural enhancement projects.

Description

The Applicant proposes to develop, in consultation with the Nez Perce Tribe, programs in the following areas of PM&E development funding, educational development, and cultural enhancement:

- Funding for costs of tribal staff time and travel costs associated with cultural resources PM&E implementation
- Support for educational development programs, including scholarship/training funds
- Support for ongoing and future cultural enhancement projects in consultation with the Nez Perce Tribe

Associated Benefits

Associated benefits would be to expand the tribe's historical database and enhance opportunities for tribal youth to learn about traditional land use and resources. The measure would also provide opportunities for tribal youth to pursue educational or vocational training, which in turn would enhance economic development opportunities within the tribe.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Fund tribal programs

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Fund tribal programs (for term of license)	$1,000,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.9. Native American Programs: Confederated Tribes of the Umatilla Indian Reservation (CTUIR)

Justification

Since 1997, in an effort to use relicensing proceedings as a vehicle to reach out broadly to the region's tribal constituencies, without regard to the extent that they may be affected by the project, the Applicant invited many tribal groups to become involved with the Hells Canyon relicensing projects. As a result of this involvement, the Applicant has learned that the tribes 1) often lack funds to fully participate in relicensing efforts, 2) seek to enhance educational opportunities for their youth, and 3) desire to develop specific programs to enhance their own understanding of and participation in their traditional culture.

Goal

The goal of this measure is to assist the CTUIR in their efforts to 1) obtain funding for participating in and/or administering cultural resources PM&E measures, 2) educate their youth by providing a scholarship/training fund, and 3) provide funds to facilitate several cultural enhancement projects.

Description

The Applicant proposes to develop, in consultation with the CTUIR, programs in the following areas of PM&E development funding, educational development, and cultural enhancement:

- Funding for costs of tribal staff time and travel costs associated with cultural resources PM&E implementation

- Support for educational development programs, including scholarship/training funds

- Support for ongoing and future cultural enhancement projects in consultation with the CTUIR

Associated Benefits

Associated benefits would be to expand the tribes' historical database and enhance opportunities for tribal youth to learn about traditional land use and resources. The measure would also provide opportunities for tribal youth to pursue educational or vocational training, which in turn would enhance economic development opportunities within the tribes.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Fund tribal programs

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Fund tribal programs (for term of license)	$1,000,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.10. Native American Programs: Shoshone-Paiute Tribes

Justification

Since 1997, in an effort to use relicensing proceedings as a vehicle to reach out broadly to the region's tribal constituencies, without regard to the extent that they may be affected by the project, the Applicant invited many tribal groups to become involved with Hells Canyon relicensing projects. As a result of this involvement, the Applicant has learned that the tribes 1) often lack funds to fully participate in relicensing efforts, 2) seek to enhance educational opportunities for their youth, and 3) desire to develop specific programs to enhance their own understanding of and participation in their traditional culture.

Goal

The goal of this measure is to assist the Shoshone-Paiute Tribes in their efforts to 1) obtain funding for participating in and/or administering cultural resources PM&E measures, 2) educate their youth by providing a scholarship/training fund, and 3) provide funds to facilitate several cultural enhancement projects.

Description

The Applicant proposes to develop, in consultation with the Shoshone-Paiute Tribes, programs in the following areas of PM&E development funding, educational development, and cultural enhancement:

- Funding for costs of tribal staff time and travel costs associated with cultural resources PM&E implementation

- Support for educational development programs, including scholarship/training funds

- Support for ongoing and future cultural enhancement projects in consultation with the Shoshone-Paiute Tribes

Associated Benefits

Associated benefits would be to expand the tribes' historical database and enhance opportunities for tribal youth to learn about traditional land use and resources. The measure would also provide opportunities for tribal youth to pursue educational or vocational training, which in turn would enhance economic development opportunities within the tribes.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Fund tribal programs

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Fund tribal programs (for term of license)	$1,000,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.3.11. Native American Programs: Shoshone-Bannock Tribes

Justification

Since 1997, in an effort to use relicensing proceedings as a vehicle to reach out broadly to the region's tribal constituencies, without regard to the extent that they may be affected by the project, the Applicant invited many tribal groups to become involved with Hells Canyon relicensing projects. As a result of this involvement, the Applicant has learned that the tribes 1) often lack funds to fully participate in relicensing efforts, 2) seek to enhance educational opportunities for their youth, and 3) desire to develop specific programs to enhance their own understanding of and participation in their traditional culture.

Goal

The goal of this measure is to assist the Shoshone-Bannock Tribes in their efforts to 1) obtain funding for participating in and/or administering cultural resources PM&E measures, 2) educate their youth by providing a scholarship/training fund, and 3) provide funds to facilitate several cultural enhancement projects.

Description

The Applicant proposes to develop, in consultation with the Shoshone-Bannock Tribes, programs in the following areas of PM&E development funding, educational development, and cultural enhancement:

- Funding for costs of tribal staff time and travel costs associated with cultural resources PM&E implementation
- Support for educational development programs, including scholarship/training funds
- Support for ongoing and future cultural enhancement projects in consultation with the Shoshone-Bannock Tribes

Associated Benefits

Associated benefits would be to expand the tribes' historical database and enhance opportunities for tribal youth to learn about traditional land use and resources. The measure would also provide opportunities for tribal youth to pursue educational or vocational training, which in turn would enhance economic development opportunities within the tribes.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Fund tribal programs

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Fund tribal programs (for term of license)	$1,000,000

The Applicant would fund this project.

Location Map

Not applicable

E.4.2.5.4. Additional Section 106 Projects

Justification

More than 1,110 archaeological sites are located in the project area for the HCC. The majority of these sites are either listed or eligible for inclusion on the National Register. The Applicant has assessed any adverse effects to these sites, identified those that may be caused by project operations, and provided for their appropriate mitigation (see section E.4.2.5.1.1. through section E.4.2.5.2.2.). However, additional adverse effects from project-related activities may be detected through monitoring conducted over the term of the new license.

Goal

The goal of this measure is to ensure ongoing protection against or mitigation for future unforeseen adverse effects of project operations to historic or cultural properties within the HCC. The proposed projects would be consistent with section 106 and other applicable laws and regulations.

Description

The Applicant proposes to fund (to a level commensurate with professional standards of contemporary archaeology) reasonably designed and implementable protection and mitigation projects for any unforeseen adverse effects attributed to HCC project operations. The Applicant would do so as the need were identified through monitoring efforts (see section E.4.2.5.1.1. through section E.4.2.5.1.5.) and pursuant to a memorandum of understanding to be negotiated among the Applicant, federal land agencies, and the Idaho and Oregon SHPOs (consistent with the intent of section 106 of the National Historic Preservation Act and other applicable laws and regulations). These measures would then be developed in consultation with FERC, the Advisory Council on Historic Preservation, Idaho and Oregon SHPOs, tribes, and appropriate land management agencies (such as the BLM and USFS). Protection or mitigation methods would be proposed based on monitoring efforts conducted during the term of the new license.

Associated Benefits

Associated benefits would be to expand the range of protection and mitigation efforts to encompass unforeseen, potential future adverse effects to historic properties.

Implementation or Construction Schedule

Time Frame	Action
Term of license	• Protect sites or mitigate for adverse effects identified through monitoring, where appropriate

Cost Estimate

The Applicant estimates the following costs, based on a 30-year license period:

Action	Cost (30 years)
Protect sites or mitigate for adverse effects identified through monitoring, where appropriate	To be determined

Funding would depend on the level of impact and future PM&E needs.

Location Map

Not applicable

E.4.2.6. Measures Recommended by the Agencies or Tribes

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.4.2.6.1. Accepted or Conditionally Accepted Measures or Facilities

Bureau of Land Management comment letter, dated January 9, 2003

BLM2-287 and BLM1-211

> A more detailed monitoring plan should be mutually developed and agreed upon between the Applicant and BLM before the monitoring program is implemented…

> …the Applicant has not provided criteria for prioritizing sites or quantifying impacts.

Response

The Applicant would develop a more detailed monitoring plan and consult with the BLM and other appropriate entities between the time of filing this final license application and issuance of a new license for the HCC. Highest priority would be given to sites in the drawdown zone of Brownlee Reservoir where repeated archaeological inventories have identified damage to culturally rich deposits.

BLM7-1

> There is no definition of what threshold of loss is not acceptable before stabilization efforts are initiated. The monitoring techniques need to be better defined and focus on more quantitative techniques to better measure site loss and impact agents.

Response

The Applicant agrees that the limits of acceptable change should be specified. The BLM has never provided guidance on limits of acceptable change that is consistent with guidelines currently in use by the BLM, in spite of requests for such guidance from the Applicant. Therefore, "limits of acceptable change" was intentionally left undefined in the HPMP. Once the Applicant has received information from the BLM and others on limits of acceptable change, the Applicant can define these parameters. The final HPMP will propose quantitative monitoring techniques, recognizing that, by the time implementation occurs, newer and better techniques may be available.

BLM7-7

> The Applicant should plan for and conduct systematic and ongoing inventories of drawdown areas, using a design adaptive to changing conditions, until all areas exposed during such

> events have been examined. In addition, there are daily fluctuations along HC reservoir which expose additional shoreline near known archaeological sites.

Response

The Applicant agrees. Future inventories in the drawdown zone would be conducted in conjunction with site monitoring.

BLM7-2

> All sites should be monitored within the first three years of the plan [HPMP] initiation. After the first three years the site can be reprioritized into a six-year schedule. Those sites that are impacted the greatest need to be monitored annually, not every six years, to ensure significant information is not being lost at too rapid a rate.

Response

The Applicant agrees with the BLM and would institute a "program of annual monitoring on the three reservoirs for the first three years, and then [would] re-prioritize; or continue annual monitoring until other protection and mitigation measures have been designed and scheduled for implementation."

U. S. Forest Service comment letter, dated January 8, 2003
USFS3-236

> The reservoir-edge site has intact deposits and experiences considerable project-induced recreation. The Forest Service recommends this site be hardened.

Response

The Applicant's acceptance of the field archaeologists' recommendation to harden site 10AM77 does not indicate that the Applicant accepts responsibility for "project-induced recreation." Implicit in the assertion of project-induced recreation is that the existence of the HCC project causes additional recreational uses on USFS, BLM, or other agency lands that are either within or near the project area and that these uses would not occur except for the existence of the HCC. The agencies further assert that such uses have an impact on their operating and maintenance costs which should be borne by IPC. This assertion of IPC responsibility for "induced use" seems disingenuous, particularly in light of the purposes for which the USFS and BLM manage the federal lands around the HCC. All of the national federal lands in the vicinity of the HCC are managed by the USFS and BLM for multiple uses, including recreation.

Moreover, in 1975, Congress created the Hells Canyon National Recreation Area (HCNRA), setting aside more than 650,000 acres consisting of wilderness areas, wild and scenic river segments, and dispersed and developed recreational areas and forest management areas. While a primary purpose of the HCNRA Act (P.L. 94-199, 1975) was to preserve the lands and waters that the Act specifically set aside, it was also intended to enhance recreational opportunities and the public enjoyment of the area. So while the USFS generally manages national forest lands for recreational use, consistent with its multiple use philosophy, Congress in enacting P.L. 94-199 apparently envisioned that more recreational use would occur within the HCNRA than within forest lands generally reserved under the 1897 Organic Act (as supplemented by the 1960 Multiple Use Sustained Yield Act—MUSYA). In fact, the USFS encourages recreational use within the HCNRA through mediums such as a USFS website dedicated solely to the HCNRA (where the USFS emphasizes that the HCNRA provides "Exciting recreational opportunities. Diverse and abundant wildlife. Artifacts from prehistoric tribes and rustic remains of early miners and settlers - HCRNA truly offers something for everyone, and much to remember". See: <http://www.fs.fed.us/hellscanyon/overview>.) In short, it is not the HCC that draws recreational users to the area, but the unique attributes of the HCNRA.

Moreover, quantifying the respective use of USFS lands as compared to HCC recreational areas would be difficult and at most speculative. For example, how would one quantify the impacts to

IPC's parks and roads by visitors whose sole purpose for visiting the area is to recreate within the HCNRA, USFS, BLM or state lands? What standard or mechanism would be used to determine whether visitors to the area result from the marketing efforts of the USFS, Bureau of Land Management (BLM), the states of Idaho and Oregon, or local counties, outfitters and guides, and other organizations? There is no doubt that the entire Hells Canyon area provides unique recreational opportunities and is a national as well as an Oregon and Idaho asset. As such, the various federal and state agencies and entities involved should provide funding to operate and manage their own lands.

USFS1-31 and USFS3-275

> Supplement the Applicant's proposed CRMP [HPMP] with additional educational and interpretive information opportunities, as well as improve the Applicant's proposed monitoring programs by articulating exact methodology and increase the frequency of site visitation."

Response

The Applicant is looking forward to working with the USFS in developing an informative and educational interpretive program. The Applicant is open to discussing modifications needed to monitor plans for historical properties directly impacted by project operations. However, the Applicant believes that additional inventories are unnecessary. The Applicant completely inventoried the APE in preparation of the draft license application.

USFS1-34

> Mitigate for adverse effects to organic-based archaeological material."

Response

The Applicant believes that the proposed monitoring plan, as modified according to constructive recommendations by the BLM, adequately addresses concerns about identifying and addressing future effects of ongoing project operations on cultural resources.

USFS3-287

> Conduct archaeological site protection measures (e.g. armoring) and/or testing, evaluation and data recovery, as needed, to rectify continuing or future adverse effects to heritage resource sites located at Big Bar and Eckles Creek on the Payette National Forest.

Response

The Applicant anticipates that it would be responsible for conducting archaeological site protection and/or testing, evaluation, and data recovery, as needed, at both Eckels Creek and Big Bar, commensurate with the Applicant's involvement with recreational facilities at these two locations.

Confederated Tribes of the Umatilla Indian Reservation comment letter, dated January 10, 2003

CTUI1-39

> The CRMP states that future activities such as monitoring and stabilization (see 4.4.2.1.3) will occur at known eligible sites. It is our belief that these statements should read, "all eligible and potentially eligible sites.

Response

Where eligibility of a site was unclear, it was treated as eligible. If monitoring such a site reveals erosion or other impacts that expose features, indicating eligibility, the site's status would be verified. If no such disturbance were noted, the site would continue to be monitored.

CTU1-55

> CRPP believes any site at which Native American human remains have been found must be monitored annually.

Response

The Applicant agrees.

CTU1-56

> The Applicant should not use a six-year monitoring cycle. Eligible and potentially eligible sites should be monitored annually or biannually depending on the condition of the site and likelihood that it will be adversely affected in the six-year time frame.

Response

The Applicant agrees with the Confederated Tribes of the Umatilla Indian Reservation and would institute a "program of annual monitoring on the three reservoirs for the first three years, and then [would] re-prioritize; or continue annual monitoring until other protection and mitigation measures have been designed and scheduled for implementation."

Nez Perce Tribe comment letter, dated January 10, 2003

NPT1-19

> Additional monitoring should be conducted on the area below Hells Canyon Dam. All eligible sites that could be affected by river erosion in this area should be monitored at least every other year. This is necessary to ensure that the sites continue to not be affected by the Project. The Applicant should not use a six-year monitoring cycle. Sites should be monitored annually or biannually depending on the condition of the site and likelihood that it will be adversely affected. The purpose of monitoring should be to observe impacts as they occur and then mitigate for them. By monitoring on a six- year cycle, sites will be destroyed before appropriate measures can be taken to protect them.

Response

The Applicant proposes to partner with the USFS as a way of furthering monitoring. The Applicant also proposes a "program of annual monitoring below Hells Canyon Dam for the first three years, and then [would] re-prioritize; or continue annual monitoring until other protection and mitigation measures have been designed and scheduled for implementation."

Shoshone-Bannock Tribes comment letter, dated January 10, 2003

SBT1-172

> None of the four categories proposed of PM&E measures by the applicant include plant resources covered under off reservation treaty rights. Please include a section addressing new measure or facilities on plant resources important to Shoshone-Bannock tribal members. This includes land acquisitions, cooperative projects, protection and monitoring of sensitive areas, etc. This would also include direct project areas, as well as transmission lines and associated roads.

Response

The Applicant notes here its serious reservations, expressed at more length in its responses to the comments of the Shoshone-Bannock Tribes on the Draft License Application, concerning the Tribes' alleged off reservation treaty rights. This point aside, the Applicant believes that project-related impacts associated with botanical resources are fully mitigated for in its proposed PM&E measures (see section E.3.3.3.2.). In addition, the Applicant has decided to remove all transmission lines associated with the HCC from this final license application, with the exception of the Pine Creek–Hells Canyon 69-kV line (Line 945). This line parallels the Oxbow–Hells Canyon Road and typically occurs in the road verge, resulting in minimal service roads.

Shoshone-Paiute Tribes comment letter, dated January 9, 2003
SPT1-16

> The Shoshone-Paiute Tribes must have appropriate input into research concerning impacts they have experienced, as well as the means to fund such input.

Response

The Applicant notes here its serious reservations, noted at more length in its responses to the tribes' comments on the Draft License Application, concerning the Tribes' alleged off reservation treaty rights. This point aside, the Applicant's intention is to fund an oral history study with the Shoshone-Paiute Tribes as it has with three other tribal groups. Thus far, the Shoshone-Paiute Tribes have not cooperated in this effort. An effort to initiate an oral history study with the Shoshone-Paiute Tribes is apparent in a letter dated August 30, 2001, from John Prescott, the Applicant's Vice President of Power Supply, to Marvin Cota, then Chairman of the Shoshone-Paiute Tribes. The letter stated the Applicant's willingness to fund an ethnographic study with the Shoshone-Paiute Tribes with the following conditions: the Applicant would need to administer this study as it does all other relicensing studies since it would become a component of the HCC license; the goals of the study would include assisting FERC in fulfilling its section 106 responsibilities with regard to traditional cultural resources, traditional cultural properties, and sacred sites; the study could address some but not all tribal interests because some tribal interests are beyond the scope of what the regulations require; and the ethnographic literature review compiled by Dr. L Daniel Myers would be available as part of the design phase of the proposed ethnographic study. Because the Shoshone-Paiute Tribes never responded to Mr. Prescott's letter, an ethnographic study was never undertaken.

E.4.2.6.2. Rejected Measures or Facilities and Explanations for Rejection

Bureau of Land Management comment letter, dated January 9, 2003

BLM7-4

> The BLM disagrees with the APE boundary stopping at the confluence of the Salmon and Snake Rivers. The Snake River is still free flowing from this point until about Asotin, Washington, at which point it would encounter the upper limits of the next reservoir. The river fluctuations created by the dam releases still impact cultural resources in this stretch of river and therefore, must be included in the APE. Stopping the APE is purely arbitrary and ignores the impacts to downstream cultural resources.

Response

The Applicant disagrees with the BLM. The determination of the APE was not purely arbitrary. The BLM had ample opportunity to provide input to its delineation and approved of the boundary in March 1998. During discussions in TRWG meetings held between July 9, 1996, and November 14, 1996, resource issues and problem statements were developed, culminating in the FCP distributed in January 1997. During that time period, cultural resources issues were included in TRWG discussions. The Applicant proposed to confine terrestrial resources studies, including cultural resource inventories, from Weiser, Idaho, to the confluence of the Snake and Salmon rivers. This study reach is described in more detail in the FCP (section V:2–3) and for each of the proposed studies. The BLM did not comment on the FCP. However, the Applicant received a document entitled "Identified BLM Issues for the Hells Canyon Complex of Dams FERC Relicensing" on December 20, 1999, more than two years after the FCP had been published. In this document, the BLM stated that the project area should extend from Weiser to Captain John

Creek, although the BLM had been involved in extensive discussions about study issues and development, including the extent of the study area, from June 10, 1997, through October 27 and 28. During the TRWG meeting of March 31, 1998, the decision was made by the TRWG that "expansion [of the study area] *was deemed unnecessary* [italics added], based on earlier TRWG recommendations for study area size"

Furthermore, prior to submittal of the BLM's "Identified BLM Issues for the Hells Canyon Complex of Dams FERC Relicensing" on December 20, 1999, the Applicant produced a second, revised set of detailed study plans, entitled *Terrestrial Final Study Plans*, made available between November 19, 1998, and March 2000. Thus, the BLM was fully aware of the extent of the study area for the proposed studies and did not object.

BLM7-6

> BLM questions whether or not all drawdown areas with potential for cultural resources were inventoried along Brownlee Reservoir and the Powder River arm of Brownlee Reservoir. Since drawdown inventories were conducted opportunistically, there may be areas exposed that have not been previously surveyed.

Response

1. The Applicant believes that the inventories conducted within the drawdown area of Brownlee Reservoir are adequate. The Applicant requests that the BLM provide precisely defined areas that it believes were not inventoried.

2. The BLM implies that the "opportunistic" nature of the inventory resulted in an incomplete inventory. This is incorrect. The survey was complete.

As the report states (Technical Report E.4-13: 27):

> ...[surveyed] areas were below reservoir pool high water on *accessible* [italics added] river terraces and bars which were not silt-covered. Transects were walked parallel to the river at 5-20 meter intervals. Transect lines were sometimes zigzagged to cover more ground and enhance chances of artifact discovery. Cutbanks, mouths of drainages, and low terraces were thoroughly examined where possible.

The *access* issue is described (Technical Report E.4-13: 33) as follows:

> Some areas on privately owned land were not accessible to the surveyors particularly in the area of Hibbard Creek, Fox Creek, and at the west end of the project along the Powder River where locked gates and warning signs barred entry.

The inventories were conducted "opportunistically" because rare, deep drawdowns during 1997 and 1999 presented the "opportunity" to examine large areas of Brownlee Reservoir not normally visible. For example, the 1997 drawdown exposed areas not seen for 40 years.

U.S. Forest Service comment letter, dated January 8, 2003
USFS1-35

> Mitigate for cultural resource sites impounded by the Hells Canyon Reservoir.

Response

The Applicant does not have an obligation to mitigate for cultural sites that may occur below the minimum pool of Hells Canyon Reservoir. Those obligations were addressed under the conditions of the original license for the project. Moreover, the baseline for relicensing measures.already includes any such alleged impacts. In determining what environmental measures are appropriate, FERC begins with an examination of the existing project and operations and its effect on the environment, as it exists at the time of relicensing. This establishes the environmental baseline. FERC does not attempt to recreate pre-project conditions or hypothesize an environmental baseline that assumes that the project does not exist nor attempt to determine what might have occurred had the project been configured, operated, or maintained differently under the prior license. In short, FERC does not attempt to determine what condition the resources would be in now if things had been done differently in the past. See City of Tacoma, 98 FERC ¶ 61,274(2002); *American Rivers v. FERC*, 201 F.3d 1186 (9th Cir. 1999); *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D.C. Cir. 2000).

USFS3-287

> …and conduct a monitoring program at Red Fish Cave to insure archaeological properties associated with the cave remain protected (cf. Section 110 of the NHPA).

Response

The Applicant disagrees that it should monitor Red Fish Cave. The site is outside the APE, and the USFS has failed to provide a correlation between project-related activities and any need for the Applicant to conduct monitoring at Red Fish Cave.

USFS3-291

> Listed below are five additional study requests needed to address heritage resource goals and objectives.
>
> 1. Understanding Accelerated Organic-Decay of Archaeological Resources Associated with Fluctuating Water Levels

Response

The Applicant believes the goal of this additional study request would be accomplished through the Applicant's proposed monitoring plan.

2. Streambank Stabilization Opportunities Within a Wild and Scenic River Corridor…Thus a study plan that addresses the feasibility of stream bank stabilization alternatives specific to the Wild and Scenic Snake River corridor, and relative to heritage resource preservation, needs developed…

Response

The Applicant believes that the requested study is a management function of the USFS and not the responsibility of the Applicant. It is the USFS's responsibility to determine the extent of constraints that may be imposed by the USFS on site stabilization activities in the Wild and Scenic Snake River corridor.

3. Reducing and/or Eliminating Recreation Impacts on Cultural Resources

Response

Implicit in this recommendation is the notion of "project-induced" recreation, which asserts that the existence of the HCC project causes additional recreational uses on USFS, BLM, or other agency lands that are either within or near the project area and that these uses would not occur except for the existence of the HCC. The agencies further assert that such uses have an impact on their operating and maintenance costs which should be borne by IPC. This assertion of IPC responsibility for "induced use" seems disingenuous, particularly in light of the purposes for which the USFS and BLM manage the federal lands around the HCC. All of the national federal lands in the vicinity of the HCC are managed by the USFS and BLM for multiple uses, including recreation.

Moreover, in 1975, Congress created the Hells Canyon National Recreation Area (HCNRA), setting aside more than 650,000 acres consisting of wilderness areas, wild and scenic river segments, and dispersed and developed recreational areas and forest management areas. While a primary purpose of the HCNRA Act (P.L. 94-199, 1975) was to preserve the lands and waters that the Act specifically set aside, it was also intended to enhance recreational opportunities and the public enjoyment of the area. So while the USFS generally manages national forest lands for recreational use, consistent with its multiple use philosophy, Congress in enacting P.L. 94-199 apparently envisioned that more recreational use would occur within the HCNRA than within forest lands generally reserved under the 1897 Organic Act (as supplemented by the 1960 Multiple Use Sustained Yield Act—MUSYA). In fact, the USFS encourages recreational use within the HCNRA through mediums such as a USFS website dedicated solely to the HCNRA (where the USFS emphasizes that the HCNRA provides "Exciting recreational opportunities. Diverse and abundant wildlife. Artifacts from prehistoric tribes and rustic remains of early miners and settlers - HCRNA truly offers something for everyone, and much to remember". See: <http://www.fs.fed.us/hellscanyon/overview>.) In short, it is not the HCC that draws recreational users to the area, but the unique attributes of the HCNRA.

Moreover, quantifying the respective use of USFS lands as compared to HCC recreational areas would be difficult and at most speculative. For example, how would one quantify the impacts to IPC's parks and roads by visitors whose sole purpose for visiting the area is to recreate within the HCNRA, USFS, BLM or state lands? What standard or mechanism would be used to determine whether visitors to the area result from the marketing efforts of the USFS, Bureau of Land Management (BLM), the states of Idaho and Oregon, or local counties, outfitters and guides, and other organizations? There is no doubt that the entire Hells Canyon area provides unique recreational opportunities and is a national as well as an Oregon and Idaho asset. As such, the various federal and states agencies and entities involved should provide funding to operate and manage their own lands.

4. Cultural Resource Survey on the Snake River Downstream From the Salmon River Confluence

Response

The Applicant disagrees with the USFS. The determination of the APE was not purely arbitrary. The USFS had ample opportunity to provide input to its delineation and approved of the boundary in March 1998. During discussions in TRWG meetings held between July 9, 1996, and November 14, 1996, resource issues and problem statements were developed, culminating in the

FCP distributed in January 1997. During that time period, cultural resources issues were included in TRWG discussions. The Applicant proposed to confine terrestrial resources studies from Weiser, Idaho, to the confluence of the Snake and Salmon rivers, including cultural resource inventories. This study reach is described in more detail in the FCP (section V:2–3) and for each of the proposed studies. The BLM had been involved in extensive discussions about study issues and development, including the extent of the study area, from June 10, 1997, through October 27 and 28. During the TRWG meeting of March 31, 1998, the decision was made by the TRWG that "expansion [of the study area] *was deemed unnecessary* [italics added], based on earlier TRWG recommendations for study area size."

5. Facilitate Completion of a Cultural Resource Management Plan for Areas Downstream of the Hells Canyon Dam

Response

The Applicant *has* completed a cultural resource management plan for the area downstream of Hells Canyon Dam. Sections 3.1.1.4.1., 3.1.2.4., 3.3.4., 4.4.2.1.5., and 4.4.2.1.6. of the HPMP specifically address the area below Hells Canyon Dam. Therefore, the draft CRMP distributed with the DLA (and rewritten as an HPMP in conformity with FERC guidelines and submitted as Technical Report E.4-15 with this final license application) meets the needs listed above.

Burns Paiute Tribe comment letter, dated January 8, 2003
BPT Land Acquisition

Acquire, enhance, and manage 15,000 acres of land to mitigate for impacts of continued dam operation. Goals are:

a. Reestablish, enhance, and preserve the traditional aquatic resources currently unavailable to the Burns people;

b. Reestablish, enhance, and preserve the traditional food, medicinal, and household material currently unavailable to the Burns people;

c. Reestablish, enhance, and preserve the traditional animal resources habitats currently unavailable to the Burns people;

d. Reestablish on the land and with new, revived resources continuous programs for the preservation and continuation of the traditional Burns Paiute culture.

BPT Education

Educate and train Tribal members to serve on the Tribal Ecosystem Interdisciplinary Team. Tribe requests Applicant funding in the following disciples:

a. Natural resources (incl. fisheries, biology, botany, chemistry, wildlife biology, etc.)

b. Social sciences (incl. anthropology archaeology, sociology, social services, etc.)

c. Economic development (incl. business administration, accounting, etc.)

d. Education (incl. teacher certification, administration of education, etc.)

BPT Cultural

Provide for the capture, documentation, and preservation of the knowledge, life skill, oral histories and tractions, archaeological sites, and archival research of the Burns People. Goals are:

a. Conduct oral histories with tribal elders, captured on multi-media;

b. Document Paiute language;

c. Locate and document archaeological sites

d. Conduct archival research

e. Create materials for the education of the public concerning the Burns Paiute people.

Response

The Applicant believes that under the Federal Power Act it is appropriate that land acquisitions for all PM&E purposes should be in the immediate vicinity of the HCC and directly related to impacts attributable to existing project operations. The cultural and education recommendations are currently being discussed with the Burns Paiute tribal staff, even though there remain substantial questions and doubts concerning the Burns Paiute Tribe's assertions regarding their alleged entitlements. IPC reserves fully its right to dispute the Burns Paiute Tribe's claims.

Confederated Tribes of the Umatilla Indian Reservation comment letter, dated January 10, 2003

CTU1-43

In the area below Hells Canyon Dam, the APE should be expanded to include-the Snake River from the mouth of the Salmon River to approximately Asotin, Washington. Because of the adverse effects that flows from the HCC are having on sites throughout the canyon, there is, no reason to assume that areas downstream from the mouth of the Salmon River are not also being affected. The potential for adverse effects from between Asotin and the Salmon River should be investigated.

Response

The Applicant disagrees with the CTUIR. The determination of the APE was not purely arbitrary. The tribe had ample opportunity to provide input to its delineation. During discussions in TRWG meetings held between July 9, 1996, and November 14, 1996, resource issues and problem statement were developed, culminating in the FCP distributed in January 1997. During that time period, cultural resources issues were included in TRWG discussions. The Applicant proposed to confine terrestrial resources studies, including cultural resource inventories, from Weiser, Idaho, to the confluence of the Snake and Salmon rivers. This study reach is described in more detail in the FCP (section V:2–3) and for each of the proposed studies. The CTUIR did not comment on the FCP. During the TRWG meeting of March 31, 1998, the decision was made by the TRWG that “expansion [of the study area] *was deemed unnecessary* [italics added], based on earlier TRWG recommendations for study area size.” The CTUIR had every opportunity to participate in these meetings, discussions, and comment periods and failed to do so.

CTU1-59

> The amount of stabilization funding the Applicant has suggested will not be adequate. Additional funds should be allocated for this purpose. The Applicant must fund this activity. Sites that may not be appropriate for stabilization should have other treatment options developed through consultation. These options could include off-site mitigation, data recovery, etc.

Response

The Applicant disagrees that the funding for site stabilization is inadequate. The cost estimate was based on an extrapolation of known and estimated costs of stabilizing archaeological sites on the Salmon River and at the Tin Shed site. The Applicant and professional agency archaeologists, hydrologists, and consulting engineers familiar with site stabilization derived these costs. Also factored in is an estimate of the Applicant’s maximum *potential* responsibility for erosion damage to archaeological sites below Hells Canyon Dam. The Applicant believes that mitigation costs, if required, should be directed to on-site cultural resources rather than off-site resources, which may or may not be relevant to project-related impacts. Further, the Applicant believes that *in-situ* preservation, where practical and possible, is preferable to data recovery and other destructive mitigation methods. The Applicant believes that the development of a comprehensive site stabilization plan for sites below the HCC is a management function of the USFS and not the responsibility of the Applicant. It is the responsibility of the USFS to determine the extent of constraints that may be imposed by the USFS on site stabilization activities in the Wild and Scenic Snake River corridor.

Nez Perce Tribe comment letter, dated January 10, 2003
NPT1-20

> It is anticipated that the amount of stabilization the Applicant has suggested will not be adequate. The Applicant should develop a more comprehensive site stabilization plan. Sites that may not be appropriate for stabilization should have other treatment options developed through consultation. These options could possibly include off-site mitigation, data recovery, etc.

Response

The Applicant disagrees that the funding for site stabilization is inadequate. The cost estimate was based on an extrapolation of known and estimated costs of stabilizing archaeological sites on the Salmon River and at the Tin Shed site. The Applicant and professional agency archaeologists, hydrologists, and consulting engineers familiar with site stabilization derived these costs. Also factored in is an estimate of the Applicant's maximum *potential* responsibility for erosion damage to archaeological sites below Hells Canyon Dam. The Applicant believes that mitigation costs, if required, should be directed to on-site cultural resources rather than off-site resources, which may or may not be relevant to project-related impacts. Further, the Applicant believes that *in-situ* preservation, where practical and possible, is preferable to data recovery and other destructive mitigation methods. The Applicant believes that the development of a comprehensive site stabilization plan for sites below the HCC is a management function of the USFS and not the responsibility of the Applicant. It is the responsibility of the USFS to determine the extent of constraints that may be imposed by the USFS on site stabilization activities in the Wild and Scenic Snake River corridor.

Shoshone-Paiute Tribes comment letter, dated January 9, 2003

SPT1-15

> Any additional research must include relevant publications and they must all be critically evaluated…

Response

The Applicant notes its reservations, expressed at further length in its responses to the comments submitted by the Tribes, concerning the Tribes' alleged legal off reservation treaty rights. That point aside, the Myers' study is complete. Myers reviewed approximately 700 bibliographic sources. He reviewed records at the National Archives and records in repositories and collections.

At the National Archives, Myers reviewed records of the Bureau of Indian Affairs, including but not limited to letters received by the Office of Indian Affairs from 1824 to 1881, Special Files of the Office of Indian Affairs (1827–1904), and Records of the Idaho, Oregon, and Washington Superintendents of Indian Affairs (1848–1874). Records relating to territories and military records were also reviewed. At the National Archives, Myers also reviewed the U.S. Congressional Serial Set, published in connection with nineteenth century survey expeditions to the western United States.

Myers reviewed homestead records at the BLM for surveys conducted from the 1870s through the 1930s.

In all, hundreds of rolls of microfilm were investigated. The complete list of these records is contained in Myers' report (Technical Report E.4-14: 215–222). The 222-page report contains information on history and ethnohistory, settlement systems, subsistence, and history. The report concludes with recommendations for gathering further information.

The Applicant welcomes specific information from the Shoshone-Paiute Tribes about areas of the report that could be improved. The Applicant would also like to receive any specific information that the Shoshone-Paiute Tribes would like to add to the documentation already provided in the report.

SPT1-17

> The Shoshone-Paiute Tribes should approve the individual who does the research. Further, the Shoshone-Paiute Tribes should be directly involved in the recording and dissemination of such information…

Response

This is an inappropriate request. The Applicant intends to engage the person best suited to accomplish the task at hand and intends as well to work cooperatively with the tribes. The law does not require tribal approval of those consultants that the Applicant engages.

SPT1-18

> Sociocultural, economic, and environmental baselines and methodologies need to be developed for the assessment of past, present, and future impacts…

Response

At relicensing, the Applicant is not required to mitigate for impacts that occurred during the original license term. The Applicant is required to describe existing conditions and provide an evaluation of proposed project operations, not an evaluation of impacts that were the result of construction and operation of the HCC under the original license. FERC has determined that, where project works already exist and are part of the existing environment, it is not reasonable to analyze the effects of relicensing using a pre-project environmental baseline.

SPT1-19

> Any analysis of the impact of the Project should also consider the Burns Paiute and the Confederated Tribes of the Umatilla Indian Reservation, each of whom was affected by the Project, not just the Shoshone-Bannock, Nez Perce, and Shoshone-Paiute.

Response

The legal record is clear that the Nez Perce Tribe had exclusive use and occupation in aboriginal times of almost the entire HCC area. Further, the Nez Perce Tribe's 1855 and 1863 Treaties with the United States preserve certain of the Tribe's off-reservation natural resource harvesting rights. No other tribe can point to entitlements of this legal stature. The allegations of competing tribes cannot erase these facts. IPC acknowledges, however, that the ethnographic literature suggests that other tribal groups had some form of presence in some parts of the HCC area, albeit of a type distinguishable from that of the Nez Perce. Accordingly, the impact analysis presented in Exhibit E.4. of the new license application *does* consider the Burns Paiute and Confederated Tribes of the Umatilla Indian Reservation. Impacts to all potentially interested tribes are considered in Exhibit E.4. by considering the impacts to the historic properties that potentially represent a tribe's cultural heritage. Also, the Applicant made a conscientious attempt to discover any traditional cultural properties, traditional cultural resources, or sacred sites that may be located in the APE by funding oral history studies with the Burns Paiute and Confederated Tribes of the Umatilla Indian Reservation, as well as with the Nez Perce. For more information about the extent of the Applicant's analysis of tribal impacts, see the Applicant's Response to Comment SPT1-11 in section VII of the Consultation Appendix. The Applicant emphasizes that its indulgence, for stewardship purposes, of attenuated tribal claims to interests affected by the HCC does not constitute a recognition of any legally enforceable entitlements.

E.4.3. Materials and Information on Survey and Salvage Activities

All materials and information regarding measures for locating, assessing, identifying, and salvaging cultural resources are included in section E.4.2.2., section E.4.2.3., and section E.4.2.4.

All materials and information regarding measures and facilities proposed by the Applicant are included in section E.4.2.5.

E.4.4. Consultation

For a summary of consultation efforts to date for the Hells Canyon Complex, see the Consultation Appendix.

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Table E.4-1 NWAA/IPC National Register evaluation of sites in the Brownlee drawdown zone[a]

Site Number	Component	NWAA/IPC Evaluation	Site Descriptions
10WN 451	Prehistoric	Potentially eligible	Field camp (lithic scatter)
IPC95-9	Prehistoric/ [Historic]	Potentially eligible	Complex camp (lithic scatter and historic bldg. remains)
IPCBD-97-02	Historic	Potentially eligible	Town/RR stop of Gypsum
IPCBD-97-03	Prehistoric/ [Historic]	Eligible	Complex camp (lithic scatter, historic road, railroad features)
IPCBD-97-04	Historic	Potentially eligible	Town/Prevost railroad stop
IPCBD-97-05	Prehistoric	Potentially eligible	Complex camp (lithic scatter)
IPCBD-97-07	Historic	Potentially eligible	Townsite of Mineral
IPCBD-97-09	Prehistoric	Eligible	Complex camp (lithic scatter and midden)
IPCBD-97-12	Prehistoric	Potentially eligible	Location (lithic scatter)
IPCBD-97-13	Prehistoric	Potentially eligible	Location (lithic scatter)
IPCBD-97-14	Prehistoric	Eligible	Complex camp (lithic scatter)
IPCBD-97-15	Prehistoric	Potentially eligible	Location (lithic scatter, quarry area)
IPCBD-97-16	Historic	Potentially eligible	Railroad camp: building foundation and dump
IPCBD-97-18	Prehistoric	Potentially eligible	Talus pit

a. Source: Tables 9 and 10 in confidential Technical Report E.4-3 ([Historic] added for clarity)

Table E.4-2 NWAA/IPC National Register evaluation of sites in the Brownlee margin zone[a]

Site Number	Component	NWAA/IPC Evaluation	Site Descriptions
10WN 452	Prehistoric	Potentially eligible	Complex camp
10WN 453	Prehistoric	Potentially eligible	Complex camp
35BA 801	Prehistoric	Eligible	Campsite
35BA 962	Prehistoric	Potentially eligible	Field camp (lithic scatter and shell midden)
IPCBD-00-36	Prehistoric/ [Historic]	Potentially eligible	Complex camp (lithic scatter and historic isolate)
IPCBD-00-37	Prehistoric	Potentially eligible	Complex camp
IPCBD-00-39	Historic	Potentially eligible	Field camp (lithic scatter)
IPCBD-00-41	Prehistoric	Potentially eligible	Field camp
IPCBD-00-42	Prehistoric	Potentially eligible	Field camp
IPCBD-00-43	Prehistoric	Eligible	Field camp
IPCBD-00-48	Prehistoric	Potentially eligible	Complex camp
IPCBD-00-49	Prehistoric	Eligible	Historic cemetery/Hibbard Creek Pioneer Cemetery
IPCBD-00-52	Prehistoric/ [Historic]	Potentially eligible	Complex camp and historic foundation
IPCBD-00-53	Prehistoric	Potentially eligible	Complex camp (lithic scatter)
IPCBD-00-54	Prehistoric	Potentially eligible	Complex camp
IPCBD-00-55	Prehistoric	Potentially eligible	Complex camp
IPCBD-00-56	Prehistoric	Potentially eligible	Complex camp
IPCBD-00-57	Prehistoric/ [Historic]	Potentially eligible	Complex camp (historic scatter and foundations)
IPCBD-00-58	Prehistoric	Potentially eligible	Field camp
IPCBD-00-61	Prehistoric	Potentially eligible	Field camp (lithic scatter, midden)
IPCBD-00-63	Prehistoric/ [Historic]	Potentially eligible	Complex camp and historic rock alignment
IPCBD-00-64	Prehistoric	Eligible	Complex camp

Table E.4-2 NWAA/IPC National Register evaluation of sites in the Brownlee margin zone[a]

Site Number	Component	NWAA/IPC Evaluation	Site Descriptions
IPCBD-00-66	Prehistoric	Potentially eligible	Field camp (lithic scatter)
IPCBD-00-68	Prehistoric/ [Historic]	Potentially eligible	Location (lithic scatter) and (historic scatter, structure remains)
IPCBD-00-70	Prehistoric	Potentially eligible	Location (lithic scatter)
IPCBD-00-71	Prehistoric/ [Historic]	Potentially eligible	Field camp (lithic scatter and historic debris)
IPCBD-00-72	Prehistoric	Potentially eligible	Location (lithic scatter)
IPCBD-00-74	Historic	Potentially eligible	Historic cabin
IPCBD-00-75	Historic	Potentially eligible	Historic/Road Canyon/Goodell Road
IPCBD-00-80	Historic	Potentially eligible	Connor Creek Ditch

a. Source: Tables 9 and 10 in confidential Technical Report E.4-3 ([Historic] added for clarity)

Table E.4-3 SAIC archaeologists' National Register evaluation of archaeological sites—Oxbow Reservoir archaeological inventory[a]

Resource #	Intensity	Diversity	Diagnostic Projectile, Point, or Other Dateable Material	Buried Deposits	Faunal Remains	Site Patterning or Feature	Integrity	Data Potential Rating	Eligibility Assessment
BLM—Oregon									
HC-17/ 35BA 894	Low	Low					Poor	0	Not eligible
BLM—Idaho									
HC-19[b]	Low	Low		Potentially present			Fair	1	Potentially eligible
Private—Idaho									
HC-23	Low	Low		Potentially present			Good	1	Potentially eligible
10AM 448	High	Moderate	Present	Present	Present	Potentially present	Good	4	Eligible
HC-15[b]	High	Moderate	Present	Potentially present		Present	Fair	3	Potentially eligible
HC-12	High	Low					Good	0	Potentially eligible

a. Source: Table 6-1 in confidential Technical Report E.4-2. 1. Intensity: high = 100 or more artifacts, including pieces of debitage; low = less than 100. 2. Diversity: moderate = 2 or more activities represented by site assemblage; low = 1 activity. 3. Data potential rating = number of data requirements met (Present) or potentially met (Potentially present). 4. Agencies and SHPOs have not concurred with these evaluations.

b. HC-15 and HC-19 have both Native American and historic components

Table E.4-4 Applicant's evaluation of National Register eligibility of Oxbow Reservoir archaeological sites

Site Number	SAIC Archaeologist's Evaluation	Applicant's Evaluation	Site to be Treated As
10AM 448	Eligible	Eligible	Eligible
HC-12	Potentially eligible	Eligible	Eligible
HC-15	Potentially eligible	Potentially eligible	Eligible
HC-17/35BA 894	Not eligible	Not eligible	Not eligible
HC-19	Potentially eligible	Potentially eligible	Eligible
HC-23	Potentially eligible	Potentially eligible	Eligible

Table E.4-5 SAIC archaeologists' National Register eligibility evaluation for archaeological sites—Hells Canyon archaeological inventory[a]

Resource #	Intensity	Diversity	Diagnostic Projectile, Point, or Other Dateable Material	Buried Deposits	Faunal Remains	Site Patterning or Feature	Integrity	Data Potential Rating	Eligibility Assessment
USFS—Whitman NF									
35WA 882	Low	Moderate		Potentially present	Potentially present		Fair	2	Potentially eligible
35WA 881	Low	Low	Potentially present			Present	Good	2	Eligible
USFS—Wallowa NF									
35WA 880	Low	Low	Potentially present			Present	Excellent	2	Eligible
Private—Idaho									
HC9/ 10AM 72	Low	Low		Potentially present			Good	1	Eligible
HC24/ 10AM 72	Low	Moderate	Present	Potentially present		Potentially present	Fair	3	Potentially eligible
Private—Oregon									
ORBA29[b]							Fair		Eligible
ORBA30[b]							Good		Eligible
35BA 1010	Low	Moderate		Potentially present			Fair	1	Potentially eligible
35BA 1009	Low	Low		Potentially present			Fair	1	Potentially eligible

a. Source: Table 6-1 of confidential Technical Report E.4-2. 1. Intensity: high = 100 or more artifacts, including pieces of debitage; low = less than 100. 2. Diversity: moderate = 2 or more activities represented by site assemblage; low = 1 activity. 3. Data potential rating = number of data requirements met (present) or potentially met (potentially present). This information applies to sites indicated, except for ORBA29 and ORBA30, which are historic sites.

b. Source: Table 6-2 of confidential Technical Report E.4-2.

Table E.4-6 Applicant's evaluation of National Register eligibility of Hells Canyon Reservoir archaeological sites

Site Number	SAIC Archaeologists' Evaluation	Applicant's Evaluation	Site to be Treated As
35WA 880	Eligible	Eligible	Eligible
35WA 881	Eligible	Eligible	Eligible
ORBA29	Eligible	Eligible	Eligible
ORBA30	Eligible	Eligible	Eligible
HC-9/10AM 72	Eligible	Eligible	Eligible
35WA 882	Potentially eligible	Potentially eligible	Eligible
35BA 1009	Potentially eligible	Potentially eligible	Eligible
35BA 1010	Potentially eligible	Potentially eligible	Eligible
HC-24/10AM 72	Potentially eligible	Potentially eligible	Eligible

Table E.4-7 Properties at Brownlee Dam[a]

Property Type	Total Number of Properties	Contributing to the Historic District	Not Contributing to the Historic District
Brownlee Dam Village			
Operators' cottages with storage sheds	13	0	0
Chlorination pumphouse	1	0	0
Chlorination structure	1	0	0
Brownlee Dam Station Yard			
Warehouse/carpenter shop	1	0	0
Carpenter shop	1	0	0
Switching house	1	0	0
Brownlee dam and powerhouse	1	0	0
Old Brownlee Trailer Court			
Mobile homes	6	0	0
Cable TV system building	1	0	0
Cottage	1	0	0
Barn	1	0	
McCormick Park			
Bathroom and 2 storage sheds	1	0	0
Woodhead Park			
Pumphouse	1	0	0
Maintenance building	1	0	
House	1	0	0
Restrooms	4	0	0
Comfort stations	2	0	0

a. Source: Technical Report E.4-14

Table E.4-8 Structures at Oxbow Dam[a]

Property Type	Total Number of Structures	Contributing to the Historic District	Not Contributing to the Historic District
Oxbow Dam Village			
Tool house with separate garage	1	1	
Operators' cottages with storage sheds[b]	19	16	3
Guest house and storage shed	1	1	
House	1		1
Unassociated storage sheds or storage buildings	2		2
Post office	1	1	
School buildings	2	2	
Motel/bunkhouse	1		1
Pumphouse	1		1
Oxbow Trailer Park/Copperfield Park			
Restroom/shower facility/storage room	1		1
Dining hall/mess	1	1	
Oxbow Fish Hatchery			
Garage	1		1
Fish hatchery	1	1	
Oxbow Maintenance and Powerhouse Areas			
Administration	1	1	
Equipment garage	1		1
Sand storage building	1		1
Storage shed	1		1
Irrigation pumphouse	1		1
Operators' cottages	2	2	
Oxbow Dam Area			

Table E.4-8 Structures at Oxbow Dam[a]

Property Type	Total Number of Structures	Contributing to the Historic District	Not Contributing to the Historic District
Oxbow Dam	1	1	
Oxbow pumphouse	1	1	
Oxbow Reservoir Boat Launches			
Restrooms	2		2

a. Source: Technical Report E.4-14

b. All but two cottages have storage sheds

Table E.4-9 Properties at Hells Canyon Dam[a]

Property Type	Total Number of Structures	Contributing to the Historic District	Not Contributing to the Historic District
Hells Canyon Dam			
Hells Canyon Dam and powerhouse	1	1	
Vista House	1	1[b]	
Restrooms	2	1	1
Hells Canyon Reservoir			
Outhouse	1		1
Hells Canyon Park			
Caretaker’s residence, two storage sheds	1	1	
Restroom building	1		1

a. Source: Technical Report E.4-14.

b. The Applicant disagrees with this evaluation.

Table E.4-10 Impacts to National Register-eligible archaeological sites on Oxbow Reservoir

Resource #	Roads	Artificial Fill/Earth-Moving	Recreation/ Access	Rock Fall/ Erosion/ Structural Decay	Vandalism	Pool Fluctuations/ Cutbank Erosion	Grazing	Magnitude of Impact Score	Preliminary Eligibility Assessment
BLM–Idaho									
HC-19						5	1	Moderate (6)	Potentially eligible
Private–Idaho									
HC-23							3	Moderate (3)	Potentially eligible
10AM 448	1		3		1	5	1	High (11)	Eligible
HC-15			3	3	3	3		High (12)	Potentially eligible
HC-12				1				Low (1)	Potentially eligible

Table E.4-11 Impacts to National Register-eligible sites on Hells Canyon Reservoir

Resource #	Roads	Artificial Fill/Earth-Moving	Recreation/ Access	Rockfall/ Erosion/ Structural Decay	Vandalism	Pool Fluctuations/ Cutbank Erosion	Grazing	Magnitude of Impact Score[a]	Preliminary Eligibility Assessment
BLM–Oregon									
USFS–Whitman NF									
35WA882		3	3	1	1			High (8)	Potentially eligible
35WA881								Low (2)	Eligible
USFS–Wallowa NF									
35WA880				1				Low (1)	Eligible
Private–Idaho									
HC9/ 10AM72	3			3				Moderate (6)	Eligible
HC24/10AM 72		5	5					High (10)	Potentially eligible
Private–Oregon									
ORBA29			3	3				Moderate (6)	Eligible
ORBA30	1	1	3	3	3			High (11)	Eligible
35BA1010	3		3	3				High (9)	Potential eligible
35BA1009	0	0	1	0	1	3	0	Moderate (5)	Potential eligible

a. 1. Magnitude of impact score: 1–2 = low; 3–6 = moderate; over 6 = high. 2. Agencies and SHPOs have not concurred with these evaluations. 3. HC-9/10AM 72 has both Native American and historic components.

Table E.4-12 Impact categories and frequency of incidences below Hells Canyon Dam by research team

Applied Paleoscience				Rain Shadow Research	
Impact Category Frequency Specific Impact		**Impact Category Frequency Specific Impact**		**Specific Impact Frequency**	
Flow		**Wildlife**		River Erosion	165
River flows present	31	Wallows	0	Non-river erosion	89
Natural processes		Licks	0	Recreational Use	209
Wind deflation/abrasion	7	Foraging (bear)	3	Vandalism	71
Stream erosion	4	**Mining**		Agricultural Use	16
Slope erosion/deflation	27	Placer mining	10	Grazing	28
Cave-in	3	Hard rock mining	0	Mining	43
Lichen	2	Construction	2	Fire	59
Exfoliation	7	**Agricultural**		Bioturbation	27
Water/mineral deposits	6	Grazing	11	Structural Decay	24
Fire	1	Fencing	3	Recreational Vehicle	3
Recreation		Road building	5	Development	10
Latrines	8	Field clearing (historic)	3	Road	5
Trails/roads	22	Salt licks	1	Rock art impacts	125
Campgrounds	27	**Pre-NRA management**		Shovel Tests	10
"Appreciation"	6	Channel modification	0	Archaeological Excavation	5
Horses	2	Bulldozing	3	**No impact**	
FS facilities	2	Reservoir-recreational development	1		
Religious practices	0	Dam exploration	2		
Looting recent	12	**NRA management**			
Looting previous record	40	Cleanup	1		
Casual collection	14	Structure modification	4		
Rock art defacement	1	Campground, road, landing construction	7		
Littering	4	Road/landing construction	0		
Rock art "enhancement"	2	Archaeological excavation	1		

Table E.4-13 Reassignment of impact categories below Hells Canyon Dam for comparison between research teams[a]

Original Applied Paleoscience Categories	Reassigned Category	Original Rain Shadow Research Categories
River flows present (ER)	River flows present (ER)	No comparable category
Stream erosion	River erosion (ER)	River erosion
Wind deflation/abrasion, slope erosion/ deflation, cave-in, lichen, exfoliation, water/mineral deposits	Nonriver erosion (ER)	Nonriver erosion, structural decay
"Appreciation," horses, littering, casual collection, use of Forest Service facilities, trails/roads	Recreational use (RC)	Recreational use, recreation vehicle
Looting (recent), looting (previous record)	Vandalism (VA)	Vandalism
Fencing, field clearing (historic), salt licks	Agricultural use (AG)	Agricultural use
Grazing	Grazing (GR)	Grazing
Placer mining, construction	Mining (MN)	Mining
Fire	Fire	Fire
Foraging (bear)	Bioturbation (RO)	Bioturbation
Latrines, campgrounds, bulldozing, reservoir-recreation development, dam exploration, cleanup, structure modification, campground, road, or landing construction	Development (PR)	Development
Road building	Road (RD)	Road
Rock art defacement and rock art "enhancement"	Rock art impacts	Rock art impacts
Archaeological excavation	Shovel test/ excavation (RE)	Shovel tests, archaeological excavation
Religious practices, wallows, licks, hard rock mining, channel modification, road/ landing construction	(not applicable; no examples)	No comparable categories

a. (ER), (RC), etc. are the IMACS codes for comparable impacts. IMACS does not distinguish riverine from nonriver erosion.

Table E.4-14 Impact levels for "River flows present" category observed by Applied Paleoscience

Impact Rank	Description	Number of Sites
1	Minor impact but not yet threatening to diminish the integrity or information value of a site	8
2	Moderate impact beginning to diminish site integrity	6
3	High-site or at least one major feature faces imminent destruction	12
4	The site has been destroyed—artifacts have been repositioned; site has lost its integrity	5

Table E.4-15 Levels of selected impacts recorded by AP

Specific Impact	Level 1 (# of Cases)	Level 2 (# of Cases)	Level 3 (# of Cases)	Level 4 (# of Cases)	Totals
River present	8	6	12	5	31
Slope erosion/ deflation	15	7	3	2	27
Trail/roads	21	1	0	0	22
Campgrounds	22	4	1	0	27
Pre-HCNRA looting	10	13	17	0	40
Placer mining	2	0	7	1	10
Grazing	5	6	0	0	11
Totals	83	37	40	8	168

Table E.4-16 Archaeological features exposed at various simulated flows

Simulated Flow (cfs)	Number of Sites Intersected by the River	Number of Features by the River
9,500–30,000	208	583
30,00–50,000	267	930
50,000–75,000	309	1,338
75,000–100,000	339	1,636

Table E.4-17 Frequencies for erosion severity and overall site condition based on Rain Shadow Research data[a]

Site Condition Scores	Unknown (1)	Inundated (2)	Poor (3)	Fair (4)	Good (5)	Excellent (6)	Totals
Minor erosion (1)	0	0	0	4	11	2	17
Moderate erosion (2)	0	0	0	7	24	1	32
Major erosion (3)	1	0	2	20	68	6	97
Erosion has destroyed site integrity (4)	0	0	6	9	4	0	19
Totals	1	0	8	40	107	9	165

a. Source: Technical Report E.4-1

Table E.4-18 High flows measured at the Weiser gauge, 1982–1983

Date	Average Daily Flow
1982	
2/17/1982	67,800
2/18/1982	61,300
2/22/1982	64,400
2/23/1982	65,100
Minimum flow	61,300
Maximum flow	67,800
1983	
3/14/1983	60,100
5/7/1983	61,900
5/8/1983	62,300
5/9/1983	61,800
5/10/1983	60,600
Minimum flow	60,100
Maximum flow	62,300

Table E.4-19 Historic high flows entering the Hells Canyon area, measured at the Weiser gauge: daily mean flows > 60,000 cfs

Year	Flow Range (Daily Means)	Number of Days
1911	60,900–67,200	16
1912	60,500–73,800	15
1913	60,200–66,500	8
1917	60,800–70,400	27
1918	60,800–62,400	3
1921	60,800–83,100	32
1922	62,400–83,100	6
1925	63,100	1
1928	60,700–62,300	4
1938	62,300–67,200	6
1943	61,100–68,900	16
1952	60,200–83,800	35
1957	62,200–65,600	6
1964	67,600–69,600	2
1965	61,000	1
1971	60,100–62,500	6
1972	60,400–62,500	3
1982	61,300–67,800	4
1983	60,100–62,300	5
1984	60,600–78,700	32
1986	60,300–78,100	18
1997	60,400–82,000	5
1998	60,300–77,700	10
Total days with flows > 60,000 cfs		261

Figure E.4-1 Stabilizing the Two Girls site (10AM448)

Figure E.4-2 The Two Girls site (10AM448) after stabilization

Figure E.4-3 Effects of siltation on historical and archaeological sites on Brownlee Reservoir

Figure E.4-4 Bank undercut on a site in the drawdown zone of Brownlee Reservoir

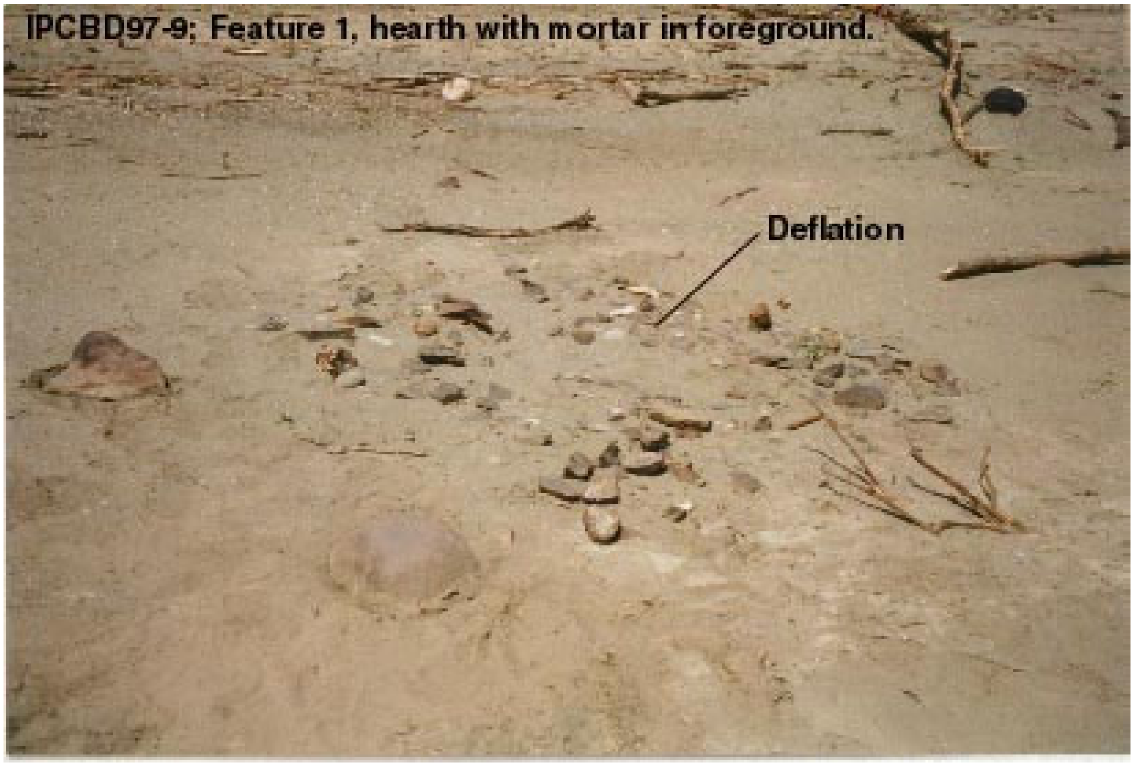

Figure E.4-5 Effects of deflation on a site within the drawdown zone of Brownlee Reservoir

Figure E.4-6 Effects of off-road vehicle use on historical and archaeological sites on Brownlee Reservoir

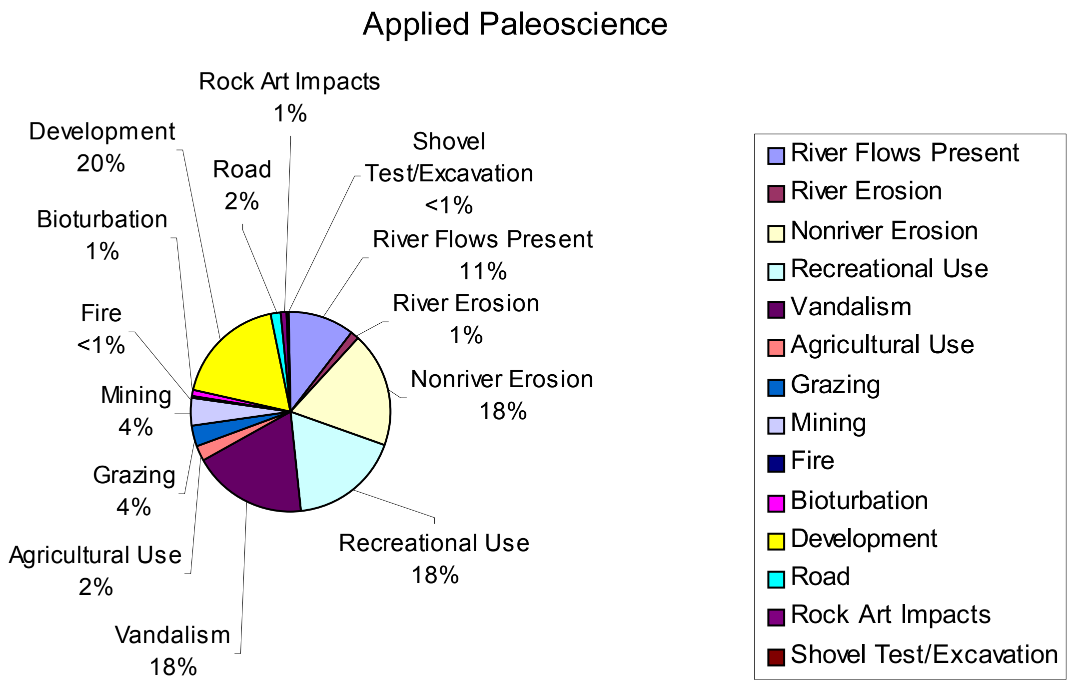

Figure E.4-7 Percentage of incidence of different impact types recorded by Applied Paleoscience for the downstream areas (sum >100% due to rounding)

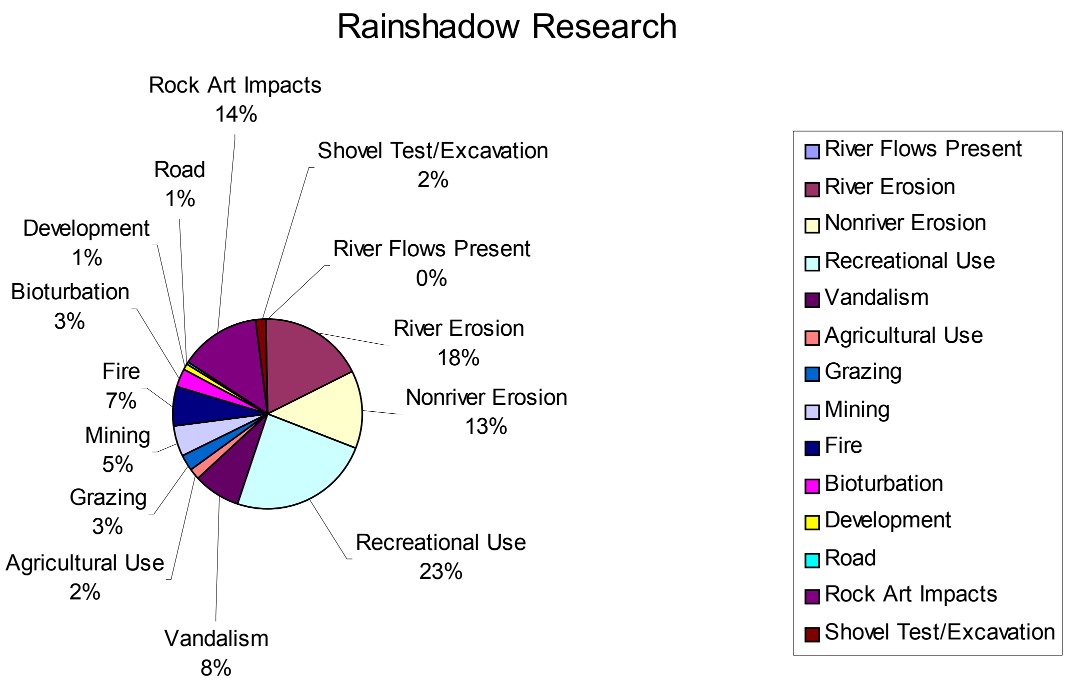

Figure E.4-8 Percentage of incidence of different impact types recorded by Rain Shadow Research for the downstream areas

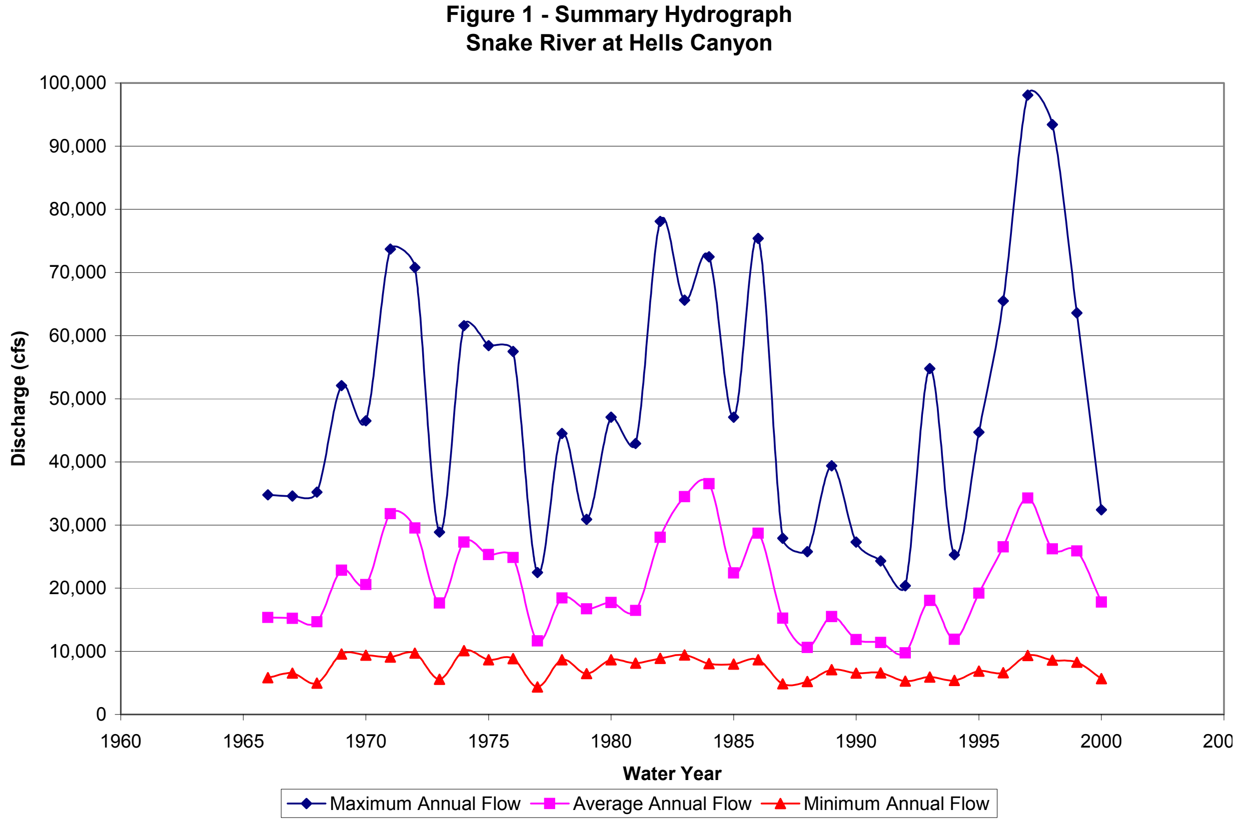

Figure E.4-9 Summary hydrograph for Snake River

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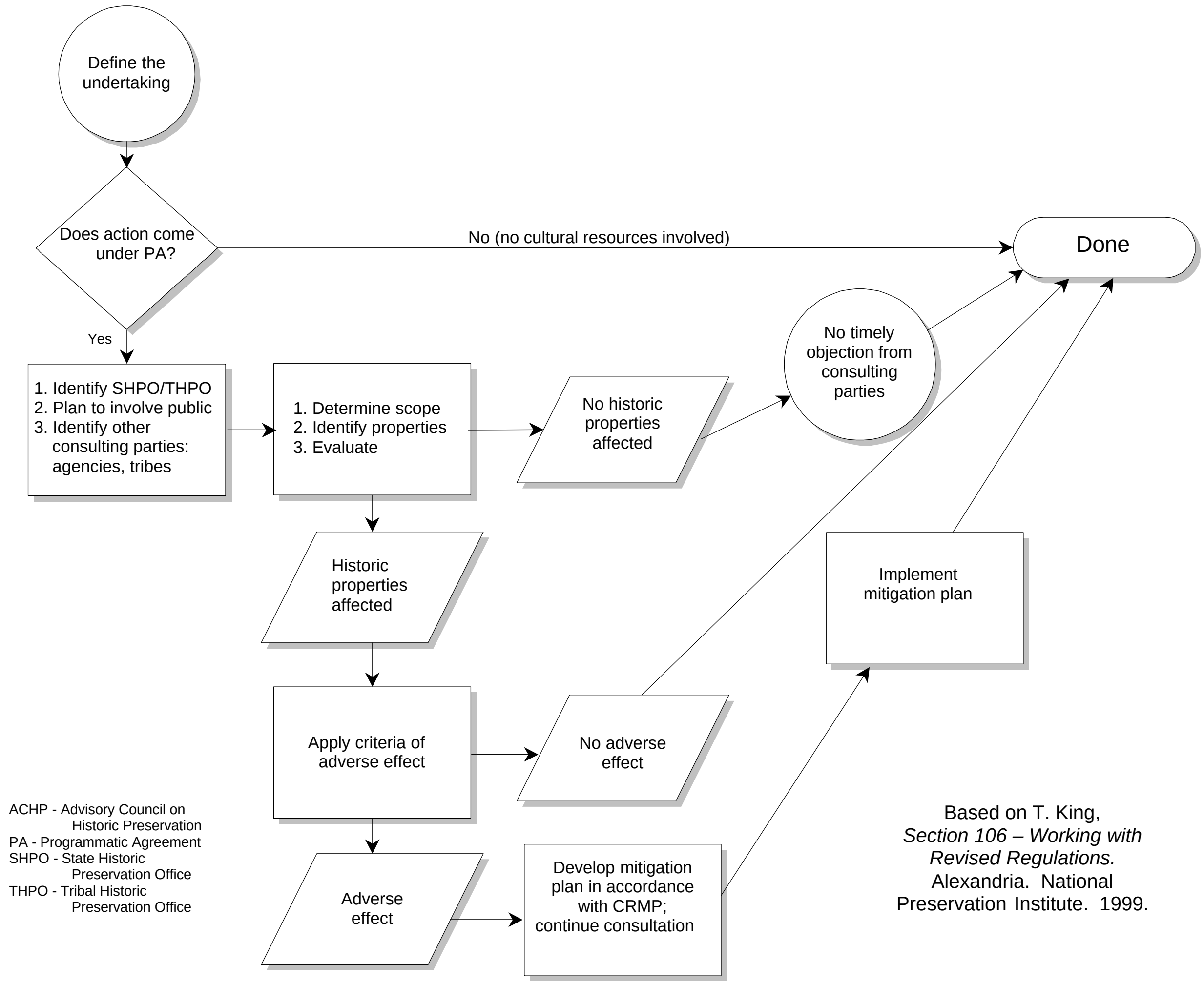

Figure E.4-10 Consultation process under the *Historic Properties Management Plan*[17]

17. In this diagram, CRMP refers to the Cultural Resources Management Plan, which later became the Historic Properties Management Plan (HPMP). As mentioned earlier, this plan was called the CRMP in the draft license application, but its contents and title were later changed to conform to FERC/Advisory Council on Historic Preservation guidelines released after the CRMP was written.

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Appendix E.4-A Excerpt of National Register evaluation recommendations for Native American prehistoric sites in the Brownlee Reservoir drawdown zone and margins (Table 9 in confidential Technical Report E.4-3)

Table 9. Evaluation Recommendations for Prehistoric Sites Recorded.

FIELD NUMBER	SITE TYPE	RESEARCH DOMAINS							NRHP ELIGIBILITY
		Chron-ology	Paleo-environment	Techno-logical	Sub-sistence	Settlement	Buried Deposits	Integrity	
10-WN-451	Field camp	+		+	+	+	+	?	PE
10-WN-452*	Complex camp	+			+	+	+?	?	PE
10-WN-453	Complex camp	+	+		+		+?	?	PE
10-WN-454	Field camp	+					+?	?	NE
10-WN-455	Location	+					?	-	NE
10-WN-470	Location						-	-	NE
35-BA-801	Complex camp	+	+	+	+	+	+	+	E
35-BA-962*	field camp			+	+		+	+	PE
IPC95-9	Complex camp	+		+		+	+	?	PE
IPCBD-97-03	Complex camp	+	+	+	+	+	+	+	E
IPCBD-97-05	Field camp			+		+	+?	?	PE
IPCBD-97-09	Complex camp	+	+	+	+	+	+	+	E
IPCBD-97-12	Location	+?		+			+?	?	PE
IPCBD-97-13	Location	+					+?	?	PE
IPCBD-97-14	Complex camp	+	+	+	+	+	+	+	E
IPCBD-97-15	Location	+		+	+	+	?	?	PE
IPCBD-97-18	Talus pit						?	?	PE
IPCBD-00-34	Location						-	-	NE
IPCBD-00-36	Field camp	+?				+	+?	?	PE
IPCBD-00-37	Base	+	+	+?		+	?	?	PE
IPCBD-00-39	Field camp	+			+	+	+?	?	PE
IPCBD-00-40	Location						-	-	NE
IPCBD-00-41	Field camp			+?		+	?	?	PE
IPCBD-00-42	Field camp	+	+	+		+	+	?	PE
IPCBD-00-43	Field camp	+	+			+	+	+	E
IPCBD-00-44	Location						-	-	NE
IPCBD-00-45	Field camp						-	-	NE
IPCBD-00-46	Location						-	-	NE
IPCBD-00-48	Complex camp	+	+	+		+	+?	?	PE
IPCBD-00-52	Complex camp	+	+			+	+?	?	PE
IPCBD-00-53	Base camp	+	+	+?	+	+	+?	?	PE
IPCBD-00-54	Complex camp				+	+	+?	?	PE
IPCBD-00-55	Complex camp				+	+	+	?	PE
IPCBD-00-56	Complex camp	+	+	+?		+	?	?	PE
IPCBD-00-57	Complex camp	+	+			+	?	?	PE
IPCBD-00-58	Field camp					+	+	?	PE
IPCBD-00-61	Field camp	+	+				+?	?	PE
IPCBD-00-62	Location	+					-	-	NE
IPCBD-00-63	Complex camp	+	+	+			+?	?	PE
IPCBD-00-64	Complex camp	+	+		+	+	+	?	E
IPCBD-00-66	Field camp	+	+				+?	?	PE
IPCBD-00-68	Location						?	?	PE
IPCBD-00-70	Location						?	?	PE
IPCBD-00-71	Field camp	+		+			?	?	PE
IPCBD-00-72	Location	+					?	?	PE
IPCBD-00-82	Location					+	-	-	NE

E: Eligible; NE: Not eligible; PE: Potentially eligible

*Sites not re-located by survey, included on the basis of earlier assessment

Appendix E.4-B Excerpt of National Register evaluation recommendations for Euro-Asian historic sites in the Brownlee Reservoir drawdown zone and margins (Table 10 in confidential Technical Report E.4-3)

Table 10. Evaluation Recommendations for Historic Sites Recorded.

SITE NO.	DESCRIPTION	INTEGRITY	CRITERIA a	b	c	d	NRHP ELIGIBILITY
IPCBD-97-01	Mining complex, prehistoric isolate	-	-	-	-	-	NE
IPCBD-97-02	Townsite of Gypsum, railroad structure remains	?	-	-	-	?	PE
IPCBD-97-03	Historic glass scatter and lithic scatter	-	-	-	-	-	NE
IPCBD-97-04	Townsite of Prevost, railroad structure remains	?	-	-	-	?	PE
IPCBD-97-06	Structure remains, debris scatter	-	-	-	-	-	NE
IPCBD-97-07	Townsite of Mineral	?	-	-	-	?	PE
IPCBD-97-08	Powerline	-	-	-	-	-	NE
IPCBD-97-10	Townsite/railroad stop of Home	-	-	-	-	-	NE
IPCBD-97-11	Structure	-	-	-	-	-	NE
IPCBD-97-16	Foundation & dump	?	-	-	-	?	PE
IPCBD-97-17	Huntington to Homestead Railroad	-	-	-	-	-	NE
IPCBD-97-19	Snake River Road	-	-	-	-	-	NE
IPCBD-97-20	Oregon Shortline Railroad	-	-	-	-	-	NE
IPCBD-97-21	Barge construction site	-	-	-	-	-	NE
IPCBD-97-23	Isolate – historic ceramic	-	-	-	-	-	NE
IPCBD-97-29	Isolate – machinery	-	-	-	-	-	NE
IPCBD-00-36	Historic isolate within a lithic scatter	-	-	-	-	-	NE
IPCBD-00-38	Olds Ferry railroad station	-	-	-	-	-	NE
IPCBD-00-49	Hibbard Creek Pioneer Cemetery	+	+	-	-	-	E
IPCBD-00-50	Hibbard Creek School	-	-	-	-	-	NE
IPCBD-00-51	Foundations	-	-	-	-	-	NE
IPCBD-00-52	Foundation and prehistoric complex camp	-	-	-	-	-	NE
IPCBD-00-57	Historic scatter, foundations, and prehistoric complex camp	-	-	-	-	-	NE
IPCBD-00-63	Historic rock alignment and prehistoric complex camp	-	-	-	-	-	NE
IPCBD-00-68	Historic scatter, structure remains, and lithic scatter	?	-	-	-	?	PE
IPCBD-00-71	Historic debris and lithic scatter	-	-	-	-	-	NE
IPCBD-00-73	Timber Canyon Road	-	-	-	-	-	NE
IPCBD-00-74	Cabin	?	?	-	-	-	PE
IPCBD-00-75	Canyon/Goodell Road	?	?	-	-	-	PE
IPCBD-00-77	Mining complex	-	-	-	-	-	NE
IPCBD-00-78	Mining complex	-	-	-	-	-	NE
IPCBD-00-79	Road	-	-	-	-	-	NE
IPCBD-00-80	Connor Creek ditch	?	?	-	-	-	PE
IPCBD-00-82	Mine and lithic scatter	-	-	-	-	-	NE

Appendix E.4-C Summary of components recorded by Rain Shadow Research that are contributory or noncontributory to the Hells Canyon archaeological district (C = contributory; N = noncontributory; U = unevaluated)

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0001		N	214	O	C	--	--	--	--	--
RR0002		N	213	O	C	--	--	--	--	--
RR0003		N	213	O	C	--	--	--	--	--
RR0004		N	213	O	C	--	--	--	N	--
RR0005		N	213	O	C	--	C	--	--	--
RR0006		N	213	O	C	--	--	--	--	--
RR0007	10IH709	U	217	I	C	C	C	--	--	--
RR0008		N	218	I	C	C	--	--	--	--
RR0009		N	218	I	U	--	C	--	--	--
RR0010		U	218/219	I	C	C	C	--	--	--
RR0011	10IH1014	U	219	I	N	--	C	--	--	--
RR0012	10IH2084	U	219	I	--	--	C	C	--	--
RR0013	10IH2085	U	219	I	C	--	--	--	--	--
RR0014	10IH1896	U	215	I	C	C	--	--	--	--
RR0015	10IH717	U	216	I	C	N	--	--	--	--
RR0016	10IH1087	U	216	I	--	C	--	--	--	--
RR0017	10IH1017	U	216	I	C	--	--	--	--	--
RR0018		N	216	I	C	--	--	--	--	--
RR0019		N	221	I	C	N	--	--	--	--
RR0020		N	221	I	--	--	C	--	--	--
RR0021		N	222	I	C	--	--	--	--	--
RR0022	10IH636	U	222	I	C	--	--	--	--	--
RR0023		N	220	O	--	--	C	--	--	--
RR0024		N	222	I	--	--	C	--	--	--
RR0025		N	222	I	--	--	C	--	--	--
RR0026	10IH697	U	223/224	I	--	C	C	--	--	--
RR0027	10IH744	U	224	I	C	--	--	--	--	N
RR0028	10IH692	U	225	I	--	C	C	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0029		N	225	I	C	--	--	--	--	--
RR0030	10IH691	U	225	I	C	--	C	--	--	C
RR0031		N	226	I	--	--	C	--	--	--
RR0032		N	216	I	C	--	--	--	--	--
RR0034	10IH699	U	220	I	C	C	C	--	--	C
RR0035		N	220	I	C	--	--	--	--	--
RR0035		N	220	I	C	--	--	--	--	--
RR0037	10IH690	U	226	I	C	--	--	--	--	--
RR0038		N	226	I	C	--	--	--	--	--
RR0039	10IH1018	U	216	I	N	--	--	--	--	--
RR0040	10IH2087	U	220	I	U	--	--	--	--	--
RR0041	35WA286	U	209	O	C	C	--	--	--	--
RR0042		N	209	O	C	--	--	--	--	C
RR0043		U	209	O	--	C	--	--	--	--
RR0044		N	209	O	C	--	--	--	--	--
RR0045		U	209	O	C	--	C	--	--	C
RR0046	35WA288	U	209	O	C	--	--	--	--	--
RR0047		N	209	O	--	--	--	--	--	N
RR0048		N	209	O	C	N	C	--	--	--
RR0050		U	208	O	C	--	C	--	--	--
RR0051	35WA290	U	208	O	N	--	--	--	--	--
RR0052	35WA291	U	208	O	N	--	--	--	--	--
RR0053	35WA69	U	208	O	C	--	--	--	--	--
RR0054	35WA65	U	209/210	O	C	C	C	--	--	--
RR0055		U	210	O	C	--	C	--	--	C
RR0056		N	210	O	N	C	--	--	--	--
RR0057		N	211	O	C	--	--	--	--	--
RR0058		N	211	O	C	--	--	--	--	--
RR0059	35WA283	N	212	O	C	--	--	--	--	--
RR0060		N	211	O	C	--	--	--	--	--
RR0061		N	211	O	C	C	C	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0062		N	211	O	C	--	--	--	--	--
RR0063		U	212	O	C	C	C	--	--	N
RR0064		N	212	O	C	--	--	--	--	--
RR0065		N	212	O	C	--	--	--	--	N
RR0066		N	212	O	C	--	--	--	--	N
RR0067		N	207	O	C	--	C	--	--	--
RR0068		N	207	O	C	--	--	--	--	--
RR0069	35WA294	U	207	O	C	--	--	--	--	--
RR0070		N	207	O	C	--	C	--	--	N
RR0071		N	207	O	C	--	--	--	--	--
RR0072		U	206	O	--	--	--	C	--	--
RR0073	35WA295 35WA296	U	206	O	C	N	C	C	--	--
RR0074	35WA297	U	206	O	C	--	C	C	--	--
RR0075		N	207	O	C	N	--	--	--	--
RR0076		N	206	O	N	--	C	--	--	--
RR0077		N	226	I	C	N	--	--	--	--
RR0078		N	226	I	--	--	--	--	--	U
RR0079		N	226	I	C	--	--	--	--	--
RR0080		N	226	I	--	--	C	--	--	--
RR0081		N	227	I	C	--	--	--	--	N
RR0082	10IH461	U	227	I	C	--	--	C	--	C
RR0083	10IH689	U	227	I	C	--	--	--	--	--
RR0084	10IH688	U	227	I	C	N	C	--	--	--
RR0085	10IH687	U	227	I	C	--	--	--	--	--
RR0086	10IH2097	U	227	I	C	--	--	--	--	--
RR0087	10IH1070	U	228	I	C	--	--	--	--	--
RR0088		N	228	I	C	--	--	--	--	--
RR0089	10IH1068	U	228	I	--	--	C	--	--	--
RR0090		N	228	I	C	--	--	--	--	--
RR0091		N	228	I	C	--	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0092	10IH686 10IH685 10IH684	U	228	I	C	--	--	--	--	--
RR0093		N	228	I	C	--	C	--	--	--
RR0094	10IH634	U	229	I	--	--	--	--	--	C
RR0095	10IH635	U	228	I	C	--	--	--	--	--
RR0096	10IH2096	U	229	I	C	--	--	--	--	--
RR0097	10IH581 10IH1038 10IH1039	U	229	I	C	--	--	--	--	--
RR0098		N	229	I	C	N	--	--	--	--
RR0099		N	229	I	N	--	C	--	--	--
RR0100		N	229	I	C	--	--	--	--	--
RR0101	10IH1037	U	229	I	C	C	C	--	--	C
RR0102		N	230	I	--	--	--	--	--	N
RR0103		N	230	I	C	C	C	--	--	--
RR0105		N	230	I	--	--	C	--	--	--
RR0106		N	231	I	C	--	--	--	C	--
RR0107		N	231	I	C	--	--	--	--	--
RR0108	10IH483	U	235	I	C	--	--	--	--	--
RR0109	10IH538	U	235	I	--	C	--	--	C	--
RR0110		U	235	I	C	--	--	--	--	--
RR0111	10IH599	U	235	I	C	--	--	--	--	--
RR0112		N	235	I	C	C	C	--	--	N
RR0113		N	235	I	C	--	--	--	--	--
RR0114	10IH1072	U	234	I	--	--	--	--	--	N
RR0115	10IH597	U	234	I	C	--	--	--	--	--
RR0116	10IH537	U	233	I	C	C	--	--	C	--
RR0117	10IH1035	U	232	I	C	--	--	--	--	--
RR0118	10IH594	U	232	I	C	--	--	--	--	--
RR0119		N	232	I	C	--	--	--	--	--
RR0120	10IH713	U	232	I	C	--	--	--	--	--
RR0121		N	232	I	C	C	--	--	C	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0122	10IH479	U	239	I	C	--	--	--	--	C
RR0123	10IH607 10IH1027	U	239	I	C	--	--	--	--	--
RR0124	10IH608	U	239	I	C	--	--	--	--	--
RR0125	10IH609	U	239	I	C	--	--	--	--	--
RR0126	10IH625	U	239	I	C	--	--	--	--	--
RR0127	10IH2091	U	239	I	C	--	--	--	--	--
RR0128	10IH714	U	239	I	U	--	--	--	--	--
RR0129	10IH623	U	239	I	C	--	--	--	--	--
RR0130	10IH1024	U	239	I	C	--	--	--	--	--
RR0131		N	239	I	C	--	--	--	--	--
RR0132		N	240	I	C	--	--	--	--	--
RR0133		N	240	I	C	--	--	--	--	N
RR0134		N	240	I	C	--	--	--	--	--
RR0135		N	240	I	C	--	--	--	--	--
RR0136		N	240	I	C	--	--	--	--	--
RR0137		N	240	I	C	--	--	--	--	--
RR0138	10IH628	U	240	I	C	--	--	--	--	--
RR0139		N	240	I	C	--	--	--	--	N
RR0140		N	240	I	C	--	C	--	--	--
RR0141		N	240	I	C	--	--	--	--	--
RR0142		N	233	I	C	--	--	--	--	--
RR0143		N	233	I	C	--	--	--	--	--
RR0144		N	233	I	C	--	--	--	--	--
RR0145		N	235	I	C	--	--	--	--	--
RR0146	10IH1033	U	236	I	C	--	C	--	--	--
RR0147		N	236	I	C	N	--	--	--	--
RR0148		N	236	I	C	--	--	--	--	--
RR0149		N	236	I	C	--	--	--	--	--
RR0150		N	236	I	C	--	--	--	--	N
RR0151	10IH1032	U	236	I	U	C	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0152		U	237	I	C	--	--	--	--	--
RR0153		N	237	I	C	--	--	--	--	N
RR0154		U	237	I	C	N	--	--	--	--
RR0155	10IH603	U	237	I	C	--	--	--	--	--
RR0156	10IH1031	U	237	I	C	N	--	--	--	--
RR0157		N	237	I	C	--	C	--	--	--
RR0158	10IH1029	U	238	I	C	--	--	--	--	--
RR0159		U	229	I	C	C	--	--	--	--
RR0160	10IH535	U	229	I	C	C	--	--	--	--
RR0161		N	239	I	C	--	--	--	--	--
RR0162		N	239	I	C	--	--	--	--	--
RR0163		N	239	I	C	--	--	--	--	--
RR0164	10IH1026	U	239	I	C	--	--	--	--	--
RR0165		N	238	I	C	--	--	--	--	--
RR0166	10IH606	U	238	I	C	N	--	--	--	--
RR0167	10IH2090	U	238	I	C	--	--	--	--	--
RR0168	10IH1028	U	238	I	C	--	--	--	--	--
RR0169		U	238	I	C	--	--	--	--	--
RR0170		N	238	I	C	--	--	--	--	--
RR0171		N	238	I	--	--	C	--	--	--
RR0172		N	238	I	C	--	C	--	--	--
RR0173		N	240	I	C	--	--	--	--	--
RR0174		N	241	I	C	N	--	--	--	--
RR0175		N	241	I	C	--	--	--	--	--
RR0176		N	241	I	C	--	--	--	--	--
RR0177		N	241	I	C	--	--	--	--	--
RR0178	10IH629 10IH613	U	241	I	C	--	C	--	--	--
RR0179	10IH1020	U	241	I	C	--	C	--	--	--
RR0180		N	242	I	C	--	--	--	--	--
RR0181	10IH614	U	242	I	C	--	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0182	10IH2093	U	242	I	C	--	--	--	--	--
RR0183		N	242	I	C	--	--	--	--	--
RR0184		N	242	I	C	--	C	--	--	--
RR0185		N	242	I	--	--	--	--	--	N
RR0186		N	242	I	C	--	--	--	--	N
RR0187		N	242	I	C	--	--	--	--	--
RR0188	10IH1019	U	242	I	C	--	C	--	--	--
RR0189		N	242	I	C	--	--	--	--	--
RR0190		N	242	I	C	--	--	--	--	--
RR0191		N	242	I	--	--	C	--	--	--
RR0192		U	242	I	--	--	C	--	--	--
RR0193	10IH1090	U	242	I	--	--	C	--	--	--
RR0194	10IH481	U	242/243	I	C	--	C	--	--	--
RR0195		N	243	I	C	--	--	--	--	--
RR0196		N	243	I	C	--	--	--	--	--
RR0197		N	243	I	N	--	C	--	--	--
RR0198		N	243	I	C	--	--	--	--	--
RR0199		N	243	I	C	--	--	--	--	--
RR0200		N	243	I	C	--	--	--	--	--
RR0201		N	243	I	--	--	--	--	--	N
RR0202		N	243	I	C	--	--	--	--	--
RR0203		N	243	I	C	--	--	--	--	--
RR0204		N	243	I	C	--	--	--	--	--
RR0205		N	243	I	C	--	--	--	--	--
RR0206		N	243	I	C	--	--	--	--	--
RR0207		N	243	I	C	--	--	--	--	--
RR0208	10IH478	U	243	I	C	--	--	--	--	--
RR0209		N	243	I	C	--	--	--	--	--
RR0210		U	243	I	C	--	C	--	--	--
RR0211		U	243	I	C	--	--	--	--	--
RR0212		N	243	I	C	--	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0213		N	243	I	C	--	--	--	--	C
RR0214		N	244	I	--	N	--	--	--	--
RR0215		N	244	I	--	--	C	--	--	--
RR0216		N	244	I	--	--	C	--	--	--
RR0217		N	244	I	C	--	--	--	--	--
RR0218		N	244	I	C	--	--	--	--	C
RR0219		N	244	I	--	--	--	--	--	N
RR0220		N	244	I	C	--	--	--	--	--
RR0221		N	244	I	--	--	--	--	--	N
RR0222		N	244	I	N	--	--	--	--	N
RR0223		N	244	I	C	--	--	--	--	--
RR0224		N	244	I	C	N	--	--	--	--
RR0225		N	244	I	C	--	--	--	--	--
RR0226		N	206	O	C	--	--	--	--	--
RR0227		N	206	O	--	N	--	--	--	--
RR0228		N	206	O	--	--	C	--	--	--
RR0229		N	206	O	--	--	C	--	--	--
RR0230		N	205	O	--	--	--	C	--	--
RR0231		N	205	O	C	--	--	--	--	--
RR0232		N	205	O	C	--	--	--	--	--
RR0233		N	205	O	N	N	C	--	--	--
RR0234		N	205	O	--	--	--	C	--	--
RR0235		N	205	O	--	--	--	C	--	--
RR0236		U	201	O	C	N	--	--	--	--
RR0237	35WA306	U	202	O	C	--	C	--	--	--
RR0238		U	202	O	C	--	C	--	--	--
RR0239		N	202	O	C	--	--	--	--	--
RR0240		N	202	O	C	--	--	--	--	--
RR0241		N	202	O	C	--	--	--	--	--
RR0242		N	202	O	--	--	--	--	--	C
RR0243	35WA305	U	202	O	C	--	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0244		N	202	O	--	--	C	--	--	--
RR0245		N	202	O	C	--	--	--	--	--
RR0246		U	202	O	C	--	C	--	--	--
RR0247		N	202	O	C	--	--	--	--	--
RR0248		U	203	O	--	C	C	--	--	C
RR0249	35WA304	U	203	O	C	--	--	--	--	--
RR0250		N	201	O	C	--	--	--	--	--
RR0251		N	201	O	--	--	C	--	--	--
RR0252	35WA307	U	201	O	C	--	--	--	--	C
RR0253		U	201	O	N	--	C	--	--	C
RR0254		N	200	O	C	--	--	--	--	--
RR0255		U	200	O	--	--	C	--	--	--
RR0256		N	200	O	C	--	--	--	--	--
RR0257		N	199	O	C	--	C	--	--	--
RR0258		N	199	O	C	--	C	--	--	--
RR0259		N	199	O	C	--	--	--	--	--
RR0260		N	199	O	C	--	--	--	--	--
RR0261		N	199	O	N	--	C	--	--	--
RR0262	35WA311	U	199	O	C	--	--	--	--	--
RR0263	35WA312	U	199	O	N	--	--	--	--	--
RR0264	35WA313	U	199	O	--	--	C	--	--	--
RR0265		N	199	O	C	--	--	--	--	--
RR0266		U	199	O	--	--	C	--	--	--
RR0267		N	199	O	--	--	C	--	--	--
RR0268		N	199	O	C	--	--	--	--	--
RR0269		N	199	O	C	--	--	--	--	--
RR0270	35WA314	U	199	O	C	--	--	--	--	--
RR0271		N	199	O	--	--	--	C	--	--
RR0272	35WA315	U	199	O	C	--	C	--	--	--
RR0273	35WA316	U	199	O	C	--	C	--	--	--
RR0274		N	199	O	N	N	C	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0275		N	199	O	--	--	--	C	--	--
RR0276		N	198	O	--	--	C	--	--	--
RR0277		N	198	O	C	--	--	C	--	--
RR0278		N	198	O	N	--	C	--	--	--
RR0279	35WA317	U	198	O	C	--	--	--	--	--
RR0280		N	198	O	--	--	C	C	--	--
RR0281		N	198	O	--	--	C	--	--	--
RR0282		U	198	O	C	C	--	--	--	--
RR0283		N	197	O	--	--	C	--	--	--
RR0284		N	197	O	--	--	C	--	--	--
RR0285		N	196	O	C	--	C	--	--	--
RR0286		N	196	O	--	--	C	--	--	--
RR0287		N	196	O	C	--	--	--	--	--
RR0288		N	193/194	O	C	--	C	--	--	--
RR0289		N	194	O	C	--	--	--	--	--
RR0290		U	193	O	--	--	C	--	--	--
RR0291	35WA352	U	193	O	C	--	--	--	--	--
RR0292	35WA353	U	193	O	N	--	--	--	--	--
RR0293		N	193	O	--	--	C	--	--	--
RR0294		N	213	O	C	--	--	--	--	--
RR0295		U	213	O	--	--	--	--	C	--
RR0296		N	193	O	C	--	C	C	--	--
RR0297		N	193	O	--	--	C	--	--	--
RR0298		N	192	O	--	--	C	--	--	--
RR0299	35WA357	U	192	O	C	--	--	--	--	--
RR0300	35WA356	U	192	O	C	--	--	--	--	--
RR0301		N	192	O	N	--	C	--	--	--
RR0302		N	192	O	--	--	--	C	--	--
RR0303		U	192	O	--	--	--	C	--	--
RR0304		N	192	O	--	--	--	C	--	--
RR0305		N	192	O	--	--	--	--	C	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0306		N	192	O	--	--	--	C	--	--
RR0307		N	192	O	--	--	C	C	--	--
RR0308		U	192	O	C	--	--	--	--	C
RR0309		U	192	O	C	--	C	C	C	--
RR0310		N	192	O	C	--	C	C	--	--
RR0311		N	192	O	C	--	--	--	--	--
RR0312		U	191	O	--	--	--	C	--	--
RR0313		U	191	O	C	--	--	C	--	--
RR0314		U	213	O	--	--	C	--	N	--
RR0315		N	191	O	N	--	C	--	--	C
RR0316		U	190	O	C	C	--	C	--	--
RR0317		N	190	O	N	--	C	C	--	C
RR0318		N	190	O	C	--	--	--	--	--
RR0319	35WA361	U	190	O	C	--	--	--	--	C
RR0320		N	190	O	N	--	C	--	--	--
RR0321		N	190	O	C	--	--	--	--	C
RR0322	35WA332	U	196	O	C	--	--	--	--	--
RR0323	35WA331	U	196	O	C	N	--	--	--	--
RR0324	35WA333	U	196	O	C	N	--	--	--	--
RR0325	35WA334	U	196	O	C	N	--	--	--	N
RR0326	35WA335	U	196	O	C	--	--	--	--	--
RR0501	10IH482	U	244	I	C	--	C	--	--	--
RR0502		N	244	I	C	--	--	--	--	--
RR0503		N	244	I	C	--	--	--	--	--
RR0504		N	244	I	C	--	--	--	--	--
RR0505		N	245	I	C	--	--	--	--	--
RR0506		N	245	I	C	--	--	--	--	--
RR0507		N	244	I	--	--	C	--	--	--
RR0508	10IH1021	U	245	I	C	--	--	--	--	--
RR0509		N	245	I	N	--	C	--	--	--
RR0510	10IH1158	U	245	I	C	--	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0511	10IH1157	U	245	I	C	C	--	--	--	--
RR0512		N	245	I	--	--	--	--	--	N
RR0513		N	245	I	C	--	--	--	--	--
RR0514		N	245	I	C	--	--	--	--	--
RR0515		N	245	I	C	--	--	--	--	--
RR0516		N	245	I	--	--	C	--	--	--
RR0517	10AM290	U	245	I	C	--	--	--	--	--
RR0518	10AM289	U	245	I	C	--	C	--	--	--
RR0519		N	245	I	--	--	C	--	--	--
RR0520		N	245	I	C	--	--	--	--	--
RR0521		N	245	I	--	--	C	--	--	--
RR0522		N	245	I	C	--	--	--	--	--
RR0523		N	246	I	C	--	--	--	--	--
RR0524		N	246	I	C	--	--	--	--	--
RR0525		N	246	I	--	--	C	--	--	--
RR0526		N	246	I	--	--	C	--	--	--
RR0527		N	246	I	C	--	--	--	--	--
RR0528		N	246	I	C	--	--	--	--	--
RR0529	10AM291	U	247	I	C	--	--	--	--	--
RR0530		N	247	I	C	--	--	--	--	--
RR0531		N	246	I	--	--	C	--	--	N
RR0532		N	246	I	C	--	--	--	--	--
RR0533		N	246	I	C	--	--	--	--	--
RR0534		N	247	I	C	--	--	--	--	--
RR0535		N	247	I	C	--	--	--	--	--
RR0536		N	247	I	--	--	--	C	--	--
RR0537		N	247	I	--	--	--	--	U	--
RR0538		N	247	I	C	--	--	--	--	--
RR0539		N	247	I	N	--	--	--	--	--
RR0540		N	247	I	N	--	--	--	--	--
RR0541		N	205	O	--	N	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0542		U	204	O	--	--	C	--	--	C
RR0543		N	204	O	C	--	--	--	--	--
RR0544		U	204	O	C	--	C	--	--	--
RR0545	35WA72	N	204	O	C	--	--	--	--	--
RR0546		U	204	O	--	C	--	--	--	--
RR0547		N	204	O	C	--	C	--	--	--
RR0548		N	204	O	C	--	--	--	--	--
RR0549		N	204	O	--	N	--	--	--	--
RR0550		U	204	O	--	C	--	--	--	--
RR0551		U	204	O	--	C	--	--	--	--
RR0552	35WA301 35WA302	U	203	O	C	C	--	--	--	--
RR0553		U	203	O	--	C	C	--	--	--
RR0554		N	203	O	C	C	C	--	--	N
RR0555		N	201	O	C	--	--	--	--	--
RR0556		N	201	O	--	C	--	--	--	--
RR0557		U	201	O	--	C	--	--	--	--
RR0558		N	245	I	--	--	C	--	--	--
RR0559		N	200	O	--	C	--	--	--	--
RR0560		N	200	O	C	--	C	--	--	--
RR0561		N	200	O	--	--	C	--	--	--
RR0562		N	197	O	--	--	C	--	--	--
RR0563	35WA328	U	197	O	C	--	--	--	--	--
RR0564		N	197	O	--	--	--	--	N	--
RR0565		N	197	O	--	--	C	--	--	--
RR0566		N	197	O	C	--	--	--	N	--
RR0567		U	197	O	C	--	--	--	--	--
RR0568		N	197	O	--	--	C	--	--	--
RR0569	35WA320	U	198	O	C	--	--	--	--	--
RR0570		N	198	O	N	--	C	--	--	--
RR0571		N	198	O	C	--	--	--	--	--

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0572		N	198	O	C	--	C	--	--	--
RR0573		U	198	O	C	C	--	--	--	--
RR0574	35WA319	U	198	O	C	--	--	--	--	--
RR0575		N	198	O	--	C	--	--	--	--
RR0576	35WA318	U	198	O	C	C	C	--	--	--
RR0577		N	197	O	C	--	--	--	--	N
RR0578	35WA340	U	195	O	C	--	--	--	--	N
RR0579		N	195	O	--	C	--	--	--	--
RR0580		U	195	O	C	--	--	--	--	--
RR0581	35WA341 35WA342	U	195	O	C	--	--	--	--	--
RR0582	35WA343	U	194	O	C	--	--	--	--	--
RR0583		N	194	O	--	--	C	--	--	--
RR0584	35WA347	U	194	O	C	--	--	--	--	--
RR0585		U	194	O	C	--	--	--	--	--
RR0586		N	195	O	C	--	--	--	--	--
RR0587		N	194	O	C	--	--	--	--	--
RR0588		N	194	O	N	--	C	--	--	--
RR0589		N	194	O	C	--	--	--	--	--
RR0590		N	194	O	--	--	C	--	--	--
RR0591	35WA351	U	194	O	C	--	--	--	--	--
RR0592		U	190	O	C	--	C	--	--	--
RR0593		N	190	O	C	--	--	--	--	--
RR0594	35WA362	U	190	O	C	--	--	--	--	--
RR0595		N	190	O	C	--	--	--	--	--
RR0596		N	190	O	C	--	--	--	--	--
RR0597		N	190	O	C	--	--	--	--	--
RR0598		N	190	O	C	--	--	--	--	--
RR0599		N	190	O	C	--	--	--	--	--
RR0600		N	190	O	N	--	--	--	--	--
RR0601		N	190	O	C	--	--	--	--	N

Temp. Site No.	Permanent Site No.	New/ Update	River Mile	Bank	Prehistoric/ Unknown	Ranching	Placer Mining	Lode Mining	Dam Construction	Other Historic
RR0602		N	190	O	C	--	--	--	--	--
RR0603		N	190	O	C	--	--	--	--	--
RR0604		N	189	O	--	--	C	--	--	--
RR0605		N	189	O	C	--	--	--	--	--
RR0606		N	189	O	C	--	--	--	--	--
RR0607		U	189	O	C	--	C	--	--	C
RR0608		N	189	O	C	--	C	--	--	--
RR0609		N	189	O	--	--	C	--	--	--
RR0610		N	189	O	C	--	--	--	--	--
RR0611		N	189	O	--	--	--	C	--	--
RR0612		N	189	O	C	--	--	--	--	--
RR0613		N	189	O	--	--	--	C	--	--
RR0614		N	189	O	C	C	--	--	--	--
RR0615		N	189	O	C	--	--	--	--	--
RR0616		N	189	O	--	--	C	--	N	--
RR0617		N	188	O	C	--	C	--	--	--
RR0618	35WA367	U	188	O	C	--	--	--	--	--
RR0619		N	188	O	C	--	C	--	--	C
RR0620		N	196	O	C	--	--	--	--	--
RR0621		U	196	O	C	N	--	--	--	--
RR0622	35WA336	U	196	O	C	N	--	--	--	--
RR0623		U	196	O	C	N	--	--	--	--

Appendix E.4-D Prehistoric site evaluations of non-significance[18]—Applied Paleoscience

	Prehistoric										NS	Explanation		
Site No.	Paleoecology	Late Prehistoric Gen.	Winter Habitation	Subsistence	Storage	Rock Art	Ritual Behavior	Lithic Proc./Proc.G	Middle Holocene Gen.	General Prehistory	Non-significant	Loss of Integrity	Age Det. Impossible	Testing Required
AP0013	1	1		1										
AP0014														
AP0015										1				
AP0016														
AP0017														
AP0018											1	1		
AP0019							?							
AP0020														
AP0021											1			1
AP0030								1						
AP0031											1	1		
AP0036														
AP0042											1	1		
AP0048											1	1		
AP0051											1	1		
AP0063											1	1		
AP0064						1								
AP0065			1											
AP0110											1	1		
AP0111				1			1			1				
AP0112											1		1	
AP0113										1				
AP0114											1			1
AP0115											1			1

18.Source: Appendix 4.29. to Volume 4 of confidential Technical Report E.4-1.

Site No.	Prehistoric: Paleoecology	Late Prehistoric Gen.	Winter Habitation	Subsistence	Storage	Rock Art	Ritual Behavior	Lithic Proc./Proc.G	Middle Holocene Gen.	General Prehistory	NS: Non-significant	Explanation: Loss of Integrity	Age Det. Impossible	Testing Required
AP0116											1	1		
AP0117								1						
AP0120											1			1
AP0127											1			1
AP0128											1			1
AP0130	1										1			1
AP0131	1										1			1
AP0132	1										1			1
AP0135											1			1
AP0142											1		1	
AP0150											1	1		
AP0156											1	1		
AP0202														
AP0215											1		1	
AP0217														
AP0224														
AP0225			1											
AP0226														
AP0242											1			1
AP0250											1			1
AP0258											1			1
AP0263											1	1		
AP0266											1			1
AP0321											1		1	
AP0328											1			1
AP0332			1								1			1
AP0333											1	1		

	Prehistoric										NS	Explanation		
Site No.	Paleoecology	Late Prehistoric Gen.	Winter Habitation	Subsistence	Storage	Rock Art	Ritual Behavior	Lithic Proc./Proc.G	Middle Holocene Gen.	General Prehistory	Non-significant	Loss of Integrity	Age Det. Impossible	Testing Required
AP0351						1								
AP0352														
AP0353					1									
AP0355											1			1
AP0403	1									1				
AP0404											1			1
AP0409											1			1
AP0410														
AP0411											1		1	
AP0422											1		1	
AP0423						1								
AP0424					1									
AP0425							?				1	1		
AP0426						1								
AP0427	1									1				1
AP0428											1	1		
AP0439											1		1	
AP0440			1							1				
AP0502											1		1	
AP0507														
AP0510			1											
AP0511											1			1
AP0521											1	1		
AP0522											1		1	
AP0529											1		1	
AP0550														
AP0555											1	1		

	Prehistoric										NS	Explanation		
Site No.	**Paleoecology**	**Late Prehistoric Gen.**	**Winter Habitation**	**Subsistence**	**Storage**	**Rock Art**	**Ritual Behavior**	**Lithic Proc./Proc.G**	**Middle Holocene Gen.**	**General Prehistory**	**Non-significant**	**Loss of Integrity**	**Age Det. Impossible**	**Testing Required**
AP0564											1	1		
AP0569											1	1		
AP0578											1	1		
AP0579														
AP0580		1												
AP0581														
AP0583									1					
AP0584					1									
AP0586						1								
Totals	6	2	5	2	3	5	1	2	1	6	49	19	10	21

Appendix E.4-E Historic site evaluations of non-significance[19]—Applied Paleoscience

	Historic Significance								NS	Explanation			
Site No.	**Hard Rock Mine**	**Placer Mine**	**Mining, Undetermined**	**Chinese Mine**	**Ranch/Homestead**	**Trans/Comm**	**Engineering**	**Recreation**	**Non-significant**	**Loss of Integrity**	**Unknown Age or Association.**	**Testing Required**	**Age < 50 Years**
AP0014									1		1		
AP0037									1		1		
AP0112									1		1		
AP0117		1							1	1			
AP0124									1	1			
AP0130													
AP0131													
AP0132													
AP0135													
AP0142		1											
AP0150		1											
AP0156		1											
AP0202									1				1
AP0215													
AP0217									1				1
AP0224									1				1
AP0225													
AP0226									1		1		
AP0242													
AP0250													
AP0258													
AP0263					1								
AP0266													
AP0321													

19.Source: Appendix 4.30. to Volume 4 of confidential Technical Report E.4-1

	Historic Significance								NS	Explanation			
Site No.	Hard Rock Mine	Placer Mine	Mining, Undetermined	Chinese Mine	Ranch/Homestead	Trans/Comm	Engineering	Recreation	Non-significant	Loss of Integrity	Unknown Age or Association.	Testing Required	Age < 50 Years
AP0328													
AP0332													
AP0333													
AP0351													
AP0352									1			1	
AP0353													
AP0355													
AP0403													
AP0404													
AP0409													
AP0410		1											
AP0411													
AP0422													
AP0423													
AP0424													
AP0425													
AP0426			1										
AP0427													
AP0428													
AP0439									1			1	
AP0440													
AP0502		1											
AP0507									1	1			
AP0510													
AP0511									1			1	
AP0521		1											
AP0522													

	Historic Significance								NS	Explanation			
Site No.	**Hard Rock Mine**	**Placer Mine**	**Mining, Undetermined**	**Chinese Mine**	**Ranch/Homestead**	**Trans/Comm**	**Engineering**	**Recreation**	**Non-significant**	**Loss of Integrity**	**Unknown Age or Association.**	**Testing Required**	**Age < 50 Years**
AP0529		1											
AP0550	1												
AP0555			1										
AP0564		1											
AP0569									1	1			
AP0578													
AP0579	1												
AP0580													
AP0581		1											
AP0583													
AP0584													
AP0586													
Totals	2	10	2	0	1	0	0	0	14	4	4	3	3

Appendix E.4-F Applicant's and consulting archaeologists' National Register evaluation recommendations for sites along the Pine Creek–Hells Canyon line (Line 945)

Temp No.	Site Type	Consulting Archaeologist NR Status	Draft Report Reference	Report Statements Supporting evaluation	IPC Evaluation	Reason for IPC Evaluation	Site Treated by IPC As
10AM 1/45	Multi-component	N/A	confidential TR E.4-5	Known site, not evaluated	Applicant believes site to be eligible	36 CFR 60.4 (d)	Eligible
10AM 77	N/A	N/A	confidential TR E.4-5	Known site, not evaluated	Applicant believes site to be eligible	36 CFR 60.4 (d)	Eligible

Appendix E.4-G Impacts to Brownlee Reservoir sites

							Mechanical							
Site No.	Hist/Pre.	Site Type	NHRP Eligibility	Siltation	Bank Erosion	Deflation	Agriculture	Camping	ORV*	Powerline	Railroad	Road	Vandalism	Totals
10-WN-451	P	Field camp	PE	1	1	1								3
10-WN-452	P	Complex camp	PE	1										1
10-WN-453	P	Complex camp	PE	1										1
35BA-801	P	Complex camp	E	1	1									2
IPC95-9	P	Complex camp	PE	1	0	1			1					3
IPCBD-00-36	P	Field camp	PE	1										1
IPCBD-00-37	P	Complex camp	PE	1	1									2
IPCBD-00-39	P	Field camp	PE	1										1
IPCBD-00-41	P	Field camp	PE	1	1									2
IPCBD-00-42	P	Field camp	PE	1	1									2
IPCBD-00-43	P	Field camp	E	1										1
IPCBD-00-48	P	Field camp	PE	1	1	1						1		4
IPCBD-00-49	H	Cemetery	PE	0	0	0							1	1
IPCBD-00-52	P	Complex camp	PE	1	1									2
IPCBD-00-53	P	Complex camp	PE	1	1									2
IPCBD-00-54	P	Complex camp	PE	1	1									2
IPCBD-00-55	P	Complex camp	PE	1	1	1								3
IPCBD-00-56	P	Complex camp	PE	1	1									2
IPCBD-00-57	P	Complex camp	PE	1	1									2
IPCBD-00-58	P	Field camp	PE	1	1									2
IPCBD-00-61	P	Field camp	PE	1	1						1			3
IPCBD-00-63	P	Complex camp	PE	1	1	1								3
IPCBD-00-64	P	Complex camp	PE	1	1							1		3
IPCBD-00-66	P	Field camp	PE	1	1			1						3
IPCBD-00-68	P	Location	PE	1	1			1						3
IPCBD-00-70	P	Location	PE	0	0	0	1							1
IPCBD-00-71	P	Field camp	PE	1	1			1						3

								Mechanical						
Site No.	**Hist/Pre.**	**Site Type**	**NHRP Eligibility**	**Siltation**	**Bank Erosion**	**Deflation**	**Agriculture**	**Camping**	**ORV***	**Powerline**	**Railroad**	**Road**	**Vandalism**	**Totals**
IPCBD-00-72	P	Location	PE	0	0	0								0
IPCBD-00-74	H	Cabin	PE	0	0	1							1	2
IPCBD-00-75	H	Road	PE	0	1	1								2
IPCBD-00-80	H	Ditch	PE	0	0	0						1		1
IPCBD-97-02	H	Townsite	PE	1	0	0								1
IPCBD-97-03	P	Complex camp	E	1	1	1								3
IPCBD-97-04	H	Townsite	PE	1										1
IPCBD-97-05	P	Complex camp	PE	1	0	0								1
IPCBD-97-07	H	Townsite	PE		1									
IPCBD-97-09	P	Complex camp	E		1	1	1				1			
IPCBD-97-12	P	Location	PE		1	1							1	
IPCBD-97-13	P	Location	PE		1	1								
IPCBD-97-14	P	Complex camp	PE		1	1								
IPCBD-97-15	P	Location	PE		1	1								
IPCBD-97-15	H	Railroad camp	PE		1	1								
IPCBD-97-18	P	Talus pit	PE		0	0	0							
					36	27	9	1	3	1	1	1	4	2
Total = 43					42%	32%	11%	1%	4%	1%	1%	1%	5%	2%

Appendix E.4-H Archaeological sites in downstream areas recorded by Rain Shadow Research subject to river erosion

Temporary Site No.	Site Type
IPC-RR0003	Lithic scatter
IPC-RR0004	Lithic scatter and historic
IPC-RR0005	Lithic scatter and historic mining tailing piles
IPC-RR0006	Lithic scatter and pecked boulder
IPC-RR0007	Prehistoric housepit village–historic mining & agriculture
IPC-RR0009	Placer mining site
IPC-RR0010	Homestead and placer mine
IPC-RR0011	Historic habitation site
IPC-RR0012	Mining site
IPC-RR0016	Stacked rock alignment/levee
IPC-RR0020	Placer tailings
IPC-RR0021	Pithouse depression
IPC-RR0023	Placer mine
IPC-RR0024	Placer mining
IPC-RR0028	Sheep operation and habitation site
IPC-RR0029	Lithic scatter–possible habitation site–and two rockshelters
IPC-RR0031	Placer tailings
IPC-RR0034	Historic homestead/ranch & prehistoric fishing camp
IPC-RR0041	Habitation
IPC-RR0044	Prehistoric cemetery
IPC-RR0045	Lithic scatter/placer tailings/navigational markers
IPC-RR0048	Lithic scatter/placer tailings
IPC-RR0050	Placer tailings/lithic scatter
IPC-RR0054	Housepits/historic ranching complex
IPC-RR0055	Placer tailings/prehistoric lithic scatter

Temporary Site No.	Site Type
IPC-RR0056	Historic trash dump/fenceline–isolated lithics
IPC-RR0057	Rockshelters
IPC-RR0059	Rockshelters with adjacent lithic scatter
IPC-RR0061	Placer tailings/prehistoric lithic scatter
IPC-RR0062	7 placed rocks features and 6 cairns
IPC-RR0063	Historic habitation/prehistoric cairns
IPC-RR0064	Stacked rock features
IPC-RR0065	Rockshelter/stacked rock features
IPC-RR0067	Placer tailings/lithic scatter
IPC-RR0068	Rockshelter with incised petroglyph
IPC-RR0070	Rock feature–rockshelter–lithic scatter–tailings
IPC-RR0073	Mine adit
IPC-RR0074	Pictographs/stacked rock features/placer tailings
IPC-RR0075	Rockshelter/stacked rock features
IPC-RR0076	Rockshelter/lithic scatter/placer tailings
IPC-RR0080	Placer tailings
IPC-RR0084	Prehistoric and historic habitations
IPC-RR0089	Placer mining complex
IPC-RR0092	Rockshelters
IPC-RR0093	Shallow prehistoric depression and historic rock wall
IPC-RR0099	Cobble scatter–placer tailings
IPC-RR0101	Rockshelter–prehistoric habitation–placer tailings
IPC-RR0102	Geodetic station
IPC-RR0105	Placer mining complex
IPC-RR0107	Small rockshelter with pigment stains
IPC-RR0112	Flaked cobbles mixed with placer tailings
IPC-RR0116	Fourteen rockshelters, historic homestead, pictographs

Temporary Site No.	Site Type
IPC-RR0132	Rockshelters with pigment
IPC-RR0133	Seven rockshelters and overhangs
IPC-RR0139	Prehistoric habitation floor, several rockshelters and boulder overhangs.historic scatter of glass bottle fragments
IPC-RR0140	Prehistoric habitation–historic campsite
IPC-RR0145	Small, diffuse lithic scatter
IPC-RR0146	Placer mining complex–lithic scatter
IPC-RR0149	Pictograph and lithic scatter
IPC-RR0157	Placer tailings
IPC-RR0170	Rockshelter with pigment
IPC-RR0171	Placer tailings
IPC-RR0172	Placer tailings and two leveled platforms
IPC-RR0178	Habitation–historic placer tailings
IPC-RR0179	Pictographs–placer tailings
IPC-RR0184	Placer tailings–talus pit
IPC-RR0185	Glass bottle dump
IPC-RR0190	Talus pits
IPC-RR0191	Placer tailings
IPC-RR0193	Placer tailings
IPC-RR0197	Placer tailings
IPC-RR0201	Historic bottle dump
IPC-RR0215	Placer tailings
IPC-RR0216	Placer tailings
IPC-RR0218	Habitation–historically used rockshelter
IPC-RR0219	Bottle dump
IPC-RR0222	Cobble tool scatter–historic dump
IPC-RR0228	Placer tailings
IPC-RR0229	Placer tailings

Temporary Site No.	Site Type
IPC-RR0233	Placer tailings
IPC-RR0234	Mine adit
IPC-RR0236	Placer tailings–lithic scatter
IPC-RR0237	Lithic scatter–placer tailings
IPC-RR0238	Placer mining feature–prehistoric habitation
IPC-RR0240	Lithic scatter
IPC-RR0246	Placer tailings–redeposited prehistoric artifacts
IPC-RR0248	Placer tailings–livestock enclosure–telephone line
IPC-RR0251	Placer tailings
IPC-RR0253	Placer mining complex–lithic scatter
IPC-RR0254	Lithic scatter
IPC-RR0255	Placer tailings
IPC-RR0256	Lithic scatter
IPC-RR0257	Placer tailings–lithic scatter
IPC-RR0258	Placer tailings–lithic scatter
IPC-RR0261	Placer tailings
IPC-RR0265	Lithic scatter
IPC-RR0266	Placer tailings–walled rockshelter
IPC-RR0272	Placer mining complex–lithic scatter
IPC-RR0274	Placer tailings–lithic scatter
IPC-RR0276	Placer tailings
IPC-RR0278	Placer tailings–lithic scatter
IPC-RR0280	Load mine prospect–placer tailings
IPC-RR0282	Lithic scatter
IPC-RR0283	Placer tailings
IPC-RR0284	Placer tailings
IPC-RR0285	Placer tailings–lithic scatter

Temporary Site No.	Site Type
IPC-RR0286	Placer tailings
IPC-RR0288	Placer tailings–habitation
IPC-RR0290	Placer tailings
IPC-RR0296	Mine adit–placer tailings
IPC-RR0298	Placer tailings
IPC-RR0301	Placer tailings
IPC-RR0310	Load and placer mining complex–lithic scatter
IPC-RR0311	Lithic scatter
IPC-RR0313	Mining settlement
IPC-RR0314	Placer tailings
IPC-RR0315	Approximately 80–90 concentrations of placer tailings
IPC-RR0317	Placer tailings–lithic scatter
IPC-RR0320	Placer tailings
IPC-RR0322	Cobble tool scatter
IPC-RR0501	Pit-house depressions, rockshelters, boulder overhangs, pictographs, talus pits, a scatter of stone artifacts, a placer-mining feature
IPC-RR0504	Lithic scatter–rockshelters
IPC-RR0507	Placer tails
IPC-RR0509	Placer tails
IPC-RR0516	Placer mining tails
IPC-RR0518	Rockshelter w/ pictographs–placer mining tails
IPC-RR0519	Placer tails
IPC-RR0521	Placer tails
IPC-RR0525	Placer mining tails
IPC-RR0526	Placer mining tails
IPC-RR0531	Placer mining tails
IPC-RR0542	Placer mining locality
IPC-RR0543	Artifact scatter

Temporary Site No.	Site Type
IPC-RR0544	Pacer mining features–lithic scatter
IPC-RR0547	Lithic scatter–placer mining features
IPC-RR0550	Circular grain silo foundation
IPC-RR0551	Ranch–prehistoric artifact scatter
IPC-RR0552	A scatter of prehistoric stone tools and flakes, an historic artifact scatter, an agricultural field bordered by a remnant fence line and stacked-rock jacks
IPC-RR0553	Placer mine
IPC-RR0554	Historic features include concentrations of placer tailings, a tent platform, three rock walls or alignments, a depression, a memorial marker, and ditch lines. prehistoric and historic artifacts are scattered along the cobble and boulder beach.
IPC-RR0555	Lithic scatter
IPC-RR0558	Habitation–placer mining complex
IPC-RR0560	Placer tails–lithic scatter
IPC-RR0562	Placer mining features
IPC-RR0565	Placer mining site
IPC-RR0568	Placer mining site with tent pad
IPC-RR0569	Hamlet or small village with pit-house depressions spread across several terraces
IPC-RR0570	Placer tails
IPC-RR0572	Placer tails–cobble tool (lithic) scatter
IPC-RR0576	Tin can dump
IPC-RR0583	Placer mining site
IPC-RR0586	Lithic scatter
IPC-RR0588	Placer mining site
IPC-RR0590	Placer mining site
IPC-RR0592	Placer mining–lithic scatter–historic scatter
IPC-RR0604	Placer mining features
IPC-RR0607	Placer mining features–lithic scatter
IPC-RR0608	Placer mining features–lithic scatter

Temporary Site No.	Site Type
IPC-RR0609	Cairn
IPC-RR0614	Tent platform–lithic scatter
IPC-RR0617	Placer mining features–storage depressions
IPC-RR0618	Rockshelter with pictographs–lithic scatter
IPC-RR0619	Placer mining features–storage depressions
IPC-RR0620	Lithic scatter
IPC-RR0621	Pecked rocks

The *Code of Federal Regulations* below—18 CFR § 4.51(f)(5)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(f)(5) *Report on recreational resources*. The report must discuss existing and proposed recreational facilities and opportunities at the project. The report must be prepared in consultation with local, state, and regional recreation agencies and planning commissions, the National Park Service, and any other state or Federal agency with managerial authority over any part of the project lands. Consultation must be documented by appending to the report a letter from each agency consulted indicating the nature, extent, and results of the consultation. The report must contain:
>
> (i) A description of any existing recreational facilities at the project, indicating whether the facilities are available for public use;
>
> (ii) An estimate of existing and potential recreational use of the project area, in daytime and overnight visits;
>
> (iii) A description of any measures or facilities recommended by the agencies consulted for the purpose of creating, preserving, or enhancing recreational opportunities at the project and in its vicinity (including opportunities for the handicapped), and for the purpose of ensuring the safety of the public in its use of project lands and waters;
>
> (iv) A statement of the existing measures or facilities to be continued or maintained and the new measures or facilities proposed by the applicant for the purpose of creating, preserving, or enhancing recreational opportunities at the project and in its vicinity, and for the purpose of ensuring the safety of the public in its use of project lands and waters, including an explanation of why the applicant has rejected any measures or facilities recommended by an agency and described under paragraph (f)(5)(iii) of this section; and
>
> (v) The following materials and information regarding the measures and facilities identified under paragraphs (f)(5)(i) and (iv) of this section:
>
> (A) Identification of the entities responsible for implementing, constructing, operating, or maintaining any existing or proposed measures or facilities;
>
> (B) A schedule showing the intervals following issuance of a license at which implementation of the measures or construction of the facilities would be commenced and completed;
>
> (C) An estimate of the costs of construction, operation, and maintenance of any proposed facilities, including a statement of the sources and extent of financing;
>
> (D) A map or drawing that conforms to the size, scale, and legibility requirements of § 4.39 showing by the use of shading, cross-hatching, or other symbols the identity and location of any facilities, and indicating whether each facility is existing or proposed (the maps or drawings in this exhibit may be consolidated); and
>
> (vi) A description of any areas within or in the vicinity of the proposed project boundary that are included in, or have been designated for study for inclusion in, the National Wild and Scenic Rivers System, or that have been designated as wilderness area, recommended for such designation, or designated as a wilderness study area under the Wilderness Act.

E.5. Report on Recreational Resources

E.5.1. Description of Recreational Resources for the Hells Canyon Complex

E.5.1.1. Recreational Facilities and Opportunities in the Vicinity of the Project

The Snake River corridor from the upper end of Brownlee Reservoir through the Hells Canyon National Recreation Area (HCNRA) includes 169.9 miles (mi) of impounded and free-flowing Snake River. Recreational use within the corridor is extensive and includes a multitude of opportunities. Fishing, powerboating, and camping are the most common activities in the reservoir areas. Float boating is also a popular activity, occurring mainly in the free-flowing reach below Hells Canyon Dam. Many recreational facilities and opportunities, as well as a variety of amenities for public use, are available throughout the Hells Canyon area. Public land surrounds much of the Snake River throughout this area, providing abundant camping and hunting opportunities.

The Hells Canyon Recreation Area (HCRA), or study area for recreation resources, encompasses the three reservoirs of the Hells Canyon Complex (HCC)[1] and the HCNRA on the Snake River. Fully developed access or camping facilities that are within and close to the HCRA are listed and described in Technical Report E.5-1. (See Figure E.5-1 for locations of most of the sites that are described in this exhibit section.)

E.5.1.1.1. U.S. Forest Service Facilities and Opportunities

The U.S. Forest Service (USFS) currently does not own or operate any recreation facilities in the area surrounding Brownlee or Oxbow reservoirs; however, much of the land in the area surrounding Hells Canyon Reservoir and below Hells Canyon Dam is USFS land. All the USFS recreation facilities above Hells Canyon Dam are limited to dispersed (also called undeveloped or impromptu) campsites and trails. The USFS currently operates and maintains four administrative sites below the dam and over 100 primitive campsites in the HCNRA between Hells Canyon Dam and Cache Creek Ranch (USFS 1994).

E.5.1.1.2. U.S. Forest Service Administrative Sites

The four administrative sites that the USFS manages within the HCNRA include maintenance facilities, historic areas, and recreational sites.

Hells Canyon Creek Recreation Site (*and Hells Canyon Visitors Center*)—Built at Hells Canyon Creek Recreation Site in 1995, the Hells Canyon Visitors Center (river mile [RM] 246.8) is located on the Oregon side of the Snake River about 1 mi north (downstream) of Hells Canyon Dam, at the northern end of Hells Canyon Road (Figure E.5-1). This recreation site is the launch site for most float trips on the Snake River through Hells Canyon. The launch site also offers commercial and private jet boat access to the upper end of the HCNRA. Amenities include a pay

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

phone, vault toilets, covered picnic shelters, a concrete boat launch, a float boat launch, and a docking system for commercial jet boats. The modern rock-and-glass visitors center is staffed seven days a week from Memorial Day weekend through September 15.

Kirkwood Historic Ranch and Associated Campsites—The Kirkwood Historic Ranch site (RM 221.5) is located on the Idaho side of the Snake River, about 27 mi north of Hells Canyon Dam (Figure E.5-1). Open all year, this historic ranch, museum, and interpretive site portrays early pioneer life in the canyon. Volunteers staff this site during the high-use season. Toilets are available. A satellite telephone is on site for reporting emergencies and fires. Three campsites within easy walking distance of the ranch can accommodate large groups and provide shade, toilets, and tables.

Pittsburg Administrative Site and Associated Campsites—On the Idaho side of the Snake River, the Pittsburg Administrative Site (RM 215) is located about 33 mi north of Hells Canyon Dam (Figure E.5-1). This site provides road access to the Snake River. It is the main exit portal for float boat trips originating at the Hells Canyon Creek Recreation Site and a launching site for jet boats using this section of the Snake River. The administrative site does not have campsites; however, the adjacent campground at Pittsburg Landing provides road access, a boat launch ramp and a float boat apron, some shade, drinking water, toilets, and picnic tables. A satellite telephone is available for reporting emergencies and fires. Directly across the river, the USFS operates a maintenance and housing facility that is not open to the public.

Cache Creek Ranch Administrative Site—On the Oregon side of the Snake River, the Cache Creek Ranch Administrative Site (RM 177) is located about 71 mi north of Hells Canyon Dam and 43 mi south of Lewiston, Idaho (Figure E.5-1). It is the only entry portal to the Snake River at the northern end of the HCNRA. Permits, maps, and other information are available at this day-use-only site. Amenities include shade, water, toilets, and tables.

E.5.1.1.3. U.S. Forest Service Special-Use Permit Sites Within the HCNRA

Sheep Creek—Sheep Creek (RM 229.5) is a privately operated site located on the Idaho side of the Snake River, about 18 mi north (downstream) of Hells Canyon Dam (Figure E.5-1). This site contains an old, refurbished farmhouse where overnight accommodation and meals are provided. Mike and Jodee Luther (Snake River Adventures) manage the site, under a USFS special-use permit.

Temperance Creek Ranch—Temperance Creek Ranch (RM 223.8) is on the Oregon side of the Snake River about 24 mi north of Hells Canyon Dam (Figure E.5-1). The USFS purchased this area in 1975. Butch and Karen Brown currently operate the site as a base for outfitted hunting trips, under a special-use permit.

Copper Creek Resort—Copper Creek Resort (RM 205) is on the Oregon side of the Snake River, about 43 mi north of Hells Canyon Dam (Figure E.5-1). The site is operated by Beamers (a guide and outfitting service) under a USFS special-use permit. Copper Creek has several cabins with beds, bathrooms with showers, cabin decks overlooking the river, and a boat dock. Meals are also available.

E.5.1.1.4. Other U.S. Forest Service Sites and Trails in the HCNRA

Stud Creek Trail (*1781*)—The Stud Creek Trail begins at the Hells Canyon Visitors Center (at the Hells Canyon Creek Recreation Site) and extends downstream along the Oregon side of the river for about 1 mi to Stud Creek (RM 246). Overnight camping and river access are available from this trail.

Snake River National Recreation Trail—This 25-mi trail runs parallel to the Snake River in Idaho. It begins at Granite Creek (RM 239.6), about 8 mi north (downstream) of Hells Canyon Dam, and ends at the Pittsburg Administrative Site. During high flows, sections of the trail sometimes flood.

Deep Creek Access Trail (*218*)—In 1989, the USFS, Idaho Department of Fish and Game (IDFG), and the Applicant cooperatively participated in a project to construct and improve the trail from Hells Canyon Dam to Deep Creek, a very popular angling destination. Deep Creek is 0.1 mi downstream of and about 350 feet (ft) below the top of Hells Canyon Dam. The Idaho side of Hells Canyon Dam marks the beginning of the access trail (Figure E.5-1). The trail is very steep, traversing almost vertical canyon walls. A series of metal stairways, landings, railings, and natural surfaces provide access for anglers and other outdoor enthusiasts to the Idaho side of the Snake River below Hells Canyon Dam. The USFS maintains a vault toilet located by the Deep Creek parking area immediately adjacent to Hells Canyon Dam and Hells Canyon Road.

Dug Bar—Dug Bar (RM 197) is on the Oregon side of the Snake River about 50 mi north of Hells Canyon Dam (Figure E.5-1). A USFS dirt road from Imnaha provides vehicle access to the Snake River. A boat ramp, vault toilet, and several campsites are located at this site.

Designated Campsites—The USFS has identified more than 100 distinct camping areas within the HCNRA. These sites are scattered throughout the Snake River corridor. For details about these campsites and other sites, see Technical Report E.5-9.

E.5.1.1.5. Area Trails

Over 50 mi of USFS hiking trails are accessible along Hells Canyon Reservoir. These trails are located along both the Idaho and Oregon sides of the Snake River. Maintenance of these trails varies.

E.5.1.1.6. Oregon Trails

Hells Canyon Trail (*1890*)—Hells Canyon Trail begins on the Oregon side of Hells Canyon Reservoir at Copper Creek Trailhead, which is located at the northern end of Homestead Road. Approximately 2 mi downstream, the Hells Canyon Trail connects with Trail 1884 at Spring Creek. Currently maintained by the USFS, this trail is in a designated wilderness.

Bench Trail (*1884*)—Bench Trail connects Spring Creek to Squaw Creek and is approximately 8.9 mi long.

McGraw Trail (*1879*)—McGraw Trail is a loop trail that goes to McGraw Creek Ridge and then continues north to connect with Bench Trail.

Thirty-two Point Trail (*1789*)—Thirty-two Point Trail is 6.3 mi long and connects Squaw Creek to USFS Road 3965.

E.5.1.1.7. Idaho Trails

Eckels Creek Trail (*223*)—Eckels Creek Trail connects with the Midslope Contour Trail and continues up Eckels Creek to Lynes Saddle Trailhead on USFS Road 111, near Cuprum, Idaho.

Allison Creek Trail (*514*)—Allison Creek Trail connects with the Midslope Contour Trail 2 mi from the trailhead.

Kinney Creek Trail (*221*)—Kinney Creek Trail connects with the Midslope Contour Trail 2 mi from the trailhead.

Midslope Contour Trail (*222*)—Midslope Contour Trail connects with Kinney, Allison, and Eckels creek trails.

Deep Creek Trail (*219*)—Deep Creek Trail starts on an old mining road in Eagle Bar and goes to Deep Creek.

Haley Ridge Trail (*220*)—Haley Ridge Trail connects with Deep Creek Trail and continues to Sheep Rock Overlook.

Copper Creek Trail (*320*)—Copper Creek Trail connects Sheep Rock and Deep Creek via the Copper Creek drainage.

E.5.1.1.8. Bureau of Land Management Facilities and Opportunities

The Bureau of Land Management (BLM) does not own or operate any recreation facilities in the HCNRA. However, much of the land surrounding Brownlee, Oxbow, and Hells Canyon reservoirs falls under BLM jurisdiction.

Heller Bar—Just north of the mouth of the Grande Ronde River, the landing at Heller Bar (RM 168.4) is about 8 mi north of the HCNRA's northern boundary (21 mi south of Asotin, Washington) (Figure E.5-1). This BLM site has a boat ramp, parking facility, and restrooms on Snake River Road. Although Heller Bar is not within or adjacent to the HCNRA, it provides significant access for boaters entering the HCNRA through the Cache Creek portal.

Impromptu Areas—The BLM manages several areas adjacent to the HCC that are used for impromptu day-use sites and campsites. Some areas provide unimproved boat launching areas, garbage pickup, and vault or portable toilets.

E.5.1.1.9. Private Facilities and Opportunities

Many private recreation facilities offer a variety of amenities along the Snake River in the HCRA. Eight facilities are described here.

Kirby Creek Lodge—This lodge (RM 219) is located approximately 80 mi upstream of Lewiston (Figure E.5-1) and 26 mi downstream of Hells Canyon Dam (Figure E.5-1). Mike and Jodee Luther, who own and operate Snake River Adventures, also own Kirby Creek Lodge and operate it under a special-use permit from the USFS. The lodge has a grassy lawn, eight guest rooms, two shared bathrooms with showers, and one shared living room. Family-style dining is also provided.

Garden Creek Preserve (*The Nature Conservancy*)—Formerly known as the Madden Ranch, this site (RM 176) is located just north of the HCNRA boundary (approximately 37 mi south of Lewiston) on what was once a working ranch (Figure E.5-1). Built in the 1920s, the lodge is a large home leased from The Nature Conservancy by River Quest Excursions (a guide and outfitting service). Surrounded by an orchard, the house overlooks the Snake River. Garden Creek runs past the orchard and supplies the property with its own hydroelectric power. There are four guest rooms and two shared bathrooms. Meals are served family style.

Hells Canyon Bed and Breakfast—This bed and breakfast is located on the Homestead Road along Hells Canyon Reservoir approximately 0.25 mi northwest of Oxbow, Oregon. Private airconditioned rooms have satellite TV, private bathroom, refrigerator, and coffee maker. Continental breakfast is provided.

Farewell Bend Motor Inn Complex—Approximately 0.5 mi upstream of Farewell Bend State Park, this complex includes a motel, gas station, café, and truck repair facility. It is located next to Interstate 84 (I-84) off Exit 353.

Wayne's Motel—This small motel is located in Huntington, Oregon, and provides lodging for visitors using the Brownlee Reservoir area.

Hells Canyon Sportsman's RV Park—This recreational vehicle (RV) park is located approximately 2 mi southwest of Oxbow along Oregon Highway 86 (Oregon 86). Rental cabins and laundry facilities are also available.

Richland Motel—Located in Richland, Oregon, this motel provides lodging for those wanting more amenities than the camping facilities at Baker County's Hewitt and Holcomb parks.

Gateway Store and Motel—This facility has a café/store, small motel, and RV storage. Gateway is located along Idaho Highway 71 (Idaho 71) approximately 4.5 mi southeast of Brownlee Reservoir. Bait, tackle, groceries, fishing licenses, gasoline, and propane are sold on site.

E.5.1.2. Recreational Facilities and Opportunities at the Project

The Applicant; federal, state, and local government agencies; and private entities own facilities within the HCC. Existing facilities range from dispersed sites that have been kept fairly primitive to developed sites with amenities such as boating facilities, toilets, and picnic areas. In February 1998, the Applicant inventoried 139 dispersed sites (see Technical Report E.5-9). Several developed camping facilities within the area are owned by the Applicant; state, federal, or county government agencies; or private entities. Developed facilities provide electrical hookups, water, bathrooms, and shower facilities for a fee. Other dispersed and impromptu camping facilities having only vault toilets and/or a public water source provide a more primitive experience. A wide array of dispersed campsites exists within the area.

E.5.1.2.1. U.S. Forest Service Facilities and Opportunities

Eckels Creek—A small area owned by the USFS, Eckels Creek (RM 256.8) is used for impromptu day use (Figure E.5-1). Campsites are located on the Idaho side of Hells Canyon Reservoir, just upstream of Big Bar on Hells Canyon Road (about 15 mi north of Oxbow Dam). While this area offers no amenities, it is one of the most popular small dispersed camping sites associated with the reservoirs. Eckels Creek provides shade, boat mooring, good bank fishing access, and privacy.

Big Bar—The USFS owns this 38-acre terraced area (RM 256.2) on the Idaho side of Hells Canyon Reservoir, 16.5 mi downstream of Oxbow Dam (Figure E.5-1). Limited facilities include vault toilets, interpretive signs, two unimproved boat ramps, and one dock. Impromptu campsites occur at various locations throughout this site. The USFS (Payette National Forest) is currently evaluating potential recreational enhancements for Big Bar.

Black Point—Black Point (RM 252.7) is a scenic overlook pullout 20 mi north (downstream) of Oxbow Dam on Hells Canyon Road (Figure E.5-1). Situated about 1,200 ft above, and immediately adjacent to, Hells Canyon Reservoir, this pullout accommodates large vehicles and provides interpretive information.

Eagle Bar—This 2.82-acre site (RM 249.5) is located approximately 7 mi downstream of Big Bar on the Idaho side of Hells Canyon Reservoir (Figure E.5-1). The USFS manages this site for dispersed camping and day use. A boat ramp is also available.

E.5.1.2.2. Bureau of Land Management Facilities and Opportunities

Oasis Site—On the Oregon side of upper Brownlee Reservoir, the Oasis site (RM 340) is located adjacent to U.S. Highway 30 (U.S. 30). Amenities include a boat ramp, a gravel parking lot, and a vault toilet. Some impromptu campsites occur in the area. In fall 1996, the BLM removed the concrete from the boat ramp and replaced it with gravel. In 1997, a vault toilet was added, and the parking area was graded as part of a cooperative effort between the BLM and the Applicant.

Steck Recreation Site—Located on the Idaho side of Brownlee Reservoir, this day- and night-use site (near RM 327) is adjacent to Olds Ferry Road (Figure E.5-1). Although the land (72.4 acres, of which 37 acres are developed) is owned by the IDFG, the BLM has a perpetual management easement, granted in 1994, for site operation. The lower camp and day-use areas are landscaped with turf and shade trees, while the upper camp area is landscaped with xeric desert grasses, shrubs, and trees. Amenities include vault toilets, drinking water, picnic tables, a covered picnic area, designated campsites, a fish-cleaning station, a boat ramp, and docks. In 1990, with assistance from the IDFG and after acquisition of adjacent land, the BLM constructed an additional boat ramp just downstream of the park. In 1995 and 1996, the BLM redeveloped the lower camping area by constructing sites with fire rings, picnic tables, and barbecue grills. Six new vault toilets were also added. In 1998, the existing downstream boat ramp was extended to provide access during low-water conditions (2,055-ft level). In 1999, the BLM finished a four-year renovation project that expanded the camping capacity and improved the overall quality of the facilities. The older, shaded area has 16 RV sites and 5 tent sites. The newer, upper area has 29 RV sites, including 4 group sites. All sites have grills, campfire rings, and picnic tables. Potable water is available at various locations throughout the park. No RV hookups or showers are available.

Spring Recreation Site—On the Oregon side of Brownlee Reservoir, Spring Recreation Site (RM 327) is adjacent to the Snake River Road, just downstream of the mouth of the Burnt River (Figure E.5-1). Access to this day- and night-use facility is via a paved road from Huntington and a gravel road from Richland. The land where the park was constructed was donated by the Applicant to the BLM for recreational development. Minimal shade is provided. The facility has vault toilets, multiple campsites, drinking water, a fish-cleaning station, a boat ramp with docks, and a large boat and trailer parking area. A BLM firefighting crew is stationed adjacent to this site.

Swedes Landing—On the Oregon side of Brownlee Reservoir, Swedes Landing (near RM 304) is adjacent to the Snake River Road (Figure E.5-1). George Stover of Weiser, Idaho, originally maintained this site. In 1958, a boat club from Baker City built wooden docks, anchor stays, and dry toilets. Swedes Landing covers approximately 3 acres, providing impromptu campsites, vault toilets, and an unimproved boat ramp area. In 1997, in a cooperative effort with the Applicant, the BLM installed an additional vault toilet and added gravel to the existing parking area and boat ramp.

Bob Creek Section C—Bob Creek section C (near RM 267.9) is located on the Oregon side of Hells Canyon Reservoir along Homestead Road. The site provides approximately 3 acres for impromptu campsites, a vault toilet, and a small unimproved boat ramp.

Copper Creek Trail (*Hells Canyon Trailhead*)—Copper Creek (near RM 260.7) is on the Oregon side of Hells Canyon Reservoir at the end of Homestead Road (Figure E.5-1). The site offers 6.56 acres for impromptu camping. In addition, reservoir access and two vault toilets are available. This site is also known as the Hells Canyon trail Trailhead because the Hells Canyon Trail connects with the Bench Trail at Spring Creek, approximately 2 mi away.

Impromptu Areas—In addition to the sites described, the BLM manages several areas adjacent to the HCC that are used for impromptu day-use sites and campsites. Some areas provide garbage pickup, vault or portable toilets, and unimproved boat-launching areas. For detailed information about these and other BLM recreation facilities, see Technical Report E.5-9.

E.5.1.2.3. Oregon State and County Park Facilities and Opportunities

Farewell Bend State Park—This day-use and overnight camping facility (RM 334) is the only state park located within the HCC area (Figure E.5-1); it is owned and operated by the State of Oregon. The park is located near the Farewell Bend turnoff from I-84, adjacent to Brownlee Reservoir. The land where the park was constructed was donated by the Applicant to the State of Oregon for recreational development. The park covers 73 acres and is extensively landscaped with turf, shrubs, and shade trees. Amenities include 101 RV sites with electrical and water hookups, 30 primitive sites with paved areas and a common water source (but no electrical hookups), and 4 hiker/biker sites for tent camping. Since 1995, the Oregon Department of Parks and Recreation has added two covered camper wagons (seasonal), two log cabins (seasonal), teepees (seasonal), and an amphitheater for interpretive programs. Additional amenities include ADA accessible restrooms, showers and campsites, electrical hookups, water hookups, picnic tables, barbecue pits, interpretive and information panels, a fishing access trail and pier, a fish-cleaning station, a designated swimming area (unguarded), a lighted boat ramp with docks, and boat and trailer parking. A fee is charged for day use and overnight camping.

Hewitt and Holcomb Parks—These parks (RM 7.5) are day- and night-use recreation facilities on the Powder River arm of Brownlee Reservoir near Richland (Figure E.5-1). The only county-owned facilities in the HCRA, these parks are owned and operated by Baker County. The land where the park was constructed was donated by the Applicant to a local sportsman's club that later donated the land to Baker County for recreational development. The park is landscaped with turf, shade trees, a paved road, and a parking area. Amenities include restroom facilities, showers, RV campsites with electrical and water hookups, picnic tables, a playground, a fish-cleaning station, boat ramps, and numerous docks. In 1996, the Applicant extended the main boat ramp at Hewitt Park by 100 ft (from elevation 2,048.5 to 2,036.5 ft mean sea level [msl]) to help boaters launching during periods of low water level. A fee is charged for overnight camping.

E.5.1.2.4. Private Facilities and Opportunities

Several private recreation facilities offer a variety of amenities along the Snake River on both sides of Brownlee and Oxbow reservoirs. Four facilities are described here.

Snake River RV Park—This 25-acre campground (RM 340) is adjacent to the privately owned Oasis Campground and near the BLM's Oasis site (Figure E.5-1). The campground contains 10 campsites with electrical, water, and sewer hookups and 10 campsites with electric hookups and water. A restroom facility with showers, laundromat, fish-cleaning station, and paved boat ramp are also provided.

Oasis Campground—On the Oregon side of Brownlee Reservoir, Oasis Campground (RM 340) is located between the BLM Oasis site and the Snake River RV Park, adjacent to the Olds Ferry–Ontario Highway (U.S. 30) and approximately 10 mi downstream of Weiser (Figure E.5-1). Oasis

Campground has a restroom with showers and 23 RV sites with electrical, water, and sewer hookups. Bait and tackle are sold on site.

Mountain Man Resort and Marina—Mountain Man Resort (RM 310) is on the Idaho side of Brownlee Reservoir, 32 mi northwest of Weiser (Figure E.5-1). It is part of a 38,000-acre ranch, accessible via the county-maintained Rock Creek Road. Before 1997, lodge amenities included accommodations for up to 34 people, meals, and a meeting room. For a fee, primitive camping facilities and teepees were available for overnight use. Guided hunting and fishing were offered on a private shooting preserve. A marina adjacent to the lodge provided boat mooring, boat rentals, fuel, bait, tackle, fishing licenses, and groceries. Since 1997, Mountain Man Lodge has been closed to the public.

Little Deacon Creek—This approximately 5-acre site (RM 310) provides a primitive boat ramp, a dock, and some graveled pads for RV parking (Figure E.5-1). This site is also used to access Mountain Man Resort from the Oregon side of the river.

E.5.1.2.5. The Applicant's Facilities and Opportunities

All Applicant-managed parks have full-time maintenance personnel, and fees are charged for overnight camping. Park rules and regulations are posted in all parks. Public telephones are available at all facilities. Informational, historical, and interpretive signs are present at various locations throughout the parks and the HCRA. The parks are open year-round, with limited amenities and reduced rates available during the off-season. The official park season runs from March 31 through September 31. The park facilities are provided and regulated in accordance with section 10(a) of the Federal Power Act. Consistent with the law and the Applicant's policies, reasonable fees are charged for use of the park facilities at Brownlee, Oxbow, and Hells Canyon projects. For more detailed information about the Applicant's park facilities, see Technical Report E.5-8.

Woodhead Park—Constructed in 1959, this park (RM 288) is located on the Idaho side of Brownlee Reservoir and adjacent to Idaho 71, approximately 24 mi west of Cambridge, Idaho, and 4 mi south of Brownlee Dam (Figure E.5-1). Remodeling and expansion of the park completed in spring 1995 enhanced camping, parking, and boating facilities. Because a realignment of Idaho 71 increased park acreage, the park now has 65 acres of turf, shade trees, and naturally landscaped areas. Woodhead Park has 124 RV sites, with electricity, water, picnic tables, and fire rings. Fifteen walk-in tent sites are equipped with water, picnic tables, and fire rings. Within large day-use areas, two large picnic areas with shelters can accommodate group gatherings. In addition, Woodhead Park has the following amenities: three restrooms, two comfort stations with showers, a wastewater treatment lagoon, a fish-cleaning station, interpretive and information displays, a trail system, paved roads, a boat trailer parking area, and two boat ramps (four-lane and single-lane) with docking systems. In spring 1996, the new four-lane boat ramp was extended to allow reservoir access down to 2,022 ft msl (reservoir “full pool” is 2,077 ft msl). The original one-lane boat ramp allows reservoir access during maximum drawdowns (1,976 ft msl).

McCormick Park—Constructed in 1958, this park (RM 284) is located on the Idaho side of Oxbow Reservoir, approximately 1 mi downstream of Brownlee Dam (Figure E.5-1). McCormick Park is a day- and night-use recreation facility with the following amenities: 9 acres of turf, shade trees, restroom facilities with showers, 34 RV sites with electrical and water hookups, numerous tent spaces, picnic tables, fire pits, and a sanitary dump station for RVs. In addition, a concrete boat ramp, boat ramp parking, and docks are adjacent to the park.

Carters Landing—Occupying about 1.7 acres, Carters Landing (RM 281) is adjacent to the Brownlee–Oxbow Road on the Oregon side of Oxbow Reservoir, approximately 4 mi downstream of Brownlee Dam (Figure E.5-1). The BLM owns this site, and the Applicant administers and maintains it. Facilities include several impromptu campsites, a composting toilet, picnic tables, garbage receptacles, and an unimproved boat launch. The Applicant charges nominal fees for use of the site.

Oxbow Boat Launch—A day-use-only site, Oxbow Boat Launch (RM 276) is located on a narrow strip of land adjacent to the Brownlee–Oxbow Road on the Oregon side of Oxbow Reservoir, approximately 10 mi downstream of Brownlee Dam (Figure E.5-1). The BLM owns this site, and the Applicant administers and maintains it. Amenities include a gravel boat ramp, a dock, a composting toilet, garbage pickup, and parking.

Copperfield Park— Copperfield Park (RM 270) is located on the Oregon side of Hells Canyon Reservoir just 3 mi downstream of Oxbow Dam and adjacent to the intersection of Idaho 71, Oregon 86, and Hells Canyon Road (Figure E.5-1). Originally constructed in 1965 and subsequently remodeled in 1989, the park has 12 acres of turf, paved roads, terraced landscaping, and numerous trees. Sixty-two RV sites have electricity, water, fire pits, and picnic tables. The park also has 10 camping sites for tents, with nearby picnic tables and barbecue stands. Restroom facilities with showers, a sanitary dump station, and additional vehicle parking are also available. Copperfield Boat Launch is nearby.

Copperfield Boat Launch—Constructed in 1994, the Copperfield Boat Launch (RM 269) is located on the Oregon side of Hells Canyon Reservoir, approximately 1 mi downstream of Copperfield Park on Homestead Road (Figure E.5-1). Amenities include a two-lane concrete boat ramp, boat docks, parking, garbage receptacles, and seasonal toilets.

Hells Canyon Park—Hells Canyon Park (RM 264) is located on the Idaho side of Hells Canyon Reservoir adjacent to Hells Canyon Road, about 9 mi downstream of Oxbow Dam (Figure E.5-1). The park's 15 acres are landscaped with turf and mature shade trees, and a paved road runs through the park. Amenities include restroom facilities with showers, an RV dump station, 24 RV sites with electrical and water hookups, picnic tables, and barbecue stands. Numerous tent sites with picnic tables are available in a turf area that has large trees and copious shade. A large day-use area within the park has parking, picnic tables, shade trees, and a swimming area. An adjacent boat ramp area provides parking for vehicles and boat trailers, four electric pedestals for recharging boat batteries, a concrete boat ramp, and boat docks.

Impromptu Areas—In addition to the developed parks, the Applicant maintains a number of impromptu camping and access sites adjacent to project waters and within the project boundary. Available at some of these areas are portable toilets, garbage pickup, and unimproved boat-launching facilities. For more detailed information about the Applicant's nonpark recreational facilities, see Technical Report E.5-9.

E.5.2. Estimates of Existing and Potential Recreational Use

To provide a format for discussions about the relicensing of the HCC and about related studies and protection, mitigation, and enhancement (PM&E) measures, the Applicant and concerned agencies and entities formed the Collaborative Team. Subsequently, the collaborative team established specific work groups to address each of the major resource categories identified for consideration in the relicensing effort. One of these work groups was the Recreation and Aesthetics Resources Work Group (RARWG). Together, the members of this work group developed plans for studies to gather general recreational-use information and to address specific recreation-related issues that the work group had identified. The Applicant submitted the resulting study plans to the Federal Energy Regulatory Commission (FERC) as part of a formal consultation package for relicensing the HCC (IPC 1997). The package contained 13 proposals for recreation-related studies to be conducted about or within the Hells Canyon Recreation Area (HCRA), the study area for recreation resources that includes the reservoirs associated with the three HCC dams plus downstream Snake River-related areas within the Hells Canyon National Recreation Area (HCNRA) (Figure E.5-2).

Through continuing consultation with agencies and other entities, the Applicant developed 13 recreational-use studies to address all of the proposed goals identified in the formal consultation package, as well as additional goals developed in the interim. The results of those studies are presented in 13 technical reports that are included as technical appendices to this license application:

- Technical Report E.5-1. *A Review of Past Recreation Issues and Use in the Hells Canyon Complex and the Hells Canyon National Recreation Area*. This report contains a comprehensive description of recreational sites and facilities within the HCRA, as well as the results of an extensive literature review concerning the history of the HCC and the HCNRA and recreational use associated with the HCRA. Emphasis is placed on information related to recreational issues associated with the HCC.

- Technical Report E.5-2. *Reservoir-Related Recreational Use at the Hells Canyon Complex.* This report contains information about the amount, timing, location, and type of reservoir-related recreational use in the HCC. The information was obtained during comprehensive recreational-use surveys and associated efforts conducted by the Applicant each year from 1994 through 1998 and again in 2000.

- Technical Report E.5-3. *Recreational Use Associated with the Snake River in the Hells Canyon National Recreation Area*. This report contains information about the amount, timing, location, and type of recreational use in the HCNRA. The information was obtained from USFS boater registration records from 1992 through 1999 and on-site and follow-up mail surveys conducted by the Applicant, with the cooperation of the USFS, during 1999.

- Technical Report E.5-4. *General Recreation Findings from Hells Canyon Complex Reservoirs: 1994–2000 Onsite Interviews and 2000 Mail Survey*. The Applicant conducted on-site interviews with recreationists in the HCC during 1994 through 1998 and again in 2000. In addition, the Applicant conducted an on-site and follow-up mail survey during 2000. This report contains results from these efforts about recreationists' demographics, activities, use patterns, comments to open-ended questions, and responses to specific questions about management of and facilities in the HCC.

- Technical Report E.5-5. *General Recreation Findings from Hells Canyon National Recreation Area: 1999 Visitor Survey*. The Applicant conducted two mail surveys targeting HCNRA users: one that followed on-site contact during 1999 and another that specifically targeted outfitters, guides, and expert boaters during 2000. This report contains results about recreationists' demographics, activities and use patterns, comments to open-ended questions, and responses to specific questions about management of and facilities in the HCNRA.

- Technical Report E.5-6. *Reservoir Level Issues in the Hells Canyon Complex*. This report contains results from several sources. The Applicant obtained HCC recreationists' comments about the area during on-site surveys (1994–1998) and with a mail survey conducted in 2000. In addition, responses to specific questions related to reservoir fluctuations were collected during the 2000 mail survey. The Applicant also quantified the relationship between the location and amount of recreational use and the water levels at Brownlee Reservoir.

- Technical Report E.5-7. *River Level Issues in the Hells Canyon National Recreation Area*. With a mail survey conducted as a follow-up to 1999 on-site surveys, the Applicant obtained HCNRA boaters' responses to open-ended questions about the area. In addition, with this same follow-up survey and a 2000 mail survey targeting outfitters, guides, and expert boaters, the Applicant collected comments to questions that were specifically about the effects of river flows. For this report, the Applicant also quantified the relationship between the amount and location of boating use in the HCNRA and the flows in the Snake River.

- Technical Report E.5-8. *Description of Existing Developed Recreation Sites in the Hells Canyon Complex and Associated Recreational Use*. This report contains descriptions of the physical size, location, management, facilities, and amenities of the eight developed parks associated with the HCC. In addition, information about the type and amount of recreational use associated with these parks is reported from the Applicant's recreational-use surveys conducted from 1994 through 1998 and in 2000.

- Technical Report E.5-9. *Description of Existing Recreation Areas in the Hells Canyon Complex and Hells Canyon National Recreation Area*. For this report, the Applicant identified undeveloped and impromptu recreational-use areas within the HCC. In cooperation with the USFS, the Applicant also identified recreational-use sites associated with the Snake River in the HCNRA. Used areas were extensively mapped, and other parameters related to site conditions were counted or estimated.

- Technical Report E.5-10. *Reservoir Angling in the Hells Canyon Complex*. Creel surveys were conducted at the HCC reservoirs from 1994 through 1998 and in 2000. This report contains information about the location, timing, and amount of angling use, as well as target species, catch and harvest rates, and length-frequency of harvested fish.

- Technical Report E.5-11. *Angling on the Snake River in the Hells Canyon National Recreation Area*. The Applicant obtained creel results from USFS boating records and on-site contact and a follow-up mail survey. This report contains results about location, timing, and amount of angling use by boaters, as well as target species, catch and harvest rates, and anglers' attitudes about angling in the HCNRA.

- Technical Report E.5-12. *Hunting Associated with the Hells Canyon Recreation Area and the Hells Canyon National Recreation Area*. For this report, the Applicant conducted an extensive literature review to obtain agency materials about hunting in the area around the HCRA. All results were compiled into comprehensive tables and graphs. In addition, the report includes all hunting-related results from previously mentioned surveys.

- Technical Report E.5-13. *Recreation in the Hells Canyon Complex: Selected Photos and Major Study Findings*. This report contains photographs from the study area that depict types of recreational use and scenes and situations related to major recreational use issues.

This exhibit contains partial study results from Technical Reports E.5-2 and E.5-4. See the appendix of this application for detail from these two studies and for results from the other recreational resources studies.

E.5.2.1. Existing Recreational Use and Users

The extent of the HCRA, the study area for recreation resources, was determined by the RARWG. The HCRA covers a 166.9-mi reach of the Snake River that extends from approximately 8 mi downstream of the bridge near Weiser—at the FERC project boundary near the crossing of an overhead powerline—downstream to the northern boundary of the HCNRA. In addition, the study area includes the reach of the Powder River that is considered part of Brownlee Reservoir. The majority of the Applicant's recreation-related study efforts have focused on the immediate Snake River corridor; however, the study area differs among the various recreation studies.

The study area contains four distinct reaches: the three HCC reservoirs and the unimpounded Snake River within the HCNRA (Figure E.5-3).

Brownlee Reservoir Reach—The Brownlee Reservoir reach of the Snake River is 58.4 mi long, extending from the FERC project boundary near the crossing of an overhead powerline (RM 343) to Brownlee Dam (RM 284.6). The Powder River reach of Brownlee Reservoir begins at the confluence with the Snake River (RM 0) and extends upstream approximately 9 mi to the upper end of the reservoir pool (RM 9.0).

Oxbow Reservoir Reach—The Oxbow Reservoir reach is about 12 mi long and extends from immediately downstream of Brownlee Dam to the Oxbow Dam (RM 272.5).

Hells Canyon Reservoir Reach—The Hells Canyon Reservoir reach extends from 24.9 mi below Oxbow Dam to Hells Canyon Dam (RM 247.6). The unique design of the powerhouse and dam associated with the Oxbow Project leaves a 2.5-mi reach of the riverbed below Oxbow Dam that is above the normal Hells Canyon Reservoir elevation. The Applicant maintains a flow of 100 cubic ft per second through this reach of original channel, which is referred to as the Oxbow Bypass. However, the bypass reach is also subject to inundation due to the backwater effect of Hells Canyon Dam and Reservoir.

The HCNRA Reach—The HCNRA reach of the study area begins at Hells Canyon Dam and extends north 71.4 mi to the northern boundary of the HCNRA, just north of the Cache Creek Administrative Site (USFS) (RM 176.1).

Type, location, and amount of recreational use in the HCRA are, to a large degree, defined by road access to the Snake River corridor. Road access varies considerably within the study area. At one extreme, roads running parallel and immediately adjacent to the reservoirs provide relatively easy access (Figure E.5-4). At the other extreme, extensive reaches have no road access; the longest such stretch is 76 mi (Figure E.5-5). For a complete description of road access within the HCRA, see Technical Report E.5-2.

E.5.2.1.1. Brownlee Reservoir Fluctuations and Changes in Angling Success

An understanding of two major issues related to recent changes in recreational use at the HCC is necessary to fully comprehend the results in this exhibit. First, fluctuation patterns at Brownlee Reservoir changed dramatically in the years immediately preceding the study period. This reservoir is the largest of the three HCC reservoirs, and it attracts the most recreational use. Second, the crappie fishery at Brownlee Reservoir experienced a substantial reduction in quality immediately prior to, and during the early years of, the study period. This fishery, having been highly productive during the years right before the study, had attracted large numbers of anglers.

E.5.2.1.1.1. Brownlee Reservoir Seasonal Fluctuations

Starting in 1991, the annual pattern of fluctuation in Brownlee Reservoir changed significantly. Before that year, the only significant drawdown that occurred regularly was for spring flood control. The amount of that drawdown varied, based on the amount of snowpack in the highland and mountain areas, expected runoff, and requests from the U.S. Army Corps of Engineers (ACOE). During high-flow years, the reservoir was drawn down much lower than during low-flow years. Then the reservoir generally remained within 20 ft of full pool during the remainder of the year.

Brownlee Reservoir is a multiple-use, year-round resource. Although the primary purpose of the reservoir is to provide a stable power source, the reservoir is also used for flood control, fish and wildlife mitigation, and recreation.

Brownlee Dam is one of several Northwest dams that is used to provide springtime flood control on the lower Columbia River and, between 1995 and 2001, to regulate flow in the lower Snake River for anadromous fish migration. For flood control, the Applicant operates the reservoir cooperatively with the ACOE North Pacific Division, according to article 42 of the existing license.

After flood-control requirements have been met in early summer, the Applicant refills the reservoir to meet peak summer electricity demands and to provide suitable habitat for spawning bass and crappie. The full reservoir also offers optimal recreational opportunities through the Fourth of July holiday.

Later in the fall, Brownlee Reservoir's releases are managed to maintain constant flows below Hells Canyon Dam. These flow requirements, which are based on the fall chinook recovery plan that the Applicant adopted in 1991, and on the minimum flow required by article 43 of the license, help ensure sufficient water levels to protect even the shallowest spawning nests, or redds. As part of the flow augmentation reasonable and prudent alternative (RPA) implemented by the 1995 and 2000 Federal Columbia River Power System (FCRPS) biological opinions, the Bureau of Reclamation (BOR) periodically releases water from BOR storage reservoirs in the upper

Snake River to assist with the migration of anadromous fish past the lower Snake River FCRPS projects. From 1995 through the summer of 2001, the Applicant cooperated with the BOR and other federal interests in these flow augmentation efforts by shaping (or prereleasing) water from Brownlee Reservoir (and later refilling the drafted reservoir space with water released by the BOR from the upper Snake River reservoirs) and by occasionally contributing water to flow augmentation efforts. To facilitate the Applicant's cooperation with the flow augmentation RPA, in 1996 the Bonneville Power Administration (BPA) entered into an energy exchange agreement with the Applicant. The agreement reimbursed the Applicant through an energy exchange mechanism for any energy losses it incurred as a result of the company's participation. The agreement expired in April 2001 and has not been renewed by the BPA.

After fall chinook spawn, the Applicant attempts to have a full reservoir by the first week of December to meet winter peak demands.

Winter—December through February

Electricity demands in the Applicant's service territory—and throughout the Northwest—are critical during the winter. To meet peak winter demands and maintain system reliability, the water level in Brownlee Reservoir is approximately 2,075 ft msl by the first week in December. If the reservoir is filled to that level, the system can provide stable, reliable energy through the winter and reduce operating costs by minimizing the need for purchasing outside power.

During these months, the Applicant maintains minimum flows below Hells Canyon Dam to ensure sufficient water levels for fall chinook spawning nests. By January or February, the Applicant begins to draft the reservoir to meet elevation targets for flood control.

Spring—March through May

The ACOE's North Pacific Division defines flood-control requirements and coordinates flood-control efforts with the Applicant. During the spring, the Applicant complies with article 42 and responds to the ACOE request to lower the water level in Brownlee Reservoir. The lower water level provides space for excess spring runoff and helps prevent flooding, primarily on the lower Columbia and lower Snake rivers.

The existing license requires that the reservoir's elevation by March 1 be at or below 2,034 ft, a level that provides approximately 500,000 acre-feet of storage space for flood control. The license also stipulates that the ACOE may request an additional 500,000 acre-feet of storage space, if necessary. However, in past years when the snow pack was less than normal, the ACOE reduced the storage space requirement.

In the mid-1980s, the ACOE examined the reservoir's flood-control operation and developed a rule curve table for Brownlee Reservoir's target elevations. These target elevations define the space in the reservoir needed for flood control and are based on forecasted runoff at both the Brownlee and The Dalles projects. More recently, the rule curve procedure was improved. This new rule curve now provides a more gradual change in reservoir elevations to reach required storage volumes by targeted dates.

The Applicant initiated the new rule curve for flood-control requirements for water year 2000. Depending on the water year and ACOE mandates, flood-control requirements for Brownlee Reservoir may continue through June. To meet mandated target elevations for flood control, the Applicant may need to spill water through the HCC. Although there are no official refill target elevations, the ACOE controls how quickly the reservoir can be refilled once flood-control requirements are met.

Summer—June through August

After the Applicant is released from flood-control responsibilities, it begins refilling Brownlee Reservoir. The refill target is 2,069 ft msl (about 8 ft below the full reservoir capacity of 2,077 ft) toward the end of May and full by the end of the June. Meeting these targets ensures that enough water is stored in Brownlee Reservoir to meet peak summer electricity demands, provide suitable spawning habitat for bass and crappie, and offer optimal recreational opportunities.

In an effort to cooperate with federal efforts to meet flow objectives at Lower Granite Dam outlined in the 1995 and 2000 FCRPS flow augmentation RPA, since 1996, the Applicant has released water from Brownlee Reservoir to contribute to the federal flow augmentation program.

If Brownlee Reservoir is full by the first of July and if projections indicate that the space will refill on time, the Applicant has contributed up to 237,000 acre-feet of water from Brownlee Reservoir during the summer. The Applicant's cooperative contribution has been generally defined by reservoir space rather than a specific amount of storage water. To make its contribution, the Applicant drafts Brownlee Reservoir to an elevation of 2,059 ft msl. When the reservoir is full, such a draft equals a contribution of approximately 237,000 acre-feet.

Also during these months, BOR projects upstream begin releasing 427,000 acre-feet of water to increase Snake River flows in an effort to meet the Lower Granite Dam flow objectives. Because BOR cannot release all of that water within the augmentation period, some of the federal water doesn't reach Lower Granite Dam during the flow augmentation period specified in the RPA. So, during July and August, the Applicant shapes (or prereleases) water from Brownlee Reservoir and later refills the drafted reservoir space with water released by the BOR from the upper Snake River reservoirs. In a typical year, Brownlee Reservoir shapes approximately 130,000 acre-feet of BOR water. The volume of water shaped fluctuates depending on the type of water year the Snake River basin is experiencing.

As mentioned earlier, the BPA agreed to an energy exchange with the Applicant for its cooperation with the flow augmentation RPA. Under this agreement, the BPA reimbursed the Applicant for energy losses resulting from shaping BOR water and contributing water from Brownlee Reservoir. Again, that agreement was not renewed by the BPA after it expired in April 2001.

Historically, there were some years when weather, stream flow, and power demands required further drafting of Brownlee Reservoir.

Fall—September through November

During the fall, Brownlee Reservoir is operated largely to benefit fall chinook below the HCC. After the delivery of flow augmentation water, Brownlee Reservoir releases are managed to maintain a constant flow below Hells Canyon Dam to provide stable conditions for spawning fall chinook. The spawning flow is based on a minimum reservoir elevation of approximately

2,040 ft msl when the program starts in October and forecasted inflows such that Brownlee Reservoir is full, around elevation 2,075 ft msl, by the first week in December. The minimum flow below Hells Canyon Dam is maintained through fry emergence in the spring and established by maintaining water over the shallowmost redd. Once this flow is set, it is considered the minimum flow necessary to keep embryos from desiccating until they emerge as fry in the spring. In other words, the spawning flow is maintained as a minimum flow until emergence is complete. It should also be pointed out that when the reservoir elevation in Brownlee Reservoir lowers, the power production capability of the plant also lowers. This situation, in turn, may require the Applicant to purchase power from other sources if the load demand cannot be met due to the loss in net head at the reservoir.

E.5.2.1.1.2. Impacts of Inflows on Brownlee Reservoir Fluctuations

Because of large annual variations in inflows, the overall effect of these changes varies. To examine how the effects differ based on inflows, the Applicant compared annual elevation patterns of Brownlee Reservoir during a low-, medium-, and high-flow year from both before and after the period when additional drawdowns were initiated.

Low-Flow Years

Inflow patterns for 1988 and 1994 were similar (Figure E.5-6). During 1988, the spring flood-control drawdown was almost 40 ft, while during 1994, the maximum drawdown was less than 20 ft. The amount of drawdown during these years with similar inflows may differ because the ACOE was more cautious in 1994 after seven consecutive years of lower-than-normal flows. In 1988, the reservoir did not drop more than 10 ft during the rest of the warm season. During the same period in 1994, the reservoir was full or nearly full for two or three weeks and then dropped 20 ft during most of the rest of the warm season.

Medium-Flow Years

During 1981 and 1995, inflows were similar and at a medium level (Figure E.5-7). During both years, spring flood-control drawdowns were about 25 to 30 ft. During 1981, the reservoir stayed within 10 to 12 ft of full pool for the rest of the warm season, while during 1995, the reservoir was full for four to five weeks and then dropped 40 ft during the rest of the warm season.

High-Flow Years

The highest flow year on record was 1997 (Figure E.5-8). Though not quite as high, 1986 inflows were similar to those in 1997. During 1986, the spring drawdown was about 40 ft, while the drawdown during the same period in 1997 was 100 ft. In 1986, the reservoir stayed within 10 ft of full pool during the remainder of the warm season, but during 1997, the reservoir stayed full for about three weeks of the warm season and then dropped about 70 ft.

Before 1992, recreationists at Brownlee Reservoir had become accustomed to a full or nearly full reservoir. After 1992, the additional drawdowns caused problems with boating access by affecting navigation and use of boat ramps (Figure E.5-9 and Figure E.5-10). Many recreationists also felt that angling had been hampered by the drawdowns. For a more complete description of the effects of reservoir fluctuations and recreationists' perceptions related to those drawdowns, see Technical Reports E.5-4 and E.5-6.

E.5.2.1.1.3. Brownlee Crappie Angling Results

In 1989, results from a creel survey conducted by the IDFG and Oregon Department of Fish and Wildlife (Mabbott and Holubetz 1990) indicated that the catch of crappie during that year was much higher than any catch recorded during the study years covered by the Applicant's creel study. During the period between 1987 and 1993, anglers harvested millions of crappie from Brownlee Reservoir. This period of phenomenal crappie angling was probably caused by the series of drought years that allowed juvenile crappie to accumulate in the system rather than be flushed out by high flows (Technical Report E.3.1-5). Anglers who fished Brownlee Reservoir during this period and the Applicant's personnel report that early in this period, anglers were catching large numbers of mostly small crappie. As the years progressed, and several successful year classes accumulated in the system, knowledgeable anglers were able to catch hundreds of relatively large (for northern areas; 10- to 12-inch) crappie daily in the late spring. Consequently, Brownlee Reservoir attracted tens of thousands of anglers targeting crappie, and most of the anglers harvested large numbers of the fish. At the Applicant's Woodhead Park, some anglers loaded freezers into their motor homes and left with hundreds, or in some cases, thousands of crappie filets. The study results described in this exhibit begin with 1994, when the phenomenal crappie fishing had ended. A few large crappie were still being caught, but not in the numbers of previous years. For discussions about the relationship between crappie populations and reservoir drawdowns, see Technical Report E.3.1-5.

E.5.2.1.2. Amount, Type, Timing, and Location of Recreational Use in the HCC

Information in this section is from Technical Report E.5-2. From May 1, 1994, through October 31, 1998, and again from May 1 through October 31, 2000, the Applicant's survey clerks conducted roving recreational-use and creel surveys within the HCRA reservoir areas. The Applicant's surveys were based on methodologies suggested by Malvestuto et al. (1978), Malvestuto (1983), and Hoenig et al. (1993). Throughout the study period, personnel counted recreationists by location during randomly selected survey periods. Also, on-site interviews were conducted with recreationists to obtain information on user demographics, recreational use, attitudes, and angling results. The Applicant's on-site surveys in the HCC required 3,658 person days during the six sampling years. This effort was distributed as follows:

- 1994—665 person days
- 1995—685 person days
- 1996—593 person days
- 1997—723 person days
- 1998—493 person days
- 2000—499 person days

During these surveys, the Applicant conducted on-site interviews with 39,591 recreationists. These interviews were distributed as follows:

- 1994—2,577 interviews

- 1995—5,564 interviews
- 1996—5,375 interviews
- 1997—13,709 interviews
- 1998—5,644 interviews
- 2000—6,722 interviews

During 1997, the interview form was much shorter than during the other years; this allowed surveyors to interview many more people.

In this section, results on recreational use are reported by season. The warm season was considered to be from May 1 through October 31; the cold season, from November 1 through April 30.

Organization of Results—Because of the size of the HCC and the variation in topography, access, type of use, and ownership of adjacent lands within the HCC, the Applicant and the RARWG divided the HCC into six management zones, designated as Zones 1 through 6 (Figure E.5-11). Two of the zones, Zones 1 and 2, were further subdivided into subzones. The zones are numbered from downstream to upstream.

- *Zone 1*—The downstream boundary of Zone 1 is the Hells Canyon Visitors Center downstream of Hells Canyon Dam (RM 247). The upstream boundary is just downstream of Copper Creek on Hells Canyon Reservoir (at the end of Homestead Road) (RM 260). Zone 1 contains two subzones. The area between the visitors center and Hells Canyon Dam is designated as subzone HT (Hells Canyon Dam tailwater). The remainder of Zone 1 upstream of Hells Canyon Dam is designated as subzone HC.
- *Zone 2*—The largest of the six zones, Zone 2 is the area from the upstream end of Zone 1 upstream to the south side of the mouth of Brownlee Creek on Brownlee Reservoir

(RM 288.4). Zone 2 contains four subzones: the downstream end of Zone 2 upstream to Oxbow Bridge (across the Snake River downstream of Oxbow Dam) is designated as subzone HC; the area from Oxbow Bridge upstream to Oxbow Dam, subzone OT (Oxbow Dam tailwater); the area between Oxbow and Brownlee dams, subzone OX; and the area in upstream of Brownlee Dam to the upstream end of Zone 2, subzone BR.

- *Zone 3*—Zone 3 is the area from the upstream end of Zone 2 upstream to just north of the Swedes Landing (BLM) site (RM 303.7).
- *Zone 4*—Zone 4 is the area associated with the Powder River arm from its confluence with the Snake River (RM 0) upstream to the upper end of the reservoir pool (RM 9).
- *Zone 5*—Zone 5 is the area from the upstream end of Zone 3 (RM 303.7) upstream to the upper side of the railroad bridge across Brownlee Reservoir at the mouth of the Burnt River (RM 328).
- *Zone 6*—Zone 6 is the area from the upstream end of Zone 5 upstream to the transmission line crossing of Brownlee Reservoir just upstream of Porter Island (RM 343).

Combination of Activity Categories—Categories used to identify activities (36 total) observed during field surveys were combined into a manageable number of groupings for reporting purposes (Table E.5-1). For example, seven categories, such as kayaker, rafter, and sailboater, were in the "water-based miscellaneous" grouping. However, the detail from the original 36 categories is available within the Applicant's database. The Applicant reports categories of activity in combinations that apply to the specific type of area described.

E.5.2.1.2.1. Recreational Use Within the HCC—All Zones Combined

In several of the graphs for results presented in this exhibit, sums of individual categories are not exactly equal to the same information presented as a total in separate graphs. These differences are small and caused by rounding to whole numbers.

Overall Hours by Season—The estimate of overall hours of recreational use in both warm and cold seasons within the HCC decreased considerably during the study period. During the warm season, recreational use was highest in 1994, at 2,128,472 hours. In 1998, the total number of recreational-use hours decreased to 1,112,083, just 52% of the 1994 total. Though recreational use increased to 1,254,188 hours in 2000, this amount was still only 59% of the 1994 total. Recreational use also decreased during the cold season, from 414,934 hours in 1994 to 172,423 hours in 1997 (Figure E.5-12). This pattern of decline held for most, but not all, of the individual zones.

Overall Hours by Season and Activity—For the cold season, the three activities that surveyors most often observed—bank angling, boat angling, and lounging—dropped considerably between 1994 and 1996. These activities then increased between 1996 and 1997. Bank angling during 1997, at 55,536 hours, was 61% of the 1994 total of 90,532 hours. Boat angling dropped much more than bank angling, from 158,203 hours in 1994 to 41,497 hours in 1997 (26% of the 1994 total) (Figure E.5-13). Warm-season totals, though much higher than cold-season totals, followed the same patterns. Lounging, boat angling, and bank angling were by far the three leading activities in terms of total hours of use. Bank angling in 2000, at 212,073 hours, was 55% of the 1994 total of 385,327 hours. As during the cold season, boat angling during the warm season decreased, even more so than bank angling did, from 634,848 hours in 1994 to 260,864 hours in 2000 (41% of the 1994 total) (Figure E.5-14). Lounging decreased from 637,844 hours in 1994 to 483,121 hours in 2000 (76% of the 1994 total). Park use accounted for most of the hours associated with the lounging category.

Park Hours by Season—Overall hours of park use decreased during both the warm and cold seasons. However, warm-season use in the parks did not decrease nearly as much in the cumulative park total as it did for all locations combined. Warm-season park use during 1994 was 550,248 hours. Use during the other six years rose and fell, with the lowest total of 382,952 hours occurring in 1997 (70% of the 2000 total). Cold-season park use in 1997 was 35,173 hours, which is 32% of the 1994 total for cold-season use (109,058 hours) (Figure E.5-15).

Cold-season hours of use by activity in all parks combined declined in all major activity categories. Bank angling dropped from 17,026 hours during 1994 to 3,712 hours during 1997

(22% of the 1994 total). Hiking/walking showed a similar drop, falling to 13% of the 1994 totals. Lounging dropped from 53,137 hours during 1994 to 9,076 hours in 1996 (17% of the 1994 total) and then increased to 24,337 hours during 1997 (46% of the 1994 total) (Figure E.5-16).

Warm-season park use by activity generally decreased during the study period. The one notable exception was picnicking, which increased from 24,324 hours during 1994 to 38,644 hours in 2000 (159% of the 1994 total). The highest number of picnicking hours (49,038) occurred during 1995. Although hours of lounging varied during the study period, the differences did not approach the magnitude of those seen for other activities. The highest total for lounging was in 1994, at 353,288 hours; the lowest was 259,096 in 1995 (73% of the 1994 level). Bank angling in the parks decreased from 56,888 hours in 1994 to 26,813 hours, or 47% of the 1994 total, in 2000 (Figure E.5-17).

E.5.2.1.2.2. Recreational Use by Zones

Zone 2 had by far the greatest amount of recreational use, followed by Zone 5. Zone 1 consistently had the least amount of use. Annual patterns of use varied considerably among both zones and years (Figure E.5-18).

E.5.2.1.2.2.1. Zone 1

Zone 1 consists of the lower two-thirds of Hells Canyon Reservoir (subzone HC) and the Hells Canyon Dam tailwater area (subzone HT). Zone 1 is the remotest of the zones or subzones accessible by road: it has no road access on the Oregon side of the reservoir. Hells Canyon Road closely parallels the reservoir along the Idaho side of subzone HC and then crosses the dam to the Oregon side. The road ends about 1 mi upstream at the USFS Hells Canyon Visitors Center. This portion of the HCC is the most rugged and has the smallest percentage of the relatively flat land that is suitable for recreational use associated with the reservoir.

Overall warm-season use in Zone 1 varied considerably during the study period. The highest amount measured was 115,746 hours in 1996; the lowest, in 1998, was 65,030 hours (56% of the 1996 high). Cold-season use was low and more stable from year to year than warm-season use was. The lowest amount measured, 19,643 hours in 1996, was 80% of the highest amount measured, 24,642 hours in 1997 (Figure E.5-19).

Subzone HT—In subzone HT, warm-season hours varied considerably during the study period, but showed no obvious trend up or down. The lowest amount, 23,375 hours during 1995, was 58% of the highest amount measured, 40,489 hours in 2000. Cold-season hours varied between 12,053 hours in 1994 and 18,661 hours in 1997 (Figure E.5-20).

Bank angling was the activity most often observed in the cold season during three of the four years measured (the exception being 1995). Cold-season anglers usually targeted steelhead. Many of these anglers used stairs on the Idaho side that lead from the top of Hells Canyon Dam down to the confluence of Deep Creek with the Snake River. Miscellaneous activities, mainly related to sightseeing and boat loading and unloading, varied from 3,939 hours during 1994 to 8,761 hours during 1995 (Figure E.5-21). During the warm season, bank angling remained an important part of overall use, but hours of bank angling were consistently lower than total hours for cold-season angling and much lower than the hours for the miscellaneous category (Figure E.5-21 and Figure E.5-22). When steelhead is not a target, bank anglers usually target trout and smallmouth bass. Warm-season use in the miscellaneous category varied from a high of 34,416 hours in 2000 to a low of 18,891 hours in 1995 (55% of the 2000 total). This category during the warm season consisted mainly of sightseers and boaters. The contribution of sightseers to the overall number of hours was relatively constant, whereas hours for boaters loading and unloading at the ramp varied considerably each year, depending on the flows in the Snake River and the availability of flows at other similar areas (Technical Report E.5-7).

Subzone HC—Recreational use in subzone HC consists mostly of bank and boat angling and camping-related activities. Because this subzone contains no developed campgrounds and only a few flat areas suitable for camping, almost all camping within the subzone occurs at the Big Bar, Eagle Bar, and Eckels Creek recreation sites.

Warm-season recreational use in subzone HC increased from 37,104 hours during 1994 to 76,939 hours in 1996 (an increase of 207%), but use then decreased to 37,480 hours in 2000, an amount almost identical to the 1994 level. Possibly, some of the people who were frustrated with the changes in access and with angling success in Brownlee Reservoir came to this area hoping for better angling results. Although this reason did not show up in any of the interview information collected at the time, the Applicant's field personnel noted that many visitors indicated frustration and changed to this area. Use levels then returned to normal for the area when these anglers found that crappie angling was no better in this area than in Brownlee Reservoir. Cold-season use was consistently low, ranging from a low of 4,833 hours in 1996 to a high of 7,977 hours in 1994 (Figure E.5-23).

Cold-season angling from both boat and bank varied dramatically during the study period, from almost none in 1996 to more than 5,000 hours in 1994 (Figure E.5-24).

During the warm seasons of the study period, both types of angling—boat and bank—increased initially and then decreased. The highest amount of all angling, over 45,000 hours in 1996 (Figure E.5-25), is lower than the amounts measured in any other areas of similar size in the HCC.

E.5.2.1.2.2.2. Zone 2

Zone 2 consists of the upper one-third of Hells Canyon Reservoir (subzone HC), the Oxbow Bypass (subzone OT), Oxbow Reservoir (subzone OX), and the lower 6 mi of Brownlee Reservoir (subzone BR). This zone is both the largest in physical dimensions and the one with by far the greatest amount of recreational use. Both major entry roads into the upper Hells Canyon area are in this zone and provide access from both Idaho and Oregon. All four of the Applicant's major developed parks are also in this zone. All of the river corridor in this long reach has road access on at least one side. Though not generally as steep as Zone 1, the topography in this zone is steep and rugged. There is little flat land suitable for additional development and recreational use.

Warm-season use in Zone 2 varied from a high of 703,397 hours in 1994 to a low of 495,388 hours in 1997 (70% of the 1994 amount). Cold-season use dropped from 155,341 hours in 1994 to 44,228 hours in 1996 (28% of the 1994 amount) (Figure E.5-26).

Subzone HC—Subzone HC provides a variety of recreational opportunities. One of the Applicant's major developed facilities, Hells Canyon Park, is located within this area. This park provides a range of camping opportunities, from tent camping to motor home parking with full hookups. It also has flush toilets, showers, shade, and a manicured turf. In addition, Hells Canyon Park hosts a considerable amount of day use. In this subzone, there are also several designated recreation areas that are not parks; they are used for camping, bank angling, and day use.

In this subzone, warm-season recreational use followed almost exactly the same pattern as that seen for Zone 2 as a whole. The highest use measured was in 1994, at 199,518 hours. The lowest, 137,757 hours (69% of the 1994 amount), was measured in 1998. Use in 2000 was 178,661 hours, or 90% of the 1994 amount. Cold-season use was consistently low; the highest amount measured was 17,723 hours during 1994, while the lowest amount of use was 8,204 hours during 1995 (Figure E.5-27).

Cold-season use by observed activity was dominated by a combination of the land-based miscellaneous and lounging categories. The graph of these activities by year shows an annual fluctuation that probably did not exist: one of the on-site survey clerks probably confused some of the detailed use categories during recording. Bank angling varied by about 50% during the study period: 1994 and 1997 amounts were about 4,000 to 5,000 hours, whereas 1995 and 1996 amounts were both about 2,400 hours. Boat angling use during the cold season was consistently low, varying from a high of 2,082 hours in 1994 to a low of 841 hours in 1996 (Figure E.5-28).

Warm-season use by observed activity in subzone HC was dominated by categories that are generally related to camping (land-based miscellaneous and lounging) as would be expected in an area with a major developed park. Boat angling use was highest in 1994 and varied up and down by as much as 40% during the other five years. Bank angling use increased to a high of 26,263 hours in 1996, but then decreased to 19,574 hours in 2000. This subzone is the only area in the HCC where personal watercraft and water skis are consistently used, although neither activity contributed more than 5% of the total use during any year (Figure E.5-29).

Subzone OT—The Oxbow Dam tailwater sampling area covers the Oxbow Bypass from Oxbow Dam to the power plant and the Snake River from the power plant to Oxbow Bridge. This subzone contains Copperfield Park, a heavily used full-service facility operated by the Applicant. The Oxbow Bypass is not very conducive to boat angling. Although it lacks attractive areas (except for Copperfield Park) for camping, the subzone regularly hosts some camping activity. It also offers high-quality and easily accessible bank angling.

During the study period, warm-season recreational use in the Oxbow Dam tailwater was high during three years (1994—136,745 hours, 1996—136,309 hours, and 2000—123,222 hours). Three years showed lower use (1995—96,475 hours, 1997—88,878 hours, and 1998—92,091 hours). Cold-season recreational use, as in many of the other areas in the HCC, was highest in 1994 at 19,224 hours. During the other three years, cold-season recreational use was less than half the 1994 amount (Figure E.5-30).

Cold-season use not related to angling in subzone OT was over 14,000 hours in 1994 and below 6,000 hours in 1995, 1996, and 1997 (Figure E.5-31).

Warm-season bank angling in subzone OT totaled 22,200 hours in 1994, increased to 39,948 hours in 1996, and then dropped to 20,744 hours in 2000 (Figure E.5-32).

Subzone OX—This subzone contains one of the Applicant's developed parks, McCormick Park, which offers a full complement of camping opportunities and amenities. Also, Carters Landing is located in this subzone; it is the most frequently used nonpark recreation site in the HCC. Several other nonpark recreation sites lie within this subzone and are used for camping, bank angling, and day-use activities. Adding to the variety of angling opportunities offered in the HCC, Oxbow Reservoir provides quality smallmouth bass angling. A slot limit and controlled season on smallmouth bass help ensure that anglers have a chance to catch larger bass (Technical Report E.5-10).

The overall hours of recreational use in subzone OX followed the same general pattern as that in Zone 2 as a whole and in subzone HC. The highest amount of warm-season recreational use occurred in 1996 at 211,819 hours. The second-highest total—189,630 hours—occurred in 1994. Recreational-use totals in the other four years for which warm-season results are available varied little from each other. The totals ranged from 149,539 hours in 1998 to 162,414 hours in 2000. The lowest total warm-season recreational use in 1998 was 71% of the highest in 1996. As in other zones, cold-season recreational use was highest in 1994 (29,866 hours). The other three years for which cold-season results are available were each about 50% of that amount (1995—14,983 hours, 1996—17,682 hours, and 1997—16,460 hours) (Figure E.5-33).

Bank angling and lounging were consistently the dominant recreational use categories during the cold-season in subzone OX. Cold-season bank angling ranged from a high of 8,896 hours in 1996 to a low of 5,647 hours in 1997 (Figure E.5-34).

Warm season use was dominated by camping-related activities (land-based miscellaneous and lounging categories) in subzone OX. Bank angling was highest in 1996 (53,888 hours). The lowest bank angling estimate, 25,858 hours in 1997, is 48% of the 1996 total. Boat angling during the warm season varied from a high of 46,552 hours in 1994 to a low of 30,350 hours in 1995 (Figure E.5-35). During 1997, the HCC experienced the highest inflows on record. High flows and muddy water combined to make Oxbow Reservoir less attractive for angling during much of this period.

Subzone BR—This subzone contains Woodhead Park, the largest of the Applicant's four developed parks. This park offers a full complement of camping opportunities and amenities. Although there are several other designated recreation sites in subzone BR, none of these receives a large amount of use when compared with sites in some of the other zones. Brownlee Reservoir offers angling for several species, including bass and crappie. During the late 1980s and early 1990s, crappie angling in Brownlee Reservoir was phenomenal, with some anglers catching and keeping hundreds of crappie a day during the late spring and early summer each year. The reduction in the quality of this fishery, as well as the reservoir drawdowns described earlier, combined to affect recreational use at Brownlee Reservoir.

Overall warm-season recreational use in subzone BR decreased during the study period. Use was the highest in 1995, at 199,376 hours. Use in 1994 and 1996 was about equal and approximately 90% of the 1995 total (177,505 and 172,079 hours, respectively). The lowest amount of warm-season use was observed in 1997, at 104,648 hours (52% of the 1995 high). Use measured in the remaining two years, 1998 and 2000, rose to about 65% of the 1995 high (140,251 and 130,320 hours, respectively).

Overall cold-season recreational use in subzone BR decreased dramatically from 88,528 hours in 1994 to a low in 1996 of 7,691 hours, which was only 9% of the 1994 total (Figure E.5-36). This decline was also evident in analyses of cold-season use by activity. Camping-related activities (land-based miscellaneous and lounging categories) declined sharply. Both boat and bank angling also decreased substantially. In 1994, bank angling accounted for 13,058 hours but dropped to 992 hours in 1996 (8% of the 1994 total) before recovering somewhat to 6,009 hours in 1997. Boat angling totaled 30,878 hours in 1994, dropped to 1,686 hours in 1996 (5% of the 1994 total), and rose to 5,917 hours in 1997 (Figure E.5-37).

In the warm season, the highest number of camping-related hours occurred in 1996, and the lowest in 1997. The totals for both boat and bank angling were highest in 1995 at 62,992 and 41,765 hours, respectively. These use categories were lowest in 1997 when boat angling totaled 18,185 hours (29% of the 1995 total) and bank angling 10,147 hours (24% of the 1995 total) (Figure E.5-38).

E.5.2.1.2.2.3. Zone 3

Zone 3 consists of the largely unroaded portion of Brownlee Reservoir between Brownlee Creek and a point just downstream of Swedes Landing. In this zone, only one small area just downstream of Swedes Landing is accessible by road. Although some boat-in camping and other land-related activities occur in this zone, the large majority of recreational use is boat angling. Anglers come from Zone 5 (upstream); Zone 1, subzone BR (downstream); or Zone 4 (the Powder River).

In 1994, Zone 3 received the lowest amount of warm-season recreational use of all zones, at 43,194 hours. This amount almost doubled in 1995 to 84,962 hours (197% of the 1994 total). This sharp increase, occurring as use in surrounding areas was declining, could be because anglers ventured farther afield in search of increasingly elusive crappie. Overall warm-season use during the remaining four study years was relatively stable. The highest total (67,858 hours) in those four years occurred in 2000 and the lowest total (54,729 hours) in 1997 (Figure E.5-39).

As in other zones of the HCC, use during the cold season dropped dramatically during the study period. From a high of 38,254 hours in 1994, recreational use dropped to a low of 1,716 hours in 1996 (4% of the high in 1994) (Figure E.5-39). As mentioned earlier, the large majority of use in this zone was for boat angling. Cold-season boat angling use followed the same pattern as that of overall cold-season recreational use (Figure E.5-40).

Warm-season use was also dominated by boat angling. However, some land-based use also occurred, including bank angling. Some recreationists boat to a suitable location and then camp, picnic, or bank fish within the area. The highest amount of warm-season boat angling (72,130 hours) occurred in 1995 (Figure E.5-41).

E.5.2.1.2.2.4. Zone 4

Zone 4 consists of the Powder River arm of Brownlee Reservoir. This reservoir reach can be divided into two distinct areas based on topography. The first, from the Snake River confluence to 7 mi upstream, is relatively deep and narrow and surrounded by large, rolling hills. About 2 mi upstream of this narrow reach, the landscape opens into a relatively flat agricultural valley and a wide, shallow pool. Access is limited in Zone 4. The narrow 7-mi reach contains one private road that dead-ends at the reservoir. The majority of the upstream pool area is surrounded by private land that, with one exception, has no convenient access to the reservoir. That exception is the area around and including Baker County's Hewitt and Holcomb parks. Zone 4 was known for quality crappie angling during the early 1990s, but it too was heavily affected by drawdowns. Most of the pool area dries up when the reservoir is drawn down 30 ft.

Overall warm-season use in Zone 4 during 1994 was 413,337 hours. This total included considerable boat angling for crappie since anglers came in from the Snake River portion of the reservoir. Total warm-season use dropped to 145,930 hours in 1995 (35% of the 1994 total). However, the lowest amount of warm-season use was 77,883 hours in 1997 (19% of the 1994 total). The total use during 2000 was 90,764 hours (22% of the 1994 total). Cold-season use followed a similar pattern, with a high of 33,288 hours in 1994 dropping to 2,010 hours in 1996 (Figure E.5-42).

Cold-season hours of use by activity varied considerably during the study period. Boat angling use was highest in 1994 (20,601 hours); no boat anglers were encountered during 1996 (Figure E.5-43).

Warm-season boat angling was by far the highest use activity in 1994 at 248,649 hours. Boat angling hours during 1995 and 1996 declined to less than 30% of the 1994 total (69,090 and 73,822 hours, respectively). Boat-angling hours were even lower in 1997, 1998, and 2000 (40,540; 44,813; and 40,811 hours, respectively) (Figure E.5-44).

E.5.2.1.2.2.5. Zone 5

Zone 5 extends from a point just north of Swedes Landing to the upstream side of the railroad bridge over the Snake River at the confluence with the Burnt River. For the entire length of this zone, the Snake River Road, a well-maintained gravel road between Huntington and Richland, closely parallels the Oregon side of the reservoir. Olds Ferry Road, a gravel road on the Idaho side that begins at Weiser, is well maintained until it reaches a point just downstream of the upper end of Zone 5. Beyond this point, the road’s condition deteriorates until it is passable only by heavy-duty, four-wheel drive vehicles. At the upper end of this zone are two BLM park areas, Spring Recreation Site on the Oregon side and Steck Recreation Site on the Idaho side. The downstream end of this zone is surrounded by rounded hills; hills are lower toward the upstream end of the zone.

Overall warm-season recreational use in Zone 5 was the highest in 1994, at 453,199 hours. Use dropped considerably during the rest of the study period. Overall warm-season use was about equal during 1995 and 1996, at 368,580 and 365,328 hours, respectively. These amounts are about 80% of the 1994 total. Warm-season use in 1997 decreased again, to 263,393 hours (58% of the 1994 total). Hours were down again in 1998 and 2000, at 198,638 hours and 201,770 hours, respectively, or each to about 44% of the 1994 total. Cold-season use dropped from a high of 131,783 hours in 1994 to a low of 21,595 hours in 1996 (16% of the 1994 total) (Figure E.5-45).

Cold-season angling use in Zone 5 was by far the highest-use activity during 1994. That year, the hours of boat and bank angling were about the same, at 47,119 hours and 41,745 hours, respectively. During the next three years, both types of angling dropped dramatically, although boat angling dropped more than bank angling did. Counts for the lounging and land-based miscellaneous categories were both highest in 1994 but did not drop as much proportionately as counts for the two angling categories did (Figure E.5-46).

Angling use during the warm season was the highest overall in 1994. Boat angling accounted for 125,500 hours in 1994, but dropped to a low of 40,475 hours in 1998 (32% of the 1994 total). Warm-season bank angling in 1994 totaled 114,374 hours. Unlike most other angling use on Brownlee Reservoir, the bank angling use in Zone 5 did not reach a high in 1994. Warm-season bank angling peaked in 1996 at 122,003 hours and then dropped to 64,942 hours in 2000 (53% of the 1996 total) (Figure E.5-47).

E.5.2.1.2.2.6. Zone 6

Zone 6 is the area between the upstream side of the railroad bridge over the Snake River at the confluence with the Burnt River and the upstream end of the Brownlee Project. The downstream end of this zone is surrounded by low, rounded hills. The upper end is surrounded by relatively flat, agricultural land. This zone contains Farewell Bend State Park, a large, full-service park operated by the State of Oregon, and two commercial campgrounds located adjacent to each other on the Oregon side near the southern end of the zone. The zone's southern end is a transition area, where the free-flowing Snake River enters Brownlee Reservoir. When the reservoir is drawn down, the transition zone moves downstream, converting reservoir into open river with accompanying currents and navigational hazards.

Overall warm-season recreation use in Zone 6 was highest in 1994, at 441,318 hours. Overall use dropped during the next two years. In 1995, recreational use was 71% of 1994 levels, at 313,328 hours. In 1996, use dropped again to 50% of the 1994 level (218,576 hours). During the last three years of the study period, recreational use in Zone 6 was relatively close to 1996 levels: 231,520 hours in 1997; 186,022 hours in 1998; and 221,211 hours in 2000. Cold-season use was 36,238 hours in 1994; 25,703 hours in 1995; 14,124 hours in 1996; and 25,993 hours in 1997 (Figure E.5-48).

The total number of hours for cold-season bank angling was highest in 1994 (10,696 hours) and lowest in 1996 (4,385 hours, or 41% of the 1994 amount). In 1994, the amount of cold-season boat angling (9,343 hours) nearly equaled that of bank angling. After 1994, boat angling in Zone 6 during the cold season dropped sharply to a low of 430 hours in 1996 (4% of the 1994 amount) (Figure E.5-49).

Warm-season angling of both types (bank and boat) dropped considerably during the study period. In 1994, bank angling in Zone 6 totaled 124,889 hours, but then dropped to 35,935 hours in 1996 (29% of the 1994 amount). This activity increased marginally in 2000 to 44,312 hours. Similarly, boat angling in 1994 totaled 77,470 hours, dropped to 24,279 hours in 1998 (31% of the 1994 amount), and increased to 29,276 hours in 2000. Warm-season powerboating unrelated to angling dropped from 16,655 hours in 1994 to 228 hours in 1998. Land-based miscellaneous activities (generally camping-related activities) decreased about 30% during the study period (Figure E.5-50).

E.5.2.1.3. Recreational Use Reported as Recreation Days and Visitor Days

Several federal land management agencies measure recreational use in *recreation days* and *visitor days*. A recreation day is defined as any person visiting an area for recreational purposes during any portion of an individual day. A visitor day is defined as twelve hours of recreational use. For the six study years, the Applicant is reporting recreation days and *recreation nights* (defined as one recreationists staying in the area for one night) and visitor days calculated from the Applicant's study results during daylight sampling (visitor days–daylight) and visitor days–daylight plus hours of use from overnight stays (visitor days–total).

These results are presented by project, as required by FERC, and show no additional use trend information when compared to the hours-of-use information presented earlier. Because of this lack of additional trend information, the graphs illustrating these results will be referenced in this text with no additional verbal description. The reader is encouraged to compare these graphs with the equivalent hours of use graphs presented earlier to see the relationship between the various methods of reporting recreational use.

Overall results by year and season for the entire HCC:

- Recreation days—Figure E.5-51
- Recreation nights—Figure E.5-52
- Visitor days–daylight and visitor days–total (warm season)—Figure E.5-53
- Visitor days–daylight and visitor days–total (cold season)—Figure E.5-54

Results by year and season for Brownlee Reservoir:

- Recreation days—Figure E.5-55
- Recreation nights—Figure E.5-56
- Visitor days–daylight and visitor days–total (warm season)—Figure E.5-57
- Visitor days–daylight and visitor days–total (cold season)—Figure E.5-58

Results by year and season for Oxbow Reservoir:

- Recreation days—Figure E.5-59

- Recreation nights—Figure E.5-60
- Visitor days–daylight and visitor days–total (warm season)—Figure E.5-61
- Visitor days–daylight and visitor days–total (cold season)—Figure E.5-62

Results by year and season for Hells Canyon Reservoir:

- Recreation days—Figure E.5-63
- Recreation nights—Figure E.5-64
- Visitor days–daylight and visitor days–total (warm season)—Figure E.5-65
- Visitor days–daylight and visitor days–total (cold season)—Figure E.5-66

E.5.2.1.4. Details of Recreational Use at Several Critical Dispersed Sites

The Applicant identified 139 dispersed and impromptu recreational-use sites associated with the reservoirs in the HCC (Figure E.5-67). These sites were identified as the result of on-site observation, survey results, and input from RARWG members. The Applicant conducted a site-condition inventory at each of these sites. The results of these inventories are presented in Technical Report E.5-9. During each randomly selected day selected for recreational-use surveys described and reported in detail in Technical Report E.5-2, surveyors recorded at each site the number and activity of all recreationists and the type of equipment (for example, cars, motorhomes, tents).

Twenty-three of these sites were identified for potential PM&E measures by the Applicant or suggested by agencies or entities involved in suggesting PM&E measures either during the consultation process or in comments made about the draft license application. Detail about study results at each of these sites is reported in Technical Reports E.5-9 and E.5-2; however, the Applicant is including additional detail of survey results for those sites identified as of particular interest during this relicensing process.

Information reported for each site includes the following:

- A detailed map of each site
- A table containing information specific to the site:
  - Site name and four-letter code
  - Site location
  - Type of access—boat, foot, 2-wheel drive, 4-wheel drive
  - Landowner/land manager
  - Perimeter area (acres of area included in sampling site)
  - Used area acreage (area of site impacted by recreational use)
  - Comments specific to the site
  - List of amenities at site
- A table containing results from recreation equipment counts—maximum number counted, 95th and 90th percentile counts, and counts of all three quartiles (75th percentile, median [50th percentile], and 25th percentile for each of five categories of equipment:
  - Camp total—the sum of all types of camping equipment counted
  - Camp unit—either tent trailer or pickup camper
  - Motorhome

  - Tent

  - Car-pickup

- A table containing results from counts during the 10 sampling days when the camp total category was the highest, including the following:

  - Date

  - Counts of car-pickups, motorhomes, camp units, tents, and camp total

- A figure with mean monthly counts of car-pickups and camp total for each site

Vehicles and equipment were chosen as the best way to examine physical carrying capacity and the percent usage of that capacity. Although the number of people were counted by activity (these results are reported as hours of use in Technical Report E.5-2), raw counts of people do not give reliable information about site usage in a dispersed use area such as the HCC. For example, people camping at developed or dispersed sites disperse throughout the area during the day. A recreationist may stay at a developed park and visit several dispersed areas during the day while angling. Or a camper at a dispersed site may spend half of the day at that site and the rest of the day at other sites or on the reservoir angling.

Generally, there is no useful way to assign a specific physical carrying capacity to the type of dispersed sites of concern in the HCC. There are no designated camping sites or areas. A large motorhome may occupy the same area that could comfortably hold three tenting groups. A group of friends may set up five tents very close to each other while the same five tents set up by strangers would be much further apart and occupy three times the area. The actual occupancy of some dispersed sites in the HCC never approaches the physical carrying capacity of that site. An example of such a site is Big Bar. This site encompasses about 35 acres and has many areas suitable for camping that are seldom or never used. Other smaller sites are occasionally occupied at a level that would be considered over physical capacity: tents and other items are crowded in a little too tightly to be comfortable. By examining the difference between the maximum occupancy observed, the 95th and 90th percentile count, plus the three quartile counts, it can be determined whether the site is occupied at or near physical capacity a significant percentage of the time.

When compared with use in the warm season, use levels in the HCC are quite low during the cold season. Usually, the amount of use in April and October are highly dependent on the weather: a warm spring or fall can lead to increased use. During the warm season, there is usually a peak in use in late May through June. The relatively short high-use season leads to a high level of site occupancy for a short period of time, usually a matter of weeks rather than months.

Eagle Bar (EAGL)

Eagle Bar is located on the Idaho side of Hells Canyon Reservoir, 1.7 mi south of Hells Canyon Dam (Figure E.5-68), and is managed by the USFS. The perimeter of the area included for sampling enclosed 2.8 acres, of which about 2 acres are obviously used. Amenities at the sites include graveled parking areas and a gravel boat ramp (Table E.5-2). This site is generally level and raised about 10 feet above the adjacent reservoir. It provides good bank angling access and is used mainly by campers.

The Applicant conducted recreational-use counts during which Eagle Bar was separately designated during 119 randomly selected days. Sixty-five of these days (55% of the total) resulted in a vehicle/equipment count of zero. For the warm-season sampling, the maximum camp total count was 15; the 90th percentile count was 4. Other vehicle/equipment counts were similar in that there was a large difference between the maximum count and the 90th percentile. The third quartile count was 1 for camp total, camp unit, and car-pickup and zero for motorhome and tent. The median count was zero for all categories except car-pickup with a median count of 1 (Table E.5-3). This site was essentially empty 50% of the time during the warm season.

The 10 sampling days with the highest camp total counts included 3 Memorial Day weekend days. Reflecting the results above, the camp total counts drop from 15 to 5 within the first 6 days on the list (Table E.5-4).

Mean daily counts, by month, of car-pickups and camp total were consistently low. The highest mean monthly camp total count was 4.4 in November, when it is still reasonable to camp and steelhead angling is popular below Hells Canyon Dam. While consistently rather low for a site that includes about 2 acres of used area, use at Eagle Bar was more consistent throughout the year than that at most other sites; January was the only month having a mean of zero for both car-pickups and camp total (Figure E.5-69).

With a maximum camp total count of 15, Eagle Bar was never occupied at what would be considered at or near maximum reasonable capacity. The site covers 2.8 acres and is nearly all flat land. Ninety-five percent of the time, the camp total count was 4 or less. This site is consistently used by a small number of campers.

Big Bar (BGBA, BGBB, BGBC, and BGBD)

Big Bar was sampled as four separate sections. This site is located on the Idaho side of Hells Canyon Reservoir, 8.7 mi south of Hells Canyon Dam (Figure E.5-70), and is managed by the USFS. The perimeter of the areas included for sampling enclosed a total of 34.5 acres, of which about 5.6 acres are obviously used. Amenities at the site include two impromptu boat ramps, two vault toilets, and a dock (Table E.5-5 through Table E.5-8). The site contains several flat areas with many trees for shade. Very little bank angling occurs at this site; the reservoir section adjacent to this site is relatively shallow.

The Applicant conducted recreational-use counts during which Big Bar was separately designated during 119 randomly selected days. Vehicle/equipment counts were zero during 42% (50 days) of these days at Big Bar section A, 45% (54 days) at section B, 58% (69 days) at section C, and 26% (31 days) at section D.

For the warm-season sampling, the maximum camp total count was highest in section D, at 25. The 90th percentile count was much lower than the maximum count in all four sections. Other vehicle/equipment counts in all four sections were similar in that there was a large difference between the maximum count and the 90th percentile. The highest median count at any of the four sections was one in any category; many categories had median counts of zero (Table E.5-9 through Table E.5-12).

The 10 sampling days with the highest camp total counts included many Memorial Day weekend days. Reflecting the results above, the camp total counts drop considerably within the 10 days on the lists (Table E.5-13 through Table E.5-16).

Mean daily counts, by month, of car-pickups and camp total for all four sections combined were the highest in May, at about 15 each, with a low of zero for both categories during December (Figure E.5-71). Figure E.5-72 illustrates monthly mean daily camp total counts for each section of the Big Bar site. In sections A, C, and D, the highest mean daily camp totals were in May; in section B, the mean count was slightly higher in June. Taken together, the cumulative mean counts were much higher in May than in any other month.

The maximum counts in the camp total category were not exceptionally high when the size of the site is considered. The 90th percentile count was, for each section, a fraction of the maximum counts. Median warm season counts of all types of equipment and vehicles showed that, at least 50% of the time, there was one or fewer items in the camp total category present in each section of Big Bar. The USFS, which manages this site, is concerned about recreational impacts on other resources at the site. The site has been identified as important winter range for mule deer and has significant value to several other resources. The USFS may, in the future, be interested in defining campsites to effectively restrict the indiscriminate use that now occurs at the site.

Eckels Creek (EKLC)

The Eckels Creek site is located on the Idaho side of Hells Canyon Reservoir, 9.7 mi south of Hells Canyon Dam (Figure E.5-73), and is managed by the USFS. The perimeter of the area included for sampling enclosed 0.59 acres, of which about 0.26 acres are obviously used. The only amenity at the site is one old dock installed by the public (Table E.5-17). This small site has mature trees to provide shade, and the site provides excellent bank angling access. It is used mostly for camping; when occupied, potential day users would be discouraged from coming through or near the campsites to get to the reservoir.

The Applicant conducted recreational-use counts during which Eckels Creek was separately designated during 72 randomly selected days. Thirty-seven (55%) of these days resulted in a vehicle/equipment count of zero. For the warm-season sampling, the maximum camp total count was 4; the 90th percentile count was 2. Other vehicle/equipment counts were similar. The third quartile count was 2 for camp total, 1 for camp unit, 2 for car-pickup, zero for motorhome, and 2 for tent. The median count was zero for all categories (Table E.5-18). This site was empty 50% of the time during the warm season.

The 10 sampling days with the highest camp total counts included three Memorial Day weekend days. Reflecting the results above, the camp total counts dropped from 4 to 2 within the first 6 days on the list (Table E.5-19).

Mean daily counts, by month, of car-pickups and camp total were consistently low during the warm season (Eckels Creek was not included in sampling as a distinct site during a year when winter sampling occurred). The highest mean monthly camp total count was 1.6 in May (Figure E.5-74).

When the maximum camp total count of four was observed, Eckels Creek was probably considered crowded unless the occupants were one group of friends or family. The area that is usable as a campsite is quite small; two separate small groups would each have to be well behaved to avoid discomfort or confrontation. This site is one of the best on Hells Canyon Reservoir for dispersed camping if recreationists are seeking solitude, shade, and easy access to a good bank angling area.

Copper Creek (TRHD)

The Copper Creek site is located on the Oregon side of Hells Canyon Reservoir, 14.7 mi south of Hells Canyon Dam (Figure E.5-75), and is managed by the BLM. The perimeter of the area included for sampling enclosed 6.56 acres, of which about 1.2 acres are obviously used. The only amenities at the site are two vault toilets (Table E.5-20). This rather large area (compared with other relatively flat areas in the vicinity) serves as a campsite, provides bank angling access, and provides access to the trailhead for the Hells Canyon Trail.

The Applicant conducted recreational-use counts during which the Copper Creek site was separately designated during 119 randomly selected days. Fifty-six (47%) of these days resulted in a vehicle/equipment total count of zero. For the warm-season sampling, the maximum camp total count was 32; the 90th percentile count was 3. Other vehicle/equipment counts were similar. The median count was either one or zero for all categories (Table E.5-21). This site was empty at least 50% of the time during the warm season.

The 10 sampling days with the highest camp total counts included two Memorial Day weekend days. Reflecting the results above, the camp total counts dropped from 32 to 7 within the first 5 days on the list (Table E.5-22).

Mean daily counts, by month, of car-pickups and camp total were consistently low during all months of the warm season except May, when the mean counts were about three times that of the next highest month (Figure E.5-76).

This site has few trees to provide shade and is at the end of the Homestead Road. The large difference between the mean daily count of camp total in May and the other warm-season months is caused mostly by a Memorial Day weekend tradition. A group from a university in western Oregon traditionally shows up at the site for a party on Memorial Day weekend. If this one anomaly is ignored, the site actually hosts little use for a site of its size.

Ashby Creek (ASHB)

The Ashby Creek site is located on the Oregon side of Hells Canyon Reservoir, 15.1 mi south of Hells Canyon Dam (Figure E.5-77), and is managed by the BLM. The perimeter of the area included for sampling enclosed 0.91 acres, of which about 0.18 acre is obviously used. There are no amenities at the site (Table E.5-23). This very small site provides a camping area and bank angling access. It is used primarily for camping and bank angling.

The Applicant conducted recreational-use counts during which the Ashby Creek site was separately designated during 119 randomly selected days. One hundred ten (92%) of these days resulted in a vehicle/equipment total count of zero. For the warm-season sampling, the maximum camp total count was 4; the 90th percentile count was zero for all categories except car-pickup, at 1. The third quartile count was zero for all categories (Table E.5-24). This site was empty at least 75% of the time during the warm season.

The 10 sampling days with the highest camp total counts included one Memorial Day weekend day. The rest were in June and July. Reflecting the results above, the camp total counts dropped from 4 to 1 within the first 4 days on the list (Table E.5-25).

The highest mean daily count, by month, of camp total was in July, at 0.5. Counts of both categories were zero during seven months of the year (Figure E.5-78).

This site has some trees to provide shade and provides bank angling access. Campers using this site are generally more interested in solitude than a comfortable campsite.

Holbrook Creek (HOLA and HOLB)

Holbrook Creek consists of two separate sections. This site is located on the Oregon side of Hells Canyon Reservoir, 19.6 mi south of Hells Canyon Dam (Figure E.5-79). This site is privately owned. The perimeter of the areas included for sampling enclosed a total of 3.6 acres, of which about 2 acres are obviously used. Amenities at the site include three impromptu boat ramps and a seasonal port-a-potty (Table E.5-26 and Table E.5-27). Both sections of this site are used primarily for camping and angling.

The Applicant conducted recreational-use counts during which Holbrook Creek was separately designated during 120 randomly selected days. Vehicle/equipment total count was zero during 10% (12 days) of these days at section A and 40% (48 days) of these days at section B.

For the warm-season sampling, the maximum camp total count was highest in section A, at 14. The 90th percentile count was less than one-half of the maximum count in both sections. Other vehicle/equipment counts in both sections were similar in that there was a large difference between the maximum count and the 90th percentile. The median camp total was 3 in section A and 1 in section B (Table E.5-28 and Table E.5-29).

The 10 sampling days with the highest camp total counts included several Memorial Day weekend days. Reflecting the results above, the camp total counts drop to about one-half of the maximum counts within the 10 days on the lists (Table E.5-30 and Table E.5-31).

Mean daily counts, by month, of car-pickups and camp total for both sections combined were the highest in May, at 6.9 and 8.8, respectively, with a low of zero for both categories during December, January, and February (Figure E.5-80). Figure E.5-81 illustrates monthly mean daily camp total counts for each section of the Holbrook Creek site. Camping use in section B was the highest in May, at 4.5, which was more than double the next highest month of June, at 2.1. Camping use in section A was much more consistent, with an average count of 3 or more during May through August.

The maximum counts in the camp total category were not exceptionally high when the size of the site is considered. The 90th percentile count was, for each section, about one-half of the maximum counts. Section A is occupied consistently at a low level during the warm season. Although they are similar in size, section B is occupied at a rate less than one-half that of section A, except during May, when the mean occupancy rate was slightly higher than that of section A.

Airstrip Site Sections A and B (AIRA and AIRB)

The airstrip site is located on the Oregon side of Hells Canyon Reservoir, 20.3 mi south of Hells Canyon Dam (Figure E.5-82). This site consists of two separate sections. Airstrip section B is a small site located adjacent to the reservoir; Airstrip section A is much larger and located just north of and across Homestead Road from section B. Section A is managed by the BLM; section B is located on land belonging to the Applicant. The perimeter of the areas included for sampling enclosed a total of 1.62 acres, of which about 1.2 acres are obviously used. Amenities at the site include an impromptu boat ramp, improved parking area, seasonal portable toilet, and picnic table (Table E.5-32 and Table E.5-33). Both sections of this site are used primarily for camping and bank angling.

The Applicant conducted recreational-use counts during which Holbrook Creek was separately designated during 120 randomly selected days. Vehicle/equipment total count was zero during 47% (56 days) of these days at section A and 49% (59 days) of these days at section B.

For the warm-season sampling, the maximum camp total count was by far the highest in section A, at 14; the maximum camp total counted at section B was 4. The 90th percentile count was less than one-third of the maximum count in section A and three-fourths of the maximum count in section B. Other vehicle/equipment counts in both sections were similar in that there was a large difference between the maximum count and the 90th percentile in section A and less difference in section B. The median camp total was 1 in both sections (Table E.5-34 and Table E.5-35).

The 10 sampling days with the highest camp total counts were mainly in June. Reflecting the results above, the camp total counts in section A drop to less than one-third of the maximum counts within the 10 days on the lists; results from section B drop from 4 to 3 within the 10 days with the highest camp total counts (Table E.5-36 and Table E.5-37).

Mean daily count, by month, of camp total was highest in May, at 3.7. Car-pickup counts were highest in September, at 2.1. The lowest mean daily count for both categories was zero in January and December (Figure E.5-83).

Figure E.5-84 illustrates monthly mean daily camp total counts for each section of the Airstrip site. Camping use in section A was the highest in June, at 2.2. The maximum count in the camp total category in section B (4) was probably at a level that would be considered crowded unless the campers were all in one group. The site is very small; however, people will put up with a little crowding to camp in a nice site on the water. Within section B, there is little room for expansion of the use area; it is a popular area that is used very consistently when compared with either section A of the same site or most of the other dispersed sites in the HCC. The maximum mean daily count in section A, at 14, was not at capacity. The site is fairly large and laid out with a lot of perimeter; people do not have to crowd in too close to each other to fit 14 camp units in the area (this conclusion is based partially on the results in Table E.5-35 that show very little use by motorhomes, which take up much more room than other camping equipment or vehicles).

Bob Creek (BOBA, BOBB, AND BOBC)

The Bob Creek site is located on the Oregon side of Hells Canyon Reservoir, 20.8 mi south of Hells Canyon Dam (Figure E.5-85). This site consists of three separate sections. Bob Creek sections B and C are small sites located adjacent to the reservoir; Bob Creek section A is larger and is located just south of sections B and C. Section A is managed by the BLM; sections B and C are located on land belonging to the Applicant. The perimeter of the areas included for sampling enclosed a total of 19.6 acres, of which about 1.9 acres are obviously used. Amenities at the site include five impromptu boat ramps and one vault toilet (Table E.5-38 through Table E.5-40). Section A is used primarily for camping and launching boats at the impromptu launch, and it offers good blackberry picking (when in season). Section B is primarily used for camping. Section C is used for camping, boat launching, angling, and picnicking.

The Applicant conducted recreational-use counts during which the Bob Creek site was separately designated during 120 randomly selected days. Vehicle/equipment total count was zero during

43% (51 days) of these days at section A, 27% (27 days) of these days at section B, and 54% (65 days) of these days at section C.

For the warm-season sampling, the maximum camp total count was by far the highest in section C, at 21 (the maximum camp total counted at section B was 8 and was 7 in section A). The 90th percentile count was less than one-half of the maximum count in all sections. In section C, it was less than one-third of the maximum count. Other vehicle/equipment counts in all three sections were similar in that there was a large difference between the maximum count and the 90th percentile count. The median camp total was 1 in sections A and B and zero in section C (Table E.5-41 through Table E.5-43).

The 10 sampling days with the highest camp total counts were mainly in June and July in sections A and C; in section B, there were several days in September on the list. Reflecting the results above, the camp total counts in section C dropped to less than one-half of the maximum counts within the 10 days on the lists; like all popular small sites, sections A and B dropped less as a percentage of the maximum count than the larger sites did (Table E.5-44 through Table E.5-46).

Mean daily count, by month, of camp total was highest in July, at 8.2. Car-pickup counts were also highest in July, at 6.8. The lowest mean daily count for both categories was zero in January, February, and December (Figure E.5-86).

Figure E.5-87 illustrates monthly mean daily camp total counts for each section of the Bob Creek site. Camping use in section C was the highest in June, at 3.5; sections A and B were the highest in July, at 2.4 and 2.3, respectively.

The maximum count in the camp total category in section C (21) was probably at about the highest comfortable level for that site. Maximum and 90th percentile camp total counts in sections A and B reflect the small size of the sites; there is not much room for differences between the two measures.

One critical concern in section A is the large area that has not been impacted by recreational use. Most of this area is flat and near the reservoir. Considerable concern was expressed during site visits with the RARWG that this area, which provides critical winter range for ungulates and other wildlife, will eventually be degraded by impromptu recreational use.

Westfall (WEST)

The Westfall site is located on the Oregon side of Hells Canyon Reservoir, 21.7 mi south of Hells Canyon Dam (Figure E.5-88), and is managed by the BLM. The perimeter of the area included for sampling enclosed 4.1 acres, of which about 1 acre is obviously used. Amenities at the site include an impromptu boat ramp and a seasonal portable toilet (Table E.5-47). This site is used primarily for camping, day use, and bank angling.

The Applicant conducted recreational-use counts during which the Westfall site was separately designated during 120 randomly selected days. Forty-two (35%) of these days resulted in a vehicle/equipment total count of zero. For the warm-season sampling, the maximum camp total count was 44; the 90th percentile count was 10% of that, at 4. The median camp total count was 1 (Table E.5-48).

The 10 sampling days with the highest camp total counts were mostly in July. Reflecting the results above, the camp total counts dropped from 44 to 7 within the first 5 days on the list (Table E.5-49).

The highest mean daily count, by month, of camp total was in July, at 8.2. Counts of both categories were zero during January, February, and December (Figure E.5-89).

This site has some trees to provide shade and provides bank angling access. The one count day during which the camp total was 44 was on Memorial Day weekend in 1998; 43 of these were tents. The next highest camp total count was 11. This number was probably because of an organized event. The used areas in this site are quite convoluted (Figure E.5-88), offering many places to set up camp and not be too near others. Except for the one day counted when the camp total was 44, this site was probably never at capacity during any days counted.

Copperfield Boat Launch (CPBL)

The Copperfield Boat Launch is located on the Oregon side of Hells Canyon Reservoir, 22.3 mi south of Hells Canyon Dam and 0.7 mi north of Oxbow, Oregon (Figure E.5-90). This site is owned by the Applicant. The perimeter of the area included for sampling enclosed 2.14 acres, of which about 1.5 acres are obviously used. The site provides a concrete boat ramp, improved parking for 65 vehicles, a dock, trash receptacles, and a seasonal portable toilet (Table E.5-50). Although a small amount of bank angling and other day use occurs at this site, the majority of use is boat launching.

The Applicant conducted recreational-use counts during which the Copperfield Boat Launch was separately designated during 120 randomly selected days. Twenty-seven (23%) of these days resulted in a vehicle/equipment total count of zero. A small amount of camping occurs at this site; the majority of these counts of camping vehicles and equipment were simply pickup campers and motorhomes used to pull and launch boats. For the warm-season sampling, the maximum car-pickup count was 20; the 90th percentile count was much less than that, at 7. The median car-pickup count was 2 (Table E.5-51).

The 10 sampling days with the highest camp total counts are shown in Table E.5-52.

The highest mean daily count, by month, of car-pickups was in July, at 4.2. Camp total counts were much lower, ranging from zero to 0.3 (Figure E.5-91).

With room for 65 vehicles and a maximum car-pickup count of 20, it is obvious that this site does not experience problems related to physical capacity.

Oxbow Boat Launch (OXBL)

The Oxbow Boat Launch is located on the Oregon side of Oxbow Reservoir, 2.8 mi south of Oxbow Dam (Figure E.5-92). This site is owned by the federal government and leased long term from the BLM by the Applicant. The perimeter of the area included for sampling enclosed 1 acre, of which about 0.78 acre is obviously used. The site provides a gravel boat ramp, improved parking, vault toilet, dock, and trash receptacles (Table E.5-53). This area is designated day use only and is the only boat ramp in the middle section of Oxbow Reservoir. Many people fish from the dock at this site.

The Applicant conducted recreational-use counts during which the Oxbow Boat Launch was separately designated during 120 randomly selected days. One hundred five of these days (88%) resulted in a vehicle/equipment total count of zero. This count is not surprising since overnight camping is prohibited. The camp equipment/vehicles counted at this site were mainly pickup campers that had been used to tow boats. For the warm-season sampling, the maximum car-pickup count was 16; the 90th percentile count was much less than that, at 9. The median car-pickup count was 3 (Table E.5-54).

The 10 sampling days with the highest camp total counts are shown in Table E.5-55.

The highest mean daily count, by month, of car-pickups was in July, at 6.3. Camp totals were much lower, ranging from zero to 0.2 (Figure E.5-93).

The Oxbow Boat Launch is the only site where the Applicant's proposed PM&E measures are directly related to increasing site capacity. While the size of the boat launch is adequate for the relatively small amount of use it receives, parking is definitely a problem. The Applicant's proposed PM&E measures are intended to both upgrade the facilities and greatly expand the parking at the site. Additionally, the PM&E measures at this site would greatly improve traffic flow, which is presently a problem.

Carters Landing (CART)

Carters Landing is located on the Oregon side of Hells Canyon Reservoir, 7.6 mi south of Oxbow Dam (Figure E.5-94). This site is owned by the federal government and leased long term from the BLM by the Applicant. The perimeter of the area included for sampling enclosed 2.54 acres, of which about 1.9 acres are obviously used. Amenities at the site include an impromptu boat ramp, five picnic tables, five fire grills, a vault toilet, trash receptacles, and improved parking (Table E.5-56). This site is very popular and used primarily for camping, day use, and bank angling.

The Applicant conducted recreational-use counts during which Carters Landing was separately designated during 120 randomly selected days. Only five (4%) of these days resulted in a vehicle/equipment total count of zero. For the warm-season sampling, the maximum camp total count was 42; the 90th percentile count was less than one-half of that, at 18. The median camp total count was 8 (Table E.5-57).

The 10 sampling days with the highest camp total counts were spread through May, June, July, and August. The top 4 were during Memorial Day weekends. Reflecting the results above, the camp total counts dropped from 42 to 19 within the 10 days on the list (Table E.5-58).

The highest mean daily count, by month, of camp total was in July, at 13.9. Counts of both camp total and car-pickup categories were zero during November, December, January, and February (Figure E.5-95).

This site has some trees to provide shade and provides reasonable bank angling access. The one count day during which the camp total was 42 was on Memorial Day weekend in 2000; 23 of these were tents. The next highest camp total count was 29. Given the size of this site, this number probably indicates that it was quite crowded; however, the 95th percentile count of 18 is well within the reasonable capacity for this site.

Old Carters Landing (OCAR)

Old Carters Landing is located on the Oregon side of Hells Canyon Reservoir, 8 mi south of Oxbow Dam (Figure E.5-96), and is owned by the Applicant. The perimeter of the area included for sampling enclosed 0.7 acre, of which about 0.6 acre is obviously used. Amenities at the site include an impromptu boat ramp, a seasonal portable toilet, and trash receptacles (Table E.5-59). This site is popular and used primarily for camping, day use, and bank angling.

The Applicant conducted recreational-use counts during which Old Carters Landing was separately designated during 120 randomly selected days. Twenty-six (22%) of these days resulted in a vehicle/equipment total count of zero. For the warm-season sampling, the maximum camp total count was 10; the 90th percentile count was one-half of that, at 5. The median camp total count was 2 (Table E.5-60).

The 10 sampling days with the highest camp total counts were spread through May, July, August, and September. Reflecting the results above, the camp total counts dropped from 10 to 6 within the 10 days on the list (Table E.5-61).

The highest mean daily count, by month, of camp total was in July and September, at 3.4. Counts of both camp total and car-pickup categories were zero during November, January, and February (Figure E.5-97).

This relatively small site has some trees to provide shade and provides reasonable bank angling access. The 90th percentile count of 5 is well within the reasonable capacity for this site.

Sag Road (SAGR)

The Sag Road Site is on the Powder River arm of Brownlee Reservoir on the Oregon side. It is 3.3 mi upstream of the mouth of the Powder River and 4.7 mi downstream from Hewitt Park (Figure E.5-98). This site is partially owned by the Applicant and partially private. This site is at the end of a private road that dead-ends at the reservoir. Access is through private land; the city of Richland has keys to the gate that are provided upon request. The perimeter of the area included for sampling enclosed 0.5 acre, of which about 0.4 acre is obviously used. The only amenity at the site is the end of the paved road, which serves as a boat ramp (Table E.5-62). This site is used primarily for boat launching, day use, and bank angling.

The Applicant conducted recreational-use counts during which the Sag Road site was separately designated during 73 randomly selected days. During 63 (86%) of these days, the vehicle/ equipment total count was zero. For the warm-season sampling, the maximum car-pickup count was 6; the 90th percentile count was only 1. The median car-pickup count was zero (Table E.5-63).

The 10 sampling days with the highest camp total counts are shown in Table E.5-64.

The highest mean daily count, by month, of car-pickups was in October, at only 0.6. Camp totals were 0.1 in both June and October, and zero in all other months (Figure E.5-99).

This relatively small site provides a boat launch and bank angling access to the relatively small percentage of reservoir users who have access.

Private Dudes Cove (PDCV)

Private Dudes Cove is located on the Oregon side of Brownlee Reservoir, 24.3 mi south of Brownlee Dam (Figure E.5-100). Portions of this site are owned by the Applicant, the federal government (managed by BLM), and a private landowner. The perimeter of the area included for sampling enclosed 35.5 acres, of which about 1.5 acres are obviously used. Amenities at the site include a private dock and outhouse. There are also two small private cabins on the site (Table E.5-65).

The Applicant conducted recreational-use counts during which Private Dudes Cove was separately designated during 71 randomly selected days. During 42 of these days (59%), the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 10; the 90th percentile count was less than one-third of that at 3. The median camp total count was zero (Table E.5-66).

All but 1 of the 10 sampling days with the highest camp total counts were in May or June. Reflecting the results above, the camp total counts dropped from 10 to 3 within the 10 days on the list (Table E.5-67).

The highest mean daily count, by month, of camp total was in May, at 2.1. Car-pickup counts were highest in May and June, at 2.8 (Figure E.5-101).

This site is used mainly by people associated with the private owner but does receive some public use.

Swedes Landing (SWLD)

Swedes Landing is located on the Oregon side of Brownlee Reservoir, 25.2 mi south of Brownlee Dam (Figure E.5-102). This site is owned by the federal government and managed by the BLM. The perimeter of the area included for sampling enclosed 2.3 acres, of which about 1.4 acres are obviously used. Amenities at the site include three vault toilets and an impromptu boat ramp (Table E.5-68).

The Applicant conducted recreational-use counts during which Swedes Landing was separately designated during 120 randomly selected days. During 26 (21%) of these days, the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 22; the 90th percentile count was less than one-third of that, at 9. The median camp total count was 2 (Table E.5-69).

The 10 sampling days with the highest camp total counts were distributed through May, June, July, and September. Reflecting the results above, the camp total counts dropped from 22 to 10 within the 10 days on the list (Table E.5-70).

The highest mean daily count, by month, of camp total was in May, at 5.9. Counts of both camp total and car-pickup categories were zero during February only (Figure E.5-103).

This site is used for boat launching, camping, day-use activities, and bank angling. The entire waterfront is used for boat launching, although the slope is quite gentle and is not a very good location for this purpose.

Connor Creek (CONN)

Connor Creek is located on the Oregon side of Brownlee Reservoir, 36.5 mi south of Brownlee Dam (Figure E.5-104). Portions of this site are owned by the Applicant, a private owner, and the federal government (managed by the BLM). The perimeter of the area included for sampling enclosed 5.8 acres, of which about 0.2 acre is obviously used. There are no amenities at the site (Table E.5-71).

The Applicant conducted recreational-use counts during which Connor Creek was separately designated during 73 randomly selected days. During 64 (88%) of these days, the vehicle/ equipment total count was zero. For the warm-season sampling, the maximum camp total count was zero. The maximum car-pickup count was 6. The 90th percentile count was 1. The median car-pickup count was zero (Table E.5-72).

The 10 sampling days had camp total counts of zero (Table E.5-73).

The highest mean daily count, by month, of car-pickups was in May, at 0.8. Camp total counts were zero for all months (Figure E.5-105).

This site is used as a day-use area for bank angling access. This site was not chosen as a distinct site because of the land-based use. It is one of several coves that were chosen for separate designation because it is used by boat anglers for protection from wind and waves.

Hibbards Landing (HIBB)

Hibbards Landing is located on the Oregon side of Brownlee Reservoir, 40 mi south of Brownlee Dam (Figure E.5-106). Portions of this site are owned by the Applicant and a private landowner. The perimeter of the area included for sampling enclosed 11.46 acres, of which about 3.2 acres are obviously used. Amenities at the site include improved parking, one impromptu boat ramp, and a seasonal portable toilet (Table E.5-74).

The Applicant conducted recreational-use counts during which Hibbards Landing was separately designated during 120 randomly selected days. During 25 (21%) of these days, the vehicle/ equipment total count was zero. For the warm-season sampling, the maximum camp total count was 24. The 90th percentile count was less than one-half of the maximum, at 11. The median count was 3 (Table E.5-75).

The 10 sampling days with the highest camp total counts were in May, June, and July. Reflecting the results above, camp total counts dropped from 24 to 12 during the 10 days on the list (Table E.5-76).

The highest mean daily count, by month, of car-pickups was in May, at 7.3. Camp total counts also were highest in May, at 8 (Figure E.5-107).

This privately owned site is used for day use, camping, and some bank angling.

Jennifers Alluvial Fan (JFAN)

The Jennifers Alluvial Fan site is located on the Idaho side of Brownlee Reservoir, about 3.7 mi downstream of Steck Park (Figure E.5-108). This site is owned by the federal government and managed by the BLM. The perimeter of the area included for sampling enclosed 6.3 acres, of which about 0.4 acre is obviously used. There are no amenities at the site (Table E.5-77).

The Applicant conducted recreational-use counts during which this site was separately designated during 73 randomly selected days. During 53 (74%) of these days, the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 3. The 90th percentile and median counts were both zero (Table E.5-78).

There were only four warm-season days with any count in the camp total category (Table E.5-79).

The highest mean daily count, by month, of camp total was in June, at 0.3. Car-pickup counts were higher, ranging from 0.2 in May to 0.6 in July and August (Figure E.5-109).

This BLM site is used very lightly for day use, camping, and some bank angling.

Kevins Alluvial Fan (KFAN)

The Kevins Alluvial Fan site is located on the Idaho side of Brownlee Reservoir, about 1.5 mi downstream of Steck Park (Figure E.5-110). Portions of this site are owned by the Applicant and a private landowner. The perimeter of the area included for sampling enclosed 8.3 acres, of which about 1.7 acres are obviously used. The only amenity at the site is a seasonal portable toilet (Table E.5-80).

The Applicant conducted recreational-use counts during which this site was separately designated during 72 randomly selected days. During 32 (44%) of these days, the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 5. The 90th percentile count was 3. The median count was zero (Table E.5-81).

The 10 sampling days with the highest camp total counts were in June, July, and August (Table E.5-82).

The highest mean daily count, by month, of camp total was in June, at 1.2. Car-pickup counts were consistently higher, peaking at 2.5 in June (Figure E.5-111).

This BLM site is used lightly for day use and camping, and it provides some good locations for bank angling.

Weiser Sand Dunes (DUNE)

The Weiser Sand Dunes site is located on the Idaho side of Brownlee Reservoir, about 6.5 mi south of Steck Park (Figure E.5-112). This site is owned by the federal government and managed by the BLM. The perimeter of the area included for sampling enclosed 1.53 acres, of which about 2.9 acres are obviously used. The only amenity at the site is a seasonal portable toilet (Table E.5-83).

The Applicant conducted recreational-use counts during which this site was separately designated during 119 randomly selected days. During 92 (77%) of these days, the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 24. The 90th percentile count was 1. The median count was zero (Table E.5-84).

Nine days during which counts were conducted had camp total counts higher than 2 (Table E.5-85).

The highest mean daily count, by month, of camp total was in May, at 1.3 (Figure E.5-113).

This BLM site is used as an off-road vehicle play area. Use at this site is not associated with Brownlee Reservoir. Many of the camping vehicles counted were probably pickup campers and motorhomes towing off-road equipment. The two high counts of camp total were probably caused by some organized event.

Weiser Sand Dunes Sections A and B (DUNA and DUNB)

For convenience, these two sites were named for the Weiser Sand Dunes. The sites had no name, and the dunes are the nearest named area. Use at these sites is not generally associated with use at the Weiser Sand Dunes. This site is located on the Idaho side of Brownlee Reservoir, about 10 mi south of Steck Park (Figure E.5-112). Both sections of this site are owned by the Applicant. There are many ATV trails at section A, but no amenities at section B (Table E.5-86 and Table E.5-87).

The Applicant conducted recreational-use counts during which these sites were separately designated during 72 randomly selected days. The vehicle/equipment total count was zero during 67% (48 days) of these days at section A and 78% (56 days) of these days at section B.

For the warm-season sampling, the maximum camp total count was by far the highest in section A, at 4 (the maximum camp total counted at section B was 1). The 90th percentile count was 1 for section A and zero for section B. Other vehicle/equipment counts in both sections were similar in that they were generally low (Table E.5-88 and Table E.5-89).

The 10 sampling days with the highest camp total counts were mainly in May and June (Table E.5-90 and Table E.5-91).

Mean daily count, by month, of camp total was highest in May, at 0.6. Car-pickup counts were highest in July, at 1.6 (Figure E.5-114).

Figure E.5-115 illustrates monthly mean daily camp total counts for DUNA and DUNB. Camping use, like all other uses, in both sites was extremely low. These sites are lightly used for day use, bank angling, and camping.

Cobb Rapids (COBB)

The Cobb Rapids site is located on the Oregon side of Brownlee Reservoir, about 8.2 mi upstream of Farewell Bend State Park (Figure E.5-116). This site is owned by the federal government and managed by the BLM. The perimeter of the area included for sampling enclosed 3.6 acres, of which about 1.6 acres are obviously used. There are no amenities at the site (Table E.5-92).

The Applicant conducted recreational-use counts during which this site was separately designated during 72 randomly selected days. During 11 (15%) of these days, the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 16. The 90th percentile count was 7. The median count was 3 (Table E.5-93).

Within the 10 days during which the count of camp total was obtained, the count dropped from 16 to 7 (Table E.5-94).

The highest mean daily count, by month, of camp total was in June, at 7.3. The highest mean daily count, by month, of car-pickups was in May, at 5.4 (Figure E.5-117).

This BLM site is used regularly for camping and bank angling. There is no capacity concern; the 90th percentile camp total count is well within the capacity of this site.

Oasis (OASC)

The BLM's Oasis site is located on the Oregon side of Brownlee Reservoir, about 7.7 mi upstream of Farewell Bend State Park (Figure E.5-118). This site is owned by the federal government and managed by the BLM. The perimeter of the area included for sampling enclosed about 1 acre, of which about 0.9 acre is obviously used. Amenities at this site include a vault toilet, a gravel boat ramp, trash receptacles, a fire grill, and two picnic tables (Table E.5-95).

The Applicant conducted recreational-use counts during which this site was separately designated during 120 randomly selected days. During 24 (20%) of these days, the vehicle/equipment total count was zero. For the warm-season sampling, the maximum camp total count was 31. The 90th percentile count was 7. The median count was zero (Table E.5-96).

Within the 10 days during which the count of camp total was obtained, the count dropped from 31 to 6 (Table E.5-97).

The highest mean daily counts, by month, of camp total was in June, at 8.6. The highest car-pickup mean was also in June, at 5.1. Both of these June means were much higher than those from any other month (Figure E.5-119).

This BLM site is used regularly for boat launching and bank angling. Some camping occurs at the site; the majority of the camp total counts were probably pickup campers and motorhomes used to launch boats.

E.5.2.2. Recreational Users, Recreational Use, and User Attitudes at the HCC

Information in this section was developed from two primary sources: 1) on-site interviews of HCC reservoir users from 1994 to 2000 and 2) a mail survey of HCC visitors in 2000.

E.5.2.2.1. Recreational Users

Gender—The on-site interviews and the 2000 mail survey included questions about gender. Percentages of male respondents for the interview and the mail survey are given in Table E.5-98.

The majority of visitors to the HCC reservoirs were male (58 to 79%, depending on the location and year). The area having the lowest percentage of male visitors was Hells Canyon Reservoir

(58 to 66%), while the area with the highest percentage was Oxbow Dam tailrace (71 to 79%). Tailrace users at Hells Canyon Dam also had slightly higher percentages of males (67 to 74%) than users of the reservoirs did. There were few differences in the percentages of males at Oxbow and Brownlee reservoirs (62 to 72% for Oxbow, 64 to 71% for Brownlee).

Over the years of interviews, no obvious pattern in the percentages of males was apparent. The 2000 mail survey had slightly higher proportions of males than the on-site interviews did. Slightly more men than women completing the mail surveys could explain this difference.

Retirees—During on-site interviews in 1995, 1996, 1998, and 2000, visitors were asked whether they were retired. Percentages of respondents who said "yes" are given in Table E.5-99. In general, about one-quarter to one-third of all reservoir users were retirees. Slightly higher percentages of retirees were present at the reservoirs in 1995 and 1996 than were present in the two more recent years (but differences were small). Few major differences in the percentages of retirees were noted at the three reservoirs, but in 1995, 1996, and 2000, the tailrace of Hell Canyon Dam had relatively fewer retirees than the other reservoir areas did.

Age—During interviews and in the mail survey, reservoir visitors were asked to provide age information. In 1994, a different age reporting format was used (in age/gender classes)—one that was not directly comparable to other years. Table E.5-100 shows the percentage of respondents in different age categories for the three reservoirs for 1995 through 2000 and for the mail survey; Table E.5-101 shows similar information from the 1994 interviews. Table E.5-102 provides age averages from the on-site interview information.

The average age of visitors to the various locations declined slightly over the years. For example, the average age of visitors to Brownlee Reservoir dropped from 46.9 years in 1995 to 43.7 in 2000. Visitors to the two tailraces were slightly younger; visitors to Brownlee Reservoir were slightly older. The distribution of visitors among six age categories was similar for the three study areas.

The highest percentages of reservoir users were in the 35-to-44 age group; the next highest groups by percentage were 45 to 54 and 55 to 64 (Table E.5-100). The lowest percentages of users were 25 to 34. Results suggest that the reservoirs attract more retirees and older adults than they do younger adults and teens. The reservoirs appear less likely to be used as "hang-outs" for teens than some smaller reservoirs close to urban areas do (for example, Lucky Peak Reservoir near Boise, Idaho). There were lower percentages of respondents in the under-25 age category among 2000 interviewees and mail respondents; because interviewees under 18 were not sent a mail survey, this lower number for the under-25 group is probably a "method effect."

Ethnicity—Reservoir visitors were asked to provide ethnicity information during on-site interviews. Table E.5-103 shows the percentage of respondents for each ethnic category by reservoir.

HCC reservoir visitors have been predominately white (84 to 95%, depending on the year and reservoir). These percentages are not surprising, given the lack of ethnic diversity in much of the surrounding region (with the notable exception of a significant Latino population). Percentages of white visitors varied somewhat over the years, but these numbers do not suggest any trend toward ethnic diversification. Native Americans were the least common visitors to the three sites, generally fewer than 1%. Brownlee Reservoir had the most diverse visitors. During the study years, about 4% of visitors were African American, 4% were Latino, and 2% were Asian American.

Residency—Reservoir visitors were asked to report the state in which they live. Table E.5-104 shows results by state for all reservoirs combined. Table E.5-105 and Table E.5-106 show residence percentages by individual reservoirs and years; Figure E.5-120 highlights percentages for visitors to the three reservoirs in 2000.

Most visitors to the reservoir complex were from Idaho and Oregon, although many users were from Washington, California, Nevada, and Utah. The HCC reservoirs are generally a local resource, but with some larger regional pull. Higher percentages of reservoir visitors than of HCNRA river users were from Oregon and Idaho: usually over 80% of reservoir users were from these two states, while percentages of river floaters from the two states ranged from 35 to 66% and percentages of powerboaters ranged from 31 to 58% (Technical Report E.5-7). Hells Canyon Reservoir attracted higher percentages from Oregon than from Idaho, while visitors to Oxbow and Brownlee Reservoirs were more evenly distributed between the two states (with slightly higher visitation from Idahoans at Brownlee Reservoir). These results generally correspond to the travel distances required for access from population centers.

E.5.2.2.2. Reservoir Trip Characteristics

E.5.2.2.2.1. Day Use versus Overnight Use

On-site interview information from 1995 through 2000 allowed classification of users into three categories: day users (those who were not staying in the HCC area overnight), overnight users who stayed at dispersed areas, and overnight users who stayed in parks or other developed facilities.

Table E.5-107 summarizes percentages in each category for each of the three reservoirs and the tailrace of Hells Canyon Dam and for all reservoirs together. Figure E.5-121 summarizes on-site results from 2000 to determine whether users were campers, whether campers stayed at a park or a dispersed site, or whether users were day users (did not stay at a park or dispersed site). The figure also shows the percentage of campers who stayed at a dispersed site because parks were full.

Most visitors to the HCC reservoirs stayed overnight (over 73%); this finding was not surprising because of the remote location (except for upper Brownlee Reservoir, which is easily accessible for Weiser area residents). In contrast, a majority of users of the tailrace of Hell Canyon Dam were day users (55 to 67%, except in 1995 when only 37% were day users) (not shown).

Among overnight visitors, more appear to stay in parks (49 to 61% of all users) than at dispersed areas (29 to 31% of all users). Though dispersed areas have fewer facilities, some users may prefer these sites for their greater privacy, lack of fees or regulation, or more natural surroundings.

Few discernible patterns were apparent among percentages of types of users across the study areas or the years surveyed. Over the five-year study period, overnight use in dispersed areas declined slightly.

Day use for 1995 may be underestimated because arrival and departure information was not collected. Also, all overnight use in dispersed areas may be overestimated because the Applicant was not always able to determine whether the site or area named by a user was in or out of the reservoir area (for example, some people may have left the canyon and camped near Halfway, Oregon).

E.5.2.2.2.2. Activities

Activity information was collected in several ways. During the 1994–2000 on-site interviews, respondents were asked to report their primary activity during the visit, and interviewers also observed activities at the time of interviews. The 2000 mail survey asked respondents to report all the activities in which they participated during their trip. Primary activity information is most useful for characterizing the main focus of visitors' trips, while the 2000 data for all activities show the diversity of activities that users report. The observational information is useful for characterizing the relative proportion of time that visitors spent engaged in various activities.

Primary Activity Participation—During the 1994–2000 on-site interviews (except for 1997 and 1999), interviewers asked visitors to report the three most important activities (in order of priority) during their visit. Analysis focused on the percentage of visitors reporting activities as one of their top three for all reservoirs in each year (Table E.5-108), as well as the percentage reporting their single primary activity in each year (Table E.5-109). Table E.5-110 shows percentages reporting activities as one of their top three from 1995 through 2000 by reservoir, while Table E.5-111 shows the percentage reporting their primary activity in 1994 for park users and users who were neither angling nor in parks (visitors who were angling were not asked their primary activity in 1994).

Figure E.5-122 shows the seven activities most commonly reported among visitors' top three activities for all reservoirs combined in 1995, 1996, 1998, and 2000. Figure E.5-123 shows the seven most common primary activities among the three reservoirs in 2000, while Figure E.5-124 shows percentages of visitors reporting other single primary activities. It should be noted that in all years prior to 2000, interviewers were instructed to report camping as a primary activity when visitors reported that they were camping in the area; therefore, camping respondents reported only two other primary activities. In 2000, interviewers only noted camping as a primary activity if visitors explicitly reported it.

The most common primary activity was fishing, regardless of whether the “top three” primary activities or the single primary activity were considered. About three-quarters of all users considered fishing among their primary activities, and about 70% considered it their main focus. No other activity aside from camping was reported by a majority of users, and most activities were reported by fewer than 10% of respondents.

While fishing remained the most popular activity in all years, its popularity was slightly lower in 1998 and 2000. The popularity of lounging, water skiing, and jet skiing increased slightly. In years when fishing quality was better (as in the early and mid-1990s), the proportion of visitors reporting fishing as their primary activity was higher.

Camping appears to be another important primary activity for majorities of users in several years (51 to 72%), but is unimportant according to 2000 data (6%). As noted above, interviewers prior to 2000 were instructed to list camping as a primary activity whenever users reported that they camped, but in 2000, only users who specifically mentioned camping as a primary activity were recorded as having camping as a primary activity. These findings suggest that even though more than half of all users were camping on their trips, most came to the reservoirs to fish; camping was a secondary focus.

The popularity of lounging varied from a low of 3% (1998) to a high of 16% (2000). These percentages, however, probably reflect changes in interview format or interview styles rather than important shifts in visitors’ activities.

Water sports (water skiing and jet skiing) and nature watching increased slightly in popularity in recent years, suggesting the possibility of future conflicts between these generally incompatible activities (incompatible when they occur in the same vicinity at the same time). However, fewer than 10% of all users considered water sports among their primary activities, and only about 2 to 6% considered nature watching among their primary activities.

Very small percentages (usually less than 5%) of visitors reported any other single activity among their primary activities (Table E.5-110). Such activities included swimming, boating for pleasure, picnicking, hiking, hunting, and riding all-terrain vehicles (ATVs). Higher percentages of visitors may actually engage in these activities than were reported, but visitors did not consider these activities their primary activities at the reservoirs, where fishing was the clear focus.

There were some differences among primary activities between reservoirs. In all years (particularly 2000), users of Hells Canyon Reservoir were less likely to report fishing as a primary activity than users of the other reservoirs were. In all years except 2000, higher percentages of Oxbow Reservoir visitors than the other reservoir visitors reported fishing as one of their three primary activities (Table E.5-110).

Data from 1994 about percentages reporting primary activities (Table E.5-111) are not directly comparable to those from other years because visitors were given different surveys based on whether they were angling, in a park, or neither. Visitors were also asked to name a primary activity for themselves as well as one for each member of their group. Results (not shown) suggest that, for most visitors, angling was still the main focus. Fishing was assumed to be the primary activity of anglers, while fishing was also the primary activity for over half the park users and for over 40% of the people who were not in a park or were not fishing at the time of the interview. No other activity was reported as a primary activity by more than 12% of the nonpark and nonangling respondents (12% reported water skiing and 12% reported jet skiing as a primary activity).

Data from 1994 show few differences between the primary activities reported for respondents and those reported for the respondents' groups. This finding suggests that most groups are relatively homogenous in regard to primary activities. However, though reporting fishing as the primary group activity, respondents in parks had higher percentages reporting lounging as their primary activity than other respondents did. This finding suggests that, within the parks, some groups have members who focus on park activities such as lounging, while others focus on fishing.

Overall Activity Participation—In 2000, mail survey respondents were asked to check any of the activities (from a list of 13) that they did during their trips; an "other" category was also available. Results are given in Table E.5-112.

While more visitors reported fishing than any other activity (84%), nearly three-quarters (72%) reported camping, and substantial proportions (24 to 45%) reported seven other activities. While primary activity data suggest that most visitors were focused on fishing, the survey data from 2000 suggest that many visitors do more than just fish. Among the three reservoirs, higher percentages of users of Brownlee and Oxbow reservoirs fish, while higher percentages of Hells Canyon Reservoir users engage in other activities, particularly camping, sightseeing, wildlife viewing, and swimming.

Among the second-tier (less-often-reported) activities, wildlife viewing and sightseeing were reported by 45 and 40%, respectively of users, while photography was reported by 30%. Such related activities suggest a general interest for being in a natural place or observing nature, activities that are tied to the health of the area's biophysical resources. In general, Hells Canyon Reservoir users reported these activities more often than Brownlee or Oxbow reservoir users did.

Over one-quarter of all visitors reported walking, while 7% reported hiking. This percentage suggests that most reservoir users do not travel along the reservoirs by foot but that if they do, they wish to explore the immediate vicinity rather than travel long distances. Fewer than 1% reported travel by horse. Hells Canyon Reservoir users were more likely to walk and hike than other users were. Taken together, these results suggest greater visitor interest in short trails than in longer ones (although the lack of longer trails may also offer a partial explanation for these results).

Powerboating was reported by nearly one-third of all visitors, with slightly higher percentages on Oxbow Reservoir than on the other reservoirs. Swimming was reported by about one-quarter of all users, with the highest percentages on Hells Canyon Reservoir (34%) and the lowest on Brownlee Reservoir (17%). Visiting cultural or historic sites was reported by only 11% of all visitors, but by 20% of Hells Canyon Reservoir users.

Conclusions about User Activities—Visitors to the HCC reservoirs are primarily focused on fishing and camping or relaxing in a natural place, although small but significant proportions also pursue other activities such as wildlife viewing, waterskiing, hiking, hunting, or swimming (with much smaller percentages reporting these activities as a primary activity). In general, Brownlee Reservoir users are more focused on fishing, while Hells Canyon Reservoir users are more likely to engage in nonfishing activities (although a majority of Hells Canyon Reservoir users identify fishing as their primary activity). Users of Oxbow Reservoir are somewhere in between (but more similar to Brownlee Reservoir users). In more recent years, with fishing success apparently lower than the historical highs of the early 1990s, the proportion of visitors focused on nonfishing activities appears to be growing.

E.5.2.2.3. User Comments about General Management

This section summarizes information from over 23,000 comments obtained through the 1994–2000 on-site interviews and the 2000 mail survey. Results are useful for suggesting the major issues of interest to reservoir visitors. For more information from interviews of HCC visitors regarding these issues, see Technical Reports E.5-4, E.5-6, E.5-10, and E.5-12.

E.5.2.2.3.1. Summary of Comment Categories and Findings

The Applicant and its contractors placed visitor comments into 13 major issue categories (for the top 6 categories, comments were also divided into positive and negative groupings). Table E.5-113 shows the percentage of comments in different categories by reservoir area and for all areas combined. Some conclusions about general management comments follows:

The most frequent comments concerned facilities (28%), with roughly similar percentages of those comments praising or criticizing the specific facilities or the general amount or type of facilities at developed parks or dispersed areas. Hells Canyon Dam tailwater and Brownlee Reservoir received more positive facility comments than other areas did.

The second most frequent comments praised or criticized general features of the reservoirs or area (for example, “the canyon is beautiful”). About 26% of all comments fell into this category, with the vast majority (almost 9 of 10) being positive. Some differences in general comments occur by reservoir, with both Hells Canyon and Oxbow tailwater areas receiving proportionally more positive comments than the reservoirs did and with Hells Canyon Reservoir receiving more positive comments than Oxbow Reservoir did. And Oxbow Reservoir received more positive comments than Brownlee Reservoir did.

Relatively fewer comments (about 10%) were about maintenance of facilities or about the area in general. Among those comments, about 7 of 10 were positive. In general, comments about Hells Canyon Reservoir and the tailwater were more positive than comments about other areas were.

Despite high levels of fishing participation and fishing’s importance among reservoir activities, relatively few comments were about angling (about 7%) or angling regulations (1%). About 7 of 10 angling comments were negative (for example, “fishing was poor”). Consistent with several other findings from the interviews and surveys, fishing comments were more plentiful among users of Brownlee and Oxbow reservoirs than among users of Hells Canyon Reservoir.

Reservoir levels and other related issues were also significant topics for comments, particularly at Brownlee Reservoir. Overall, about 14% of all comments focused on water level issues, with negative comments outnumbering positive ones by about 13 to 1. On Brownlee Reservoir, where 21% of all comments were about water levels, the ratio of negative to positive comments was 20 to 1. A separate report on reservoir levels (Technical Report E.5-6) provides more specific information about these results and related issues.

Access issues (for example, roads, boating facilities, and trails) were the subject of about 6% of all comments; about 80% of these comments were criticisms. Brownlee Reservoir received more of these comments, as well as more of the negative ones; Hells Canyon Reservoir received the fewest number of comments and the fewest negative ones.

Only about 1% of all comments praised or criticized the various private and governmental organizations that manage facilities or land in the reservoir areas. While many visitors may be able or willing to evaluate agencies and their management performance if asked, open-ended questions did not elicit many specific agency evaluations. Fewer than 3% of all comments were about visitor impact issues (for example, litter or crowding), fees, regulations and law enforcement, commercial services, or hunting issues. While a few visitors expressed strong feelings about these topics, most users did not comment about them.

Each of the 13 major comment categories was further divided into comment subcategories to help characterize the content. Table E.5-114 through Table E.5-132 show the percentages of comments in each subcategory for each category. Each summary table also shows the percentage of positive and negative comments within the category and the total percentage of comments within that category relative to all comments (as summarized in Table E.5-113).

E.5.2.2.3.2. Summary of Findings for Major Comment Categories

E.5.2.2.3.2.1. General Comments

About one-quarter to one-third of all comments (depending on the area) were general in nature, and most were positive about the canyon or reservoirs (for example, “we love this area”) (Table E.5-113). Table E.5-114 summarizes the comments (from all comments) that were general in nature and the percentages of those general comments that fall into each of 11 subcategories. Conclusions suggested by general comment data include the following:

The vast majority of general comments were positive (91% of all comments in this category), but most were unspecific (fewer than 11% identified locations). Results suggest that many users had a satisfactory experience, a finding consistent with those from surveys of recreation users (who choose to go to locations and do activities that they enjoy).

There were few important differences in the percentage of general comments for the different areas, with the notable exception that Hells Canyon Reservoir and the two tailraces had generally higher percentages of general comments and Oxbow and Brownlee reservoirs had lower percentages of general comments.

Among the roughly 10% of general comments that were positive and identified specific locations, the larger parks (Hells Canyon, Copperfield, McCormick, Woodhead, and Farewell Bend) were the most common locations (see Table E.5-115, which shows the number of comments made about each). Although the number of positive comments is probably not the best indicator of the quality of a facility, Hells Canyon Park received more compliments than the other parks.

About 5% of general comments requested that a reservoir should be "left as it is," suggesting either high satisfaction with current facilities, resources, and use levels or some concern that managing agencies might "change things."

Relatively few comments focused on the topics of hazards, cattle management, or fish kill.

E.5.2.2.3.2.2. Facility Development Comments

About one-quarter to one-third of all comments (depending on the area) were about reservoir facilities; of these comments, about 55% were positive and 45% were negative (Table E.5-113). Table E.5-116 summarizes the comments that were about facilities and the percentages of those facility comments that fall into each of 21 subcategories. For the three most common subcategories, Table E.5-117 shows the number of specific comments associated with various locations. Conclusions suggested by facility comment data include the following:

In general, there were more positive facility comments for Hells Canyon Reservoir (79%) and Hells Canyon Dam tailwater (69%) than for Oxbow Reservoir (53%), Oxbow Dam tailwater (47%), or Brownlee Reservoir (58%).

Most positive comments about facilities were general in nature (only about 12% of positive comments were specific enough to be placed into 1 of the 4 positive subcategories). In contrast, over 80% of the critical facility comments were specific and could be placed into 1 of the 15 negative subcategories.

Two notable findings among the specific positive facility comments were support for the improvements on Brownlee Reservoir (probably associated with Woodhead Park improvements) and the addition of toilets at Oxbow Dam tailrace.

The most common facility complaints overall were associated with shortage of restrooms (9%), shortage of facilities in general (8%), and interest in electric or water hookups (4%). However, these criticisms were voiced by relatively small numbers of users.

Percentages of comments in the negative facility subcategories varied by area. However, findings suggest that there are, or have been, toilet facility problems at Oxbow Dam tailrace (32% of all facility comments at Oxbow Dam tailrace) and Hells Canyon Reservoir and that many Brownlee Reservoir users are interested in more shade (6% of facility comments at Brownlee Reservoir).

Relatively few comments were made about other facility needs such as fish-cleaning stations, garbage cans, swimming docks, interpretive kiosks, or design/site improvements (fewer than 2 to 3% of all facility comments for any subcategory). While some visitors are interested in these facility developments or improvements, most did not comment about them. Additional questions on the 2000 mail survey focused on the importance of facility development attributes and evaluations of current facilities.

For the three most common subcategories for facility development, the number of comments associated with specific parks or survey sample areas was counted (Table E.5-117). Not surprisingly, the larger parks and use areas that were sampled generally received more comments. However, patterns suggest at least two additional findings: 1) shade and the lack of restrooms are key issues at several locations on Brownlee Reservoir, and 2) Hewitt and Holcomb parks and Hells Canyon Park may have restroom shortages.

E.5.2.2.3.2.3. Maintenance/Service Comments

About 10% of all comments (depending on the area) were about facility maintenance or services, with about 7 out of 10 of those comments being positive (Table E.5-113). Table E.5-118 summarizes the comments that were about facility maintenance and service and the percentages of those maintenance/service comments that fall into each of 15 subcategories. For the two most common subcategories, Table E.5-119 shows the number of specific comments associated with various locations. Conclusions suggested by maintenance/service comment data include the following:

In general, there were more positive facility comments for Hells Canyon Reservoir (75%), Hells Canyon Dam tailwater (94%), Oxbow Reservoir (75%), and Oxbow Dam tailwater (84%) than for Brownlee Reservoir (64%).

In general, positive comments were more likely to focus on general park upkeep or general maintenance than on service.

Relatively few maintenance service compliments were specific in nature, although about 8% were focused on clean restrooms. Fewer than 1% of these compliments focused on landscaping (trees and lawns), and fewer than 1% focused on the reservation system.

Of the general critical comments, roughly similar percentages focused on maintenance (7%) and service (6%).

Some criticisms were specific in nature. The most common were about restrooms (4%), insects (4%), landscaping (2%), and weeds (2%).

Some notable differences occurred in percentages by area. Percentages for maintenance praise were generally higher for Hells Canyon Reservoir and the tailwater than for other areas and were lower for Brownlee Reservoir than for other areas. (Oxbow Dam tailwater percentages should be considered with caution because of small sample sizes for that area.)

Within the two most common subcategories, the number of comments associated with specific parks was counted (Table E.5-119). Not surprisingly, the larger parks generally had more comments. However, the comment patterns suggest that 1) Copperfield and Woodhead parks receive more than their share of maintenance praise given their high use levels, while 2) Hewitt and Holcomb parks and Spring Recreation Site have greater criticism about upkeep than might be expected given their lower use levels.

E.5.2.2.3.2.4. Angling and Angling Regulation Comments

About 7% of all comments (depending on the area) were about fishing, with another 1% about angling regulations. While fishing was the most common primary activity, relatively few comments were made about fishing (less than 10% for all areas) (Table E.5-113). Table E.5-120 and Table E.5-121 summarize the comments that were about angling and angling regulations and the percentages of those angling and angling regulation comments that fall into each of 13 fishing subcategories and 9 angling regulation subcategories. Conclusions suggested by angling comment data include the following:

Among the fishing comments, 78% were criticisms. Among the angling regulation comments, 94% were criticisms. Rather than suggest that fishing quality is poor, these numbers probably show that people often comment on fishing when it does not meet their expectations. A separate report focuses on fishing quality evaluations and success rates (Technical Report E.5-10).

For comments in the two fishing categories, few important general differences in percentages occurred by area.

When comments were positive, they tended to be general in nature (over 85% of positive comments). Only about 3% of all angling comments praised fishing for a specific species.

When fishing comments were criticisms, they often tended to be more specific, although about 35% of the critical comments were general.

Among the specific criticisms of fishing, more fish (11%) received more interest than larger fish (2%). Results suggest that many users prefer the reservoirs to be high quality “meat” or “quantity” fisheries than “trophy” fisheries. For more detailed information about fishing, user preferences for different species, and fishing success, see Technical Report E.5-10.

There is some interest in reducing the carp population at Oxbow Dam tailwater (18% of all angling comments for that area). For other users, however, the high carp populations immediately below the dam may be the focus of their visits to that area.

A significant percentage of angling comments, particularly from Brownlee Reservoir, focused on water level fluctuations. A separate major comment category focused on water level issues; see Technical Report E.5-6 for more detail.

The small number of comments on angling regulations limits the usefulness of those results. (Most of those comments were general criticisms that fit into the subcategory “regulations should be changed.”)

E.5.2.2.3.2.5. Reservoir Water Level Comments

Among all reservoir users, about 14% of all comments pertained to water operations and reservoir level issues (Table E.5-113). The only categories with more comments were general comments (26%) (Table E.5-114) and facility development comments (28%) (Table E.5-116). These data suggest that reservoir levels are among users’ most important recreation issues.

Table E.5-122 summarizes the comments that were about water operations and reservoir levels and the percentages of those reservoir level comments that fall into each of 12 subcategories. Conclusions suggested by comment data on reservoir level include the following:

There were differences between the percentages of comments on reservoir levels for Hells Canyon and Oxbow reservoirs (4 to 8%, respectively) and the percentage of comments for Brownlee Reservoir (21%). This difference probably reflects the smaller daily changes on Hells Canyon and Oxbow reservoirs (usually less than 5 ft total change from full pool) compared with larger fluctuations on Brownlee Reservoir (where in some years levels have dropped nearly 100 vertical ft from full pool). Although Brownlee Reservoir fluctuates on a daily basis, those fluctuations are virtually imperceptible compared with the seasonal fluctuations for flood control and downstream flow augmentation. Based on these data, reservoir levels are a more important issue on Brownlee Reservoir.

Among reservoir level comments, the vast majority were critical of reservoir levels (96 to 98%). Users appear less likely to provide comments when levels create acceptable conditions, but they are vocal when conditions are poor. This tendency illustrates one of the problems with using open-ended questions to assess evaluations about water level.

The most often mentioned subcategories for Hells Canyon and Oxbow reservoirs were "stop fluctuations" (33 and 42%, respectively), levels and biological issues (19 and 16%), and specific criticisms of low levels (14 and 15%). Most of the biological issues focused on effects on fish and fishing.

The less often mentioned comments for Hells Canyon and Oxbow reservoirs were the need for more information about levels (5 and 2%, respectively), general criticisms (4 and 10%), water quality criticisms (6 and 2%), and "remove the dams" (5 and 1%). Blue-green algae blooms are a common occurrence on HCC reservoirs in some summers and appear to be responsible for many of the water quality comments.

On Brownlee Reservoir, the most common subcategories were "stop fluctuations" (30%), specific criticism of low levels (26%), levels and biological issues (13%), and general criticism of levels (10%). Because Brownlee Reservoir does not fluctuate significantly on a daily basis, the "stop fluctuation" comments probably refer to criticisms of seasonal changes.

Less often mentioned comments for Brownlee Reservoir were water quality criticisms (5%), the need for more information about levels (3%), and "remove the dams" (1%).

Comments about angling (a separate comment category) also included a subcategory associated with effects of reservoir level on fishing. While angling made up only 4 to 6% of all comments for Hells Canyon and Oxbow reservoirs, respectively (Table E.5-120), 17 to 18% of those angling comments were critical of water level effects. For Brownlee Reservoir, 9% of all comments were about fishing, and 34% of those were critical of water levels.

Taken together, comments in response to open-ended questions suggest that reservoir level issues are important to many users, particularly on Brownlee Reservoir. Specific level comments appeared to focus on a wide variety of issues, including effects on fishing, use of boat ramps, access to parts of the reservoirs, problems with boats being left high and dry (Hells Canyon and Oxbow reservoirs), and the aesthetics of a drawndown reservoir (Brownlee Reservoir). These issues are examined more closely in the report on reservoir levels (Technical Report E.5-6).

E.5.2.2.3.2.6. Access Comments

For many visitors, access issues were generally of less importance, comprising only 6% of all comments. Slightly more comments in this category were for Brownlee Reservoir than for the other areas (Table E.5-113).

Table E.5-123 summarizes the comments that were about access and the percentages of those access comments that fall into each of 15 subcategories. For 3 common subcategories, Table E.5-124 shows the number of specific comments associated with various locations. Conclusions suggested by comment data about access include the following:

Most of the access-related comments were criticisms (89%); notably, every single access comment for Oxbow Dam tailrace was negative.

The only significant proportion of the specific access comments that were positive related to land access at Hells Canyon Dam tailrace.

Among the specific comments that were criticisms, boat docks and launches generally received the greatest attention. Oxbow Dam tailwater users showed interest in more boat ramps (23%).

Hells Canyon and Oxbow reservoir users showed interest in improved or additional docks or moorings (29 and 19%, respectively). Brownlee Reservoir users showed interest in additional or improved roads (25%) and longer boat ramps (9%).

A number of comments fit into the "other land access issues" category (17% overall, but 42% for Hells Canyon Dam tailwater). These comments included general concerns about the availability of public lands, including permits for jet boats and access in the HCNRA. Interest in access in the nearby HCNRA partially explains the high percentage of comments in this category for the Hells Canyon Dam tailwater area.

Table E.5-124 shows tallies of specific comments for three key access subcategories. Several findings are notable. Longer boat ramps were a particular issue at several upper Brownlee Reservoir locations, but they did not appear to be an issue at lower Brownlee Reservoir sites. The two parks where dock improvements interested more users were Hells Canyon and Woodhead parks. Road improvement comments were more plentiful for areas that currently have no, or very poorly maintained, roads (for example, the middle part of Brownlee Reservoir).

E.5.2.2.3.2.7. Visitor Impact Comments

Concern about visitor impacts made up a small percentage (3%) of comments overall (Table E.5-113). This percentage is surprising since litter, crowding, and user conflicts are often among the most commonly reported issues in surveys of recreation users. Taken at face value, these data indicate few major problems with visitor impacts.

Table E.5-125 summarizes the comments that were about visitor impacts and the percentages of those visitor impact comments that fall into each of nine subcategories. For the two most common subcategories, Table E.5-126 shows the number of specific comments associated with various locations. Conclusions suggested by comment data on visitor impacts include the following:

Among the few visitor impact comments, about 9 in 10 were criticisms of current use or impact levels.

Litter was the most important issue for users who commented on visitor impacts. About 24% of these comments were general criticisms about litter, 9% were requests for improving litter pickup or maintenance, and 11% were calls for improved litter enforcement.

The second most common visitor impact comments were associated with crowding (24% of all comments), particularly at Hells Canyon Dam tailwater area (53%), Hells Canyon Reservoir (36%), and Oxbow Reservoir (30%). In contrast, only 13% of visitor impact comments at Brownlee Reservoir were about crowding.

Roughly similar percentages of visitor impact comments suggested there were conflicts (4%), problems with other groups (3%), or few/no conflicts (5%).

Specific comments about two key visitor impact subcategories (litter and crowding) are shown in Table E.5-126. They suggest that 1) while litter complaints were more frequent for Hells Canyon Reservoir section 2, frequency of crowding complaints in both sections 1 and 2 were similar; 2) crowding complaints at Oxbow Reservoir were most plentiful for McCormick Park, while litter complaints were most plentiful outside the park; and 3) Brownlee Reservoir had few crowding complaints, and litter complaints were most plentiful in the middle part of the reservoir.

E.5.2.2.3.2.8. Fee Comments

Comments about fees, an often contentious topic in recreation settings, made up only about 3% of comments overall, although 86% of those comments were criticisms (Table E.5-113). Because relatively few respondents made comments about fees, conclusions cannot be made about reservoir users' attitudes toward fees.

Table E.5-127 summarizes the comments that were about fee issues and the percentages of those comments about fees that fall into each of six subcategories. Table E.5-128 shows the number of specific comments associated with various locations for the "fees too high" subcategory. Observations about comment data about fees include the following:

The most common (48%) fee comments were that “fees are too high.” Another 21% of fee comments showed general opposition to fees, while praise for fees was rare, making up about 5% of fee comments overall. About 7% of fee comments expressed opposition to raising fees.

Some comments supported senior fee discounts (about 14% of comments at Oxbow Reservoir and tailwater area, 13% at Hells Canyon Reservoir, and 5% at Brownlee Reservoir). However, subcategory percentages at Hells Canyon and Oxbow tailwater areas can be misleading because sample sizes there were small.

Numbers of comments for the “fees too high” subcategory are shown by location in Table E.5-128. Generally, fee comments were from visitors to the larger parks. Interestingly, however, two of the larger parks (Hells Canyon and Woodhead parks) had relatively lower numbers of fee comments, while McCormick, Farewell Bend, and Hewitt and Holcomb parks appeared to have more comments than would be expected based on use levels. Hells Canyon and Woodhead parks may have better-quality facilities or resources relative to their fees than the other parks do.

E.5.2.2.3.2.9. Enforcement/Regulations Comments

Comments about enforcement and general regulations made up less than 1% of all comments and were largely negative (94%) (Table E.5-113). Because fewer than 1% of visitors remarked on enforcement and regulations, conclusions cannot be drawn about user attitudes toward these topics.

Table E.5-129 summarizes the comments that were about enforcement and regulation issues and the percentages of those enforcement/regulation comments that fall into each of 13 subcategories. Observations about comment data on enforcement and regulation include the following:

The most common enforcement/regulation comments mentioned the need for more enforcement (34%). Only 1% of enforcement comments advocated less enforcement.

Roughly similar percentages of comments advocated for more and less regulation, indicating that consensus about specific regulation changes is unlikely.

A majority of regulation enforcement comments at the Hells Canyon tailwater area advocated for jet boat control or prohibitions. This conflict is addressed in greater detail in the general recreation report about the HCNRA (Technical Report E.5-3).

About 11% of all enforcement/regulation comments addressed powerboat–nonmotorized user conflicts and included support for the following: a ban on waterskiing or jet skiing (5%), more regulations for jet skiing (3%), and more no-wake zones (3%). These comments were generally more plentiful for Hells Canyon Reservoir than for the other areas, although support for more no-wake zones was higher for Brownlee Reservoir.

E.5.2.2.3.2.10. Commercial Services Comments

Fewer than 1% of all comments were about commercial services, although nearly all of those (97%) were criticisms of existing services or requests for additional services (Table E.5-113). However, conclusions cannot be drawn about an issue that fewer than 1% of visitors remarked on.

Table E.5-130 summarizes the comments that were about commercial service issues and the percentages of those commercial services comments that fall into each of eight subcategories. Observations about comment data on commercial services include the following (Figure E.5-4):

The majority of comments in this category (61%) advocated having additional food services available in the canyon. At least some visitors wanted additional restaurants or grocery stores in the area.

There was also some interest in gas services in the canyon, particularly among users of Brownlee Reservoir and the Hells Canyon tailwater area.

Similarly, there was some interest in the availability of ice in the canyon, particularly at Hells Canyon Reservoir (23% of commercial services comments for that area). Users of Oxbow and lower Brownlee reservoirs have ice available at two nearby locations, offering some explanation for why there were lower percentages (7 to 8%) for those areas.

E.5.2.2.3.2.11. Hunting Comments

General reservoir users made very few comments about hunting (well less than 1% of all comments) (Table E.5-113 and Table E.5-131). Comments on hunting were only categorized into praise or criticism, and about three-quarters were critical. A separate report focuses on hunting issues in the area (Technical Report E.5-12).

E.5.2.2.3.2.12. Agency Evaluation Comments

About 1% of all comments offered specific agency evaluations (Table E.5-113), and most of those (72%) were about the Applicant (the agency conducting the interviews; interviewers wore Idaho Power Company hats and name tags and traveled in company trucks or boats with the corporation logo displayed prominently). However, some comments also offered evaluations of the BLM or USFS (federal agency praise and criticism) (14%), the IDFG (4%), or other state or local agencies (10%).

Table E.5-132 summarizes the comments that were about management agencies in the canyon and the percentages of those comments about agencies that fall into each of eight subcategories. Observations about comment data about agencies include the following:

Evaluation comments were most often positive (60%). Comments about the Applicant were slightly more positive (about 70% positive) than for other agencies, while those for federal agencies were more negative (about 70% negative).

Because many comments were made during live interviews, some “social desirability bias” may have played a role in the comments about the Applicant. Offering criticism of an agency to an individual representing that agency is generally difficult. Also, because interviewers allow visitors the opportunity to tell agencies about their preferences and needs, many visitors may feel justified in offering a positive evaluation of that agency. Besides allowing managers to collect information about visitors, extensive surveys can be a useful way to improve public relations between a managing agency and users.

There were relatively few important differences among areas, although all comments about federal agencies from the Hells Canyon tailwater area were positive, and comments about federal agencies from Brownlee Reservoir were slightly more negative than comments from other areas were.

E.5.2.3. Potential Recreational Use

Estimating the potential for change in recreational use at the HCC, as at any other location, requires the consideration of several usually interrelated factors. Population changes that occur within the region that contributes recreationists to an area can cause increases or decreases in the amount of recreational use. In addition, the particular activity or combination of activities that recreationists engage in while in an area can become more or less popular among the recreating public. On-site conditions at the recreation area can also change, making the area more or less attractive to recreationists.

E.5.2.3.1. Population Growth

While most recreationists using the HCC come from within 100 mi of the project area, some come from the Pacific Northwest (Idaho, Washington, and Oregon), and others come from elsewhere in the nation.

The U.S. population grew by 10% between 1980 and 1990, and by 13% between 1990 and 2000 (281 million in 2000) (Figure E.5-125). This increase is expected to continue at a slower rate of 9% per decade through 2020.

During the 1990s, the population of the Pacific Northwest grew at a much higher rate than the population of the United States as a whole. During the 1990s, Idaho's population grew by 29%;

Washington's, by 21%; and Oregon's, by 20% (Figure E.5-126). Population growth in the Pacific Northwest is expected to continue to outpace national growth in the foreseeable future.

A large portion of recreationists in the HCC come from locations either adjacent to or in the immediate area of the projects. In Oregon, these locations include Baker, Malheur, Union, and Wallowa counties; and in Idaho, Ada, Adams, Boise, Canyon, Gem, Idaho, Lewis, Nez Perce, Owyhee, Payette, Valley, and Washington counties (Figure E.5-127).

Between 1980 and 1990, the population in all of the surrounding counties in Oregon actually decreased. During the 1990s, population in Baker, Union, and Wallowa counties each increased small amounts, while the population of Malheur County increased by 21.5% (Figure E.5-128).

During the 1980s, population in three of the four Idaho counties that border the northern HCC (Idaho, Lewis, and Adams counties) decreased, while Nez Perce County increased slightly in population. During the 1990s, population in Adams County increased slightly, as did the population of Lewis County (though not to the level of 1980). The population of Idaho and Nez Perce counties increased substantially during the 1990s (Figure E.5-129).

During the 1980s, the population in counties bordering the southern HCC (Washington, Payette, Gem, Valley, and Boise counties) changed little. Population in Washington and Gem counties actually decreased, while population in Payette, Valley, and Boise counties increased small amounts. During the 1990s, all three of these counties had rates of population increase that were higher than that of the national average (Figure E.5-125 and Figure E.5-130).

Ada and Canyon counties in Idaho do not immediately border the HCC, but they have much higher populations than the other Idaho counties of interest, are within a convenient driving distance of the HCC, and contribute substantial numbers of recreationists to the HCC. During the 1980s and 1990s, population growth rates in both of these counties (Figure E.5-131) considerably exceeded that of the nation (Figure E.5-125).

During the 1980s, the population of the counties surrounding the HCC increased by 8.2%, from 456,876 to 494,456. During the 1990s, the population increased by 27.9%, to 632,631 (Figure E.5-132).

E.5.2.3.2. National Trends in Participation in Selected Activities

National surveys have been conducted to determine numbers of participants in outdoor recreational activities and to identify any trends in such participation (Cordell et al. 1995). These studies have shown that the largest increases have been in nonconsumptive activities, such as camping, hiking, picnicking, and general motorboating. Participation in fishing and hunting decreased slightly between 1983 and 1995 and then increased between 1995 and 2000 (Figure E.5-133).

In the United States between 1983 and 1995, though absolute numbers for participation in most activities increased, the percentage of people participating in fishing and hunting decreased by 3.8%. The percentage of people participating in the following activities increased: motorboating by 39.9%; primitive camping, 58.2%; developed camping, 38.3%; sightseeing, 39.5%; and walking, 42.8% (Figure E.5-134).

E.5.2.3.3. Changes in On-Site Conditions

At the HCC, many changes that influence recreation use have occurred and will continue to occur. Such changes include tremendous capital investments in facilities made by the Applicant (Woodhead Park), Baker County (Holcomb Park area), the BLM (Steck Recreation Site), and other entities. But no changes have had, or are likely to have, the impact that the changes in overall angling success at the HCC and in seasonal fluctuation patterns at Brownlee Reservoir have had during the last decade.

Changes in Angling Success—Angling is by far the most popular recreational activity at the HCC reservoirs. During the late 1980s and early 1990s, crappie anglers experienced phenomenal success at Brownlee Reservoir. Expectations among these anglers were raised to unrealistic levels. Crappie anglers are usually “meat fishing,” and word spreads quickly when a particular reservoir becomes “hot.” Some anglers came from hundreds of miles away, stayed for several days, and left with hundreds (and sometimes thousands) of crappie filets. Some anglers actually loaded freezers into their motor homes and filled them with crappie before they left. Crappie angling success dropped in 1993 and continued to decline in 1994. As seen in the Applicant's use results, overall recreational use and particularly angling use continued to decline considerably after 1994. This decline can be attributed, to a large degree, to the decline in angling success.

Changes in Seasonal Fluctuation Patterns at Brownlee Reservoir—As described in section E.5.2.1.1.1., dramatic changes in the way Brownlee Reservoir water level is managed have been made in the past decade. Prior to 1992, the only significant drawdowns occurred from late winter through mid-spring for flood control. During the remainder of the year, the reservoir usually remained within 10 to 15 ft of full. Beginning in 1992, to assist the migration of anadromous fish past ACOE projects in the lower Snake and Columbia rivers, the Applicant instituted additional drawdowns and water releases during the warmer, high-use season. Usually beginning after the Fourth of July, the reservoir has been drawn down considerably to provide flows to help flush salmon smolts through the lower Snake and Columbia river reservoirs to the sea. These drawdowns have been based on an agreement between the Applicant and the BPA, an agreement that expired in April 2001. Beginning in 1991, late in the year, usually before the reservoir can be completely refilled, the reservoir has again been drawn down to capture inflows into Brownlee Reservoir, while a constant low outflow has been maintained for salmon spawning downstream of Hells Canyon Dam. These additional drawdowns have resulted in the reservoir being full only four or five weeks during the warm, high-use season. Figure E.5-9 shows reservoir levels from 1990 through 2000 and major boat ramp elevations. During the last decade, each of the boat ramps on Brownlee Reservoir, except for the old ramp at Woodhead Park, has been unusable at least a few times. Additionally, during the more extreme drawdowns, many anglers have had difficulty accessing their accustomed areas for bank angling. Many anglers may have become frustrated with attempting to fish or launch boats from shore under these conditions. These anglers simply do not visit the reservoir as often as they did in previous years, or they do not return at all.

Conclusion—The counties and states that supply recreationists to the HCC can all be expected to continue to increase in population for the foreseeable future. In addition, the number of participants nationally is increasing for all the major activity categories associated with recreational use in the HCC, and numbers can be expected to increase for the foreseeable future. These two factors alone could lead to the conclusion that recreational use at the HCC will increase steadily in the future. Unfortunately, projecting future use is never simple. After undergoing fairly dramatic decreases from 1994 through 1998, recreational use in the HCC appeared to stabilize and then rebound slightly in 2000. The present users are those who will visit the HCC given the present operational regime and angling success. If either or both of these factors change, the Applicant and other managing entities in the HCC should monitor recreational use in the area and, if use dramatically increases in a short time, be ready to respond with appropriate managerial input.

E.5.3. Measures and Facilities Recommended by the Agencies

To consolidate measures, the Applicant has included measures or facilities recommended by the agencies in section E.5.4.5. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.5.4. Applicant's Existing and Proposed Measures or Facilities

The Applicant's proposed recreation plan is based on the FERC policy concerning recreational development at licensed projects (18 CFR § 2.7). The policy provides for the development of recreational resources that are "consistent with the needs of the area to the extent that such development is not inconsistent with the primary purpose of the project" and "reasonable expenditures" for recreational development based on an approved plan. Among others, the policy establishes the expectation that licensees develop suitable public recreational facilities with adequate public access, including consideration for the needs of individuals with physical handicaps; cooperate with appropriate agencies and interested entities in determining public recreation needs and developing site plans; encourage governmental agencies and private interests to assist in carrying out plans, including for operation and maintenance of facilities; cooperate with governmental agencies in planning, providing, operating and maintaining facilities on public lands adjacent to the project area; provide for litter and sanitation control at facilities operated by the licensee; and inform the public about recreation opportunities, including rules governing accessibility and use of recreational facilities.

Therefore, the Applicant proposes a Recreation Plan for the HCC that considers land- and water-based recreational opportunities. The Recreation Plan consists of the Applicant's existing and proposed PM&E measures identified in this section. This plan was developed after consultation with the following agencies, nongovernmental organizations, and counties: the USFS, BLM, National Park Service, Idaho Department of Parks and Recreation, IDFG, Oregon Department of Parks and Recreation, Oregon Department of Fish and Wildlife, FERC, Idaho Rivers United, Oregon State Marine Board, Baker and Wallowa counties (Oregon), Washington and Adams counties (Idaho), and various tribes. The Applicant also referred to and considered recreational planning documents of the BLM, USFS, Idaho Department of Parks and Recreation, IDFG, applicable counties, and Idaho Department of Commerce. The Applicant considered the following in developing its Recreation Plan:

- Issue identification
- Study results
- Resource agencies' objectives in management plans
- Other measures recommended by resource agencies
- Potential measures from brainstorming sessions by the RARWG
- Vision statements for the management zones
- Project economics
- Agencies' comments to the draft license application

See the Consultation Appendix (Volume 1, Specific Resource Issues [Recreation Resources]), for further detail.

The Applicant's Recreation Plan is designed to accomplish the following objectives: 1) promote public safety and increase public awareness of recreational opportunities by providing interpretive, informative, and educational panels and kiosks at developed recreation sites and by providing information through a website and a toll-free telephone number; 2) promote reasonable health and safety standards through a litter and sanitation plan; 3) provide accurate and timely information about water flow and river fluctuations downstream of Hells Canyon Dam via the website, toll-free telephone number, and on-site flow monitors; 4) provide accurate and timely information about water flow and reservoir fluctuations at HCC reservoirs via the website and toll-free telephone number; 5) provide safe and reasonable access to recreational areas; 6) reduce congestion and conflict among visitors and resources related to recreational activities; 7) provide reasonable and amenable recreation facilities that provide for a range of recreational opportunities; 7) reduce impacts to cultural, terrestrial, and aquatic resources; 9) provide a forum for the coordination of resources between the Applicant and law enforcement agencies; and 10) provide opportunities to work cooperatively with agencies and other entities to provide adequate and reasonable recreational developments that incorporate desired future conditions. The Recreation and Aesthetics Resources Work Group (RARWG) developed the desired future conditions to guide the accommodation of future demand for land- and water-based recreation (see the vision statements for management Zones 1 through 5 in Appendix 2 of the *Hells Canyon Resource Management Plan* [HCRMP, or Technical Report E.6-1]).

Finally, consistent with 18 C.F.R § 4.51(f)(5) of the FERC regulations, the Applicant's proposed Recreation Plan includes measures that create, preserve, and enhance recreational opportunities at the HCC. To that end, the Applicant has proposed measures that include new development of recreational sites; continuing existing recreational facilities, plans and opportunities; and upgrades to existing parks, campsite definition, vault toilets, and interpretive displays.

E.5.4.1. Existing Measures to Be Continued for Recreation and Safety Downstream of Hells Canyon Dam

The following existing recreational measures would continue to be maintained downstream of Hells Canyon Dam over the life of the new license. See Table E.5-133 for the Applicant's existing measures, costs, and implementation schedules. These measures have been voluntarily implemented by the Applicant and are not requirements of its existing license.

E.5.4.1.1. Monitors for Flow Information Downstream of Hells Canyon Dam

Justification

This measure responds to the expressed needs of a growing number of commercial and private boaters who desire accurate river flow information. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this mitigation measure is to continue to operate and maintain monitors to provide information about river flow below Hells Canyon Dam.

Description

The Applicant currently provides monitors for river flow information to report outflows from Hells Canyon Dam via satellite transfer. Graphs on the monitors display hourly outflows for the previous seven days, hourly outflows for the previous 24 hours, and projected hourly outflows for the next 24 hours. Information at these monitors is updated hourly. This measure is not a requirement in the Applicant's existing license. The monitors are located at Hells Canyon Creek Recreation Site, Oregon; Pittsburg Landing, Idaho; Cache Creek Administrative Site (USFS), Oregon; Hells Gate Marina, Lewiston, Idaho; Heller Bar, Washington; and the USFS Clarkston Office, Washington. The Applicant would continue to operate and maintain these monitors to provide river flow information.

Associated Benefits

Public safety, navigation information, commercial and private recreational use and trip planning

Implementation or Construction Schedule

Ongoing

Cost Estimate

The Applicant would incur operation and maintenance (O&M) costs for this measure. The estimated average annual cost for O&M: $50,000.

Functional Design Drawings

Not applicable

Location Map

See Figure E.5-135.

E.5.4.1.2. Memorandum of Understanding between the U.S. Forest Service and the Applicant

Justification

This measure provides staffing resources to assist the USFS in operating the Hells Canyon Visitors Center. This arrangement with the USFS allows for additional dissemination of educational information about the HCNRA and regulatory information about the HCC to the public. Providing additional human resources at this facility allows all three on-site employees to dedicate more time to providing education about the HCNRA, natural resources, history, boating etiquette, the HCC, and recreation facilities and opportunities in the area. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this mitigation measure is to continue the existing memorandum of understanding (abbreviated as MOU on tables in this exhibit) between the USFS and the Applicant at the Hells Canyon Visitors Center.

Description

This measure is not currently a requirement in the Applicant's existing license. In 1999, the Applicant began providing one employee to assist in staffing the Hells Canyon Visitors Center. This employee provides the same services as those provided by two USFS staff at the site. Providing additional human resources at this facility allows all three on-site employees to dedicate more time to providing education about the HCNRA, natural resources, history, boating etiquette, the HCC, and recreation facilities and opportunities in the area. The Applicant would continue to implement the existing memorandum of understanding with the USFS and employ one person, full time from May through October and part time from November through April, at the Hells Canyon Visitors Center, as currently established.

Associated Benefits

Recreation, public access, interpretation and education about regulations and environmental resources, public safety, ongoing cooperative partnership with the USFS

Implementation or Construction Schedule

The memorandum of understanding would be updated in 2005.

Cost Estimate

The Applicant would incur the cost of employing one staff member, full time from May through October and part time from November through April, at the Hells Canyon Visitors Center. The estimated average annual cost for O&M to cover salary, transportation, and personal expenses for years 1 through 30 of a new license[2]: $80,000.

Functional Design Drawings

Not applicable

Location Map

See Figure E.5-1.

2. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of Federal Energy Regulatory Commission's discretion for setting a new license term.

E.5.4.2. Desired Future Conditions and Goals for the HCC

Desired future conditions for recreation resources describe and establish the ideal conditions that the participants of the RARWG would like to achieve in the long term, through the comprehensive efforts of every entity with responsibilities or jurisdiction in the project area. These desired future conditions are the conditions toward which the Applicant's relicensing effort would contribute. Developing the desired future conditions does not assign sole responsibility to the Applicant to achieve the future conditions and does not assume that the Applicant would be the only entity contributing to them. Therefore, the Applicant's proposed PM&E measures are not intended to address all of the issues raised by the desired future conditions.

For recreation in the HCC, the RARWG developed desired future conditions that tie directly to land and water use. The group studied existing access, geomorphic, natural resource, and recreation conditions within the project area and identified six zones of relatively homogeneous characteristics. For each of these zones, the group prepared vision statements to project desired conditions into the future and developed guidelines for recreational activities and facilities. A conceptual recreation hierarchy was developed using several elements: major nodes (areas with high levels of recreation development and several facilities), minor nodes (areas with a lower level of recreation development and fewer facilities than major recreation nodes), points (locations of single recreation facilities, functions, or features), and lines (linear recreation features, mainly trails). The vision statements and the recreation hierarchy were applied to existing and future recreation sites to create recommendations for recreation opportunities and facilities. The desired future conditions for each zone provide a basis for the Applicant's proposed PM&E measures. They also provide useful information for other agencies that provide recreation facilities, opportunities, and management within the project area.

Desired future conditions do not address:

- Existing resource conditions
- The feasibility of achieving these desired future conditions

- The overall effect the desired future conditions may have on other resources
- The beneficial and adverse societal impacts that may result from trying to achieve any of the desired future conditions
- The cost of achieving desired future conditions and who or what entity should bear what portion of the cost

The Applicant's relicensing process is not expected to address all of these issues. Relicensing studies have identified ongoing effects of project operations to recreation resources of the HCC, and the conclusions from those studies have been considered in developing proposed PM&E measures.

The vision statements for management Zones 1 through 6 are in Appendix 2 of the HCRMP (Technical Report E.6-1). For further description of all zones, see section E.5.2.1.2. and Figure E.5-11.

E.5.4.3. Existing Measures or Facilities to Be Continued for Recreation and Safety in the HCC

The following existing recreational measures or facilities would continue to be maintained in the HCC over the course of a new license. Many existing measures or facilities also have proposals for enhancements; see section E.5.4.4. Existing measures for recreation in the HCC are presented by management zone. Zones with no existing measures are not listed. See Table E.5-133 for the Applicant's existing measures, costs, and implementation schedule.

The Applicant has also developed plans for emergency action (on file with FERC) and public safety (Technical Report H.13-2) regarding the project and intends to continue implementing those plans.

E.5.4.3.1. Existing General Measures for All Zones

E.5.4.3.1.1. Continuation of Litter and Sanitation Plan

Justification

Litter and sanitation are problems at some dispersed and impromptu recreation sites (see section I of the Consultation Appendix).

Goal

The goal of this measure is to continue the existing plan for both litter disposal and portable toilet placement within the HCC project area.

Description

The Applicant maintains litter receptacles outside of its developed recreation facilities and places portable toilets at several highly used dispersed recreation sites along HCC reservoirs in Zones 1, 2, 5, and 6. O&M of the existing litter and sanitation plan would be ongoing and would remain the responsibility of the Applicant for the duration of the new license period. This measure is not a requirement in the Applicant's existing license.

Associated Benefits

Reasonable health and safety standards, protection of cultural and other resource values, aesthetics, quality of recreational experience

Implementation or Construction Schedule

Ongoing

Cost Estimate

The Applicant would fund this measure. The estimated average annual cost for O&M to maintain existing litter receptacles and portable toilets for years 1 through 30 of a new license: $25,000.

Functional Design Drawings

Not applicable

Location Map

See Figure E.5-136.

E.5.4.3.1.2. Continuation of Public Safety Program

Justification

The FERC requires a public safety program. The Applicant acknowledges that continuing this measure is in the best interest of the public and public safety.

Goal

The goal of this measure is to continue the existing public safety program.

Description

The Applicant has developed and implemented a public safety program for the project area (Technical Report H.13-2) and intends to continue implementing this plan. O&M of the existing public safety program would be ongoing and would remain the responsibility of the Applicant for the life of the new license.

Associated Benefits

Public safety, public information, security of facilities

Implementation or Construction Schedule

Ongoing

Cost Estimate

The Applicant would fund this measure. The estimated average annual cost for O&M for years 1 through 30 of a new license: $10,000.

Functional Design Drawings

See Technical Report H.13-2.

Location Map

Not applicable

E.5.4.3.1.3. Continuation of Aid to Local Law Enforcement

Justification

This measure promotes and improves public safety in the HCC by decreasing emergency response times and increasing law enforcement presence. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to continue aid to local law enforcement services through the existing memorandum of understanding between the Applicant and Adams County.

Description

This measure proposes to continue to enhance local law enforcement protection for the HCC through the existing memorandum of understanding between the Applicant and Adams County. This measure is not a requirement in the Applicant's existing license. The Applicant provides Adams County with deputy funding, vehicle mileage reimbursement, and housing in the HCC.

Associated Benefits

Public safety and security

Implementation or Construction Schedule

The agreement would be updated during 2003.

Cost Estimate

The Applicant would partially reimburse local law enforcement for enhanced law enforcement services and accrued vehicle mileage. The Applicant's portion of the estimated annual O&M cost to assist Adams County with deputy funding, vehicle mileage reimbursement, and housing for years 1 through 30 of a new license: $60,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.3.1.4. Continuation of Road Maintenance

Justification

This measure ensures continued access to HCC sites and facilities.

Goal

The goal of the measure is to continue maintenance of roads that the Applicant owns and maintains.

Description

The Applicant currently maintains three roads within Zones 1 and 2 of the HCC: Oxbow–Hells Canyon Road, 22 mi; Homestead Road from Oxbow, Oregon, to Ballard Creek, 6 mi; and Brownlee–Oxbow Road, 12 mi. O&M of roads that the Applicant owns and maintains would remain the responsibility of the Applicant for the duration of the new license.

Associated Benefits

Recreation, public safety, public access, Applicant access to project facilities

Implementation or Construction Schedule

Ongoing

Cost Estimate

The Applicant would continue to fund this measure. The estimated average annual cost to continue O&M of the roads that the Applicant owns and maintains for years 1 through 30 of a new license: $100,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.3.2. Existing Measures for Zone 2

E.5.4.3.2.1. Continuation of Operation and Maintenance of Applicant-Managed Parks and Recreation Facilities

Justification

Applicant-managed parks and recreation facilities require ongoing O&M.

Goal

The goal of this measure is to continue the existing O&M of all Applicant-managed parks and recreation facilities.

Description

The Applicant currently operates and maintains six parks and recreation facilities within Zone 2 of the HCC:

- Hells Canyon Park, Hells Canyon Reservoir, Idaho
- Copperfield Park, Hells Canyon Reservoir, Oregon
- Oxbow Boat Launch, Oxbow Reservoir, Oregon
- Carters Landing, Oxbow Reservoir, Oregon
- McCormick Park, Oxbow Reservoir, Idaho
- Woodhead Park, Brownlee Reservoir, Idaho

O&M of existing Applicant-managed parks and recreation facilities would remain the responsibility of the Applicant for the duration of the new license period.

Associated Benefits

Recreation, public access

Implementation or Construction Schedule

Ongoing

Cost Estimate

The Applicant would fund this measure. The estimated average annual cost to continue existing O&M activities for Applicant-owned parks and recreation facilities for years 1 through 30 of a new license: $600,000.

Functional Design Drawings

Not applicable

Location Map

See Figure E.5-1.

E.5.4.4. Proposed Measures or Facilities for Recreation and Safety in the HCC

The Applicant proposes the following measures or facilities for recreation resources in the HCC. Proposed recreation measures in the HCC are consistent with desired future conditions and presented by management zone. Zones, as well as recreational sites within the zones, are numbered from downstream to upstream. Zones without proposed measures are not listed. See Table E.5-134 for the Applicant's proposed PM&E measures, costs, and implementation schedule. Locations for the following PM&E measures are given in Figure E.5-137 through Figure E.5-140.

E.5.4.4.1. Proposed General Measures for All Zones

E.5.4.4.1.1. Provision of Boat Moorage on HCC Reservoirs

Justification

This mitigation measure provides needed enhancements for boating and angling access at HCC recreation sites. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this mitigation measure is to develop and implement a plan to provide boat moorage and angling access on HCC reservoirs.

Description

The Applicant proposes to develop and implement a plan to provide moorage facilities and docks at developed and dispersed recreation sites in the HCC in consultation with the appropriate counties and agencies. The Applicant would encourage counties and agencies to apply for grant monies associated with boat moorage and would be willing to assist in these efforts. Future needs for boat moorage and angler access in the HCC would be identified and addressed through the Applicant's proposed recreation adaptive management plan (section E.5.4.4.1.5.). O&M for boat moorage facilities included in this plan would be the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would develop a boat moorage plan for the HCC reservoirs in consultation with the appropriate counties and agencies. After a new license is issued, the plan would be developed by year 3 and implementation would be completed within year 5.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon elements of this measure. The Applicant's portion of the estimated total capital costs to develop and implement a boat moorage plan for the HCC for years 3 through 5 of a new license: $180,000. The estimated O&M costs to replace and/or repair facilities every sixth year for the life of new license: $24,000.

Functional Design Drawings

Not applicable

Location Map

The Applicant would develop a location map after a new license is issued.

E.5.4.4.1.2. Enhancement of Litter and Sanitation Plan

Justification

Litter and sanitation are issues that need to be addressed at dispersed and impromptu recreation sites. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to enhance the existing litter and sanitation plan.

Description

The Applicant proposes to enhance the existing litter and sanitation plan for the HCC by providing additional portable and vault toilets at appropriate dispersed recreation sites and by implementing a biannual litter pickup program. After a new license is issued, the Applicant would develop plan enhancements in consultation with the appropriate agencies and entities. The Applicant would operate and maintain the litter and sanitation plan and its enhancements.

Associated Benefits

Recreation, aesthetics, protection of cultural and other resource values, public health and safety, user satisfaction

Implementation or Construction Schedule

In consultation with appropriate agencies and entities, the Applicant would plan and implement proposed enhancements within year 1 after a new license is issued and would operate and maintain the enhancements over the life of the new license.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon elements of this measure. The estimated initial capital costs to plan and implement enhancements for year 1 of a new license: $60,000. The estimated average annual O&M cost to administer the enhancement for years 1 through 30 of a new license: $55,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.4.1.3. Information and Education (I&E) Plan

Justification

This measure promotes protection and preservation of cultural, natural, and historical resources through education. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this enhancement measure is to develop and implement an integrated I&E plan for the HCC.

Description

The Applicant proposes to develop an I&E plan that includes the following elements:

- Review and selection of appropriate themes, such as watchable wildlife, geologic history and canyon features present before inundation, benefits of hydropower, the fishery, historic trails, Native American cultures, pioneers, recreation resources, and public safety (for example, boating regulations)
- Review and selection of appropriate interpretive media to be used, such as signs and kiosks (at roadside and key sites), visitor center(s), brochures, and pamphlets
- Development of a website and toll-free phone number accessing pertinent recreation-related information
- Review and selection of prioritized sites where the interpretive media will be located

Through these efforts, the Applicant would then implement the plan in consultation with the appropriate agencies and entities. The Applicant would operate and maintain the I&E facilities and amenities resulting from this plan.

Associated Benefits

Interpretation, information, education, protection of cultural and other resource values through education

Implementation or Construction Schedule

In consultation with appropriate agencies and entities, the Applicant would develop the proposed plan during years 1 and 2 after a new license is issued. Construction and implementation would occur during years 3 through 6. The Applicant would maintain facilities associated with the plan over the life of the new license.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon elements of this measure. The estimated total capital cost to develop and implement this plan for years 1 through 6 of a new license: $1,380,000. The estimated average annual O&M cost to implement this plan for years 7 through 30 of a new license: $30,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.4.1.4. Law Enforcement Program

Justification

This enhancement measure addresses public safety issues and law enforcement efforts in the HCC project area. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this enhancement measure is to coordinate the prioritization of law enforcement resource use among appropriate law enforcement agencies in the project area.

Description

The Applicant proposes to regularly coordinate and sponsor a forum and to provide funds for prioritizing the resources used among applicable law enforcement agencies. The Applicant would sponsor biannual meetings regarding law enforcement issues, resources, and responsibilities;

provide access to its property and facilities; and contribute to the O&M costs associated with this measure. This proposed measure would supplement the measure in section E.5.4.3.1.3.

Associated Benefits

Public safety, recreation, public access, protection of cultural and other resource values, user satisfaction, emergency response time, security

Implementation or Construction Schedule

In consultation with appropriate law enforcement agencies, the Applicant would plan and implement the proposed program within year 1 after a new license is issued and would continue the program through the life of the new license.

Cost Estimate

The Applicant would fund O&M costs associated with this measure. The estimated average annual cost for O&M to implement this measure for years 1 through 30 of a new license: $15,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.4.1.5. Recreation Adaptive Management Plan

Justification

This measure provides a framework through which the Applicant can plan, implement, and/or modify new or existing measures when needs have been documented through monitoring and consultation. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a recreation adaptive management plan (abbreviated as RAMP in figures in this exhibit) for the HCC to identify and address the adequacy of the Applicant's Recreation Plan over the life of the new license.

Description

The Applicant proposes a recreation adaptive management plan to ensure the adequacy of its Recreation Plan, as well as to identify and address recreation management, measures, and facility needs for the HCC over the life of the new license. Whenever monitoring results indicate that justified changes may be needed, the plan would provide a way to ascertain the appropriate level of recreation development or management in relation to the use of recreation sites and other measures, while protecting other resource values.

Changes needed to the Applicant's Recreation Plan would be identified from the results of the Applicant's monitoring efforts, consultation and from FERC requirements. Identified recreation measures, changes, and needs would be prioritized and addressed in consultation with appropriate agencies and entities based on level of need and available funds.

Consultation with appropriate agencies and entities would occur in coordination with filing of FERC Form 80 recreation reports. Figure E.5-141 illustrates an example of monitoring, planning, and consultation activities—and their frequencies—over the course of two six-year cycles of the proposed recreation adaptive monitoring plan. Table E.5-135 outlines major categories, monitoring efforts, and reporting schedule of the plan. Some monitoring efforts—such as informal onsite observations and traffic counters—would occur annually, while surveys for social indicators and general recreational use would occur every six years. Reporting would occur annually and every six years (comprehensive report). Developing, operating, and maintaining the recreation adaptive monitoring plan would include consultation with the appropriate agencies and entities.

Associated Benefits

Recreation, protection of cultural and other resource values, user satisfaction, access, public safety

Implementation or Construction Schedule

In consultation with appropriate agencies and entities, the Applicant would plan and implement the proposed plan within year 3 after a new license is issued and would maintain the plan through the life of the new license.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction and O&M associated with this measure. The proposed capital cost limit every sixth year (from year 9 through year 27) of the new license period: $300,000. The Applicant's estimated O&M cost to implement the monitoring efforts for the recreation adaptive management plan every sixth year (beginning year 6 through year 24) over the life of the license: $450,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.4.1.6. Enhancement of Road Maintenance

Justification

The Applicant owns and/or maintains roads within the project area. These roads provide access to project facilities and facilitate project operations. These roads provide additional benefits, such as access for residential, recreational, and business activities of the general public and for general economic development. These roads are critical for emergency access in the case of medical emergencies, and they facilitate response to natural disasters, such as wild fires. While providing many benefits, these roads, the associated vehicle traffic, and maintenance activities are potentially detrimental to cultural and natural resources through direct and indirect impacts (Technical Report E.3.2-43).

Goal

The Applicant proposes to enhance road management on its roads or on roads for which it has assumed maintenance responsibility, thereby improving public safety and further protecting at-risk cultural and natural resources.

Description

The Applicant proposes to develop a road management plan in consultation with county, state, and federal agencies. The plan would include three elements: best management practices, a road atlas, and a public information program to reduce vehicle collisions with big game animals.

The first element would identify and implement best management practices for maintenance of roads that are under the Applicant's jurisdiction. Best management practices for road maintenance would address ongoing maintenance concerns regarding cultural resources, noxious weeds, sensitive plants, threatened and endangered species, soil erosion, and aquatic resources. The Applicant would implement best management practices during regularly scheduled road maintenance.

The second element of the plan would develop a road atlas from a geographic information system. The atlas would contain spatially based information regarding roads and sensitive resources. The atlas would enable spatial and temporal analyses of existing and proposed road maintenance activities in relation to at-risk resources and thereby help to reduce conflicts between road-related activities and sensitive resources. Examples of potential conflicts include roadside application of herbicide near rare plant populations and road construction projects near active bald eagle nests.

The third element of the plan would address a program for increasing public awareness of vehicle collisions with big game along Applicant-maintained roads. This element would help reduce one source of big game mortality and increase public safety.

Associated Benefits

Protection of cultural, wildlife, and botanical resources; substrate stability; public safety

Implementation or Construction Schedule

The Applicant would develop the road management plan and associated road atlas within year 2 after a new license is issued and would implement the plan through the life of the new license.

Cost Estimate

The Applicant would fund this measure. The estimated total capital cost for years 1 and 2: $20,000. The Estimated annual cost for O&M for year 3 through year 30 of the new license: $30,000.

Functional Design Drawings

Not applicable

Location Map

Not applicable

E.5.4.4.1.7. Performance of Operation and Maintenance at Applicant-Enhanced BLM and USFS Reservoir-Related Recreation Sites

Justification

This measure responds to recommendations by the BLM and USFS and also ranked high during RARWG discussions about potential PM&E measures. This measure provides O&M services for recreation at reservoir-related dispersed sites that are managed by the BLM and USFS and that have been enhanced by the Applicant.

Goal

The goal of this measure is to provide recreation O&M services at reservoir-related dispersed sites that are managed by the BLM and USFS and that have been enhanced by the Applicant.

Description

The Applicant proposes to perform recreation-related O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek section C, Westfall, and Swedes Landing. After a new license is issued, proposed services would be limited to those that are directly associated with detailed site enhancements implemented by the Applicant at these sites and that have been developed and agreed upon in consultation with the appropriate agencies. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would the Applicant actively enhance habitat at sites that are not covered by agreed-upon site plans. The BLM and USFS would be responsible for conducting environmental analyses on their lands in compliance with the National Environmental Policy Act.

Associated Benefits

Recreation, public access, enhanced visitor services, user satisfaction, reduced responsibility of federal agencies to provide O&M on some of the lands that they manage

Implementation or Construction Schedule

The Applicant would begin implementing this proposed measure after enhancements are completed to the dispersed sites identified above.

Cost Estimate

The Applicant would incur O&M costs associated with performing this measure. After site construction is completed for all sites, the cumulative estimated average annual cost of providing O&M services for year 3 through year 30 of a new license at reservoir-related sites that are managed by the BLM and USFS and enhanced by the Applicant: $100,000.

Functional Design Drawings

Not applicable

Location Map

See Figure E.5-137 through Figure E.5-140.

E.5.4.4.2. Proposed Measures for Zone 1

E.5.4.4.2.1. Enhancement of Eagle Bar Dispersed Recreation Site

Justification

This measure was recommended by the USFS and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides protection to cultural and other resources. This measure also provides additional and improved boating access to Hells Canyon Reservoir. See section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to enhance the Eagle Bar dispersed recreation site and the boat ramp access to Hells Canyon Reservoir.

Description

The Applicant has developed a site plan and proposes to implement that plan for Eagle Bar in consultation with the USFS. The Applicant would fund all reasonable and agreed-upon elements of its proposed site plan. Elements of the site plan would include reconstructing the boat ramp, designating parking for boat ramp use and trailhead access, designating campsites with picnic shelters and fire rings, constructing a vault toilet, constructing a fishing pier using Americans with Disabilities Act (ADA) guidelines and standards, and providing potable water in the vicinity. The Applicant would encourage the USFS to apply for any grant monies applicable to this measure, and the Applicant would assist in this effort. The USFS would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M at the enhanced Eagle Bar site would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the USFS to plan proposed enhancements within year 1 after a new license is issued. Enhancements would be completed within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The total capital cost for years 1 through 3 of a new license: $150,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.).

Functional Design Drawings

See Figure E.5-142 and Figure E.5-143.

Location Map

See Figure E.5-137.

E.5.4.4.2.2. Development of Site Plan for Big Bar Recreation Site

Justification

This measure was recommended by the USFS and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop a recreation site plan for Big Bar Recreation Site in consultation with the USFS.

Description

The Applicant proposes to develop a site plan for Big Bar in consultation with the USFS to define the extent of future development. The Applicant would fund reasonable and agreed-upon elements associated with this measure. If demand becomes consistently high and is so indicated by the results of monitoring efforts associated with the recreation adaptive management plan, consultation with the appropriate agencies and entities would identify the appropriate level and extent of recreation development that would best accommodate recreational use and demand at this site, while also protecting other resource values. The USFS would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. Implementation of additional phases of this proposed site plan would be identified and addressed through the Applicant's proposed recreation adaptive management plan (section E.5.4.4.1.5.).

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the USFS to complete this proposed plan within year 2 after a new license is issued.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon elements of this measure. The estimated total capital cost to develop a site plan for the Big Bar Recreation Site for years 1 and 2 of a new license: $50,000.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the USFS.

Location Map

See Figure E.5-137.

E.5.4.4.2.3. Enhancement of Boat Ramp and Associated Facilities at Big Bar Section D Recreation Site

Justification

This measure was recommended by the USFS and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection and improves boat access to the lower end of Hells Canyon Reservoir. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to enhance the boat ramp access to lower Hells Canyon Reservoir and associated facilities at Big Bar Section D Recreation Site.

Description

The Applicant proposes to consult with the USFS to enhance the Big Bar Section D Recreation Site's boat ramp and associated facilities. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Enhancements would include relocating and enhancing the boat ramp, designating boat ramp parking, and upgrading toilet facilities. The Applicant would encourage the USFS to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. The USFS would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Big Bar Section D Recreation Site would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin to plan and implement this proposed measure by year 1 after a new license is issued and would complete enhancements by year 4.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The Applicant's portion of the estimated total capital cost for years 1 through 4 of a new license: $250,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the USFS.

Location Map

See Figure E.5-137.

E.5.4.4.2.4. Development of Site Plan and Enhancement of Eckels Creek Dispersed Recreation Site

Justification

This measure was recommended by the USFS and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop a site plan and enhance Eckels Creek dispersed recreation site in consultation with the USFS.

Description

The Applicant proposes to develop a site plan and enhance Eckels Creek dispersed site in consultation with the USFS. The Applicant would fund all reasonable and agreed-upon construction costs for this measure. Enhancements would include improving boat moorage, providing a portable toilet, and defining campsites. The Applicant would encourage the USFS to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. The USFS would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Eckels Creek dispersed recreation site would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin to plan and implement these proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for years 1 through 3 of a new license: $30,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the USFS.

Location Map

See Figure E.5-137.

E.5.4.4.3. Proposed Measures for Zone 2

E.5.4.4.3.1. Enhancement of Operation and Maintenance of Applicant-Managed Parks and Recreation Facilities

Justification

This measure provides for an expected increase in O&M costs caused by enhancements at Applicant-managed parks and recreation facilities.

Goal

The goal of this measure is to supplement the existing O&M of all Applicant-managed parks and recreation facilities.

Description

The Applicant proposes to enhance O&M of Hells Canyon Park, Bob Creek section A, Copperfield Boat Launch, Copperfield Park, Oxbow Boat Launch, Carters Landing, McCormick Park, and Woodhead Park. O&M of these parks and facilities would remain the responsibility of the Applicant.

Associated Benefits

Recreation, public access, enhanced visitor services, user satisfaction

Implementation or Construction Schedule

The Applicant would begin implementing this proposed measure within year 3 of a new license and would continue the measure over the life of the new license.

Cost Estimate

The Applicant would fund this measure. The estimated average annual cost for O&M for years 3 through 30 of a new license: $100,000.

Functional Design Drawings

Not applicable

Location Map

See Figure E.5-138.

E.5.4.4.3.2. Enhancement of Copper Creek Dispersed Recreation Site

Justification

This measure was recommended by the BLM and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for the dispersed recreation site at Copper Creek in consultation with the BLM.

Description

The Applicant proposes to consult with the BLM to plan and develop enhancements at Copper Creek dispersed site. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements would include providing designated campsites with picnic shelters and fire rings, providing potable water in the vicinity, designating trailhead parking, and creating an equestrian staging area. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. The BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Copper Creek dispersed site would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the BLM to plan and implement the proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for years 1 through 3 of a new license: $50,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the BLM.

Location Map

See Figure E.5-138.

E.5.4.4.3.3. Reconstruction of Hells Canyon Park

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure resolves issues related to irrigation, tent camping, parking at the tent area, traffic flow, RV parking, restroom occupancy, and park congestion. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to reconstruct Hells Canyon Park to make appropriate upgrades to facilities and meet the current standards of services.

Description

The Applicant proposes to relocate the main park entrance, redesign traffic flow, add a comfort station, redesign campsites for RVs and tents, designate parking for the tent area within the park, update the irrigation system, and add a group picnic shelter in the day-use area. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. O&M of Hells Canyon Park would remain the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin implementing this proposed measure within year 3 after a new license is issued and complete it within year 5.

Cost Estimate

The Applicant would fund this measure. The estimated total capital cost for construction for years 3 through 5 of a new license: $2,000,000. The estimated average annual cost for O&M for a new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

See Figure E.5-144 and Figure E.5-145.

Location Map

See Figure E.5-138.

E.5.4.4.3.4. Development of Airstrip A&B Dispersed Recreation Site

Justification

This measure was recommended by the BLM and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the

Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for the dispersed recreation site at Airstrip A&B in consultation with the BLM.

Description

The Applicant proposes to consult with the BLM to develop a site plan and to implement elements of the site plan. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements would include designating five to six universal campsites, providing a vault toilet, and constructing a day-use area adjacent to the reservoir. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Airstrip A&B would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the BLM to plan and implement proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost to enhance Airstrip A&B for years 1 through 3 of a new license: $40,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the BLM.

Location Map

See Figure E.5-138.

E.5.4.4.3.5. Enhancement of Bob Creek Section A Dispersed Recreation Site

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for the dispersed recreation site at Bob Creek section A.

Description

The Applicant proposes to develop and implement a site plan in consultation with the appropriate agencies and entities. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Site plan elements would include providing numerous universal campsites and a vault toilet and constructing a nature trail. O&M of the Bob Creek section A site would be performed by and become the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would plan and begin to implement proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for construction of enhancements at Bob Creek section A for years 1 through 3 of a new license: $50,000. The Applicant's estimated average annual cost for O&M for a new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the appropriate agencies and entities.

Location Map

See Figure E.5-138.

E.5.4.4.3.6. Enhancement of Bob Creek Section B Dispersed Recreation Site

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for the dispersed recreation site at Bob Creek section B.

Description

The Applicant proposes to develop and implement a site plan in consultation with the appropriate agencies and entities. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements would include designating Bob Creek section B site a day-use site, defining shoreline access, and eliminating boat launching. The Applicant would encourage the appropriate agencies and entities to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. O&M of the Bob Creek section B site would be performed by and become the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would plan and begin implementing proposed enhancements within year 1 after a new license is issued and would complete them within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Estimated total capital costs for enhancements at Bob Creek section B for years 1 through 3 of a new license: $25,000. The Applicant's estimated average annual cost for O&M for a new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the appropriate agencies and entities.

Location Map

See Figure E.5-138.

E.5.4.4.3.7. Enhancement of Bob Creek Section C Dispersed Recreation Site

Justification

This measure was recommended by the BLM and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for the dispersed recreation site at Bob Creek section C in consultation with the BLM.

Description

The Applicant proposes to consult with the BLM to develop a site plan and implement elements of the site plan. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements would include providing 8 to 12 universal campsites with picnic tables and fire rings. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. The BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Bob Creek section C would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the BLM to plan and implement proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The total capital cost for enhancements at Bob Creek section C for years 1 through 3 of a new license: $50,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the BLM.

Location Map

See Figure E.5-138.

E.5.4.4.3.8. Enhancement of Westfall Dispersed Recreation Site

Justification

This measure was recommended by the BLM and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for the Westfall dispersed recreation site in consultation with the BLM.

Description

The Applicant proposes to consult with the BLM to develop and implement a site plan. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Site plan elements would include providing five to eight universal campsites, each with a picnic table and fire ring, and installing a vault toilet. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this effort.

BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of the Westfall dispersed recreation site would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the BLM to plan and implement proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for enhancements at Westfall dispersed recreation site for years 1 through 3 of a new license: $60,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the BLM.

Location Map

See Figure E.5-138.

E.5.4.4.3.9. Enhancement of Copperfield Boat Launch Area

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection, as well as weed control. It also provides enhanced accommodation for the day-use activities that currently occur at the site. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to enhance the Copperfield Boat Launch to better accommodate day-use activities.

Description

The Applicant proposes to install numerous covered picnic tables, provide landscaping, and construct a vault toilet. The Applicant would fund all reasonable and agreed-upon elements of this measure. O&M of the Copperfield Boat Launch would remain the responsibility of the Applicant.

Associated Benefits

Recreation, public access, visitor satisfaction, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin implementing this proposed measure within year 3 after a new license is issued.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon elements of this measure. The estimated total construction cost for year 3 of a new license: $100,000. The Applicant's estimated average annual cost for O&M for the new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

See Figure E.5-146 and Figure E.5-147.

Location Map

See Figure E.5-138.

E.5.4.4.3.10. Enhancement of Oxbow Boat Launch

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to implement a site plan for the enhancement of Oxbow Boat Launch.

Description

The Applicant proposes to consult with the appropriate agencies and entities to improve the Oxbow Boat Launch by providing designated traffic flow areas, a concrete boat ramp, a turnaround adjacent to the boat ramp, and parking for vehicles and boat trailers. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. The BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Oxbow Boat Launch would remain the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would plan and begin implementing proposed enhancements within year 1 after a new license is issued and would complete enhancements within year 3.

Cost Estimate

The Applicant would fund this measure. The estimated capital cost for construction for year 3 of a new license: $80,000. The estimated average annual cost for O&M for throughout the new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

See Figure E.5-148 and Figure E.5-149.

Location Map

See Figure E.5-138.

E.5.4.4.3.11. Enhancement of Carters Landing and Old Carters Landing Recreation Sites

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides cultural and other resource protection. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to implement a site plan for Carters Landing and Old Carters Landing recreation sites.

Description

The Applicant would consult with the appropriate agencies and entities to implement these site plans. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements would include designating traffic flow areas and vehicle and boat trailer parking, providing universal campsites with picnic tables and fire rings, providing a day-use area with picnic tables, constructing a concrete boat ramp, and enhancing access according to ADA guidelines and standards. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. The BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of the sites would continue to be the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the appropriate agencies and entities within year 1 after a new license is issued and complete proposed enhancements within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated capital cost for construction for years 1 through 3 of a new license: $80,000. The Applicant's estimated average annual cost for O&M throughout the new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

See Figure E.5-150 through Figure E.5-153.

Location Map

See Figure E.5-138.

E.5.4.4.3.12. Reconstruction of McCormick Park

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure resolves issues related to irrigation, tent camping, traffic flow, RV camping, restroom occupancy and congestion, access to meet ADA standards, day use, parking at boat ramps, and road dust. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to reconstruct McCormick Park to make appropriate upgrades to facilities and meet the current standards of services.

Description

The Applicant would consult with the appropriate agencies and entities to develop and implement a site plan. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The site plan would redesign traffic flow, pave roads, update the irrigation system, expand the existing comfort station, redesign RV and tent campsites, designate parking areas for the boat ramp and day-use areas, construct a vault toilet adjacent to the boat ramp parking area, and expand the day-use area to include a walking bridge over the Wildhorse River. O&M of McCormick Park would remain the responsibility of the Applicant.

Associated Benefits

Recreation, public access, protection of cultural and other resource values, visitor satisfaction

Implementation or Construction Schedule

The Applicant would begin implementing this proposed measure within year 3 after a new license is issued and complete reconstruction by year 5.

Cost Estimate

The Applicant would fund this measure. The estimated total capital cost for construction for years 3 through 5 of a new license: $3,000,000. The Applicant's estimated average annual cost for O&M for the new license period is included in an existing measure (section E.5.4.3.2.1.) and an enhancement measure (section E.5.4.4.3.1.) for O&M of Applicant-managed parks and recreation facilities.

Functional Design Drawings

See Figure E.5-154 and Figure E.5-155.

Location Map

See Figure E.5-138.

E.5.4.4.4. Proposed Measures for Zone 4

E.5.4.4.4.1. Enhancement of Hewitt and Holcomb Parks

Justification

This measure was recommended by Baker County and ranked high in priority during RARWG discussions about potential PM&E measures. This measure enhances amenities at both sites and provides additional services. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for Hewitt and Holcomb parks in consultation with Baker County, Oregon.

Description

The Applicant proposes to develop a site plan for Hewitt and Holcomb parks in consultation with Baker County to define the extent of future development. If demand becomes consistently high, and is so indicated by the results of monitoring associated with the recreation adaptive management plan, the Applicant would consult with the appropriate agencies and entities to determine the appropriate level and extent of recreation development to best accommodate recreational use and demand at this site, while also protecting other resource values. Site, scope, and location of improvements would be based on trends, visitor preferences, facility conditions, and other requirements as established by the recreation adaptive management plan. At Hewitt Park, elements of the plan could include landscaping, providing a new toilet facility and fish-cleaning station, and widening the road between the parks. At Holcomb Park, site plan elements could include designating RV campsites with electrical and water hookups, redesigning park layout, improving the day-use area, and providing picnic shelters and a vault toilet. The Applicant would encourage Baker County to apply for any grant monies applicable to this measure; the Applicant would assist in this effort. Baker County would be responsible for conducting necessary environmental analyses on its lands. O&M of Hewitt and Holcomb parks and enhancements would be the responsibility of Baker County since user fees are levied at this site.

Associated Benefits

Recreation, public access, user satisfaction, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin to consult with Baker County to plan and implement some proposed enhancements within year 1 after a new license is issued. Additional proposed enhancements would be implemented as deemed appropriate through the recreation adaptive management plan.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for years 1 through 3 of a new license: $100,000.

Functional Design Drawings

See Figure E.5-156 for existing conditions; the Applicant would develop a site plan in consultation with Baker County.

Location Map

See Figure E.5-139.

E.5.4.4.5. Proposed Measures for Zone 5

E.5.4.4.5.1. Development of Low-Water Boat Launch at or near Swedes Landing

Justification

This measure was recommended by the Applicant and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides improved boat access to

Brownlee Reservoir during seasonal reservoir drawdowns and periods of low reservoir levels. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for a boat launch that could be used during low-water periods at or near Swedes Landing.

Description

The Applicant proposes to consult with the BLM, Baker County, and the Oregon State Marine Board to find a suitable location, develop a site plan, and implement the site plan for a low-water boat launch. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The Applicant would encourage the appropriate agencies and entities to apply for any grant monies applicable to this measure; the Applicant would assist in these efforts. The Applicant would not be responsible for conducting environmental analyses on agency lands for compliance with the National Environmental Policy Act. O&M of the boat launch at or near Swedes Landing would be performed by and become the responsibility of the Applicant.

Associated Benefits

Recreation, public access, visitor satisfaction, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the BLM, Baker County, and the Oregon State Marine Board to find a suitable location and to begin planning and implementing proposed enhancements within year 1 after a new license is issued. Proposed enhancements would be completed within year 3.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost to develop a low-water boat launch for years 1 through 3 of a new license: $250,000. The estimated average annual cost for O&M for the new license period is included in a proposed enhancement measure (section E.5.4.4.1.7.) for O&M of reservoir-related recreation sites managed by the BLM and USFS.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the BLM, Baker County, and the Oregon State Marine Board.

Location Map

The Applicant would develop a location map during a suitability study.

E.5.4.4.5.2. Enhancement of Swedes Landing

Justification

This measure was recommended by the BLM and ranked high in priority during RARWG discussions about potential PM&E measures. This measure provides protection of cultural and other resource values. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this enhancement measure is to develop and implement a site plan for Swedes Landing in consultation with the BLM.

Description

The Applicant proposes to consult with the BLM to develop a site plan and to implement that site plan. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements of the plan would include redesigning site layout and designating numerous universal campsites with picnic tables and fire rings. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in this efforts. The BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Swedes Landing and its enhancements would be performed by and become the responsibility of the Applicant as described in section E.5.4.4.1.7.

Associated Benefits

Recreation, public access, user satisfaction, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with BLM to plan and implement the proposed enhancements within year 2 after a new license is issued and would complete enhancements within year 4.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for years 2 through 4 of a new license: $75,000.

Functional Design Drawings

The Applicant would develop design drawings in consultation with the BLM.

Location Map

See Figure E.5-140.

E.5.4.4.5.3. Enhancement of Spring Recreation Site

Justification

This measure was recommended by the BLM and ranked high in priority during RARWG discussions about potential PM&E measures. This measure enhances the usability of the site and provides needed services and facility upgrades, such as defined campsites. This measure also provides protection for cultural and other resources. See the specific resource issues document pertaining to recreation in section I of the Consultation Appendix to see the linkage between issues, study results, agency consultation, and PM&E development.

Goal

The goal of this measure is to develop and implement a site plan for Spring Recreation Site to enhance recreation facilities and improve boat ramp access to Brownlee Reservoir.

Description

The Applicant proposes to consult with the BLM to develop a site plan and to implement elements of that site plan. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. Elements would include redesigning site layout, designating numerous universal campsites with picnic tables and fire rings, reconstructing the boat ramp, improving boat trailer parking, improving the fish-cleaning station, providing boat moorage, providing potable water in the vicinity, and constructing vault toilets. The Applicant would encourage the BLM to apply for any grant monies applicable to this measure; the Applicant would assist in these efforts. The BLM would be responsible for conducting environmental analyses on its lands in compliance with the National Environmental Policy Act. O&M of Spring Recreation Site and its enhancements would be the responsibility of the BLM since user fees are levied at this site.

Associated Benefits

Recreation, public access, visitor satisfaction, protection of cultural and other resource values

Implementation or Construction Schedule

The Applicant would begin consultation with the BLM to plan and implement proposed enhancements within year 2 after a new license is issued. Proposed enhancements would be completed within year 4.

Cost Estimate

The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The estimated total capital cost for years 2 through 4 of a new license: $500,000.

Functional Design Drawings

See Figure E.5-157 for existing conditions; the Applicant would develop a site design in consultation with the BLM.

Location Map

See Figure E.5-140.

E.5.4.5. Measures or Facilities Recommended by the Agencies

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.5.4.5.1. Accepted or Conditionally Accepted Measures or Facilities

Bureau of Land Management comment letter, dated January 10, 2003

BLM2-118

> Enhancement of Low-Water Boat Launch at or near Swedes Landing—IPC does not provide estimates of funding required from Baker County, BLM and OSMB. No specific details are provided. Therefore, BLM is unable to determine impacts or if IPC funding levels are adequate. BLM is concerned that a significant boat ramp may require auxiliary facilities that do not currently exist such as parking area, campground, and appropriate access road. BLM supports the proposal for IPC to provide O&M. O&M for the auxiliary facilities would also be appropriate.

Response

Specific information and a detailed site plan for the Applicant's proposed enhancements of Low-water boat launch at or near Swedes Landing would be developed in consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by the FERC, in development of its plan. Costs provided are the Applicant's best estimates and its intention would be to fund all reasonable and agreed upon elements of proposed plan. The Applicant would encourage Baker County and/or appropriate agencies to obtain possible grant monies to assist, where possible, in these efforts.

Reference the Applicant's proposed measure to perform O&M at Applicant-Enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar Section D, Eckels Creek, Copper Creek, Airstrip Section A, Bob Creek Sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon receipt of a new license. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed upon site plans.

Oregon State Marine Board comment letter, dated January 6, 2003

OSMB1-19

> The Marine Board provides annual funding to support the Oregon Adopt-a-River Program, which is administered through SOLV—a non-profit volunteer-based program designed to combat litter and vandalism. The Adopt-a-River Program coordinates the efforts of citizens and groups willing to commit to removing litter twice a year from a designated two-mile segment of a river or stream. In addition, SOLV organizes the Down by the Riverside event, an annual enhancement and cleanup at public parks along rivers and at lakes statewide. We encourage the Applicant to consider utilizing these programs in association with the litter and sanitation measures described in the application. Brochures describing these programs are enclosed.

Response

The Applicant appreciates the information and will consider utilizing these programs in association with the litter and sanitation measure.

OSMB1-30

> The Marine Board supports this proposal and suggests that Applicant consider the Marine Board's design and layout guidelines and facility cost estimates when designing improvements.

Response

Comment noted.

OSMB1-31

> The Marine Board supports this proposal and suggests that Applicant consider the Marine Board's design and layout guidelines and facility cost estimates when designing improvements.

Response

Comment noted.

OSMB1-34

> Spring Recreation Site should include several elements and be consistent with the Marine Board's design and layout guidelines. The Marine Board supports this proposal and suggests that Applicant consider the Marine Board's design and layout guidelines and facility cost estimates when designing improvements.

Response

Comment noted.

E.5.4.5.2. Rejected Measures or Facilities and Explanations for Rejection

Bureau of Land Management comment letter, dated January 10, 2003

BLM2-25 and BLM8-111

> Increased information about current or planned Brownlee levels—BLM agrees that Brownlee visitors would like improved information regarding reservoir levels. However, this study did not address the fact that many users do not have access to a computer and many do not speak English as their first language. Creativity is needed to respond to this need. No proposed mitigation measure addresses this issue yet. IPC should do so.

Response

In developing and implementing new information and education (I&E) measures, the Applicant, along with identified agencies, would consider the need for providing visual, verbal, and audio ethnic interpretation. The following is an attachment from the RARWG meeting held April 17, 2002, and was discussed with the BLM and others during consultation:

> The purpose of the I&E program is to provide enhanced experiences for visitors and residents by developing and implementing a program during year one and two of new license issuance followed by facility maintenance and support over the term of the new license. The program will identify interpretive themes, media, sites and services for interpretation and environmental and cultural education in the project area. Support for the program will include all necessary operations and maintenance aspects such as repair of vandalism and updates of the program over time. The I&E Program will be managed by the Applicant and will involve appropriate agencies and entities in its development.
>
> The I&E Program should include:
>
> Development of a plan that includes:
>
> 1) Review and selection of appropriate themes, such as (but not limited to) watchable wildlife, geologic history and canyon features present before inundation, the benefits of hydropower, fishery, historic trails, Native American cultures, pioneers, recreation resources in the area and public safety information (e.g. Boating regulations);
>
> 2) Review and selection of appropriate interpretive media to be used, such as signs and kiosks (roadside and at key sites), visitor center(s), brochures, pamphlets;
>
> 3) Review and selection of prioritized sites where the media will be located and etc.;
>
> The plan should be reviewed and approved by the appropriate agencies and entities, including detailed cost estimates for facilities, artwork, design costs, and others. Following approval of

the plan, design standards for signs, brochures, artwork and other features will need to be developed. Once these standards are developed, construction of built facilities such as signs, and the artwork to go into these signs will need to be created. Once constructed, the media will need to be sited and installed at selected sites per the report.

Development of a support program to maintain the I&E Program over the term of the new license that includes:

1) Review and selection of appropriate maintenance procedures and practices;

2) Review and selection of appropriate methods and timeframes for program updates. Maintenance and support for the program should be reviewed and approved by the RARWG, including detailed cost estimates. Following construction, or other media development, maintenance of the program will begin.

BLM2-37

Develop a reservoir management strategy to minimize reservoir water level impacts on recreation and boat launch sites.

Response

The Applicant believes that proposed PM&E measures adequately address this project impact. The Applicant's proposed provision of boat moorage on HCC reservoirs (section E.5.4.4.1.5.), enhancement of Hewitt and Holcomb Parks (section E.5.4.4.4.1.), development of a low-water boat launch at or near Swedes Landing (section E.5.4.4.5.1.), and enhancement of Spring Recreation Site (section E.5.4.4.5.3.) directly address reservoir fluctuations and Brownlee Reservoir access. See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) to see the linkage between issues, study results, agency consultation, and PM&E development.

BLM2-38

> Determine a reservoir management strategy that compromises the needs of recreationists and other resource needs. Establish a drawdown limit and timing that satisfies a majority of recreation interests.

Response

The warmwater fish plan would provide optimum spawning conditions for warmwater fish and is compatible with the fall chinook program. The plan also ensures a nearly full reservoir through the July 4 holiday. Also see Technical Report E.3.1-5, chapters 1 and 4.

BLM2-48 and BLM8-131

> Some reduction in targeted effort for bass probably occurred because anglers had trouble launching boats during extreme drawdowns—BLM agrees. This simple statement indicates a conclusion should be drawn that identifies that changes in drawdown require special facilities to accommodate user needs. Bass anglers are not as likely to launch their $20,000 boats from a rocky unimproved ramp that is only accessible over a rough gravel road. They need a quality concrete ramp that is designed to meet varying drawdown levels. An appropriate road must access this ramp. IPC's proposed mitigation measure for a low water launch at Swede's Landing addresses this project impact but a final site plan is required. IPC should assume full responsibility for funding development and implementation of the site plan.

Response

"An appropriate road must…"—The Applicant believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road.

"IPC's proposed mitigation…"—The Applicant believes that developing a final site plan at this time is premature for this final license application. The Applicant proposes to develop a site plan in consultation with agencies once a new license is issued. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plan and implementation. The Applicant believes that funding levels estimated for its proposed measures for Swedes Landing are adequate. Future needs would be identified and addressed through the Applicant's proposed RAMP (section E.5.4.4.1.5.)

BLM2-57 and BLM8-127

> O&M of Homestead Road and dispersed sites on BLM lands—BLM agrees. Since the reservoirs attract the anglers, IPC should assume a greater share of the maintenance on the Homestead Rd. as well as the cost of operations and maintenance of the dispersed sites on BLM lands. IPC has already begun this effort by contributing to restroom construction in the past and by possibly contributing to a BLM construction project in the near future. BLM and IPC have had good working relationships regarding management of the recreation resource along the reservoirs.

Response

"BLM agrees"—Comment noted.

"Since the reservoirs attract the anglers…"—The Applicant believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road. See the Applicant's proposed measure to perform O&M at the Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon receipt of a new license. Nevertheless, the Applicant believes that it is not appropriate for federal agencies, such as the BLM, to shift management responsibilities, including funding, to licensees of hydropower projects at relicensing. Where the Applicant has identified recreational needs through its studies that have an appropriate nexus to the HCC, the Applicant has proposed recreational measures. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans.

BLM2-60

> Fund an appropriate share to contract development of an overall Recreation Area Management Plan with a holistic view of the watershed disregarding current landownership.

Response

The Applicant is not responsible for identifying or managing for recreational use in the entire watershed. The Applicant's proposed measures in its Recreation Plan in the FLA are based on comprehensive studies that address user needs and preferences. These measures provide funding levels to ensure a holistic approach to recreation management in the HCC and no additional plan with the Applicant's participation is needed for this relicensing process.

BLM2-61

> Fund an appropriate share to construct and maintain a range fence paralleling Hells Canyon Reservoir from the tunnel to Copper Creek. The purpose of this fence is to keep range cattle out of recreation sites along the reservoir.

Response

Much of the recreational land in the area targeted is managed by the BLM, and the cattle that are grazing in this area are from BLM grazing allotments adjoining or near this area. The open-range grazing that is occurring here, therefore, is BLM's responsibility rather than an impact of the HCC. Provisions have been included in PM&E measures for botanical resources to provide fencing to protect sensitive resources in specific locations on Applicant lands where such protection is needed. A policy has also been added to section 6.3.5. of the Hells Canyon Resource Management Plan for the development and implementation of a plan for fencing on Applicant lands to inhibit open-range grazing and protect sensitive resources.

BLM2-62

> Provide an appropriate share of funding to conduct environmental analysis and implement the needs identified in the BLM document, 'Analysis of Management Situation and Conceptual Recreation Plan for Hells Canyon Complex Oregon & Idaho BLM" (AMS).

Response

All sites referenced were discussed during consultation. The Applicant's proposed continuation of the litter and sanitation plan (section E.5.4.3.1.1.) includes sites designated as Kevin's Alluvial Fan (KFAN) and Weiser Sand Dunes (DUNE). Its proposed enhancement of the litter and sanitation plan (section E.5.4.4.1.2.) would include KFAN, DUNE, Jennifer's Alluvial Fan (JFAN), Snake River Boat Launch (SRBL), and Oasis for its proposed biannual litter pickup. Sites JFAN and SRBL may also be included in the sanitation part of this measure if they are selected for portable toilet locations through ongoing consultation. The Applicant believes that proposed PM&E measures are adequate for these sites. Steck Park recently underwent major enhancements by the BLM, which the Applicant believes may have been in response to the "crappiethon" and was therefore overbuilt for current demand for recreational use (see Figure 20 in Technical Report E.5-8). Oasis recently underwent enhancements by the BLM that the Applicant believes are adequate for the current recreation demand. Future needs at these sites may be addressed through the Applicant's proposed RAMP (section E.5.4.4.1.5.).

BLM2-67

> Development of Law Enforcement MOUs with Nez Perce County and Asotin County for assistance with search and rescue (low flows are the cause of many boating accidents)

Response

Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how emergency services are provided, and of the Applicant's involvement in providing and supporting emergency services in Hells Canyon.

Among the various powers authorized to counties by Idaho State Code (Section 31-604), and Oregon Code is very similar, are the authorities "To levy and collect such taxes for purposes under its exclusive jurisdiction as are authorized by law" and other actions necessary to effectively carry out the duties imposed on it by the provisions of the Idaho Code and constitution. Section 31-2202 of the Code defines the duties of the county sheriff, including preserving the peace; arresting and taking to court persons who attempt to commit or who have committed a public offense; commanding the aid of citizens in carrying out their responsibilities; and working with the state department of law enforcement in regulating traffic and responding to calls. The Sheriff's Office is to be funded by taxes collected by the County. The State Code in Section 31-4800 also provides for counties to establish and for voters to approve funding for consolidated emergency communications systems. Section 31-3901 of Idaho Code enables counties to establish ambulance service and to levy a special property tax to support that service. The Code states, "Providing ambulance service is a governmental function." Therefore, State Code places responsibility with local government for certain services to be provided and establishes a taxing system by which those services are to be funded.

In life-threatening situations, Life Flight responds out of Boise. Life Flight and the Applicant historically have had informal cooperative arrangements in the canyon. A number of employees have paid memberships in Life Flight, which provides emergency service on call. Life Flight estimates that in the past two years (2001–2002) they have made 10 trips into the canyon to fly injuries to St. Alphonsus Hospital in Boise. The Applicant maintains landing zones at Brownlee yard, the Oxbow warehouse, the old school house in Oxbow Village, the landing strip, and at Big

Bar. Training sessions are occasionally conducted jointly with Applicant employees and Life Flight personnel. A gas tank for the Life Flight helicopters is maintained at the Applicant's Oxbow facilities. These conditions also allow the HCC to provide a staging area for Life Flight trips to more distant places, such as Enterprise and the Wallowa Lake area.

The Applicant believes its existing and proposed law enforcement measures (section E.5.4.3.1.2. and E.5.4.4.1.4.) are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

As to safe boating flows, in the summer of 1988, the ACOE agreed that 6,500 cfs was the safe flow for navigation on the Hells Canyon reach of the Snake River. Although 5,000 cfs is the license minimum flow at Johnson Bar, the Applicant has voluntarily maintained a minimum flow of 6,500 cfs since 1988, except for a few very short periods for adverse operating conditions and special relicensing-related flow studies. The Applicant proposed a normal minimum operating flow of 6,500 cfs in the DLA, which until just recently was considered safe for navigation by the ACOE. In Section VI—Water Control Plan from the ACOE's *Water Control Manual* (revised 1993) for the HCC, the ACOE stated:

> 6.06 OPERATION FOR NAVIGATION.
>
> River Flows Required For Navigation. The Corps of Engineers has interviewed most river boat operators using the Snake River above Lewiston, Idaho, to gain the benefit of their navigation experience in establishing the reasonably safe, minimum navigable flow for the reaches above and below the mouth of Salmon River. Engineering personnel familiar with open-river navigation have accompanied the mail boat operator from Lewiston to Johnson's Bar Landing to observe the operating conditions experienced with various river discharges. The July 1988 field investigation indicated that more optimum jet boat operating conditions are experienced when the minimum navigable flow is limited to 6,500 cfs for the Snake River above its confluence with the Salmon River. However, more experienced jet boat operators can navigate the river, if necessary, when the flow at Johnson's Bar is 5,000 cfs. Article 43 of the Federal Power Commission license allows Idaho Power Company to reduce the river flow

> at Johnson's Bar to 5,000 cfs during periods of low flow or for normal minimum plant operations. When it becomes apparent that minimum flows must be reduced below requirements for safe navigation, the Idaho Power Company will advise the Corps of Engineers and downstream interests as far in advance as possible.
>
> In order to maintain navigable flows below Johnson's Bar Landing for as much of the time as possible, releases for power will be coordinated with navigation schedules during low flows. This will be accomplished so that navigable flows can be maintained for certain days of the week, most desirable for navigation interests, as determined from time to time, with less than navigable flows for the other days of the week. The Corps of Engineers Reservoir Control Center (RCC) will confer with the Idaho Power Company and navigation interests in formulating and coordinating such schedules.

Due to the recent low flow conditions, the Applicant had requested a variance from the13,000 cfs Lime Point license flow requirement. In 2001 and 2002, IPC, in cooperation with the ACOE and the Northwest Professional Passenger Vessel Association (NWPPVA), developed and coordinated minimum flow release schedules that were in the best interest of power generation and navigation. The minimum flow schedules consisted of providing timed releases of 8,500 cfs. These timed pulses met upstream and downstream needs for the commercial navigation community, while still maintaining the normal operating minimum flow of 6,500 cfs and allowing the Applicant to retain as much inflow as possible to use for generating electricity during heavy load periods. While these flow schedules did put constraints on the operation of the HCC, the ACOE agreed with the Applicant that these timed flow pulses were an effective balance between the need for power generation and navigation and did not greatly harm the overall public interest.

The Applicant has worked with the ACOE and the commercial navigation community to provide increased flows during certain hours of the day when the commercial traffic on the river is at its highest. It is critical that the Applicant have the lowest minimum flow possible during light load periods in order to conserve Brownlee Reservoir storage for as long as possible—especially in low-flow years—for use during the highest demand periods.

Congress established the Hells Canyon National Recreation Area (HCNRA) in 1975. At the time the HCNRA Act was passed, the HCC license contained essentially the same restrictions (minimum flow and ramp rate) on Snake River flows that are proposed in the DLA. In the HCNRA Act, the U.S. Forest Service (USFS) was charged with maintaining the quality of the recreational experience that made the HCNRA special. Since 1975, the USFS has allowed many commercial outfitters to add and operate boats larger than any used in 1975.

The largest commercial boats currently operating on the Hells Canyon reach of the Snake River—some measuring 44 feet long with a 12-foot-wide bottom—began to appear in the late 1980s and early 1990s. Since their inception, these large boats have been able to operate successfully with the 6,500-cfs minimum flow, as evidenced by their continuous operation. However, over the past two low-flow years, the commercial operators have not been comfortable operating with a minimum flow of 6,500 cfs. The Applicant believes that this is due in part to the size of the boats that are presently being built and the insufficient skill level of some of the boat pilots. Based on discussions that the Applicant has had with commercial boaters, there are plans to construct even larger boats than are currently in operation.

If there is a problem associated with very large boats and navigation, it is not due to changes in operations by the Applicant. The Applicant maintains that the USFS did not fulfill its congressional mandate of maintaining the recreational experience. The increase in the number of larger boats has introduced navigation issues that did not exist in the recreational experience that Congress mandated the USFS to maintain. Higher minimum flow requirements for recreational navigation should be prohibited under the FPA because the FERC and the ACOE are without authority to impose indirectly that which has been directly prohibited by Congress in the HCNRA Act, such as establishing a “flow requirement of any kind” or a rule which “limits, constricts or conflicts” with existing uses of the river for power purposes. See Appendix 2 for further discussion of the HCNRA Act.

BLM2-68

> Development of a new ramp at Heller Bar Recreation Site to accommodate low water launches and take outs. The existing ramp becomes the only reasonable water access point during low water conditions forcing motorized and non-motorized boaters to use the same facility. They have differing needs that often create conflict during this scenario.

Response

Numerous tributaries to the Snake River also contribute to potentially low water conditions at Heller Bar. The Applicant has no control of flows from these tributaries. This BLM-proposed mitigation measure was not revealed during previous years of consultation with the BLM. It appears as though the BLM and Asotin County have ignored (for years) the need to improve conditions at Heller Bar, which is owned by the Washington Department of Fish and Game and operated by the BLM. USFS manages types and amounts of use within the HCNRA. Therefore, the BLM should seek cooperation and funding from the Washington Department of Fish and Game (owner) and USFS.

BLM2-69

> Development of an agreement with Asotin County for road maintenance of the Heller Bar road (road is sometimes inundated during high flows, and receives additional use during low flows due to difficult navigation below Heller Bar.)

Response

Numerous tributaries to the Snake River also contribute to potentially high and low water conditions at Heller Bar Road in Asotin County. The Applicant has no control over high-flow conditions. This BLM-proposed mitigation measure was not revealed during previous years of consultation with the BLM. The BLM needs to clarify why the road receives additional use during low flows. The Applicant believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road.

BLM2-75

> Fund a communications consultant to analyze the feasibility of the project area to have complete communication coverage plus have communication between all stakeholders. Install the recommended system and maintain it.

Response

"Fund a communications consultant…"

BLM has not previously raised this issue. The Applicant is currently coordinating efforts among several agencies, including law enforcement communication experts, to enhance communication coverage in the HCC and will continue to coordinate such efforts through its proposed law enforcement program (section E.5.4.4.1.2.) as well as provide aid to local law enforcement efforts (section E.5.4.4.1.3.). The Applicant believes that these proposals are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how and to what extent emergency services are presently provided.

Currently the counties, the Applicant and the states are involved in a cooperative effort to establish an emergency communication system in the canyon. Because of the topography, communications within the canyon and to command posts outside of the canyon are undependable. The new system will establish an "all-call" frequency into the Boise area for all emergency services in the canyon. A 911 emergency service will be part of this. The Applicant is providing coordination and communication sites for this effort. For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

BLM2-77

Provide funding for EMTs and ambulance to be located near the reservoirs.

Response

The Applicant believes that its proposed law enforcement PM&E measures (section E.5.4.3.1.3. and E.5.4.4.1.4.) are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how and to what extent emergency services are presently provided.

In section E.5.4.5., see response to BLM2-67 for discussion regarding Idaho and Oregon tax code and the Applicant's participation in Life Flight emergency services.

As a property and facility owner in these counties, the Applicant pays taxes that support these emergency services. While the company, as a public utility, pays its taxes on investments, rather than land, to the states, that tax money is distributed to the counties according to a formula determined by the states. In 2001, the Applicant paid the taxes shown in Table 1 to the four counties within which the HCC is located.

Table 1 Property taxes paid by Idaho Power Company to HCC counties—2001

County	Taxes Paid [a]	Total County Taxes [b]	Percent of Total Taxes Paid by IPC
Adams County, ID	$353,200.50	$2,983,354.00	12%
Baker County, OR	$630,868.32	$11,311,000.00	6%
Wallowa County, OR	$380,001.81	$5,319,000.00	7%
Washington County, ID	$958,811.74	$6,266,991.00	15%
Total to Four Counties	$2,322,882.37	$25,880,345.00	9%

a. Idaho Power Company Tax Department

b. Idaho State Tax Commission, Property Tax Budget; and Oregon State Department of Revenues—Value & Taxes Imposed Tables—Table A2, FY 2000-2001

The significance of the taxes paid by the Applicant is overlooked by the agencies advocating that the Applicant provide greater mitigation for emergency services. In the year shown in Table 1, the Applicant's taxes paid to Baker County, OR, were 6 percent of the county's total taxes; 7 percent of Wallowa County, OR, total taxes; 15 percent of Washington County, ID, total taxes; and 12 percent of Adams County, ID, total taxes. Additionally in 2001, the Applicant paid over $1.5 million in federal lands fees for the HCC and well over $0.5 million in kilowatt hours fees to the states, some of which were distributed to the four counties. Therefore, it can be seen that the Applicant is currently providing substantial mitigation to the counties for emergency services through taxes (other services provided to the company by the counties include recording of land records and maintenance of some roads within and leading to the project area).

To obtain a better understanding of the adequacy of these tax payments, information on the frequency of use of these services is needed, and other actions in support of emergency services taken by the Applicant also must be considered. In spite of paying significant county taxes for services, the Applicant has contributed a great deal more toward emergency services in the canyon as described below. A summary of contributions above and beyond taxes by the Applicant to help support these services is also provided below.

Ambulance/EMT—Historically, employees and their spouses in the canyon often were trained as EMTs, LPNs, and RNs. An ambulance purchased by community groups in Halfway was housed in Oxbow Village. Upon receiving an emergency call, the company's trained personnel would respond. Approximately a year ago, no certified EMTs or other appropriate health professionals remained in the village, and the ambulance was relocated to the Pine-Eagle Health Clinic in Halfway, which now acts as an ambulance district (with volunteer labor) and responds to emergencies locally and in the canyon. In 2002, the clinic estimates that it made 10 trips in which it carried people from the canyon to area hospitals for treatment. An EMT also is now resident in Oxbow Village and could respond to emergencies if the ambulance were again to be located in the village.

The Cambridge Ambulance Service also operates as a volunteer emergency service to the canyon. In 2002, the service estimates that 6 trips were made to address emergencies in the canyon.

Hospitals—Hospitals to which injuries or illnesses from the canyon are taken are the Weiser hospital, the Baker City hospital, St. Alphonsus hospital in Boise, and up to the time it closed over a year ago, the Council hospital. The Pine-Eagle Clinic in Halfway provides outpatient services to the area.

For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

BLM2-78

Provide and fund appropriate training for search and rescue personnel.

Response

The Applicant believes that its proposed law enforcement PM&E measures (section E.5.4.3.1.3. and E.5.4.4.1.4.) are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how and to what extent emergency services are presently provided.

In section E.5.4.5., see response to BLM2-67 for discussion regarding Idaho and Oregon tax code and the Applicant's participation in Life Flight emergency services. Also see response to BLM2-77 for discussion regarding the Applicant's property taxes paid to applicable Idaho and Oregon counties, the Applicant's participation in ambulance/EMT services, and hospital services.

For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

BLM2-93

> Assist in developing and implementing an access and travel management plan on public lands within the planning area (rim to rim from Farewell Bend to Captain John Rapids).

Response

Prior to this, BLM has not proposed that the Applicant assist in developing and implementing an access and travel management plan on public lands. The Applicant rejects this request, as the Applicant cannot evaluate it without understanding the goals, elements, products, benefits, and cost of this plan. The Applicant believes that its proposed information and education plan (section E.5.4.4.1.3.) may provide the assistance that the BLM is requesting.

BLM2-94

> Provide a percentage for annual maintenance of the Snake River and Homestead Roads in Oregon.

Response

The Applicant believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road. The Applicant believes that its proposed road maintenance PM&E measures in the DLA and FLA (section E.5.4.3.1.4. and E.5.4.4.1.6.) are adequate and meet the desired future conditions as identified in the RARWG Vision Statements (see Appendix 2 of the HCRMP) for all recreational zones.

BLM2-100

> Contribute an appropriate share to the operations and maintenance, replacement, and development of recreational sites and facilities on BLM lands. Also included are detailed site designs, engineering survey and design work, environmental analysis and NEPA documentation.

Response

See section E.5.4.4.1.7. (about operation and maintenance at Applicant-enhanced BLM and USFS reservoir-related recreation sites). The Applicant believes that it is the BLM's responsibility to conduct environmental analysis and NEPA documentation for federal actions on BLM lands. However, the Applicant rejects any BLM suggestion "to provide funds to manage, enhance, and provide O&M funds [...] in areas degraded by recreational activities for the term of the new license." The BLM does not provide any justification for such a request. The Applicant proposes measures to protect, mitigate, or enhance wildlife habitat, as appropriate, on dispersed sites on Applicant-owned lands. Recreation site plans developed by the Applicant for dispersed recreational sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (i.e., hardening sites, restricting access, using native plant materials). The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by an agreed-upon site plan.

As to funding and appropriate share of sites and facilities on BLM lands, it is inappropriate for federal agencies, such as the BLM, to shift management responsibilities to licensees at relicensing. Interspersed throughout the USFS and BLM comments is the assertion that the existence of the HCC project causes additional recreational uses on USFS, BLM, or other agency, lands that are either within or near the project area and that these uses would not occur except for the existence of the HCC. The agencies further assert that such uses have an impact on their operating and maintenance costs which should be borne by the Applicant. This assertion of the Applicant responsibility for "induced use" seems disingenuous, particularly in light of the purposes for which the USFS and BLM manage the federal lands around the HCC. All of the national federal lands in the vicinity of the HCC are managed by the USFS and BLM for multiple uses, including recreation.

Moreover, in 1975, Congress created the Hells Canyon National Recreation Area (HCNRA), setting aside more than 650,000 acres consisting of wilderness areas, wild and scenic river segments, and dispersed and developed recreational areas and forest management areas. While a primary purpose of the HCNRA Act (P.L. 94-199, 1975) was to preserve the lands and waters that the Act specifically set aside, it was also intended to enhance recreational opportunities and the public enjoyment of the area. So while the USFS generally manages national forest lands for recreational use, consistent with its multiple use philosophy, Congress in enacting P.L. 94-199 apparently envisioned that more recreational use would occur within the HCNRA than within forest lands generally reserved under the 1897 Organic Act (as supplemented by the 1960 Multiple Use Sustained Yield Act—MUSYA). In fact, the USFS encourages recreational use within the HCNRA through mediums such as a USFS website dedicated solely to the HCNRA (where the USFS emphasizes that the HCNRA provides "Exciting recreational opportunities. Diverse and abundant wildlife. Artifacts from prehistoric tribes and rustic remains of early miners and settlers - HCRNA truly offers something for everyone, and much to remember". See: <http://www.fs.fed.us/hellscanyon/overview>.) In short, it is not the HCC that draws recreational users to the area, but the unique attributes of the HCNRA.

Moreover, quantifying the respective use of USFS lands as compared to HCC recreational areas would be difficult and at most speculative. For example, how would one quantify the impacts to the Applicant's parks and roads by visitors whose sole purpose for visiting the area is to recreate within the HCNRA, USFS, BLM or state lands? What standard or mechanism would be used to determine whether visitors to the area result from the marketing efforts of the USFS, Bureau of Land Management (BLM), the states of Idaho and Oregon, or local counties, outfitters and guides, and other organizations? There is no doubt that the entire Hells Canyon area provides unique recreational opportunities and is a national as well as an Oregon and Idaho asset. As such, the various federal and states agencies and entities involved should provide funding to operate and manage their own lands.

BLM2-104

> Acquire river frontage easement or fee title land to provide additional mainstream free flowing river recreation opportunities. Acquire access on the Little Salmon River between Rapid River and Salmon to provide access for fishing of releases from Rapid River Hatchery.

Response

The Little Salmon River has no relationship to the HCC or this relicensing proceeding. The Applicant opposes acquiring easements or fee titles to properties for public access that are not associated with ongoing impacts related to operation of the HCC.

BLM2-105

> Acquire, in fee title or easement, the rights for the public to recreate on the following parcels: (identification of general parcel locations were provided in a communication dated May 1, 2001).

Response

The Applicant disagrees with the proposal to acquire these private properties at this time. The Applicant's recreation technical reports on use and user preference do not indicate the need for acquiring private lands at this time. The Applicant's existing and proposed measures and facilities provide recreational opportunities consistent with 18 CFR 2.7 of FERC regulations regarding recreation. The Applicant's proposed RAMP (section E.5.4.4.1.5.) would provide a process to monitor the change of use patterns of users by location.

BLM2-108

> Continuation of Road Maintenance—BLM supports the continuation of maintenance by IPC on these roads. However, the DLA does not identify all roads which access the HCC and what percentage of their use is project related. If roads are used for project related purposes, the BLM believes the maintenance costs should be prorated between IPC and the appropriate county road district.

Response

Road access to the HCC is extensively described in Technical Report E.5-2 (section 2.8.), illustrated in Figures 3 and 4 of that report, and described in ten other recreation technical reports. BLM needs to provide the Applicant and FERC with its definition of "roads are used for project related purposes." The Applicant is unable to respond without that definition. The Applicant believes that this PM&E measure is adequate. The Applicant also believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road.

BLM2-111

> Enhancement of Litter and Sanitation Plan—BLM supports this measure. IPC should provide information on number, location, and cost of portable and vault toilets it plans to provide at dispersed recreation sites. If "appropriate" sites are located on non-IPC lands, will IPC still operate and maintain? Specific information on the litter and sanitation program needs to be provided to determine if applicant funding levels are suitable.

Response

Specific information regarding proposed enhancement to the Applicant's litter and sanitation plan (section E.5.4.4.1.2.) would be developed through consultation with all counties and land managing agencies or entities associated with the HCC and others, as defined by FERC. If needed, the Applicant would enhance its existing plan throughout the life of the license as part of its proposed RAMP (section E.5.4.4.1.5.). Costs provided are the Applicant's best current estimates, and its intention would be to fund all reasonable and agreed-upon elements of the proposed plan.

BLM2-112

> Information and Education (I&E) Plan—BLM supports development and implementation of an I&E Plan in Hells Canyon. IPC needs to identify agencies it will consult in development of the I&E Plan. IPC also needs to provide specific information on elements of the plan, projects to be implemented and associated costs. BLM is unable to provide comment on funding level since IPC has not provided any detailed information for this measure.

Response

Specific information regarding the Applicant's proposed information and education plan (section E.5.4.4.1.3.) would be developed through consultation with all counties and land managing agencies or entities associated with the HCC and others, as defined by FERC. Costs provided are the Applicant's best current estimates, and its intention would be to fund all reasonable and agreed-upon elements of the proposed plan.

BLM2-114

> Recreation Adaptive Management Plan—BLM strongly supports development and implementation of a recreation adaptive management plan. IPC needs to identify agencies and entities that will be consulted and which will be involved in actual plan development. The

> measure states that IPC would fund construction and O&M associated with the measure but it does not identify who would fund development of the plan itself.

Response

Specific information regarding the Applicant's proposed RAMP (section E.5.4.4.1.5.) would be developed in consultation with all counties and land managing agencies or entities associated with the HCC and others, as defined by FERC. Costs provided are the Applicant's proposed funding limit and recreation needs identified through the RAMP would be prioritized based on the level of need and proposed funding caps.

BLM2-116

> Enhancement of Copper Creek Dispersed Recreation Site, Enhancement of Airstrip A&B Dispersed Recreation Sites, Enhancement of Bob Creek Section C Dispersed Recreation Site, Enhancement of Westfall Dispersed Recreation Site—BLM supports this measure however, no specific details or justification are provided. BLM is unable to determine the suitability of proposed funding levels, the appropriate level of O&M costs, and integration with other resource values. All proposed development and enhancements of dispersed recreation sites require detailed site plans.

Response

See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) for the linkage between issues, study results, agency consultation, and PM&E development. Specific information and detailed site plans for the Applicant's proposed enhancements of Copper Creek (section E.5.4.4.3.2.), Airstrip sections A and B (section E.5.4.4.3.4.), Bob Creek section C (section E.5.4.4.3.7.), and Westfall (section E.5.4.4.3.8.) dispersed recreation sites would be developed in consultation with all counties and land managing agencies or entities associated with the HCC and others, as defined by FERC. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed upon elements of proposed plans. See the Applicant's proposed measure to perform O&M at Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon the Applicant's receipt of a new license. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans.

BLM2-322

> Road/Access—The current transportation infrastructure serving the HCC is inadequate to meet existing needs. There is a major safety need that is overlooked in the draft application. The maintenance and enhancement of several roads within the project boundary needs to be addressed. The Steck Road, an eleven mile gravel road, west from Weiser to Steck Park; the Snake River Road, a forty-one mile gravel road, north from Huntington to Richland, the Homestead Road, a ten mile gravel road, north from Oxbow to the HCNRA boundary, and the Snake River road from Asotin to Heller Bar are all administered by county road districts. The majority of traffic on these roads, year around, is induced by the reservoirs, the developed facilities on them, and access to dispersed sites on BLM lands. There have been a number of accidents involving reservoir users because of road surface condition. In addition, campers pulling trailers and boats have reported damage to their equipment on an increasing basis. Use along these routes by recreationists going to sites in the HCC will increase, and the safety concerns of travelers driving over washboard will increase….
>
> BLM suggests that the Applicant needs to provide, or help provide, for the safe ingress and egress to the HCC. The current application is inadequate in this area. IPC should join other agencies in developing a road management plan for the canyon. IPC should contribute to O&M costs for all main access roads into the canyon.

Response

The Applicant believes that the transportation infrastructure is adequate and meets the desired future conditions as identified in the RARWG Vision Statements for all recreational zones identified in this final license application. Future needs may be addressed through the Applicant's proposed RAMP (section E.5.4.4.1.5.). The Applicant believes that it provides adequate funding through taxes for these needs. The Applicant also believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road.

BLM2-323

> Operations and Maintenance (O&M)—On-going operations and maintenance is a major concern for BLM. Past and current budgets have not been adequate to serve the recreating public in a quality manor. Several of the studies point this out in various ways, i.e. visitor satisfaction levels, litter and waste concerns, land impacts, etc. It is obvious BLM dispersed and developed sites are not meeting public expectations. IPC has not offered any O&M mitigation measures for non-IPC sites. Since these recreation sites exist only in response to the existence of the reservoirs, IPC should provide for O&M costs for these recreationists.

Response

Congress and the BLM decide on the allocation of resources to BLM lands and obviously decided that full-time, on-site personnel were not required at facilities managed by the BLM in the HCC. See section E.5.4.4.1.7. about operation and maintenance at Applicant-enhanced BLM and USFS reservoir-related recreation sites. Interspersed throughout the USFS and BLM comments is the assertion that the existence of the HCC project causes additional recreational uses on USFS, BLM, or other agency, lands that are either within or near the project area and that these uses would not occur except for the existence of the HCC. The agencies further assert that such uses have an impact on their operating and maintenance costs which should be borne by the Applicant. This assertion of Applicant responsibility for "induced use" seems disingenuous, particularly in light of the purposes for which the USFS and BLM manage the federal lands around the HCC. All of the national federal lands in the vicinity of the HCC are managed by the USFS and BLM for multiple uses, including recreation.

Moreover, in 1975, Congress created the Hells Canyon National Recreation Area (HCNRA), setting aside more than 650,000 acres consisting of wilderness areas, wild and scenic river segments, and dispersed and developed recreational areas and forest management areas. While a primary purpose of the HCNRA Act (P.L. 94-199, 1975) was to preserve the lands and waters that the Act specifically set aside, it was also intended to enhance recreational opportunities and the public enjoyment of the area. So while the USFS generally manages national forest lands for recreational use, consistent with its multiple use philosophy, Congress in enacting P.L. 94-199 apparently envisioned that more recreational use would occur within the HCNRA than within forest lands generally reserved under the 1897 Organic Act (as supplemented by the 1960 Multiple Use Sustained Yield Act—MUSYA). In fact, the USFS encourages recreational use within the HCNRA through mediums such as a USFS website dedicated solely to the HCNRA (where the USFS emphasizes that the HCNRA provides "Exciting recreational opportunities. Diverse and abundant wildlife. Artifacts from prehistoric tribes and rustic remains of early miners and settlers - HCRNA truly offers something for everyone, and much to remember". See: <http://www.fs.fed.us/hellscanyon/overview>.) In short, it is not the HCC that draws recreational users to the area, but the unique attributes of the HCNRA.

Moreover, quantifying the respective use of USFS lands as compared to HCC recreational areas would be difficult and at most speculative. For example, how would one quantify the impacts to the Applicant's parks and roads by visitors whose sole purpose for visiting the area is to recreate within the HCNRA, USFS, BLM or state lands? What standard or mechanism would be used to determine whether visitors to the area result from the marketing efforts of the USFS, Bureau of Land Management (BLM), the states of Idaho and Oregon, or local counties, outfitters and guides, and other organizations? There is no doubt that the entire Hells Canyon area provides unique recreational opportunities and is a national as well as an Oregon and Idaho asset. As such, the various federal and states agencies and entities involved should provide funding to operate and manage their own lands

BLM2-331

> The BLM requests that the Applicant develop site plans for Spring Recreation Site in order to determine if proposed funding levels are appropriate.

Response

Specific information and a detailed site plan for the Applicant's proposed enhancements of Spring Recreation Site (section E.5.4.4.5.3.) would be developed in consultation with counties and agencies associated with the HCC and any others, as defined by FERC. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed plan except for ongoing O&M.

BLM2-333

> The BLM requests that the Applicant develop site plans for Swede's Landing, Copper Creek, Airstrip, Bob Creek, and Westfall in order to determine if proposed funding levels are appropriate.

Response

Specific information and detailed site plans for the Applicant's proposed enhancements of Copper Creek (section E.5.4.4.3.2.), Airstrip sections A and B (section E.5.4.4.3.4.), Bob Creek section C (section E.5.4.4.3.7.), Westfall (section E.5.4.4.3.8.), and Swedes Landing (section E.5.4.4.5.2.) dispersed recreation sites would be developed through consultation. This consultation would include all counties and land managing agencies or entities associated with the HCC and others, as defined by FERC. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed plans. The Applicant would encourage the BLM and other appropriate agencies to obtain possible grant monies to assist, where possible, in these efforts. See the Applicant's proposed measure to perform O&M at Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon the Applicant's receipt of a new license. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans.

BLM2-342

> The BLM requests that the Applicant cooperatively develop a travel management plan for the entire HCC integrating all resource needs.

Response

The Applicant rejects this request, as the Applicant cannot evaluate it without understanding the goals, elements, products, benefits, and cost of this plan. BLM needs to clarify its intent of "the Applicant cooperatively develop."

BLM8-8

> Extreme low and high water flows cause problems in the areas below the HCNRA boundary. Specific mitigation measures which could mitigate these problems include:
>
> - Development of Law Enforcement MOUs with Nez Perce County and Asotin County for assistance with search and rescue (low flows are the cause of many boating accidents);
>
> - Development of Bar Recreation Site to accommodate low water launches.

- Development of an agreement with Asotin County for road maintenance of the Heller Bar road (road is sometimes inundated during high flows, and receives additional use during low flows due to difficult navigation below Heller Bar.)

Response

"Development of Law Enforcement MOUs"—The Applicant believes that its proposed continuation of aid to local law enforcement (section E.5.4.3.1.3.) and the law enforcement program (section E.5.4.4.1.4.) are adequate. Any additional needs may be addressed through the proposed RAMP (section E.5.4.4.1.5.).

"Development of a new ramp at Heller Bar"—This BLM-proposed mitigation measure was not revealed during previous years of consultation with the BLM. Numerous tributaries to the Snake River contribute to potentially low water conditions at Heller Bar. The Applicant has no control of flows from these tributaries. Therefore, the BLM should seek cooperation and funding from the Washington Department of Fish and Game (owner) and USFS to accommodate low water launches.

"Develop an agreement with Asotin County"—The Applicant rejects this proposed mitigation measure by the BLM. Numerous tributaries to the Snake River also contribute to potentially high and low water conditions at Heller Bar Road in Asotin County. The Applicant has no control over high-flow conditions. This BLM-proposed mitigation measure was not revealed during previous years of consultation with the BLM. The Applicant believes that each agency or entity owning a road in the Hells Canyon area should be responsible for operation and maintenance of that road.

BLM8-9

HELLER BAR

Location:	Washington side of Snake River, 0.5 mile below mouth of Grande Ronde River
County:	Asotin
Approximate Size:	20 acres
Owner:	Washington Department of Fish & Game, Managed by BLM
Current Amenities:	2 lane boat ramp, 6 vault toilets, paved access road
Visitor Use Estimate:	60,000 visits/yr
Current Visitor Profile:	Primary boat access for Hell's Canyon, Lower Salmon, and Grande Ronde
Identified Needs:	Another 2 lane boat ramp
	Concrete apron for gear preparation
	Additional maintenance coverage
	Additional law enforcement coverage
	Noxious weed control
One time cost:	\$40,000; IPC share: 25%
Annual costs:	\$25,000; IPC share: 15%

Response

This BLM-proposed mitigation measure was not revealed during previous years of consultation with the BLM. Numerous tributaries to the Snake River contribute to potentially high and low water conditions at Heller Bar. The Applicant has no control of flows from these tributaries. The BLM and the USFS have the responsibility to manage and control the type and number of users coming into the Heller Bar facility. Therefore, the BLM should seek cooperation and funding from the Washington Department of Fish and Game (owner) and USFS to separate use between floaters and jet boaters at Heller Bar. It appears that the BLM is requesting information from the Applicant that it has already quantified and established for the Applicant's level of responsibility for Heller Bar from page 2 of its revised comments submitted to the Applicant (LuVerne Grussing, BLM) (one-time cost: $40,000; IPC share: 25%, annual costs: $25,000; IPC share: 15%). The Applicant requests that the BLM justify this level of responsibility and share its methodologies for doing so.

BLM8-28

> This suggests that IPC has a project impact on Heller Bar. Therefore, this seems to indicate IPC's partial responsibility for O&M at Heller Bar.

Response

The Applicant disagrees. The Applicant has simply acknowledged this as one of the many areas where the public accesses the Snake River and potentially the HCNRA. This does not in any way suggest that the HCC has an impact on Heller Bar, or that the Applicant should have any responsibility for improvements and O&M at Heller Bar. The USFS manages types and amounts of use within the HCNRA. Therefore, the BLM should seek cooperation and funding from the USFS.

BLM8-58

> Public recreators are consistently using private lands adjacent to the reservoirs. There is a need to acquire, in fee title or easement, the rights of the public to recreate on the following parcels: Holbrook Creek, Sag Road, Swede's, Hibbard Creek, and Cobb Rapids. IPC may be 100% responsible to fulfill this need.

Response

The Applicant's recreation technical reports do not indicate the need for acquiring private lands at this time. Therefore, the Applicant does not have a responsibility to acquire public rights to use those private lands. The public uses these lands because the private landowners have done nothing or little to stop them. The Applicant believes that there are numerous examples of private property owners who have been very successful in limiting public use of their lands in the vicinity. The Applicant cannot be responsible for nor has the authority to limit public use on private lands. The Applicant's proposed RAMP (section E.5.4.4.1.5.) would provide a process to monitor the change of use patterns of users by location. The Applicant sees no reason why it should be 100% responsible.

U.S. Forest Service comment letter, dated January 8, 2003

USFS1-294

> IPC should develop the recreational facilities recommended by the resource agencies on the Recreation and Aesthetics Resource Work Group (RARWG).

Response

The Applicant incorporated numerous measures identified by the RARWG in the DLA. The Applicant believes that its proposed PM&E measures, which are based on findings from study of use and user preference and are consistent with 18 CFR 2.7 of FERC regulation regarding recreational opportunities, are adequate and that the proposed RAMP (section E.5.4.4.1.5.) would provide a process to monitor the adequacy of recreation measures throughout the new license period.

USFS2-216

> Visitor Impacts—PM&E measures need to address both short term and potential long-term impacts and needs. A PM&E that provides for bi-annual litter patrols and additional vault toilets and portable toilets will be beneficial in the short term, but does not adequately address long term or potential future problems. A PM&E commitment is needed that provides for additional measures in the future years of the license, as specific problem areas surface. Provisions for additional vault toilets, replacement of older deficient toilets, and increased levels of garbage pickup/management should be included. The finding concerning crowding,

particularly in the Hells Canyon Dam tailwater and Hells Canyon Reservoir areas, suggests additional PM&E's are needed to fully address the concerns. The PM&E's should include an adequate level of facility development in the near term (within the first 5 years of the license) to alleviate the crowding, and also include measures that address additional future development needs (adaptive management planning) as impacts and visitor preferences change.

Response

The excerpts concerning litter and crowding are from the general comments and cannot be understood out of context.

Only about 3% of comments were within the visitor impact category (Technical Report E.5-4, page 35). Twenty-four percent of all visitor impact comments (overall) were general litter criticisms, or 0.7% of all comments. The same calculation applied to improving litter pickup (9% of the 3%) yields 0.27% of all comments. Applying this calculation to improve litter enforcement (11% of the 3%) yields 0.33% of all comments.

Only 3% of comments were within the visitor impact category. Twenty-four percent of all visitor impact comments (overall) were about crowding issues, or 0.7% (24% of the 3%) of all comments. The same calculation applied to the referenced area-specific percentages yields the following results:

Hells Canyon Dam tailwater area	1.68%
Hells Canyon Reservoir	1.08%
Oxbow Reservoir	0.90%
Brownlee Reservoir	0.39%

Obviously, crowding was not a major concern of recreationists responding to requests for general comments.

In Technical Report E.5-4, the author reports the results of analysis of mail-survey responses to direct questions about crowding:

> In general, the HCC reservoirs do not appear to be approaching social carrying capacity. No reservoir had responses for crowding at percentages above 50% (the percentage margin between a "low normal" and "high normal" crowding situation) for the year, and the average for all reservoirs through the year was 43%.

The Applicant will not repeat all crowding and encounter-related results in this response. These results include general comments (taken out of context above), perceived crowding responses and scores, crowding by season, crowding compared with other areas, crowding in parks, and areas where people reported feeling crowded. None of these results indicated anything other than a few specific spots with consistent crowding (boat ramps, restrooms, etc.).

Also in Technical Report E.5-4, the author points out that the crowding indices used were developed for backcountry settings and should be used with caution when applied to "developed settings or higher density settings such as many parks on the HCC reservoirs."

The Applicant believes that study results related to crowding do not indicate the need for specific PM&E measures related to the issue. PM&E justification was based on agency input, need for facility upgrades and improvements, study results, need for enhanced access, and resource protection.

"A PM&E commitment…"—Additional recreation needs and replacement of deficient facilities would be identified and addressed through the Applicant's proposed RAMP (section E.5.4.4.1.5.).

USFS2-217

> Enforcement/Regulations—The three specific conflict types recorded (jet skiers, loud and rowdy people, and people camping too close) suggest additional law enforcement measures

are needed in the HCC. A PM&E that adequately and directly funds additional officers and associated support such as signing, communications equipment and patrol boats, is warranted. Regulations need to be clearly understood, well posted and as uniform and consistent as possible among agencies. Also, the resources and means must be available to effectively share the information with the public. A forum of agencies and entities involved in law enforcement in the Hells Canyon area should be empowered to determine current and future law enforcement related needs. Ongoing and future needs should also be part of IPC's proposed Recreation Adaptive Management Plan (RAMP) process, and since most of the needs are HCC project related, IPC should be responsible for a significant portion of the current and future.

Response

The purpose of Technical Report E.5-4 was to present the results of studies developed through consultation with the RARWG and did not address project operation impacts that establish the Applicant's level of responsibility for funding law enforcement needs. Most identified recreational user conflicts do not necessarily dictate increased law enforcement. Most of the user conflicts identified were of the varieties that are unavoidable when people congregate. User conflicts can stem from different types of recreation, user preferences, and visitor expectations. These conflicts may warrant modifications to recreation management rather than increased law enforcement, which would be addressed through the proposed RAMP (section E.5.4.4.1.5.). The Applicant believes that its proposed continuation of aid to local law enforcement (section E.5.4.3.1.3.) and the law enforcement program (section E.5.4.4.1.4.) are adequate. Further details regarding the Applicant's proposed RAMP and law enforcement program would be developed through consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. The Applicant believes that it has a shared responsibility for future recreation needs with land managing agencies that have jurisdiction and mandates to provide for recreation in the HCC. During the 2000 warm season, the maximum number of jets skis counted at any one time on Brownlee, Hells Canyon, and Oxbow reservoirs was 15, 8, and 5, respectively. The mean number counted was one or less for all three reservoirs. The median was zero for all three reservoirs. At least half the time, there were no jet skis present on any of the three reservoirs. Considering that the three reservoirs together impound more than 95 river miles, the maximum counts were very low. Many people feel that jet skiers are a problem, no matter how many there are or what they are doing.

Reservoir	Maximum	Mean	Median
Brownlee	15	1.0	0
Hells Canyon	8	0.9	0
Oxbow	5	0.4	0

The Applicant believes its existing and proposed law enforcement measures (section E.5.4.3.1.2. and E.5.4.4.1.4.) are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how emergency services are provided, and of the Applicant's involvement in providing and supporting emergency services in Hells Canyon.

In section E.5.4.5., see response to BLM2-67 for discussion regarding Idaho and Oregon tax code and response to BLM2-77 for discussion regarding the Applicant's property taxes paid to applicable Idaho and Oregon counties.

The Applicant's involvement in support of law enforcement has evolved over the last decade. Prior to the last year, the Applicant worked with Adams County to provide year-around housing in Brownlee Village for two part-time marine deputy sheriffs. This housing substantially cut response time to emergencies as well as operational costs for the sheriff's office. The deputies work part-time during the recreation season (May through September). The Applicant has also provided personal watercraft and a jet boat for the deputies. Washington County has also contributed funding toward the services of these deputies on Brownlee Reservoir. As of

September 2002, a memorandum of agreement was signed by the Applicant and the Adams County Sheriff to provide full costs and housing for a full-time deputy sheriff to supplement the two part-time marine deputies. In addition, the Applicant has funded two temporary summer season deputies in the Adams County Sheriff's office to serve in the canyon. These deputies in Idaho counties have been cross-deputized to respond to calls in Washington County, ID, and in Baker County, OR. Since Oregon sheriffs have jurisdiction in all counties, those authorized in Baker County also have jurisdiction in Wallowa County. This puts a full-time deputy and four part-time (recreation season) marine deputies in the canyon as residents that can serve in any of the four counties bordering Hells Canyon. A major part of the cost is borne by Idaho Power.

Disturbances requiring law enforcement in Hells Canyon are at their height during summer holidays. Sheriff's deputies from all nearby counties in both states, and the state police from both states, are generally assigned to the canyon to deal with recreationists. At other times during the season, counties will send deputies to the canyon for "saturation patrols", a focus of manpower in a single area. The Applicant assists in these situations by providing housing when it is available.

Currently the counties, the Applicant and the states are involved in a cooperative effort to establish an emergency communication system in the canyon. Because of the topography, communications within the canyon and to command posts outside of the canyon are undependable. The new system will establish an "all-call" frequency into the Boise area for all emergency services in the canyon. A 911 emergency service will be part of this. The Applicant is providing coordination and communication sites for this effort.

Summary of Contributions in Addition to Taxes Provided by the Applicant to Help Support Emergency Services (Table 2) provides a summary of contributions that the Applicant has made during the past several years, in addition to county taxes, that helps support the identified emergency service. FERC should note that, without the participation of the Applicant in supporting these services, the services would not be available to these small, rural communities.

Table 2 IPC emergency services contributions in addition to taxes provided by IPC

Recipient	Location	Amount or Type of Donation	Date of Donation
Adams County Sheriff (aiding all surrounding counties)	Hells Canyon	$70,219 + vehicle miles for 16 months of enhanced law enforcement	September 2002, retroactive to June 1, 2002
Cambridge Ambulance District	Cambridge, ID		
Cambridge Community Clinic	Cambridge, ID	$1,000	2002
Council Medical Clinic	Council, ID	$10,000	2002
Indian Valley Fire District	Adams County, ID	$1,000	2001
Pine-Eagle Ambulance District	Halfway, OR	$10,000	2001
Pine-Eagle Medical Clinic	Halfway, OR	$1,000	2003
Washington County Sheriff	Washington County, ID	$25,000 for labor and $1,000 for equipment for enhanced law enforcement on Brownlee Reservoir	2003
Weiser Ambulance	Weiser, ID	$5,000	2003
Weiser Hospital	Weiser, ID	$25,000	2002

The Applicant has provided many instances of assistance to community emergency services in the past beyond any federal, state or local government requirement. The information presented above documents this fact.

For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

USFS2-224

> Memorandum of Understanding between the USFS and the Applicant—The Forest Service supports this measure. This full time staff member does not currently work full time for the Hells Canyon Creek Launch Site, nor does this staff member work full time for HCNRA related issues. This proposal would provide additional services based on the year round staffing. The MOU that is currently in place serves as an interim measure until the new license is issued. The Forest Service maintains that this PM&E measure should be included as a requirement of the new license.

Response

See modifications to the proposed PM&E measure about continuation of the MOU between the USFS and the Applicant (section E.5.4.1.2.). Wording used in the DLA unintentionally implied that this employee would be available to the USFS full time.

In 1999, the Applicant provided an employee to assist in staffing the Hells Canyon Visitors Center. This employee provides the same services as those provided by two USFS staff at the site. Providing additional human resources at this facility would allow all three on-site employees to dedicate more time to providing education about natural resources, history, boating etiquette, the HCC, and recreation facilities and opportunities in the area. The Applicant would continue to implement the existing MOU with the USFS and employ one person, full time from May through October and part time from November through April, at the Hells Canyon Visitors Center as currently established.

USFS2-227

> Provisions of Boat Moorage on HCC Reservoirs—In order to adequately assess the effects of this PM&E on National forest lands, specific information is needed as to where the projects would occur. What project costs are being proposed as “Applicant's portion”? Since the

> $180,000 and $120,000 are preliminary cost estimates, then additional explanation is needed to address how IPC proposes to cover the actual costs in the year of work.

Response

The Applicant believes that its proposed provision of boat moorage on HCC reservoirs (section E.5.4.4.1.1.) is adequate. Specific information regarding this measure would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed plans. The Applicant would encourage the USFS and other appropriate agencies/entities to obtain possible grant monies to assist, where possible, in these efforts.

USFS2-228

> The Forest Service is concerned about IPC's DLA proposal to allow a maximum daily fluctuation on the Hells Canyon Reservoir of 10 feet rather than the currently imposed 5 feet. The Forest Service maintains that, in order to avoid problems with boat stranding, boat launching and bank access, the maximum daily fluctuation should not exceed 5 feet. See the Forest Service's previous response to the DLA under E.5.2.2.3.2.5, Reservoir Level Comments, pages E. 5-55 and 56.

Response

The Applicant's studies provide an adequate assessment of project-related impacts for the purposes of developing mitigation measures at relicensing.

USFS2-229

Litter and Sanitation Plan—The Forest Service goal for this PM&E provision is to adequately provide for the health and safety of Hells Canyon area users, during the entire life of the license. Another goal is to minimize the impacts of litter and waste on the natural resources.

The wording of the provision suggests that the portable and vault toilets would be installed in year 1, then, only operation and maintenance would occur in subsequent years. The provision needs to be worded to make it clear that new vault toilets can be installed in future years, in locations that may not need it now but may need it in later years of the license period. Also, replacement of older, deficient toilets will be needed during the license period.

How monitoring results and consultation with appropriate agencies will be used to decide how the Litter and Sanitation Plan would be implemented should be described. A RAMP is needed to address this and other concerns related to implementation of the PM&E's. The mechanism of how the consultation with appropriate agencies would work needs to be spelled out in more detail. See page 216 for discussion on Development of Plans Proposed by the DLA.

The estimated costs of $60,000 and $55,000 appear quite low for all the work described. A new concrete single vault toilet costs approximately $10,000 and a double vault is approximately $23,000. These costs will rise with inflation during the life of the license. More explanation is needed as to what specific work will be covered by the estimated costs, and how costs over and above these estimates will be handled.

Response

The Applicant believes that its proposed litter and sanitation measures (section E.5.4.3.1.1. and E.5.4.4.1.2.) are adequate for accommodating associated short- and long-term needs. Future needs would be identified and addressed through the Applicant's proposed RAMP (section E.5.4.4.1.5.). Further details regarding the Applicant's proposed litter and sanitation measures and its RAMP would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the

Applicant's receipt of a new license. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed plans.

USFS2-230

> Information and Education (I&E) Plan—The I&E plan needs to be a fully integrated effort with all resources and developed upon the foundation of the zone/node concept developed by the RARWG. The design standards and guides should be considered when developing the I&E plan. The I&E plan should be developed and implemented by a professional contractor.
>
> This effort needs to be coordinated by a workgroup that includes all the interested agencies and tribes that would consult with IPC. This plan needs to be developed collaboratively with the Forest Service, BLM, State, Counties and other landowners that are responsible for HCC lands. IPC informed the RARWG that these plans would be developed and approved by a stakeholder workgroup that would include the above stated agencies. This plan should be linked to the RAMP. This planning effort needs to be thoroughly defined before the Forest Service can be assured that these plans will meet Forest Service objectives.
>
> The statement "further enhancing visitor information provided within the Oxbow vicinity" could be more specific. The RARWG was unanimous as to the need for the construction of a major visitor center (that would provide information and interpretation of the Hells Canyon area) at or near Oxbow. The statement should be modified to state outright it is anticipated that a new major I&E Visitor Center will be constructed at or near Oxbow.

Response

In developing and implementing new I&E measures, the Applicant, along with identified agencies, would consider the need for providing visual, verbal, and audio ethnic interpretation. The following is an attachment from the RARWG meeting held April 17, 2002, and was discussed with the USFS and others during consultation:

The purpose of the I&E program is to provide enhanced experiences for visitors and residents by developing and implementing a program during year one and two of new license issuance followed by facility maintenance and support over the term of the new license. The program will identify interpretive themes, media, sites and services for interpretation and environmental and cultural education in the project area. Support for the program will include all necessary operations and maintenance aspects such as repair of vandalism and updates of the program over time. The I&E Program will be managed by the Applicant and will involve appropriate agencies and entities in its development.

The I&E Program should include:

Development of a plan that includes:

1) Review and selection of appropriate themes, such as (but not limited to) watchable wildlife, geologic history and canyon features present before inundation, the benefits of hydropower, fishery, historic trails, Native American cultures, pioneers, recreation resources in the area and public safety information (e.g. Boating regulations);

2) Review and selection of appropriate interpretive media to be used, such as signs and kiosks (roadside and at key sites), visitor center(s), brochures, pamphlets;

3) Review and selection of prioritized sites where the media will be located and etc.;

The plan should be reviewed and approved by the appropriate agencies and entities, including detailed cost estimates for facilities, artwork, design costs, and others. Following approval of the plan, design standards for signs, brochures, artwork and other features will need to be developed. Once these standards are developed, construction of built facilities such as signs, and the artwork to go into these signs will need to be created. Once constructed, the media will need to be sited and installed at selected sites per the report.

Development of a support program to maintain the I&E Program over the term of the new license that includes:

1) Review and selection of appropriate maintenance procedures and practices;

2) Review and selection of appropriate methods and timeframes for program updates. Maintenance and support for the program should be reviewed and approved by the RARWG, including detailed cost estimates. Following construction, or other media development, maintenance of the program will begin.

USFS2-231

Law Enforcement Program—The Forest Service goal for this PM&E is to adequately provide for public safety in the HCC area.

When the forum of agencies involved in law enforcement in the Hells Canyon area determines specific needs, IPC should fund a significant portion of the total cost. Included is start up and annual funding needs of additional law enforcement officers, costs of acquiring and implementing centralized communications, signing needs, and needed equipment including patrol boats. In addition to the law enforcement agency forum, the Recreation Adaptive Management Plan (RAMP) needs to address how future law enforcement needs are to be dealt with. The RAMP committee will be considering overall adaptive needs in the HCC and needs to work in coordination with the law enforcement forum group to establish the timing and levels of development needed. This provision for future needs should be described in detail.

IPC's estimated average annual O&M share of $15,000 appears quite low for all probable cost needs that will arise as law enforcement issues escalate in the future.

Response

The Applicant believes that its existing and proposed law enforcement measures (section E.5.4.3.1.2. and E.5.4.4.1.4.) are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. The Applicant's costs for law enforcement measures would be significantly more than $15,000. Future law enforcement needs would be identified through the Applicant's proposed RAMP (section E.5.4.4.1.5.). Further details regarding the Applicant's proposed law enforcement measures and its RAMP would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license.

Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how emergency services are provided, and of the Applicant's involvement in providing and supporting emergency services in Hells Canyon.

In section E.5.4.5., see response to BLM2-67 for discussion regarding Idaho and Oregon tax code, response to BLM2-75 for discussion of the Applicant's involvement with emergency response communication coordination, response to BLM2-77 for discussion regarding the Applicant's property taxes paid to applicable Idaho and Oregon counties, and response to USFS2-217 for discussion regarding the Applicant's law enforcement MOU and the Applicant's emergency services contributions.

For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

USFS2-232

> Recreation Adaptive Management Plan [RAMP]—The Forest Service goal is to have a RAMP that is effective, specific as to Applicant responsibilities, and responsive to changing recreational development needs during the entire license period.
>
> IPC has not provided nearly enough detailed explanation of how the RAMP will be developed and how it will actually operate. It is understood that some of the details of the RAMP process

would need to be worked out in another forum, in consultation with appropriate agencies and entities. But in order to be able to effectively comment on the suitability of this draft PM&E provision, we need to see more explanation of the basic framework and operation of the RAMP. Some of the questions that IPC needs to address include: How and by whom will specific triggers for necessary changes and additions to PM&E's be established? What specific role will agencies and entities have in the RAMP development and implementation? How will triggers be adaptive over time, as conditions change that may justify changing a prior established trigger or PM&E? What are the roles and authorities of the RAMP stakeholder group? Page E.5-84, 85. Monitoring efforts—such as on-site observations and traffic counters—would occur annually, while surveys for social indicators and general recreational use would occur every 6 years. Reporting would occur annually and every 6 years (comprehensive report).

The Forest Service recommends that seasonal occupancy levels be reported annually for the individual parks and campgrounds in the HCC, to develop trend information. During the license period, we anticipate that campground occupancy levels and crowding concerns will be a key trigger point in determining the future needs for additional development at Big Bar.

Response

The Applicant believes that its proposed RAMP (section E.5.4.4.1.5.) is adequate for accommodating recreation needs throughout the new license period. See modifications made to the description of the RAMP and the associated table and figure for details regarding the monitoring and plan schedule. Further details regarding the Applicant's proposed RAMP would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. Changes needed to the Applicant's Recreation Plan (section E.5.4.4.) would be identified from results of the Applicant's monitoring efforts. Costs provided are the Applicant's proposed funding limit, and recreation needs identified through the RAMP would be prioritized based on the level of need and proposed funding caps. O&M costs proposed are for RAMP monitoring efforts. See the monitoring elements of the Applicant's proposed RAMP.

The USFS recommendation for reporting of seasonal occupancy levels is inconsistent with other USFS comments. The information requested is not practical by the agency's own admission. The following is Comment USFS3-40 (page 207, paragraph 1):

> The data used in the study was from actual recreational use surveys, and the Forest Service realized it is probably not practical to have this type of sample survey every year. But if campground fee envelopes and receipts are continually collected and summarized by park personnel, it should be relatively easy to track, summarize, and report occupancy levels. This level of monitoring should be completed and reported each year.

The Applicant cannot respond to this comment unless the expectations are more clearly defined and consistently applied. The Applicant also points out that the very large majority of camping areas in the HCC are not fee areas and that the Applicant does not manage or have any jurisdiction over the majority of camping areas in the HCC.

The RAMP includes plans to annually report on use at parks operated by the Applicant. The Applicant can make no commitment to report annually on use levels at parks and campgrounds operated by other entities. For such an effort to be successful and the results to be meaningful, several potentially difficult problems would have to be solved:

- Use information would potentially come from multiple management entities: the Applicant, two USFS entities with multiple camping areas, two BLM entities with multiple camping areas, one state park, and one county park. Since the Applicant does not have any jurisdiction over other entities' facilities, the Applicant would not be held responsible for the actions (or inactions) of other entities. Any action related to this request would need to be independent of FERC license requirements.

- To provide meaningful results, there would have to be agreement on a consistent method of obtaining and reporting the information. Methodologies would need to be based on valid sampling techniques (with no component based on professional judgment or opinion) and consistent across all sites.

USFS2-233

> The PM&E needs to specify IPC responsibility for future development needs that exceed the estimated cost amounts, and also specify how the RAMP decision making process will occur.
>
> This section needs more detail and explanation provided. How did IPC arrive at these estimated cost figures? The Forest Service maintains that probable future PM&E needs, as they are identified in the ongoing RAMP process, will greatly exceed the $300,000 and $450,000 estimates. How will actual costs over and above these estimates be handled? Will the RA MP process be constrained by how much IPC is willing to spend at any given time? The Forest Service agrees that IPC should fund “the construction, and O&M associated with this measure. The amounts listed, (capital costs of $300,000 every 6th year, and O&M of $450,000 every 6th year) are very low considering the large list of potential PM&E measures developed by the RARWG.
>
> The Forest Service again emphasizes that IPC needs to provide a greater level of detail on how the RAMP would work (especially the agency consultation process), how decisions would be made, and also how specific triggers (such as occupancy levels of nearby campgrounds and increasing resource impacts) would be developed and used as a decision tool.

Response

The Applicant believes that its proposed RAMP (section E.5.4.4.1.5.) is adequate for accommodating recreation needs throughout the new license period. See the monitoring, reporting, and plan schedule of the RAMP. Further details regarding the Applicant’s proposed RAMP would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant’s receipt of a new license. Costs provided are the Applicant’s proposed funding caps. Recreation needs identified through the RAMP would be prioritized based on the level of need and proposed funding caps. O&M costs proposed are for RAMP monitoring efforts.

USFS2-234

> Enhancement of Road Maintenance—Road maintenance is an important issue. Road design and construction standards are also an important issue. An integrated plan for road management needs to be developed. This plan, which could be part of a larger Access and Travel Management Plan for the Hells Canyon Complex, needs to address safety, construction and maintenance standards, protection of or mitigation for impacts to natural or cultural resources, etc. The main access road was built in an era of less concern for public safety and for the protection of resources. As the mix and number of users increase, safety becomes even more important.
>
> The level of road maintenance should meet established guidelines for high standard roads and provide for the safety of road users. The Forest Service needs assurance that safe and reasonable, year round access to NFS lands and facilities will be maintained.
>
> IPC, in conjunction with other resource agencies and interested parties, would develop the best management practices to be implemented throughout the life of the license to insure protection of the resources listed above. The $10,000 O&M annual estimate seems low given the description of BMP as on page E-86.

Response

See modifications made to the enhancement of road maintenance (section E.5.4.4.1.6.). Providing safe access is also of great importance to the Applicant. It is difficult to respond to the USFS, as it did not provide the Applicant with these maintenance level documents. The Applicant believes that the level at which it has provided and will continue to provide safe and reasonable access for the public on this private road is adequate without following the federal guidelines and standards set forth by the USFS.

USFS2-235

> A Preliminary Design Report should be developed for each site that requires development in this zone. This report would be developed in consultation with and approved by the appropriate agencies. This report would develop objectives that would carry out the Zone 1 vision statement developed by the RARWG. This report would include a vision statement for the site, goals and objectives, landscape design goals and objectives, a list of needed facilities with quantities, and a justification statement. Once this report is developed and approved, the conceptual design should be developed and approved. Then construction drawings and contract would be prepared. Concurrently, the processes required by NEPA would be ongoing if the site is managed by a public agency. Construction drawings and contracts for sites must be approved by the appropriate line officer, forest engineer, and forest landscape architect. The preliminary design report should be required for development in all zones (section E.5.4.4.2. Proposed Measures for Zone 1).

Response

The Applicant disagrees with the USFS proposal that the Applicant develop a preliminary design report for recreation development on federal lands. The Applicant would consult with land managers to develop recreation site plans. The USFS would be welcome to utilize these plans to develop any further products required by internal processes of the USFS. Recreation site plans developed by the Applicant for dispersed recreation sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (i.e., hardening sites, restricting access, using native plant materials). The Applicant believes that it is the responsibility of the USFS to conduct environmental and NEPA analysis on its lands, as that is a federal action. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by an agreed-upon site plan.

USFS2-237

> IPC should assume the financial responsibility for site planning, NEPA analysis, capital improvement, and O&M costs for the Forest Service sites located on the Hells Canyon Reservoir. The rationale for IPC having full responsibility is because nearly all of the recreation use occurring at these sites is directly linked to HCC project operations. Technical Reports E.5-2 and E.5-4 provide study findings that strongly support this linkage of recreation use with the HCC project.

Response

The Applicant is proposing that it fund site planning and capital improvements for Big Bar, Eagle Bar, and Eckels Creek located adjacent to Hells Canyon Reservoir. The Applicant's intention would be to fund all reasonable and agreed-upon elements of proposed plans. However, the Applicant would encourage the USFS and other appropriate agencies to obtain possible grant monies to assist, where possible, in these efforts. The Applicant would not incur financial responsibility for NEPA analysis, as that is a federal action. See section E.5.4.4.1.7. about operation and maintenance at Applicant-enhanced BLM and USFS reservoir-related recreation sites. The Applicant disagrees with the USFS comment that "nearly all of the recreation use…is linked to HCC project operations."

USFS2-238

> Enhancement of Eagle Bar Dispersed Recreation Site-The Forest Service maintains that work related to Eagle Bar is a mitigation measure rather than an enhancement.
>
> The site plan (Figure E.5-74) shows an outdoor gazebo. There may be a need for a picnic shelter, however a gazebo is not a structure that would fit in with the architectural style that was discussed as appropriate for the area. This design seems quite extensive. A review of the design by the Forest Service should be conducted before any further planning is done. See

related comments regarding Eagle Bar E.6-45 and Preliminary Design Report above E.5.4.4.2).

The Forest Service would work in cooperation with IPC to finish the site plan development. Subsequent NEPA analysis, capital improvement, and O&M costs should be Applicant responsibility due to the direct linkage of the use of this site with project operations. The "estimated" amount of $150,000 does not appear to include all of these associated costs. An explanation is needed concerning how inflation will be accounted for and how actual costs at the time of implementation will be covered.

Response

"The Forest Service maintains…"—The Applicant believes that proposed improvements to Eagle Bar include both mitigation and enhancement as defined by the FERC in its Hydroelectric Project Licensing Handbook (1991):

Section 4.51(f)(5) of the FERC regulations require that an applicant's report on recreation resources address facilities proposed by the applicant for the purpose of creating, preserving or "enhancing" the recreational opportunities of the project. In the FERC publication Hydroelectric Project Licensing Handbook (1991), FERC defines "enhancement" as the act of increasing the value or effectiveness of a resource beyond the level that exists at the time of the application. The Applicant believes that it has used this term appropriately in the FLA. Using the concept of mitigation for recreation is not consistent with FERC regulations under 18 CFR 4.51(f)(5).

"The site plan (Figure E.5-74) shows…"—The USFS was provided numerous opportunities (RARWG meetings and on-site discussions) to develop and review the conceptual plan and alternatives for Eagle Bar prior to its inclusion in the DLA. The Applicant is surprised that this feedback was not provided earlier to revise this plan for the DLA. This is a prime example of why the Applicant has proposed delaying development of specific site plans until a new license is issued. Further details regarding the Applicant's proposed enhancement of the Eagle Bar dispersed recreation site (section E.5.4.4.2.1.) would be developed through consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed plans.

The Applicant disagrees with the USFS proposal that the Applicant develop a preliminary design report for recreation development on federal lands. The Applicant would consult with land managers to develop recreation site plans. The USFS would be welcomed to utilize these plans to develop any further products required by internal processes of the USFS. Recreation site plans developed by the Applicant for dispersed recreation sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (i.e., hardening sites, restricting access, using native plant materials). The Applicant would not incur financial responsibility for NEPA analysis, as that is a federal action. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by an agreed-upon site plan.

See the Applicant's proposed measure to perform O&M at Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon the Applicant's receipt of a new license. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans.

Costs provided are the Applicant's best estimates (in present dollars), and its intention would be to fund all reasonable and agreed-upon elements of proposed plans. The Applicant would encourage the USFS and other appropriate agencies to obtain possible grant monies to assist, where possible, in these efforts. Further details regarding the Applicant's proposed PM&E measures would be developed through consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. However, the Applicant believes that the proposed measures and cost estimates to implement those measures are adequate. The Applicant's cost analysis is consistent with FERC's analysis and direction in determining current costs without inflation.

USFS2-239

> Restriction of Public Access to Redfish Cave—The Forest Service commends IPC's recognition of the resources at Redfish Cave. Currently the cave trail is a low standard path that is well camouflaged and not in need of obliteration. The Forest Service proposes that a portion of these funds be used for effectiveness monitoring (condition of the trail and gate).

Response

The Applicant is surprised that this feedback was not provided earlier to revise this measure for the DLA. This measure was originally proposed by the USFS during RARWG consultation and was ranked high in priority by the USFS. This is another prime example of why the Applicant has proposed delaying detailed development of several plans until a new license is issued. The Applicant has removed this measure from the application.

USFS2-240

> Development of Site Plan for Big Bar Recreation Site—The Payette Forest Plan goal for the Hells Canyon area and for Big Bar is to provide recreational opportunities that represent a blend of developed and dispersed recreation settings and facilities, and to plan and develop new facilities and sites to meet the projected demand while protecting resource values.
>
> IPC should work in cooperation with the Forest Service to develop a site plan. The site plan would be detailed and specific in addressing the immediate PM&E needs at Big Bar. Total needs are only partially identified in section E.5.4.4.2.4.—only needs at Big Bar D are discussed. The Forest Service maintains that the identified needs at Big Bar C should be included in the detailed site plan work identified in section E.5.4.4.2.3. as well as in the actual work identified in section E.5.4.4.2.4. The Forest Service presented the specific Big Bar C

needs in the RARWG meetings, as part of the group's potential PM&E list exercise. Along with the detailed site plan for immediate needs at Big Bar C and D, the site planning effort will include a more general schematic plan for the anticipated longer term needs at Big Bar sections A, B, C and D

The site plan elements being proposed as PM&E's within the first 5 years of the license will be accomplished outside of the RAMP process. These immediate need elements are required PM&E's that are not subject to the RAMP. The long-term needs identified in the site plan schematic would be subject to the RAMP process and "consultation with appropriate agencies". The consultation process would be helpful to determine priority needs, but the Forest Service would retain the final decision authority on the level and extent of recreation development (see Preliminary Design Report in E. 5.4.4.2, #1).

The cost of developing the site plan should be IPC's responsibility due to direct linkage of the use of this site with project operations. Identifying an "estimated" amount now is acceptable, but there needs to be additional explanation of how inflation will be accounted for and how actual site plan costs at the time the plan is developed will be covered.

IPC proposes no PM&E for the development of the site with the exception of those noted in E.5.4.4.2.4, below, nor is there any discussion of the reoccurring O&M costs. The Forest Service maintains that work proposed above related to Big Bar is a mitigation measure rather than an enhancement (see forms of the term enhancement in E.5.4.4.2, #2.).

Response

"The Payette Forest Plan…"—Comment noted.

"IPC should work…"—The Applicant believes that its proposed Big Bar measures (section E.5.4.4.2.2. and E.5.4.4.2.3.) are adequate, considering data collected from recreation studies conducted from 1994 through 2000. Future needs and implementing elements of the Big Bar site plan would be identified through the Applicant's proposed RAMP (section E.5.4.4.1.5.). Further details regarding the Applicant's proposed Big Bar measures would be developed through consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license.

"The site plan elements…"—The Applicant believes that enhancements proposed to occur within the first five years of the new license period and the RAMP are adequate. The Applicant would not implement any reasonable and agreed-upon site plan elements on USFS lands without the consent of the USFS.

"The cost of developing…rather than an enhancement."—Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed site plans. The Applicant believes that its proposed PM&E measures involving access to HCC reservoirs are directly related to project operations. The Applicant-proposed enhancements to recreation facilities are due to the existence of the project and were therefore titled enhancements in the DLA.

See the Applicant's proposed measure to perform O&M at Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon the Applicant's receipt of a new license. Recreation site plans developed by the Applicant for dispersed recreation sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (i.e., hardening sites, restricting access, using native plant materials). The Applicant believes that it is the responsibility of the USFS to conduct environmental and NEPA analysis on its lands, as that is a federal action. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans.

USFS2-241

Enhancement of Boat Ramp and Associated Facilities at Big Bar D Recreation Site—The Forest Service agrees with the proposed PM&E measures to provide these amenities at Big Bar D. The Forest Service maintains that work proposed above related to Big Bar is a mitigation measure rather than an enhancement. (See forms of the term enhancement, E.5.4.4.2 #2)

The Forest Service submitted a potential PM&E measure in RARWG meetings for Big Bar C that needs to be implemented concurrently with the Big Bar D developments. Primary development items at Big Bar C include improving access roads, providing toilet facilities, constructing 15 to 20 universal campsites, landscaping, providing a well with hand pump, and protecting a cultural resource site. The Big Bar site plan, to be developed cooperatively by IPC and the Forest Service, will specify detailed design elements for Big Bar D and C areas (see Preliminary Design Report in E.5.4.4.2, #1).

Implementation of the site plan, via the PM&E that proposed "Enhancement of Boat Ramp and Associated Facilities at Big Bar D" will be IPC's responsibility. As stated above, improvements at Big Bar C are needed and should be included in IPC's PM&E description, implementation schedule and cost estimate sections.

Since nearly all of the recreational use at Big Bar is directly HCC project related, IPC should be responsible for the site planning, NEPA analysis, capital improvement, and O&M costs. The "estimated" amount of $250,000 does not appear to include all of these associated costs. Explanation is needed concerning how inflation will be accounted for and how actual costs at the time of implementation will be covered.

Response

The Applicant believes that its proposed Big Bar measures (section E.5.4.4.2.2. and E.5.4.4.2.3.) are adequate, considering data collected from recreation studies conducted from 1994 through 2000. Future needs and implementing elements of the Big Bar site plan would be identified through the Applicant's proposed RAMP (section E.5.4.4.1.5.). Further details regarding the Applicant's proposed Big Bar measures would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed site plans. The Applicant's cost analysis is consistent with FERC's analysis and direction in determining current costs without inflation. The Applicant believes that its proposed PM&E measures involving access to HCC reservoirs are directly related to project operations.

See the Applicant's proposed measure to perform O&M at Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon the Applicant's receipt of a new license. The Applicant believes that it is the responsibility of the USFS to conduct environmental and NEPA analysis on its lands, as that is a federal action. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans. The Applicant would not mitigate for impacts on USFS lands identified during NEPA analysis that are not directly related to the Applicant's ongoing operations.

USFS2-242

> Development of Site Plan and Enhancement of Eckels Creek Dispersed Recreation Site—The Forest Service goal is to plan and develop the site to meet projected demand while protecting resource values.
>
> The Forest Service agrees with the proposed PM&E measures to provide these amenities at Eckels Creek. The Forest Service maintains that work proposed above related to Eckels Creek is a mitigation measure rather than an enhancement (see Preliminary Design Report in E.5.4.4.2, #1 and forms of the term enhancement, E.5.4.4.2 #2).

Improvements at the site should include protecting the cultural resource site. The Forest Service maintains that since nearly all of the recreational use at Eckels Creek is directly project related, IPC should be responsible for the costs of site planning, capital improvement, and O&M. The “estimated” amount of $30,000 does not appear to include all of these associated costs. Explanation is needed concerning how inflation will be accounted for and how actual costs at the time of implementation will be covered.

The goal of the Zone 1 vision statement (page E.5-72), to “reflect and respect the character and essence of the natural landscape”, is particularly applicable here. A development plan that emphasizes retention of the existing shade trees and maintaining the secluded nature of the site is needed.

Response

See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) for the linkage between issues, study results, agency consultation, and PM&E development. The Applicant believes that its proposed enhancement of the Eckels Creek dispersed site (section E.5.4.4.2.4.) is adequate, considering data collected from recreation studies conducted from 1994 through 2000. Further details regarding this measure would be developed through consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant’s receipt of a new license. Costs provided are the Applicant’s best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed site plans. The Applicant’s cost analysis is consistent with FERC’s analysis and direction in determining current costs without inflation. The Applicant believes that its proposed PM&E measures involving access to HCC reservoirs are directly related to project operations. See the Applicant’s proposed measure to perform O&M at Applicant-enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar section D, Eckels Creek, Copper Creek, Airstrip section A, Bob Creek sections B and C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in consultation with the appropriate agencies upon receipt of a new license. The Applicant believes that it is the responsibility of the USFS to conduct environmental analysis for NEPA requirements on its lands, as that is a federal action. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed-upon site plans. The Applicant would not mitigate for impacts on USFS lands identified during NEPA processes that are not directly related to Applicant's ongoing operations.

USFS3-29

> The study findings show the need to set a minimum allowable flow between 5,000 and 7,000 cfs, with 6,000 cfs needed for boats larger than 24 feet. When the findings on the minimum safe flow for navigation and on preferred daily fluctuation are compared with IPC's "Proposed Operation" (PO) Model, it is apparent there is a conflict. The PO model, as described in section 4.6.2, pages 48 and 49, calls for a 6,500 cfs minimum flow release below Hells Canyon Dam (except it is allowed to drop to 5,000 cfs on dry years), with a daily fluctuation of up to 10,000 cfs. A daily maximum fluctuation that is representative of the user preferences should be maintained, at least during the primary boating season. PM&E measures should be developed to address this need.

Response

The Applicant believes that its studies and proposed mitigation measures are adequate.

USFS3-42

> Litter and Sanitation—PM&E measures need to address both short term and potential long-term impacts and needs. Bi-annual litter patrols and additional portable toilets are short-term helps that do not adequately address long term or potential future problems. A PM&E commitment is needed that provides for additional vault toilets and garbage pickup/ management in the future as specific problem areas surface.

Response

The Applicant disagrees with USFS opinion regarding litter patrols and additional portable toilets only meeting short-term needs. The Applicant believes that its proposed litter and sanitation measures (section E.5.4.3.1.1. and E.5.4.4.1.2.) are adequate to meet related short- and long-term needs. The Applicant has proposed its RAMP (section E.5.4.4.1.5.) to specifically identify and address the types of needs referenced by USFS. The Applicant's measures were clearly discussed in RARWG meetings.

USFS3-43

> Road improvements within dispersed sites—The study findings indicate about 43% of access roads to dispersed sites and 50% of associated spur roads are in need of grading, and about 35% of spurs would need gravel to be brought up to passenger vehicle standard. A PM&E to address grading needs of main access roads appears to be warranted. However, road improvements could enable enough additional use to exacerbate other site problems such as litter and waste. Road improvements at dispersed sites should be coordinated with litter and waste management and with planned future facility developments.

Response

The Applicant does not agree that a specific PM&E should be developed to address grading of main access roads. Collection of road-condition data at dispersed sites was independent of any other consideration regarding management of or potential effects to encouraging additional recreation use or effects to other resources. The Applicant agrees that, if road improvements were made, it is likely those improvements could enable enough additional use to exacerbate other site problems. The Applicant believes its proposed PM&E measures are adequate to enhance, manage and monitor recreational opportunities throughout the new license period. The Applicant believes that its proposed Recreation Plan (section E.5.4.4.) would adequately address these concerns by coordinating dispersed site road management with litter and waste management and with planned future facility developments

USFS3-46

Litter and Sanitation Plan—A related finding was made in study E.5-9, section 5.1.4.5, which discussed the "major problem" of litter and waste, particularly in the HCC area. IPC's DLA partially addresses the problem in the Litter and Sanitation Plan section of the DLA (E.5.4.4.1.2). Twice per year litter patrols and additional portable toilet are short-term helps that do not adequately address long term or potential future problems. A PM&E commitment is needed that provides for additional vault toilets and garbage pickup/management in the future as specific problem areas surface.

Response

The Applicant disagrees with USFS opinion regarding litter patrols and additional portable toilets only meeting short-term needs. The Applicant believes that its proposed litter and sanitation measures (section E.5.4.3.1.1. and E.5.4.4.1.2.) are adequate to meet related short- and long-term needs. The Applicant has proposed its RAMP (section E.5.4.4.1.5.) to specifically identify and address the types of needs referenced by the USFS. The Applicant's measures were clearly discussed in RARWG meetings.

USFS3-48

Dispersed site development—It is quite understandable that dispersed campsite users would indicate a preference for no substantial developments, since they are the primary user group looking for the more primitive camping that involves less crowding and no user fees. However, the crowding concern, especially in the IPC parks, suggests that some additional campground development in currently dispersed use areas is necessary. Primitive dispersed camping opportunities could still be provided in many areas, even if a few select dispersed areas are chosen for development.

There's a wide range of possible development levels, from no facilities at all to full service campgrounds with Recreational Vehicle (RV) hookups. The choice doesn't have to be limited

> to either full RV campsite development with all amenities, or primitive sites with only minimal site developments (such as use of "passive barriers" to define camp site areas). The Forest Service maintains that a few smaller campground developments (specifically at Big Bar and Eagle Bar on Hells Canyon Reservoir) with basic amenities such as potable water, some individual campsites (with picnic tables, fire rings and shade shelters), toilet facilities and some landscaping are needed within the first five years of the new license. The developments should be an IPC responsibility and described in a PM&E measure in the FLA. A related PM&E measure is needed that addresses possible long-term development needs and how monitoring and an Adaptive Management Plan will be used to determine the extent and timing of future developments. Specific IPC funding responsibilities needs to be addressed in the short term and long term PM&E's.

Response

"A related finding...Hells Canyon and McCormick Parks"—The Applicant points out that the section in Technical Report E.5-8 referenced here ends by suggesting that the reader should see Technical Report E.5-4 for a more complete description of the results related to crowding. In Technical Report E.5-4, the author points out that the crowding indices used were developed for backcountry settings and should be used with caution when applied to "developed settings or higher density settings such as many parks on the HCC reservoirs." The USFS failed to take this caution into account.

From page 53 of Technical Report E5-4:

> The highest crowding scores (or percentages of visitors who reported some degree of crowding) were for Hells Canyon Park (61% and mean score of 3.9), with McCormick Park (57% and 3.4), Carters Landing (55% and 3.3), and Woodhead Park (50% and 3.1) also relatively high.

> The first number in parenthesis is the percentage reporting some degree of crowding. The second is the mean of another crowding score (1 through 9, 1 = not at all crowded to 9 = Extremely crowded). The first number reflects the percentage of people who felt crowded

at any level; the second is a measure of the intensity of such feelings. Even at the sights with the highest scores (Hells Canyon Park), only 61% experienced any feelings of crowding at all, and the measure of intensity, with a mean of 3.9, fell within the “slightly crowded” category. The Applicant believes that, based on the results and contrary to the impression given by USFS references taken out of the context of all related results, there is no reason to consider crowding a problem at any areas within the HCC.

“It is quite understandable...no user fees.”—Comment noted.

“However, the crowding concern...chosen for development.”—See the crowding discussion above in this response.

“There’s a wide range...to define campsite areas”—Comment noted.

“The Forest service maintains...of the new license.”—The Applicant submits that the USFS is entitled to any opinion it chooses about needs on land it manages. The Applicant simply maintains that neither the out-of-context crowding results presented here and elsewhere in the DLA comments nor the use results indicate that there is any demand that Big Bar or Eagle Bar be further developed at this time. Rather, the Applicant has understood throughout ongoing consultation that the USFS has placed enhancements at these two areas as high priorities in these proceedings.

The Applicant maintains that, contrary to the opinion voiced by the USFS throughout these comments, there is nothing in the crowding-related results that can or should be interpreted as an indication that crowding is anything other than a minor issue anywhere in the HCC. According to results presented in Technical Report E.5-4, the highest crowding score for a reservoir or park was 3.9, which is in the “slightly crowded” category.

USFS3-49

> The need for additional Law Enforcement presence within the Hells Canyon Recreation Area (HCRA) is evident from this finding. There is an increasing need to resolve conflicts and respond to emergencies. IPC should continue to work with the Hells Canyon Public Safety Committee to explore potential PM&E measures that might be required. For more information on PM&E needs related to law enforcement see comments on the DLA, E.5.2.2.3.2.9, Enforcement/Regulations on page 181 of this document

Response

During the 2000 warm season, the maximum number of jet skis counted at any one time on Brownlee, Hells Canyon, and Oxbow Reservoirs was 15, 8, and 5, respectively. The mean number counted was one or less for all three reservoirs. The median was zero for all three reservoirs. At least half the time, there were no jet skis present on any of the three reservoirs. Considering that the three reservoirs together impound more than 95 river miles, the maximum counts were very low. Many people feel that jet skiers are a problem, no matter how many there are or what they are doing.

Reservoir	Maximum	Mean	Median
Brownlee	15	1.0	0
Hells Canyon	8	0.9	0
Oxbow	5	0.4	0

Most identified recreational user conflicts do not necessarily dictate increased law enforcement. Most of the user conflicts identified were of the varieties that are unavoidable when people congregate. User conflicts can stem from different types of recreation, user preferences, and visitor expectations. These conflicts may warrant modifications to recreation management rather than increased law enforcement, which would be addressed through the proposed RAMP (section E.5.4.4.1.5.). The Applicant believes that its proposed continuation of aid to local law enforcement (section E.5.4.3.1.3.) and the law enforcement program (section E.5.4.4.1.4.) are adequate.

USFS3-59

> Study E.5-7 concludes that the quality of river user experience is being impacted by IPC flow regimes. Flows that have large daily fluctuations impact the user in many ways and are considered a major issue by users. Reducing large daily fluctuations would directly reduce negative impacts to the users experience as well as indirectly reduce impacts to campsites and terraces caused by modified user patterns. The Forest Service concludes that the negative impacts to campsites and terraces caused indirectly by daily flow fluctuations must be addressed by IPC. The Forest Service would support a flow scenario that maintains a flow fluctuation that is within the range of user acceptance.

Response

The USFS position concerning impacts to upland areas (terraces) caused by the existence of the HCC and the present and proposed operational regimes is presented in a fragmented manner within these comments. This makes it difficult to respond comprehensively without combining the individual ideas presented throughout these USFS comments. Taken together, these USFS comments present the following:

1. The HCC traps sediments and causes the depletion of beaches within the HCNRA. Since beaches are used for camping, the disappearance of the beaches causes campers to move to the upland terraces, thereby increasing the impact of recreational activities in these areas.

2. HCC operations cause increased erosion of the upland terraces. This reduces the size of the upland terraces, thereby reducing the carrying capacity of the campsites in some areas and forcing campers to utilize additional areas where this is possible. This increases the impacts of recreational activities in these areas.

In these comments, the USFS states that, because of the impacts listed above, the Applicant should mitigate for these increased impacts to upland areas by the following actions (items taken verbatim from USFS comments are in italics):

1. *Prepare and implement a monitoring and mitigation plan that addresses campsite carrying capacity and effects related to beach erosion.*

2. *Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, riparian ecosystems, and recreation resources that have been affected by IPC project operations.*

The Applicant believes that the USFS conclusions related to these issues are incorrect and unsupported by either the Applicant's study results or any data or other information, other than anecdote and opinion, provided by the USFS.

The Applicant's study results have shown that only a small proportion of the sediments trapped by the HCC are of a size that would contribute to building or maintaining beaches. Furthermore, sediments in sandbars within the Hells Canyon reach are largely composed of materials originating from the Idaho Batholith, which was largely cut off as a sediment supply prior to construction of the HCC. The HCC is not responsible for the majority of the decline in size and numbers of beaches. During the development of the draft geomorphology and sediment reports, the Applicant realized that it would not be possible to include everything in the draft documents. The Applicant decided that it would be better use of limited time to investigate areas not covered in other reports or efforts rather than duplicate work previously done by Grams (1991) and Grams and Schmidt (1999a). The Applicant did not challenge the empirical information presented in these reports because we did not have any reason to believe that it was incorrect. The Applicant did challenge the conclusions reached by Grams and Schmidt because they appeared to ignore potentially important issues (notably, changes in supply due to development upstream of the HCC and continuing supply from local tributaries). However, due in part to sharp criticism by reviewers, including Federal agencies and Grams and Schmidt (Wilcock et al. USFS Comments Appendix D, 2002), the Applicant decided that it was necessary to reproduce the empirical work performed by Grams and Schmidt that was documented in Grams' senior thesis (Grams, 1991) as well as in their follow-up report commissioned by the USFS (Grams and Schmidt, 1999a). The FLA includes an extension of the aerial photography analysis including the time covered by Grams and Schmidt, and is accompanied by a discussion of the results. The Applicant discovered some noteworthy issues while attempting to duplicate and extend Grams and Schmidt's work, including:

- In counting sand bars in aerial photographs, Grams and Schmidt used 1964 as their baseline. Each sandbar visible in the 1964 series of photographs was noted and the river mile recorded. In subsequent years, Grams and Schmidt looked only at these locations to determine if the sandbar was still in place or had disappeared. If the sandbars were still at the original river mile, these were counted and if no sandbars were identifiable at the original river mile then no sandbar was counted. The lone exception to this seems to be at RM 241.6 where Grams and Schmidt record a sandbar existing in 1973 but not in 1964. This methodology would essentially eliminate any potential for an increase in the number of bars and would show any shifting in location of a sandbar as absolute loss therefore biasing the results toward loss of sandbars. In contrast, the Applicant chose to count all sandbars in each photo series regardless of whether or not it appeared in the 1964 series of photographs. This produced distinctly different results than Grams and Schmidt, (as discussed later in this section) and the Applicant considers it a much more valid methodology in evaluating changes in the number of sandbars within the river system.

- Clearly in evaluating the number of sandbars by aerial photography, the flow in each series of photographs is important. Photographs taken at higher flows would tend to show fewer sandbars because some sandbars previously exposed could be covered by water. In 1973, (an important year for analysis for Grams and Schmidt's theory because it is the first series after completion of the HCC) four different series of photographs were taken at four different flows (18,000 cfs, 12,000 cfs, 7,700 cfs, and 5,000 cfs). Given that the 1964 series of photographs were taken during a flow of about 11,000 cfs, clearly the 12,000 cfs photos would be the best to use for a sandbar comparison to remove any error associated with flow level. However, Table 1 (Grams and Schmidt, 1999a) identifies the 1973 flow as the March 25 flow. They report that the March 25 flow in the table to be 218 cms or approximately 7,700 cfs; yet, in the 1991 report, Table 3 (page 21) reports the March 25 flow as being 5000 cfs. It is unclear which series of photographs Grams and Schmidt actually used for the 1973 sandbar count. Knowing the series of photos and the approximate flow that is associated with that series is vital for accurate presentation of the sandbar count data.

- The Applicant's sandbar analysis included the following years of aerial photography: 1955, 1964, 1973 (5,000 cfs, 12,000 cfs, and 18,000 cfs), 1977, 1982 and 1997. In comparison, Grams and Schmidt indicated that "the sand bar frequency analysis was accomplished by counting the number of sand bars in each photo series including the 1955, 1964, 1973, 1977 and 1982 series" (Grams, 1991). Advancements in computer hardware and software allowed the Applicant to use scanned images in the analysis, many of which were developed directly from the film negatives. This enabled the Applicant to accurately identify areas of sand, and to disregard areas that were made up of other material (rocks, gravels, etc.). It also helped clarify images that were in shadows, or ones that were around areas of high glare. Grams and Schmidt noted, "The 1964 photograph series was chosen for the initial classification because it shows more detail than the 1955 series" (Grams, 1991). The Applicant reported the 1955 findings because the images scanned directly from positives (better quality than prints) showed an amount of detail comparable to later photography. Whenever possible, the Applicant used the best available resources to help minimize any error that might be associated with this project.

- The results from the Applicant's sandbar analysis (using the approach of not considering 1964 as a baseline) varied dramatically from conclusions that Grams and Schmidt made reference to in their 1991 and 1999 reports. Grams and Schmidt made a reference to the decline in sandbars in their 1991 report by saying that the "greatest change occurred between 1964 and 1973 when the number of bars declined by 128", and that "the frequency and area of sand bars decreased by over 75 percent between 1964–1973" (Grams, 1991). The Applicant's analysis identified a total of 242 sandbars in 1964 and 150 sandbars in 1973 (12,000 cfs flow), which corresponds to a decrease in the frequency of sandbars by 38% (not 75% as reported by Grams and Schmidt). These values are based upon the actual counts made for each aerial flight for each specific year.

- The Applicant has also found that a rapid rate of erosion did not continue between 1973 to 1977 as reported by Grams and Schmidt in their 1991 report. The 1973 flight (5,000 cfs flow) concluded a sandbar count of 181 bars, and in 1977 (5,300 cfs flow) 175 bars were identified. Sandbar numbers have also increased slightly between 1982 and 1997: 113 sandbars in 1982 (14,100 cfs flow) and 118 sandbars in 1997 (approximately 21,000 cfs flow). If the difference in flows between these two years was taken into account, this increase would likely be greater. The 1973 (18,000 cfs flow) flight was also counted, and 132 bars were identified. This is comparable to the 118 bars counted from the 1997 (21,000 cfs flow) flight. Ignoring effects of discharge on the counts, the difference between these two years is 14 bars, or approximately 10.6% between 1973 and 1997, which is far less than the reduction presented by Grams and Schmidt.

- Flow is an important factor that needs to be taken into consideration when sandbars are being counted. Elevation changes at various locations within the study reach can lead to sandbars being covered or uncovered at different flows. The Applicant has the means to scientifically analyze and model the flow fluctuations that occur within the study reach by incorporating a 1-D hydrodynamic water model into the sandbar analysis. This model is further discussed in E.1-4. The combination of the sandbar count data and the hydrodynamic water model gives the Applicant the ability to determine how much effect flows actually do have at various locations within the study reach. When the effects of discharge (and associated water surface elevations) are accounted for, the sandbar counts are relatively stable between 1973 and 1997. Additional discussion is included in E.l-1.

Prior to 1955, there is not a spatially complete set of aerial photographs available to evaluate the status and conditions of sandbars pre-HCC within Hells Canyon. However, there are a limited number of oblique photographs and video images that were taken prior to construction of the HCC. (For more information about sediments, see Appendix 4, section 6, in the Consultation Appendix, section VII.) Elsewhere in these comments, the USFS has said that beaches are popular campsites. The Applicant's study results have shown that some HCNRA campers consider beaches a significant campsite amenity, not a campsite unto itself. One of the several attributes rated as necessary by a higher percentage of survey respondents (than beaches was rated) was shade. Beaches generally have no shade. The temperature in Hells Canyon is often over 100 °F during the high-use period and sometimes tops 110 °F. The USFS is trying to give the impression that, if there were large beaches everywhere in the HCNRA, all camping would occur on these beaches and the upland terraces would not be impacted by human use. The Applicant strongly disagrees with this USFS opinion.

The Applicant's study results led to the conclusion that the very large majority of erosion caused by the Snake River in the HCNRA was the result of high flows that are outside the control of the Applicant. The contribution of HCC operations to any reduction in the size of campsites caused by erosion is minimal.

The Applicant and the USFS cooperated in 1998 and 1999 to conduct a comprehensive inventory of recreation sites within the HCNRA (Technical Report E.5-9). Additionally, each site was surveyed (by global positioning system [GPS]) and described in detail. While this effort is a good example of what can be accomplished during a truly cooperative effort, one component of the effort was disappointing. The USFS had conducted site-condition surveys at a proportion of recreation sites in the HCNRA in 1973, 1975, 1978, 1979, 1980, and 1994. The type of information collected did not allow for any meaningful comparison with later results. No trends could be established using this information, either at any individual site or for the area in general. The USFS has no information about trends over time at any sites to support the claims described above. Additionally, the Applicant repeatedly requested that the USFS identify specific sites where the impacts described above were occurring with the goal of investigating these claims. Finally, on April 17, 2001, Applicant personnel met with USFS personnel in Riggins, Idaho, to evaluate the results of the site inventory and compare results with those from earlier efforts. Applicant personnel asked directly for a list of sites and the type of HCC-induced impacts occurring at each. The USFS had no response at that time, other than general anecdotal information. The USFS never identified a single site where these impacts were occurring but continued to make the assertions as a general observation based only on opinion.

The official USFS campsite map indicated about 100 designated campsites. The results of the Applicant/USFS inventory showed more than 140 sites. Several of the campsites within the HCNRA are very popular; most other USFS-designated campsites are either never used or seldom used (Technical Report E.5-3). There is no shortage of campsite carrying capacity in the HCNRA. Those sites that are used almost continuously during the warm season are heavily impacted by recreational use. Erosion occurs at these sites because of people camping and walking repeatedly in the same areas. Some of these sites have severe erosion at the shoreline associated with access trails. The USFS allows these impacts to continue when a large number of USFS-designated campsites are hardly or never used. The Applicant maintains that the majority of the severe recreational-use impacts at upland camping areas are the result of the USFS not actively fulfilling its mandate to protect the HCNRA from such impacts. There are many more designated campsites than are required to meet the demand. The Applicant suggests that a simple rotation of campsite closings would greatly alleviate the majority of such impacts. During the cooperative effort to inventory and describe recreation sites in the HCNRA, the USFS on-site personnel could not specifically identify the location of many USFS-designated campsites. It is impossible for the majority of users to find most of the designated campsites using the maps available from the USFS. Users pass by many desirable USFS-designated campsites because they are unaware of their existence; many are located on terraces just out of site from river level.

The Applicant maintains that, as just described, the USFS controls and is mandated to manage the overuse that leads to the very large majority, if not all, of the recreational-use impacts to upland areas. Therefore, the Applicant is not accountable for monitoring recreational impacts at recreational-use sites in the HCNRA or for mitigating the impacts of such overuse.

USFS3-63

> Impacts and Effects on NFS Lands and Resources—IPC's proposed operation hydrology model allows a minimum flow of 5,000 cfs at Hells Canyon Dam, and a 10,000 cfs maximum daily fluctuation. The 5,000 cfs allowances would not provide an adequate minimum flow necessary for navigation. The high daily flow fluctuation allowance would negatively impact floaters and boaters and cause campsite problems. To accommodate recreation uses and other resources, IPC should consider an integrated flow scenario that incorporates minimum flow allowances and daily fluctuation rates within the identified user preference range.

Response

The Applicant believes that no additional studies related to these issues are needed. Existing information is adequate. User preferences alone cannot dictate overall operations of the HCC. User preferences must be weighed against the broader context of the public interest where operating for recreation preferences undermines the economic value of the project to the region. It is important to note that the USFS controls and manages the amount and type of use in the HCNRA. Generally, the numbers of users have not declined, so it is not clear whether there is any significant effect due to fluctuation of flows. Not withstanding identified user preferences, opportunities in the HCNRA continue to provide quality experiences.

As the USFS pointed out earlier in these comments on the DLA, Congress established the HCNRA in 1975. As the Applicant has pointed out in these responses, Congress did not intend that the HCNRA Act be used to control flows in the Snake River (see Appendix 2 in Applicant's responses to comments on the DLA). At the time the HCNRA Act was passed, the HCC license contained essentially the same restrictions (minimum flow and ramp rate) on Snake River flows that were proposed in the DLA. In the HCNRA Act, the USFS was charged with maintaining the quality of the recreational experience that made the HCNRA special. Since 1975, the USFS has allowed many commercial outfitters to add and operate boats larger than any used in 1975. During low-flow years, the large boats cannot comfortably operate under the flow conditions that existed before establishment of the HCNRA and continue to date. If there is a problem associated with very large boats and navigation, the Applicant maintains that the USFS did not fulfill its congressional mandate of maintaining the recreational experience. The increase in the number of larger boats has introduced navigation issues that did not exist in the recreational experience that Congress mandated the USFS to maintain.

USFS3-79

> The new license proposal will need to include provisions for IPC to share in the costs associated with river and reservoir related recreation and opportunities. IPC should contribute an appropriate share to the operations and maintenance, replacement, and development of

recreational sites and facilities on NFS lands that are impacted by the hydroelectric project. This share should be commensurate with the effects of the project on those recreation opportunities. Site management and development will meet Forest Service quality standards and meet all applicable regulations such as accessibility guidelines of the Americans with Disabilities Act.

Response

The Applicant believes that its existing and proposed PM&E measures are adequate and respond appropriately to this USFS comment. Future recreation needs and cooperative efforts for the HCC would be identified through the Applicant's proposed RAMP (section E.5.4.4.1.5.). The RAMP would include ongoing consultation throughout the new license period with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license.

As to alleged impacts to NFS lands from the HCC, interspersed throughout the USFS and BLM comments is the assertion that the existence of the HCC project causes additional recreational uses on USFS, BLM, or other agency, lands that are either within or near the project area and that these uses would not occur except for the existence of the HCC. The agencies further assert that such uses have an impact on their operating and maintenance costs which should be borne by the Applicant. This assertion of Applicant responsibility for "induced use" seems disingenuous, particularly in light of the purposes for which the USFS and BLM manage the federal lands around the HCC. All of the national federal lands in the vicinity of the HCC are managed by the USFS and BLM for multiple uses, including recreation.

Moreover, in 1975, Congress created the Hells Canyon National Recreation Area (HCNRA), setting aside more than 650,000 acres consisting of wilderness areas, wild and scenic river segments, and dispersed and developed recreational areas and forest management areas. While a primary purpose of the HCNRA Act (P.L. 94-199, 1975) was to preserve the lands and waters that the Act specifically set aside, it was also intended to enhance recreational opportunities and the public enjoyment of the area. So while the USFS generally manages national forest lands for recreational use, consistent with its multiple use philosophy, Congress in enacting P.L. 94-199 apparently envisioned that more recreational use would occur within the HCNRA than within forest lands generally reserved under the 1897 Organic Act (as supplemented by the 1960 Multiple Use Sustained Yield Act—MUSYA). In fact, the USFS encourages recreational use within the HCNRA through mediums such as a USFS website dedicated solely to the HCNRA (where the USFS emphasizes that the HCNRA provides "Exciting recreational opportunities. Diverse and abundant wildlife. Artifacts from prehistoric tribes and rustic remains of early miners and settlers - HCRNA truly offers something for everyone, and much to remember". See: <http://www.fs.fed.us/hellscanyon/overview>.) In short, it is not the HCC that draws recreational users to the area, but the unique attributes of the HCNRA.

Moreover, quantifying the respective use of USFS lands as compared to HCC recreational areas would be difficult and at most speculative. For example, how would one quantify the impacts to the Applicant's parks and roads by visitors whose sole purpose for visiting the area is to recreate within the HCNRA, USFS, BLM or state lands? What standard or mechanism would be used to determine whether visitors to the area result from the marketing efforts of the USFS, Bureau of Land Management (BLM), the states of Idaho and Oregon, or local counties, outfitters and guides, and other organizations? There is no doubt that the entire Hells Canyon area provides unique recreational opportunities and is a national as well as an Oregon and Idaho asset. As such, the various federal and states agencies and entities involved should provide funding to operate and manage their own lands.

USFS3-83

In addition to the above referenced comments on IPC's proposed PM&E's, there are several omissions that the Forest Service maintains should have been addressed in the DLA package:

- IPC proposes no PM&E's for the HCNRA area below Hells Canyon Dam.

- IPC proposes no PM&E's for impacts to trails or trailheads located along the Hells Canyon Reservoir.

- In most of the PM&E's that IPC has proposed, IPC's portion of financial responsibility is listed as a certain "estimated" dollar amount. The Forest Service maintains that for Forest Service sites located on Hells Canyon Reservoir, all costs (site planning, NEPA analysis, capital improvement, and O&M) should be IPC's responsibility. For PM&Es at other locations on NFS lands the Forest Service maintains that IPC's portion should be expressed as a percentage of the total actual costs that will be experienced in the year that the work is done. Identifying an "estimated" amount now is acceptable, but there needs to be additional explanation of what percentage share of the costs of specific work elements will be IPC's responsibility and how inflation and actual costs in the year of work will be covered.

Response

"IPC proposes no PM&E's for the HCNRA…"—The Applicant believes that its existing measures for flow-information monitors below Hells Canyon Dam (section E.5.4.1.1.) and an MOU between the USFS and the Applicant for the Hells Canyon Visitor Center (section E.5.4.1.2.) are adequate and not required in the existing license.

"IPC proposes no PM&E's for impacts to trails…"—The Applicant has proposed enhancement of the litter and sanitation plan (section E.5.4.4.1.2.), enhancement of the Eagle Bar dispersed site (section E.5.4.4.2.1.), and enhancement of the Copper Creek dispersed recreation site (section E.5.4.4.3.2.), which include trailheads along Hells Canyon Reservoir. The Applicant believes that funding for trail enhancements and maintenance should remain the responsibility of the USFS.

"Identifying an "estimated" amount"—The Applicant believes that the USFS should provide the Applicant's suggested percentage share of funding and associated justification.

USFS3-84

> IPC Proposed Operations: The proposed operations flow scenario does not provide minimum flow levels for navigation and other summer recreation uses, summer flow augmentation for anadromous fisheries, sediment replacement for sand beaches and gravels for redds, and limits on daily and hourly river level fluctuations to protect, mitigate or enhance positive attributes of the shoreline of Hells Canyon. IPC needs to propose operations flow scenarios that address a variety of resource needs.

Response

The Applicant believes that its proposed operations do provide and maintain adequate recreational opportunities and resource protection. When considering the minimum flow levels for navigation and other summer recreation uses, proposed operations would be virtually indistinguishable from present and past operations. The USFS is therefore stating that none of the past recreationists have had a “quality” experience. In direct contradiction to this, on page 213 of its DLA comments, the USFS states: “Since the enactment of the HCNRA and Wild and Scenic Rivers designation, the Hells Canyon reach is known for providing quality recreational experiences.” With forty to fifty thousand boaters per year, most of who are repeat visitors (Technical Report E.5-5), it is hard to believe that none of these visitors had a “quality recreation experience.” Additionally, the Applicant suggests that the Hells Canyon reach, in all probability, also provided a quality recreational experience before designation of the HCNRA.

Congress established the HCNRA in 1975. As the Applicant has pointed out in these responses, Congress did not intend that the HCNRA Act be used to control flows in the Snake River. At the time the HCNRA Act was passed, the HCC license contained essentially the same restrictions (minimum flow and ramp rate) on Snake River flows that were proposed in the DLA. In the HCNRA Act, the USFS was charged with maintaining the quality of the recreational experience that made the HCNRA special. Since 1975, the USFS has allowed many commercial outfitters to add and operate boats larger than any used in 1975. During low-flow years, the large boats cannot comfortably operate under the flow conditions that existed before establishment of the HCNRA and continue to date. If there is a problem associated with very large boats and navigation, the

Applicant maintains that the USFS did not fulfill its congressional mandate of maintaining the recreational experience. The increase in the number of larger boats has introduced navigation issues that did not exist in the recreational experience that Congress mandated the USFS to maintain.

USFS3-88

> Memorandum of Understanding between the USFS and the Applicant—This full time staff member does not currently work full time for the Hells Canyon Creek Visitor Station, nor does this staff member work full time for Hells Canyon NRA related issues. This proposal would provide additional services based on year round staffing. The MOU that is currently in place serves as an interim measure until the new license is issued. The Forest Service maintains that this PM&E measure should be included as a requirement of the new license.

Response

See modifications to the proposed PM&E measure about continuation of the MOU between the USFS and the Applicant (section E.5.4.1.2.). Wording used in the DLA unintentionally implied that this employee would be available to the USFS full time.

In 1999, the Applicant provided an employee to assist in staffing the Hells Canyon Visitors Center. This employee provides the same services as those provided by two USFS staff at the site. Providing additional human resources at this facility would allow all three on-site employees to dedicate more time to providing education about natural resources, history, boating etiquette, the HCC, and recreation facilities and opportunities in the area. The Applicant would continue to implement the existing MOU with the USFS and employ one person, full time from May through October and part time November through April, at the Hells Canyon Visitors Center as currently established.

USFS3-90

> Continuation of Road Maintenance—The Hells Canyon Road receives substantial traffic including public usage. Although this is a private road, the safety of the public is of great importance to the Forest Service. This road should be maintained at a level equal to a Forest Service Traffic Service Level B, Maintenance Level 4, FSH 7709.56. Road Pre-construction Handbook, and meet all MUTCD (Manual Uniform Traffic Control Devices) standards that are required for roads of similar vehicular use and speed. (E.5.4.3.1.4/E.5.4.4.1.6. Continuation of Road Maintenance).

Response

Providing safe access is also of great importance to the Applicant. It is difficult to respond to the USFS, as it did not provide the Applicant with these maintenance level documents. The Applicant believes that the level at which it has provided and will continue to provide safe and reasonable access for the public on Hells Canyon Road is adequate, irrespective of whether federal guidelines and standards are met.

In section E.5.4.4.1.6. the Applicant proposes to develop a road management plan in consultation with county, state, and federal agencies. The plan would include three elements: best management practices, a road atlas, and a public information program to reduce vehicle collisions with big game animals.

The first element would identify and implement best management practices for maintenance of roads that are under the Applicant's jurisdiction. Best management practices for road maintenance would address ongoing maintenance concerns regarding cultural resources, noxious weeds, sensitive plants, threatened and endangered species, soil erosion, and aquatic resources. The Applicant would implement best management practices during regularly scheduled road maintenance.

The second element of the plan would develop a road atlas from a geographic information system. The atlas would contain spatially based information regarding roads and sensitive resources. The atlas would enable spatial and temporal analyses of existing and proposed road maintenance activities in relation to at-risk resources and thereby help to reduce conflicts between road-related activities and sensitive resources. Examples of potential conflicts include roadside application of herbicide near rare plant populations and road construction projects near active bald eagle nests.

The third element of the plan would address a program for increasing public awareness of vehicle collisions with big game along Applicant-maintained roads. This element would help reduce one source of big game mortality and increase public safety.

USFS3-91

> Recreation Adaptive Management Plan-Additional detail is needed on how the RAMP would work (especially the agency consultation process), how decisions would be made and also how specific triggers for needed action would be developed, what those triggers may be, and how they would be used as a decision tool. For further discussion, see the Forest Service comments on the DLA, page 186 of this document.

Response

The Applicant believes that its proposed RAMP (section E.5.4.4.1.5.) is adequate for accommodating recreation needs throughout the new license period. See the associated table and figure for details regarding the monitoring and plan schedule. Further details regarding the Applicant's proposed RAMP would be developed during consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. Costs provided are the Applicant's proposed funding limits, and recreation needs identified through the RAMP would be prioritized based on the level of need and proposed funding limits. O&M costs proposed are for RAMP monitoring efforts.

USFS3-92

> A Preliminary Design Report should be developed for each site that requires development in this zone. This report would be developed in consultation with and approved by the appropriate agencies. This report would develop objectives that would carry out the Zone 1 vision statement developed by the RARWG. This report would include a vision statement for the site, goals and objectives, landscape design goals and objectives, a list of needed facilities with quantities, and a justification statement. Once this report is developed and approved, the conceptual design should be developed and approved. Then construction drawings and contract would be prepared. Concurrently, the processes required by NEPA would be ongoing if the site is managed by a public agency. Construction drawings and contracts for sites must be approved by the appropriate line officer, forest engineer, and forest landscape architect. The preliminary design report should be required for development in all zones. (E.5.4.4.2. Proposed Measures for Zone 1)

Response

The Applicant disagrees with the USFS proposal that the Applicant develop a preliminary design report for recreation development on federal lands. The Applicant would consult with land managers to develop recreation site plans. The USFS would be welcomed to utilize these plans to develop any further products required by internal processes of the USFS. Recreation site plans developed by the Applicant for dispersed recreation sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (i.e., hardening sites, restricting access, using native plant materials). The Applicant believes that it is responsibility of the USFS to conduct environmental and NEPA analysis on its lands, as that is a federal action. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by an agreed-upon site plan.

USFS3-94

> IPC should have the financial responsibility for site planning, NEPA analysis, capital improvement, and O&M costs for the Forest Service sites located on the Hells Canyon Reservoir. The rationale for IPC having full responsibility is because nearly all of the recreation use occurring at these sites is directly linked to the HCC project operations. Technical Reports E.5-2 and E.5-4 provide study findings that strongly support this linkage of recreation use with the HCC project.

Response

The Applicant's measures are based on agency input, need for facility upgrades and improvements, study results, enhanced access needs, and resource protection.

The Applicant believes that its comprehensive proposed Recreation Plan (section E.5.4.4.) is adequate for the following reasons. The Applicant's intention would be to fund all reasonable and agreed-upon elements of proposed plans. The Applicant would encourage the USFS and other appropriate agencies/entities to obtain possible grant monies to assist, where possible, in these efforts. The Applicant would consult with land managers to develop recreation site plans. The USFS would be welcomed to utilize these plans to develop any further products required by internal processes of the USFS. The Applicant believes that NEPA analysis should be conducted by the appropriate federal land managing agency, as that is a federal action. Recreation site plans developed by the Applicant for dispersed recreation sites on federal lands, in consultation with the appropriate agency, would incorporate wildlife and habitat protection measures (i.e., hardening sites, restricting access, using native plant materials). The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by an agreed-upon site plan. See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) for the linkage between issues, study results, agency consultation, and PM&E development.

Additionally, interspersed throughout the USFS and BLM comments is the assertion that the existence of the HCC project causes additional recreational uses on USFS, BLM, or other agency, lands that are either within or near the project area and that these uses would not occur except for the existence of the HCC. The agencies further assert that such uses have an impact on their operating and maintenance costs which should be borne by the Applicant. This assertion of Applicant responsibility for "induced use" seems disingenuous, particularly in light of the purposes for which the USFS and BLM manage the federal lands around the HCC. All of the national federal lands in the vicinity of the HCC are managed by the USFS and BLM for multiple uses, including recreation.

Moreover, in 1975, Congress created the Hells Canyon National Recreation Area (HCNRA), setting aside more than 650,000 acres consisting of wilderness areas, wild and scenic river segments, and dispersed and developed recreational areas and forest management areas. While a primary purpose of the HCNRA Act (P.L. 94-199, 1975) was to preserve the lands and waters that the Act specifically set aside, it was also intended to enhance recreational opportunities and the public enjoyment of the area. So while the USFS generally manages national forest lands for recreational use, consistent with its multiple use philosophy, Congress in enacting P.L. 94-199 apparently envisioned that more recreational use would occur within the HCNRA than within forest lands generally reserved under the 1897 Organic Act (as supplemented by the 1960 Multiple Use Sustained Yield Act—MUSYA). In fact, the USFS encourages recreational use within the HCNRA through mediums such as a USFS website dedicated solely to the HCNRA (where the USFS emphasizes that the HCNRA provides "Exciting recreational opportunities. Diverse and abundant wildlife. Artifacts from prehistoric tribes and rustic remains of early miners and settlers - HCRNA truly offers something for everyone, and much to remember". See: <http://www.fs.fed.us/hellscanyon/overview>.) In short, it is not the HCC that draws recreational users to the area, but the unique attributes of the HCNRA.

Moreover, quantifying the respective use of USFS lands as compared to HCC recreational areas would be difficult and at most speculative. For example, how would one quantify the impacts to the Applicant's parks and roads by visitors whose sole purpose for visiting the area is to recreate within the HCNRA, USFS, BLM or state lands? What standard or mechanism would be used to determine whether visitors to the area result from the marketing efforts of the USFS, Bureau of

Land Management (BLM), the states of Idaho and Oregon, or local counties, outfitters and guides, and other organizations? There is no doubt that the entire Hells Canyon area provides unique recreational opportunities and is a national as well as an Oregon and Idaho asset. As such, the various federal and states agencies and entities involved should provide funding to operate and manage their own lands.

USFS3-96

> Seasonal occupancy levels need to be reported annually for the parks and campgrounds in the HCC, to develop trend information. During the license period, we anticipate that campground occupancy levels and crowding concerns will be a key trigger point in determining the future needs for additional development at Big Bar. See the Forest Service review of Technical Report E.5-8 for further explanation and for a description of a possible method to gather the data annually using campground fee information.

Response

The USFS is contradicting itself. The following is USFS3-40 comment:

> The data used in the study was from actual recreational use surveys, and the Forest Service realized it is probably not practical to have this type of sample survey every year. But if campground fee envelopes and receipts are continually collected and summarized by park personnel, it should be relatively easy to track, summarize, and report occupancy levels. This level of monitoring should be completed and reported each year.

The Applicant points out that the very large majority of camping areas in the HCC (including Big Bar) are not fee areas and that the Applicant does not manage or have any jurisdiction over the majority of camping areas in the HCC.

The RAMP (section E.5.4.4.1.5.) includes plans to report annually on use at parks operated by the Applicant. The Applicant can make no commitment to report annually on use levels at parks and campgrounds operated by other entities. For such an effort to be successful and the results to be meaningful, several potentially difficult problems would have to be solved:

- Use information would potentially come from multiple management entities: the Applicant, two USFS entities with multiple camping areas, two BLM entities with multiple camping areas, one state park, and one county park. Since the Applicant does not have any jurisdiction over other entities' facilities, the Applicant would not be held responsible for the actions (or inactions) of other entities. Any action related to this request would need to be independent of FERC license requirements.

- To provide meaningful results, there would have to be agreement on a consistent method of obtaining and reporting the information. Methodologies would need to be based on valid sampling techniques (with no component based on professional judgment) and consistent across all sites.

Further details of monitoring efforts associated with the RAMP would be developed during consultation with agencies and entities, as deemed appropriate by FERC, upon the Applicant's receipt of a new license.

Idaho Department of Fish and Game comment letter, dated January 10, 2003
IDFG1-114

> Big Bar Development—We recommend the management priority for this unique site be for wildlife instead of intensive recreation. Presently, the site provides important habitat for wintering mule deer, waterfowl, and other wildlife during spring and summer. Development and operation of the Hells Canyon Complex has permanently impacted substantial acreage of critical low elevation winter habitat for wildlife. The IDFG strongly cautions against intensive recreation development at this site. Another important factor to consider is that human development in winter range generally leads to adverse human-wildlife conflicts. Wildlife generally suffers the brunt of the negative impacts. It places the IDFG in a very difficult situation of having to deal with wildlife depredations in remote locations.

Response

Any actions taken at Big Bar must fall under USFS management direction and consultation. The Applicant has no management jurisdiction at Big Bar. The Applicant's proposed measures for Big Bar were USFS recommendations and an objective in the Payette National Forest Land Management Plan.

IDFG1-116

> Enhancement of Spring Recreation Site—The IDFG believes that a breakwater needs to be built at the Spring boat ramp for safety and to allow shoreline mooring.

Response

The Applicant would develop a detailed site plan for the proposed enhancement of Spring Recreation Site (section E.5.4.4.5.3.) in consultation with the BLM and any other agency determined by FERC upon the Applicant's receipt of a new license. Reconstructing the boat ramp has been identified in the proposed measure. A breakwater may or may not be necessary.

Idaho Department of Parks and Recreation comment letter, dated January 10, 2003

IDPR1-5

> We do not support the applicant's proposal for a minimum flow of 5,000 cfs out of Hells Canyon Powerhouse (HCP) and a ramp rate limit of one foot per hour measured at Johnson Bar (B.3.1.). According to E.1-4 Chapter 3, page 12, "A minimum flow of 6,500 cfs below Hells Canyon Dam is modeled by CHEOPS to represent the agreement between IPC and the COE initially dated September 1988. This agreement was entered into to maintain navigation flows below the project. However, IPC's license stipulates a minimum flow of 5,000 cfs below Hells Canyon Dam at Johnson Bar. Depending on water conditions, flows below 6,500 cfs may be released below Hells Canyon Dam if 13,000 cfs is maintained at Lime Point." This

> proposed change would have negative effects on both float and motorized boating, as detailed in E.5-7. We support a minimum flow of 6,500 cfs from HCP to maintain navigational flows.

Response

Although the Applicant typically releases a minimum flow of 6,500 cfs below Hells Canyon Dam, the current minimum flow license constraint and the Applicant's proposed license constraint is 5,000 cfs to accommodate atypical conditions. Exhibit B has been updated to clarify minimum flow requirements and identify conditions under which operations would necessitate a minimum flow less than 6,500 cfs.

Technical Report E.5-7 addresses user preferences. User preferences alone cannot dictate overall operations of the HCC. User preferences must be weighed against the broader context of the public interest where operating for recreation preferences undermines the power benefits of the project to the region. The USFS controls and manages, through management decisions and permitting processes, the amount and type of use in the HCNRA. Generally, the numbers of users have not declined, so it is not clear whether there is any significant effect due to fluctuation of flows, or minimum flow specifically. Notwithstanding identified user preferences, opportunities in the HCNRA continue to provide quality experiences. Since the proposed 5,000 cfs minimum flow for atypical operational needs is not a deviation from past protocol, the Applicant does not expect negative effects that would diminish recreation experiences.

IDPR1-20

> Regarding E.5.4.4.1.5 Recreation Adaptive Management Plan, Idaho's 2003-2007 Statewide Comprehensive Outdoor Recreation and Tourism Plan calls for the adoption of "standard measures and database parameters for outdoor recreation research in Idaho in order to establish trends." Accordingly, IDPR requests that IPC consult with the agency's Outdoor Recreation Data Center when developing survey instruments and measures to assure that data gathered at Hells Canyon Complex sites can be readily compared with data gathered in other research efforts. Further, we request that future research includes not only current recreation

> users, but the general population of Southwest Idaho, in order to gauge latent recreation demand.

Response

"Regarding E.5.4.4.1.5.…in other research efforts"—The Applicant would develop the recreational use monitoring methodologies for the RAMP in coordination with several agencies and entities.

"Further, we request that…gauge latent recreation demand"—The Applicant would conduct studies that result in information necessary to properly manage recreational use in the HCC.

IDPR1-23

> IDPR supports the proposed action in E.5.4.4.2.2 Restriction of Public Access to Redfish Cave. We believe, however, that some additional efforts to revegetate the obliterated trail may be needed beyond year three of the license. If the cave itself remains open, the public is likely to continue trampling vegetation and creating unauthorized trails.

Response

In USFS comments to the DLA, the USFS requested that the Applicant's proposed restriction of public access to Redfish Cave (section E.5.4.4.2.2.) not be included in this final license application and that proposed funds be reallocated to other measures. The Applicant was surprised since this measure was a USFS recommendation and rated high by the RARWG. The Applicant has responded to this request from the USFS by removing this measure from the application.

Oregon Department of Fish and Wildlife comment letter, dated January 10, 2003

ODFW3-50

> ODFW requests that access to the Stud Creek Trail be improved similar to the stairway and railings provided on the Idaho side of the river.

Response

The Applicant disagrees with the ODFW recommendation. The USFS manages this trail and has not raised similar concern. This portion of river is designated as wild. Materials and structures such as those on the Deep Creek Trail may not be appropriate. The USFS would have to give final approval of any maintenance or improvements to this trail.

ODFW3-56

> Coordinate development and implementation of BMPs with state and federal agencies: ODFW, IDFG, USFS, BLM, USFWS, and NMFS. Identify how $10,000 will be spent.

Response

See modifications made to the Applicant's proposed enhancement to road maintenance (section E.5.4.4.1.6.). Annual O&M would increase from $10,000 to $30,000, as modified in this final license application. Further details of this proposed measure would be developed during consultation with the appropriate agencies and entities, and any others as defined by FERC, upon the Applicant's receipt of a new license. Costs provided are the Applicant's best estimates. The Applicant would fund all reasonable and agreed-upon elements of this plan.

ODFW3-57

> The FLA should include a detailed site plan for the dispersed recreation site at Cooper Creek.

Response

The Applicant assumes that the ODFW is referring to Copper Creek instead of Cooper Creek. The Applicant believes that developing a detailed site plan for Copper Creek is premature. A detailed site plan for enhancement of Copper Creek (section E.5.4.4.3.2.) would be developed during consultation with the BLM, and any other agency and entity defined by FERC, upon the Applicant's receipt of a new license. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plan and implementation.

ODFW3-58

> IPC needs to consult with state and federal agencies regarding proposed changes to Hells Canyon Park. Consultation should include ODFW, IDFG, and the USFWS. IPC needs to specify anticipated removal or modification to existing vegetation. No trees should be damaged or removed in reconstructing this park.

Response

The Applicant would consult with all agencies and entities associated with the HCC and any others, as defined by FERC, regarding proposed changes to Hells Canyon Park. The proposed concept for the reconstruction of Hells Canyon Park (section E.5.4.4.3.3.) was developed in consultation with the RARWG, and an effort was made to save as many of the existing trees as possible. Some tree removal may be necessary as a result of poor tree health because of age or disease, public safety concerns (because of falling branches/trees from poor health or weather damage), or park reconstruction.

ODFW3-59

> IPC needs to develop detailed site plans for review by federal and state resource agencies and include such plans and agency comments in the FLA.

Response

The Applicant believes that developing detailed site plans for Airstrip section A and B (section E.5.4.4.3.4.), Bob Creek sections A (section E.5.4.4.3.5.), B (section E.5.4.4.3.6.), C (section E.5.4.4.3.7.), and Westfall (section E.5.4.4.3.8.) are premature. Detailed site plans for these enhancements would be developed during consultation with the BLM, and any other agency and entity as defined by FERC, upon the Applicant's receipt of a new license. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plans and implementation.

ODFW3-60

> IPC needs to consult with state and federal agencies regarding proposed changes to the access sites and recreation areas. Consulted agencies should include ODFW, IDFG, and the USFWS. A detailed site plan needs to be included in the FLA. IPC needs to specify removal or modifications expected to existing vegetation. No trees should be damaged or removed in enhancement of this park.

Response

The Applicant believes that its proposed measures for the Copperfield boat launch area (section E.5.4.4.3.9.), the Oxbow boat launch (section E.5.4.4.3.10.), Carters and Old Carters Landing recreation sites (section E.5.4.4.3.11.), and McCormick Park (section E.5.4.4.3.12.) are adequate. The proposed concept plans were developed in consultation with the RARWG, and an effort was made to save as many of the existing trees as possible. Some tree removal may be necessary as the result of poor tree health because of age or disease, public safety concerns (because of falling branches/trees from poor health or weather damage), or park reconstruction. The Applicant would consult with all agencies and entities associated with the HCC, and any others defined by FERC, regarding proposed enhancements.

ODFW3-61

> IPC's obligation to enhance Hewitt and Holcomb Parks should include operation and maintenance costs for those parks as well.

Response

The Applicant believes that it has a shared responsibility to provide a variety of recreation opportunities in the HCC with all resource agencies associated with the HCC. The Applicant also believes that there is a shared responsibility among the Applicant and these agencies for operating recreation facilities in the HCC in a manner to reduce new or ongoing impacts on fish and wildlife. The Applicant further believes that O&M of Hewitt and Holcomb parks should remain the responsibility of Baker County since the county levies fees at these facilities.

ODFW3-63

> IPC should develop a site plan with Baker County to be included in the FLA. IPC should describe specific measures to be implemented including plans, costs, and implementation schedule. IPC should fund O&M of Hewitt and Holcomb Parks.

Response

The Applicant believes that its proposed enhancement of Hewitt and Holcomb parks (section E.5.4.4.4.1.) is adequate. The Applicant believes that developing a detailed site plan for these enhancements is premature. Further details of this measure would be developed during consultation with Baker County, the appropriate agencies and entities, and any others defined by FERC upon the Applicant's receipt of a new license. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plans and implementation. Costs provided are the Applicant's best estimates. The Applicant would fund all reasonable and agreed-upon construction costs associated with this measure. The Applicant would encourage Baker County to apply for any applicable grant monies associated with this measure and would be willing to assist in this effort. Baker County would be responsible for ongoing O&M for the site since the county levies fees at these facilities.

ODFW3-64

> IPC should develop a final site plan for a suitable boat launch at or near Swede's Landing in cooperation with BLM, Baker County and OSMB for inclusion in the FLA. IPC should include specific measures to be implemented and funding necessary for implementation. IPC should assume full responsibility for funding, developing and implementing the site plan.

Response

The Applicant believes that its proposed development of a low-water boat ramp at or near Swedes Landing (section E.5.4.4.5.1.) is adequate. The Applicant believes that developing a detailed site plan for this measure is premature. The Applicant would develop further details of this measure during consultation with Baker County, BLM, OSMB, and any other agencies defined by FERC. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plans and implementation. Costs provided are the Applicant's best estimates. The Applicant would fund all reasonable and agreed-upon construction costs of this measure. The Applicant would not be responsible for conducting environmental and NEPA analysis on agency lands, as that is a federal action. The Applicant would encourage agencies to apply for appropriate grant monies for this measure and would be willing to assist in these efforts.

ODFW3-65

> IPC should develop a final site plan to enhance Swedes Landing in cooperation with BLM for inclusion in the FLA. IPC should fund development of the site plan and enhancements to Swedes Landing.

Response

See modifications made to the Applicant's proposed enhancement of Swedes Landing (section E.5.4.4.5.2.). The Applicant believes that its proposed measure is adequate. The Applicant believes that developing a detailed site plan for this measure is premature. The Applicant would develop further details of this measure during consultation with BLM and any other agencies defined by FERC. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plans and implementation. Costs provided are the Applicant's best estimates. The Applicant would fund all reasonable and agreed-upon construction costs of this measure. The Applicant believes that it is the responsibility of the BLM to conduct environmental and NEPA analysis on its lands, as that is a federal action. The Applicant would encourage the BLM to apply for appropriate grant monies for this measure and would be willing to assist in this effort.

ODFW3-66

> IPC should develop a final site plan for the Spring Recreation Site in cooperation with the BLM for inclusion in the FLA. IPC should indicate which elements of the plan will be implemented, cost of implementation, time frame for implementation, and funding by IPC.

Response

The Applicant believes that its proposed enhancement of Spring Recreation Site (section E.5.4.4.5.3.) is adequate. The Applicant believes that developing a detailed site plan for this measure is premature. The Applicant would develop further details of this measure during consultation with BLM and any other agencies defined by FERC. Then, present user needs and most recent design standards, construction techniques, and materials could be incorporated into the site plans and implementation. Costs provided are the Applicant's best estimates. The Applicant would fund all reasonable and agreed-upon construction costs of this measure. The Applicant believes that it is responsibility of the BLM to conduct environmental and NEPA analysis on its lands, as that is a federal action. The Applicant would encourage the BLM to apply for appropriate grant monies for this measure and would be willing to assist in this effort.

Oregon Parks and Recreation Department comment letter, dated January 10, 2003
OPRD1-2

Goal—Services

1. Provide sanitation facilities.

    a. Install fish cleaning station $30,000

    b. Replace 1 drain field and septic tank $23,000

2. Provide potable water

    a. Install water treatment $15,118

    b. Install new well and reservoir $50,000

3. Provide adequate maintenance at areas receiving recreation use.

    a. Construct new shop $350,000

    b. Upgrade irrigation system $50,000

4. Provide security and safety measures

    a. (see Access, Goal 2.a)

5. Allow for vendor/concession services and resort opportunities.

6. Provide and enhance education, information and interpretive opportunities.

    a. Renovate existing office into visitors/interpretive/camp store. $44,000

Response

The Applicant acknowledges that the list contains measures to achieve service-related goals at Farewell Bend State Park. The Applicant believes OPRD has incorporated these measures into a "wish list" of potential PM&E measures for Farewell Bend State Park without providing adequate justification. The Applicant believes many of the measures and associated costs described under Goal—Services, such as constructing a new shop ($350,000), are excessive and not related to ongoing operational impacts of the HCC project. The Applicant rejects such goals as measures for inclusion in the FLA. However, the Applicant is willing to continue a dialogue with OPRD to prioritize measures that could be included as cooperative efforts at Farewell Bend State Park. This could occur through the Applicant's proposed RAMP (E.5.4.4.1.5.).

OPRD1-3

Goal—Access

1. Maintain, provide and improve appropriate road access.

    b. Replace 1000 linear feet of roadway curbing. $36,522

2. Maintain, provide and improve appropriate water access.

    a. Restore/protect shoreline $500,000+ (Terrestrial PM&E?)

c. Construct riverside trail $20,000

7. Maintain, provide and improve other appropriate land based access.

a. Overlay existing asphalt trails $19,875

Response

The Applicant acknowledges the list of measures to promote access-related goals at Farewell Bend State Park. The Applicant believes OPRD has incorporated these measures into a "wish list" of potential PM&E measures for Farewell Bend State Park without providing adequate justification. The Applicant believes many of the measures and associated costs described under Goal—Access, such as replace 1000 linear feet of roadway curbing ($36,522), are excessive and not related to ongoing operational impacts of the HCC project. The Applicant rejects such goals as measures for inclusion in the FLA. However, the Applicant is willing to continue a dialogue with OPRD to prioritize measures that could be included as cooperative efforts at Farewell Bend State Park. This could occur through the Applicant's proposed RAMP (E.5.4.4.1.5.).

OPRD1-4

Goal—Facilities

1. Provide land-based facilities.

a. Construct picnic shelter in day use area. $53,000

b. Construct registration/office building $206,859

c. Construct playground $33,124

2. Provide water-based facilities.

Response

The Applicant acknowledges the list of measures to promote facilities-related goals at Farewell Bend State Park. The Applicant believes OPRD has incorporated these measures within their goals into a "wish list" of potential PM&E measures for Farewell Bend State Park without providing adequate and detailed justification. The Applicant believes many of the measures and associated costs described under Goal—Facilities, such as construct registration/office building ($206,859), are excessive and not related to ongoing operational impacts of the HCC project. The Applicant rejects such goals as measures for inclusion in the FLA. However, the Applicant is willing to continue a dialogue with OPRD to prioritize measures that could be included as cooperative efforts at Farewell Bend State Park. This could occur through the Applicant's proposed RAMP (E.5.4.4.1.5.).

OPRD1-5

Goal—Recreational Opportunities

1. Provide opportunities for land based recreational use.

    a. Replace 52 RV electrical hookups in Campground A $171,124

2. Provide opportunities for water based recreational use.

    a. (see Access, goal 2.a)

    b. Install handicapped access fishing piers (2) $75,000

    c. Install weir or dike to protect boat launching area and users $70,000

Response

The Applicant acknowledges the list provided are goals related to recreational opportunities at Farewell Bend State Park. The Applicant believes OPRD has incorporated these measures within their goals into a “wish list” of potential PM&E measures for Farewell Bend State Park without providing adequate and detailed justification. The Applicant believes many of the measures and associated costs described under Goal—Recreational Opportunities, such as replacement of 52 RV electrical hookups in Campground A ($171,124), are excessive and not related to ongoing operational impacts of the HCC project. The Applicant rejects such goals as measures for inclusion in the FLA. However, the Applicant is willing to continue a dialogue with OPRD to prioritize measures that could be included as cooperative efforts at Farewell Bend State Park. This could occur through the Applicant’s proposed RAMP (E.5.4.4.1.5.).

Oregon State Marine Board comment letter, dated January 6, 2003
OSMB1-12

> Boating law enforcement and safety services—The Board has provided a consistent level of assistance on an escalating scale over the years to enable an on-water enforcement and safety presence within the Hells Canyon Project. But our ability to meet the growing need for enforcement and safety services statewide is limited because of revenue constraints and other factors. In particular, you will notice that no funds are budgeted in current contracts to address capital outlay needs. This has been the case for the past few years, as the purchase of new boats and engines has had to be deferred due to funding limitations. While the Board intends to continue to support local marine patrol efforts associated with the Hells Canyon Project at near-current levels, we believe that patrol efforts are not adequate and that the Applicant should provide annual funding to complement boating law enforcement and safety services made possible with Marine Board contracts.

Response

The Applicant is proposing to continue its existing program for local law enforcement (section E.5.4.3.1.3.) and is proposing an additional program (section E.5.4.4.1.4.) to address public safety issues related to the HCC, and are adequate given the Applicant's ongoing involvement in providing resources for and supporting emergency services. These measures will complement boating law enforcement services made possible by OSMB in the HCC. Future law enforcement needs would be identified and addressed through the Applicant's proposed law enforcement program and its proposed RAMP (E.5.4.4.1.5.). Combined, these measures provide for continued law enforcement presence at necessary levels.

Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how emergency services are provided, and of the Applicant's involvement in providing and supporting emergency services in Hells Canyon.

In section E.5.4.5., see response to BLM2-67 for discussion regarding Idaho and Oregon tax code, response to BLM2-77 for discussion regarding the Applicant's property taxes paid to applicable Idaho and Oregon counties, and response to USFS2-217 for discussion regarding the Applicant's law enforcement MOU and the Applicant's emergency services contributions.

For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

OSMB1-13

> Specifically, we foresee the need to expand existing enforcement efforts and upgrade the equipment available to county marine deputies and state troopers. Listed below is the

additional marine enforcement effort and estimated costs that the Marine Board believes is needed and the Applicant has the responsibility to underwrite as a part of project enhancement and mitigation measures.

Brownlee Reservoir—To provide an effective marine enforcement and safety presence on Brownlee, patrols need to be expanded to cover the full 25 to 26 weeks during the “warm season” as defined by the Applicant (May 1–October 31) and to provide patrols on more than one portion of the reservoir at a time. This would entail adding two officers who, working together, would patrol the reservoir in coordination with existing efforts of Baker County and Oregon State Police. The additional officers could be additional seasonal deputies hired by Baker County under contract to the Applicant or additional hours of OSP troopers also paid under contract to the Applicant. The desired result would be a dedicated team of two marine officers whose primary responsibility would be patrolling waters within the Hells Canyon Project, adding 496 hours of patrol effort on Brownlee Reservoir and the remainder of their time split evenly between Hells Canyon Reservoir (288 hours) and Oxbow Reservoir (288 hours). The estimated cost for two additional seasonal marine officers is $40,000 per annum adjusted for inflation. An additional $10,000 per annum, with periodic adjustments for inflation, should be contributed by the Applicant for necessary supplies, fuel, maintenance, and other operating costs associated with these positions.

Hells Canyon Reservoir—To provide an effective marine enforcement and safety presence on Hells Canyon Reservoir, patrols need to be expanded to cover the full 25 to 26 weeks during the “warm season” as defined by the Applicant (May 1–October 31) and to increase the frequency and duration of patrols during this time period. The desired result would be a dedicated team of two marine officers who would spend an estimated 288 hours patrolling Hells Canyon Reservoir in coordination with Baker County Sheriff and Oregon State Police marine patrols. The estimated cost is included in the costs associated with Brownlee Reservoir above.

Oxbow Reservoir—To provide an effective marine enforcement and safety presence on Oxbow Reservoir, patrols need to be expanded to cover the full 25 to 26 weeks during the “warm season” as defined by the Applicant (May 1–October 31) and to increase the frequency and duration of patrols during this time period. The desired result would be a dedicated team of two marine officers who would spend an estimated 288 hours patrolling Oxbow Reservoir in coordination with Baker County Sheriff and Oregon State Police marine patrols. The estimated cost is included in the costs associated with Brownlee Reservoir above.

Snake River (below HC dam)—To provide an effective marine enforcement and safety presence on the Snake River below Hells Canyon Dam, patrols need to be expanded to cover the primary floating season (mid May to mid September) and to increase the frequency and duration of patrols during this time period. The desired result would be a dedicated team of two marine officers who would spend an estimated 576 hours patrolling the Snake River below Hells Canyon Dam in coordination with USFS HCNRA, Wallowa County Sheriff and Oregon State Police marine patrols. The estimated cost for two additional seasonal marine officers is $20,000 per annum adjusted for inflation. An additional $5,000 per annum, with periodic adjustments for inflation, should be contributed by the Applicant for necessary supplies, fuel, maintenance, and other operating costs associated with these positions. Also, an estimated $60,000 should be supplied for the initial purchase of a suitable jet boat to serve as a platform for the marine officers, with full replacement costs to be paid at periodic intervals through the life of the license.

Snake River (above Farewell Bend SP)—To provide an effective marine enforcement and safety presence on the Snake River above Farewell Bend State Park, patrols need to be expanded cover the full 25 to 26 weeks during the “warm season” as defined by the Applicant (May 1–October 31) and to increase the frequency and duration of patrols during this time period. The desired result would be a dedicated team of two marine officers who would spend an estimated 576 hours patrolling the Snake River above Farewell Bend State Park in coordination with Malheur County Sheriff and Oregon State Police marine patrols. The estimated cost for two additional seasonal marine officers is $20,000 per annum adjusted for inflation. An additional $10,000 per annum, with periodic adjustments for inflation, should be contributed by the Applicant for necessary supplies, fuel, maintenance, and other operating costs associated with these positions. Also, an estimated $45,000 should be supplied for the initial purchase of a suitable jet boat to serve as a platform for the marine officers, with full replacement costs to be paid at periodic intervals through the life of the license.

Recommendation:

The Applicant should provide details of the “existing agreement” referenced in the draft application and specify how the proposed estimated annual O&M cost of $60,000 would be utilized.

The Applicant should make additional significant contributions to improve and enhance the overall boating safety and law enforcement efforts made by law enforcement agencies based in Oregon and in conjunction with the efforts of agencies based in Idaho as well as those of federal agencies with responsibilities in the Hells Canyon Project. This contribution should take the form of direct support for the three county sheriffs’ marine patrol programs and/or the Oregon State Police Fish & Wildlife Division marine patrol functions. Support is intended to complement existing and future services by effectively increasing the on-water patrols of the waters in the Hells Canyon Project. All additional marine officers should be certified through the Marine Board’s Marine Safety and Law Enforcement Academy. The detail supporting this recommendation can be found in the narrative above.

Response

The Applicant strongly disagrees with OSMB conclusions and recommendations. The OSMB attended one out of 57 RARWG meetings and 5 field trips. In light of this, the Applicant believes that this disconnection from the process has resulted in the OSMB’s inappropriate recommendations. The OSMB has recommended inappropriate and excessive measures within the HCC and additional measures far beyond the project boundaries and not associated with the HCC. The Applicant requests that the OSMB share with all members of the RARWG and FERC specific justification for each recommendation.

The Applicant believes its existing and proposed law enforcement measures (section E.5.4.3.1.2. and E.5.4.4.1.4.) are adequate given the Applicant’s ongoing involvement in providing resources for and supporting emergency services. Various agencies have stated in their comments that the Applicant is not adequately supporting emergency services in the canyon, and that FERC should require additional mitigation from the Applicant for demands on emergency services resulting from its employees living in the canyon and for tourists and recreationists drawn to the canyon by the HCC. The comments clearly indicate that individuals and agencies are not fully aware of how emergency services are provided, and of the Applicant's involvement in providing and supporting emergency services in Hells Canyon.

In section E.5.4.5., see response to BLM2-67 for discussion regarding Idaho and Oregon tax code, response to BLM2-77 for discussion regarding the Applicant's property taxes paid to applicable Idaho and Oregon counties, and response to USFS2-217 for discussion regarding the Applicant's law enforcement MOU and the Applicant's emergency services contributions.

For more information about emergency services and public safety, see Appendix 3 in the Consultation Appendix, section VII.

OSMB1-14

> The Applicant should assume a leadership role in convening and running the biannual law enforcement meetings proposed in this measure. The Applicant should involve all affected law enforcement agencies in the proposed biannual meetings. The Applicant should also invite other affected state and federal agencies that have an interest in law enforcement to participate in the proposed biannual meetings. The Applicant should provide an adaptive management approach to the law enforcement program and devise a means to fund the changes. The Marine Board recommends that the Applicant consider timing the proposed biannual meetings to precede and to follow the main warm recreation season.

Response

The Applicant would take a leadership role in facilitating biannual law enforcement meetings and provide a meeting place. The Applicant believes that its proposed law enforcement program (section E.5.4.4.1.4.) is adequate. The goal of this enhancement measure is to coordinate the prioritization of resource use among appropriate law enforcement agencies in the vicinity of the HCC. Further details of the law enforcement program and the RAMP (section E.5.4.4.1.5.) would be developed in consultation with law enforcement agencies, and any others as defined by FERC, upon the Applicant's receipt of a new license for the HCC. See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) for the linkage between issues, study results, agency consultation, and PM&E development.

OSMB1-15

> The Marine Board supports the Applicant's proposal to assess boat moorage needs in the project area and to prepare a plan conducted in cooperation with counties and agencies, along with implementation of the plan. It is not clear, however, what type of moorage needs the plan is intended to address. Boaters need to have loading and unloading structures associated with launch sites.
>
> These typically are wooden floats intended for temporary, short-term use by boaters as they launch or retrieve boats at ramps. There is a need for this type of support facility at each launch site—a need that does not necessarily have to be included as a part of the study—and should be considered basic improvements that satisfy minimum standards for boater safety and convenience. It is not clear whether these "boarding floats" are intended to be included in the scope of the "plan".
>
> In addition to boarding floats, boaters can benefit from moorage facilities located at various points along a linear waterway or large reservoir where they can tie-up for a period of time, either for safe harbor or for overnight stays. These needs can be met using wooden floats or mooring buoys. Typically, these "transient" moorages are intended to be used by boaters for up to 72 hours only. The Marine Board supports including transient moorage facilities in the scope of the proposed plan. However, the measure as proposed does not clearly explain what type of moorage the plan is intended to address.
>
> The Marine Board has identified the following boat-in sites where transient moorage could be provided along with upland sanitation; estimated costs in current dollars are also shown:

Cove boat-in	Add transient tie-up, piles and composting toilet.	$91,000
Aspen boat-in	Add transient tie-up, piles and composting toilet.	$91,000
Connor Creek	Add boarding floats, piles and composting toilet, water well.	$75,000
North Island boat-in	Add transient tie-up, piles and composting toilet.	$91,000
Ashby Creek	Add boarding floats, piles and composting toilet.	$57,000
Powder Point boat-in	Add transient tie-up, piles and composting toilet and water.	$93,000
Snake River Mine boat-in	Add transient tie-up, piles and composting toilet.	$91,000

The measure also refers to "angling access" as a part of the proposed plan. It is not clear whether the Applicant intends to study the need for angling access and boat moorage as joint or separate facilities. It is also not clear whether angling access refers to bank or pier angling or angling from boats. It has been the experience of the Marine Board that angling from transient floats or boarding floats should not be encouraged. A person angling from a boarding float or transient float can effectively deny or discourage boaters from accessing the float, frequently resulting in confrontations.

Also, as in many of the measures where plans are proposed, the Applicant identifies an estimated cost amount for plan implementation. Without knowing what results the plan will produce, the Applicant's estimate essentially represents a ceiling amount the Applicant appears to be willing to contribute towards plan implementation. This amount may or may not adequately cover the costs associated with facilities recommended in the completed plan. If the estimate and contribution of the Applicant were below actual costs, then the cost of fully implementing the plan would presumably fall on "counties and agencies." If counties and agencies were unable to pay for elements of the plan that the Applicant does not fund, then the plan would not be fully implemented.

It is also unclear whether the review of the boat moorage plan in year 15 could result in additional funding being provided by the Applicant.

Recommendation:

The Marine Board recommends that the Applicant further clarify the scope and intent of the proposed plan. As a part of the final application, the Applicant should reevaluate boating proposals at all sites in the project area and determine whether basic boarding floats either exist or are included as a part of proposed measures. This review does not need to be included as a part of the proposed boat moorage plan and any results should be incorporated as a part of appropriate individual site measures presented in the final application. The Applicant should also recognize in the application that the estimated cost associated with the plan and implementation may be not be adequate and state clearly whether the Applicant or its partners will be responsible for supplying additional funds to fully implement the plan. The Applicant should also indicate whether additional Applicant funding would be contributed as a result of the review in year 15. The Applicant should also clarify the type of "angler access" referred to in the application.

Response

The Applicant has modified its proposed provision of boat moorage on HCC reservoirs (section E.5.4.4.1.1.) and believes that it is adequate. Additional boat-mooring needs would be developed through the Applicant's proposed RAMP (section E.5.4.4.1.5.). Further details of the provision of boat moorage and the RAMP would be developed through consultation with appropriate agencies and counties and any others defined by FERC upon the Applicant's receipt of a new license for the HCC. Costs provided are the Applicant's best estimates, and its intention would be to fund all reasonable and agreed-upon elements of proposed plans. The Applicant would encourage appropriate agencies and counties to obtain possible grant monies to assist, where possible, in these efforts.

The Applicant believes that the OSMB has no justification for these recommendations. The OSMB's 1999–2005 Six-Year Statewide Boating Facilities Plan, on page 59, under Recommendations, says: "Continue to implement a system of additional transient tie-up facilities for non-trailerable boats (over 26 feet) where possible." The same document, on page 2 of the Glossary, defines "transient tie-up" as "short term tie up float, without individual slips, used by non-trailered cruising boats on a first come first serve basis." This plan recommends transient tie-ups with on-shore toilet facilities at five locations on Brownlee Reservoir, including Ashby Creek (Ashby Creek is on Hells Canyon Reservoir), and one on Oxbow Reservoir. Additionally, the plan recommends a ramp, vault toilet, and other amenities at Bob Creek on Hells Canyon Reservoir.

The recommended actions listed in this comment are taken directly from the OSMB plan referenced above. It is obvious from these recommendations and contradictions that the OSMB assembled the referenced OSMB document with no information about the HCC reservoirs or the type of boating use they host. It is easy to understand how sites in different reservoirs can be confused while assembling such comprehensive documents. It is not easy to understand how the OSMB can recommend several very expensive facilities that target nontrailered boats over 26 feet on multiple-day cruises (houseboats) when there is only one such boat in the HCC (one privately owned and docked pontoon boat on Hells Canyon Reservoir). The Applicant's surveyors spent thousands of person-days on the HCC reservoirs during the survey period and, other than the one referenced above, never observed a single boat fitting this description.

The OSMB should not recommend facilities when it has little or no understanding of the type of recreational use occurring in the HCC reservoirs.

OSMB1-16

> The Applicant should identify and implement an appropriate approach to collect and dispose of gray water and human waste generated by boaters who use the Hells Canyon Project.
>
> The Marine Board's 2001–2006 Boat Waste Disposal Plan for Coastal and Inland Waters identifies the following needs on the Oregon side of the Hells Canyon Project:
>
> Farewell Bend State Park—New dump station with landside holding tank and utility extension. Estimated cost in 2001 dollars $12,500.

Hewitt Park—New pumpout and dump station combination with municipal sewer hook-up, landside utility extension, pumpout, tie-up floats, gangway to pumpout and waterside utility extension. Estimated cost in 2001 dollars $82,000.

A BLM site north end of Brownlee Pool—Floating restroom. Estimated cost in 2001 dollars $90,000.

Powder River Arm—Floating restroom. Estimated cost in 2001 dollars $90,000.

Response

The OSMB has overreached with its recommendations and provides no justification for their inclusion. In fact, in most cases the recommendations are inconsistent with existing use and user preferences identified in the Applicant's recreation studies. For example, the OSMB recommendation for pumpout stations and dump stations appear particularly out of place. The OSMB *2001–2006 Boat Waste Disposal Plan*, on page 47 of Section 8 Appendices—Glossary of Terms, defines Pumpout as "stationary device that pumps sewage collected in a boat's holding tank to a municipal treatment facility." Based on this definition, pumpout stations are typically designed for houseboats. Houseboats are not commonly found within the HCC; in fact, there is only one concessionaire's houseboat semi-permanently moored on Hells Canyon Reservoir. This hardly warrants such a measure.

Additionally, the OSMB *2001–2006 Boat Waste Disposal Plan*, on page 46 of section 8 "Appendices—Glossary of Terms," defines "dump station" as "a stationary device that receives sewage collected from a portable carried aboard a boat." Applicant surveyors did not observe any boaters using or carrying this type of equipment.

The recommended actions listed in this comment are taken directly from the OSMB *1999–2005 Six-Year Statewide Boating Facilities Plan*. It is apparent from these recommendations and contradictions that the OSMB assembled the referenced OSMB document with little or no information about the HCC reservoirs or the type of boating use they host. Consequently, there is no basis for the OSMB recommending these very expensive and unnecessary facilities that target houseboats and a type of portable equipment not used by HCC boaters.

Finally, the OSMB recommendations are completely out of step with discussions that took place within RARWG regarding types of facilities and management objectives for the HCC area. In light of this, the Applicant requests the OSMB share with all members of the RARWG and the FERC specific justification for each recommendation. The Applicant also requests that OSMB clarify contradictions between its *1995 Vessel Waste Disposal Plan* and its *1999–2005 Six-Year Statewide Boating Facilities Plan* regarding floating toilets and land-based vault toilets recommended at the same site (Powder River Arm and north end of Brownlee Pool).

OSMB1-17

> If CVA funding is reauthorized the Marine Board may be in a position to provide assistance for the purchase and installation of these types of facilities, depending on demand for funds and other priorities statewide. If not, the Applicant should consider incorporating contingency funds as a project mitigation and enhancement measure to address these needs.
>
> In addition, these facilities require frequent maintenance. Floating restrooms need to be deployed for use in warm-weather months and decommissioned and winterized during the off-season. When in place on the reservoir, they need to be serviced by boat and pumped out at regular intervals or hauled to shore for servicing. Pumpouts and dump stations need to be checked and serviced regularly. The Applicant should address the maintenance and replacement costs associated with these facilities.

Response

The Applicant disagrees with the OSMB. Neither the Applicant's study results nor the RARWG, other than the OSMB, identified these needs. See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) for the linkage between issues, study results, agency consultation, and PM&E development. Additional litter and sanitation needs would be identified and developed through the Applicant's proposed RAMP (section E.5.4.4.1.5.).

OSMB1-20

> The Marine Board recommends that the Applicant identify and implement an appropriate approach to collect and dispose of gray water and human waste generated by boaters who use the Hells Canyon Project. The Applicant should consider the needs identified in the Marine Board's Boat Waste Disposal Plan (a copy of which is enclosed) as well as other potential improvements and address maintenance issues relative to any facilities proposed in the application. The Marine Board also urges the Applicant to only utilize foam floatation that is fully encapsulated, as required by Oregon law.

Response

The Applicant believes that its existing and proposed litter and sanitation measures (section E.5.4.3.1.1. and E.5.4.4.1.2.) are adequate. Boat pumpouts, portable human waste dumpstations, or floating restrooms on the reservoirs were not identified as needs by the Applicant's study results or the RARWG, other than the OSMB. The Applicant believes that OSMB recommendations do not fit the types of watercraft and recreational use on HCC reservoirs. See Consultation Appendix, section I, Narrative Summary (Specific Resource Issues: Recreation Resources) for the linkage between issues, study results, agency consultation, and PM&E development. Additional litter and sanitation needs would be identified and developed through the Applicant's proposed RAMP (section E.5.4.4.1.5.).

OSMB1-25

> The Marine Board recommends that the Applicant review all boating improvements proposed on the Oregon side of the project against Marine Board design and layout guidelines. The Applicant should provide assurances in the application that all boating facilities will provide a level of development and design function that are, at the very least, commensurate with

Applicant owned and operated facilities. Where these conditions are not present or programmed in the application, the Applicant should program the resources to assist other public partners in developing and maintaining facilities to this level over the life of the license. Achieving this level of development and maintenance should be provided for in the application and separate from the RAMP.

The Marine Board recommends that the Applicant clarify whether the replacement of aging facilities is an activity that must pass muster through the proposed RAMP process. The Applicant should consider identifying, independent of the RAMP, a replacement schedule and costs for facilities that are most likely to be permanent fixtures at sites throughout the term of the license.

The Marine Board recommends that the Applicant clearly indicate whether funding above the $300,000 for capital costs and $450,000 for O&M every six years, as identified in the application, are subject to revision if the need for additional funds is indicated as part of the RAMP.

Response

Modifications made to the Applicant proposed enhancements at Bob Creek (section E.5.4.4.3.5., E.5.4.4.3.6., and E.5.4.4.3.7.), Westfall (section E.5.4.4.3.8.), Oxbow Boat Launch (section E.5.4.4.3.10.), Carters Landing (section E.5.4.4.3.11.), Swedes Landing (section E.5.4.4.5.1.), and its RAMP (section E.5.4.4.1.5.) are adequate to address short and long-term recreation needs for the HCC. Additional facility needs would be identified and developed through the Applicant's proposed RAMP. Specific details regarding the Applicant's proposed enhancements would be developed through consultation with all counties and land managing agencies or entities associated with the HCC, and others as defined by the FERC, upon receiving a new license. Costs provided are the Applicant's best estimates and its intention would be to fund all reasonable and agreed upon elements of proposed enhancements. The Applicant would encourage appropriate agencies/counties to obtain possible grant monies to assist, where possible, in these efforts. The Applicant believes replacement of aged facilities would be included in its proposed RAMP. The Applicant believes capital and O&M costs proposed in its RAMP are adequate. Costs provided are the Applicant's proposed funding caps, and recreation needs identified through the RAMP would be prioritized based on the proposed funding caps. O&M costs proposed are for RAMP monitoring efforts. Please see modifications made to the Applicant's proposed RAMP (section E.5.4.4.1.5.).

See also the Applicant's proposed measure to perform O&M at Applicant-Enhanced BLM and USFS reservoir-related recreation sites (section E.5.4.4.1.7.). The Applicant proposes to perform recreation O&M services at Eagle Bar, Big Bar Section D, Eckels Creek, Copper Creek, Airstrip Section A, Bob Creek Section C, Westfall, and Swedes Landing. Proposed recreation services to be performed would be limited to those services directly associated with detailed site enhancements, at sites listed, developed in with the appropriate agencies upon receipt of a new license. The Applicant would not assume any responsibility for impacts to resources (wildlife, plants, cultural), nor would it actively enhance habitat at sites not covered by agreed upon site plans.

OSMB1-27

> The Marine Board recommends that the Applicant consider needs for additional boating access on the Oregon side of Hells Canyon Reservoir in the vicinity of Copper Creek.

Response

The Applicant believes any additional boating access on the Oregon side of Hells Canyon Reservoir would be identified during development of site plans for dispersed sites with the appropriate agencies/counties. If necessary, future boating access needs on Hells Canyon Reservoir would be identified and developed through the Applicant's proposed RAMP (section E.5.4.4.1.5.). The Applicant believes boat ramps proposed at Eagle Bar (section E.5.4.4.2.1.) and Big Bar Section D (section E.5.4.4.3.2.) would greatly improve access to Hells Canyon Reservoir.

OSMB1-28

> The Marine Board recommends that the Applicant consider needs for additional boating access on the Oregon side of Brownlee Reservoir. In addition, the Applicant should explain the rationale behind the proposed elimination of boat launching at Bob Creek.

Response

For clarification, Bob Creek section B is on Hells Canyon Reservoir. In developing its six-year plan, OSMB was remiss in not conducting appropriate consultation with the applicable landowners (the Applicant and BLM) and all other appropriate agencies (RARWG). The BLM's Analysis of Management Situation (AMS) does not identify similar needs in the vicinity of Bob Creek. The OSMB attended one out of 57 RARWG meetings and 5 field trips. In light of this, the Applicant believes that this disconnection from the process has resulted in the OSMB's inappropriate recommendations. The Applicant requests that the OSMB share with all members of the RARWG and FERC specific justification for each recommendation. The Applicant believes that reservoir bathymetry, valuable riparian habitat, and the proximity to Copperfield Boat Launch justify the Applicant's proposed enhancements to Bob Creek section B (section E.5.4.4.3.6.). A specific site plan for Bob Creek section B would be developed during consultation with appropriate land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license.

OSMB1-29

> The Marine Board recommends that the Applicant consider needs to improve boating facilities on the Oregon side of Hells Canyon Reservoir at the Westfall site.

Response

The Applicant disagrees with OSMB recommendations. To clarify, there are not currently and never have been any boating facilities at Westfall to be improved. The OSMB attended one out of

57 RARWG meetings and 5 field trips. In light of this, the Applicant believes that this disconnection from the process has resulted in the OSMB's inappropriate recommendations. The BLM's AMS does not identify similar needs at the Westfall site. In developing its six-year plan, the OSMB was remiss in not conducting appropriate consultation with the Applicant and all other appropriate agencies (RARWG). The Applicant requests that the OSMB share with all members of the RARWG and FERC specific justification for each recommendation. The Applicant believes that its proposed enhancements to the Westfall dispersed site (section E.5.4.4.3.8.) are adequate and ranked as high priority by the BLM during the RARWG's potential PM&E development process. The Westfall dispersed site is approximately 0.5 mile from Copperfield Boat Launch. A specific site plan for Westfall would be developed during consultation with appropriate land managing agencies or entities associated with the HCC, and others as defined by FERC, upon the Applicant's receipt of a new license. If necessary, future boating access needs on Hells Canyon Reservoir would be identified and developed through the Applicant's proposed RAMP (section E.5.4.4.1.5.).

OSMB1-32

> The Marine Board recommends that the Applicant include boating facility enhancements and replacements in the scope of items to be considered. Applicant funding to assist with these enhancements and replacements should be included in the application. In addition, the Marine Board recommends that the Applicant share in the cost of maintaining both sites, including boating facilities and include funding for this purpose in the application.

Response

The Applicant believes it proposed enhancements to Hewitt and Holcomb Parks (E.5.4.4.4.1.) are adequate. The amenities included in the description section of this measure (toilet facility and fish-cleaning station at Hewitt Park; and RV campsites with electrical and water hookups, redesigning park layout, improving the day-use area, and providing picnic shelters and a vault toilet at Holcomb Park) address the major issues identified as needing improvement at this site. The Applicant's proposed provision of boat moorage on HCC reservoirs (E.5.4.4.1.1.) would also include Hewitt and Holcomb Parks if needs were identified at these parks during consultation to develop a boat moorage plan. Future needs at Hewitt and Holcomb Parks would be identified and addressed through the Applicant's proposed RAMP (E.5.4.4.1.5.). Specific site plans for Hewitt and Holcomb would be developed during consultation with Baker County, and others as defined by the FERC, upon receiving a new license. The Applicant believes O&M of Hewitt and Holcomb Parks should remain the responsibility of Baker County since it levies fees at these facilities.

OSMB1-33

> The Applicant should ensure the proposed low-water boat launch at or near Swedes Landing is consistent with the Marine Board's layout and design guidelines.
>
> The Marine Board recommends that the Applicant indicate that additional funding to implement the proposal would be sought from various sources, including a potential grant from the Marine Board.

Response

See modifications made to the Applicant's proposed development of the low-water boat launch at or near Swedes Landing (section E.5.4.4.5.1.).

OSMB1-35

> In our review of the draft application material we were unable to locate any proposed mitigation or enhancement measures for Farewell Bend State Park. We are aware that there is a need for a breakwater or similar protection measure to protect the public and the facilities at the boat launch area. Assuming that existing boating facilities are suitable and usable by the public, periodic replacements of floats and piles, resurfacing and replacement of ramps and parking areas and upgrades to restrooms and other support facilities will need to be performed in future years. The Applicant should consider the needs the Oregon Parks and Recreation

> Department at Farewell Bend State Park and propose mitigation and/or enhancement measures for this important recreation resource.

Response

The Applicant believes further consultation is needed with OSMB and OPRD to determine the feasibility of a potential breakwater structure and its location. The Applicant believes existing boating access facilities at Farewell Bend State Park are adequate. The Applicant's proposed provision of boat moorage on HCC reservoirs (section E.5.4.4.1.1.) would also include Farewell Bend State Park if needs were identified at these parks during consultation to develop a boat moorage plan. Future facilities and necessary replacement or renovation of existing facilities at this state park would be identified and addressed through The Applicant 's proposed RAMP (section E.5.4.4.1.5.).

The Applicant acknowledges that the list provided by OPRD contains measures to achieve goals at Farewell Bend State Park. The Applicant believes OPRD has incorporated these measures into a "wish list" of potential PM&E measures for Farewell Bend State Park without providing adequate justification. The Applicant believes many of the measures and associated costs, such as constructing a new shop ($350,000), are excessive and not related to ongoing operational impacts of the HCC project. The Applicant rejects such goals as measures for inclusion in the FLA. Moreover, study results from Technical Reports E.5-2 and E.5-4 do not support such major modifications. However, The Applicant is willing to continue a dialogue with OPRD to prioritize measures that could be included as cooperative efforts at Farewell Bend State Park.

OSMB1-36

> In addition, we could not find any discussion of the potential threats posed by the introduction of invasive aquatic nuisance species-particularly zebra mussel, hydrilla and mitten crab-at the project. These nonnative species have had negative, if not disastrous, impacts on native fish, stream ecology, recreation opportunities, and project facilities in California and other states. A

plan to prevent the introduction of these species and to manage them should be inadvertently introduced needs be developed and implemented.

Response

There is no evidence that HCC operations increase the likelihood of the introduction of invasive aquatic nuisance species and therefore it is the responsibility of the USFWS, ODFW, IDFG, and any other appropriate agencies to develop a plan to prevent the introduction of these species.

E.5.5. Materials and Information on Measures and Facilities

All materials and information regarding existing measures and facilities to be continued by the Applicant are included in section E.5.4.1. and section E.5.4.3. All materials and information regarding measures and facilities proposed by the Applicant are included in section E.5.4.4.

E.5.6. Areas Associated with the National Wild and Scenic Rivers System or Wilderness

Much of the Hells Canyon area downstream and north of Hells Canyon Dam is within the Hells Canyon National Recreation Area (HCNRA), established by Congress with a distinct set of management objectives pursuant to the HCNRA Act in 1975 (Public Law 94-199). Within the HCNRA are a wilderness and several rivers with segments designated as wild, scenic, or recreational. Three wilderness study areas have also been designated in Hells Canyon. However, as explained below, Congress stipulated in the HCNRA Act that the Federal Power Act would continue to apply to projects or portions of projects within the HCNRA that existed before the act was passed. Congress also determined that the implementation of the HCNRA Act, along with the associated designations for wilderness and wild, scenic, and recreational rivers, must not conflict with present and future use of water for power. Finally, Congress prohibited flow requirements of any kind on waters of the Snake River below Hells Canyon Dam.

Section 4. (a) of the HCNRA Act provides:

> Notwithstanding any other provision of law, or any authorization heretofore given pursuant to law, the Federal Power Commission may not license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project work under the Federal Power Act (41 Stat. 1063), as amended (16 U.S.C. 791a et seq.), within the recreation area: Provided, That the provisions of the Federal Power Act (41 Stat.1063) shall continue to apply to any project (as defined in such Act), and all of the facilities and improvements required or used in connection with the operation and maintenance of said project, in existence within the recreation area which project is already constructed or under construction on the date of enactment of this Act.

Sections 6. (a) and 6. (b) of the HCNRA Act provide:

> *Sec. 6. (a):* No provision of the Wild and Scenic Rivers Act (82 Stat. 906), nor of this Act, nor any guidelines, rules or regulations issued hereunder, shall in any way limit, restrict, or conflict with present and future use of the waters of the Snake River and its tributaries upstream of the boundaries of the Hells Canyon National Recreation Area created hereby, for beneficial uses, whether consumptive or nonconsumptive, now or hereafter existing, including, but not limited to, domestic, municipal, stockwater, irrigation, mining, power, or industrial uses.

> *Sec. 6. (b):* No flow requirements of any kind may be imposed on the waters of the Snake River below Hells Canyon Dam under the provisions of the Wild and Scenic Rivers Act (82 Stat. 906), of this Act, or any guidelines, rules, or regulations adopted pursuant thereto.

Thus, the HCNRA Act “grandfathers” the HCC and makes it clear that it is the FPA, and not the HCNRA Act or the Wild and Scenic Rivers Act, that governss HCC operations. The HCNRA Act also establishes two conditions of fundamental importance to the relicensing of the HCC: (1) neither the HCNRA Act nor the Wild and Scenic Rivers Act may be the basis for any condition which in any way would limit, restrict or conflict with the either the present or future use of waters of the Snake River for consumptive or nonconsumptive beneficial uses, including power purposes, and (2) the Act prohibits flow requirements of any kind from being imposed at or below the HCC. The provisions of the HCNRA Act and any accompanying guidelines established to implement the HCNRA Act, as well as the provisions of the Wild and Scenic Rivers Act, are therefore not applicable to the HCC at relicensing. Mitigation for any project impacts within the HCNRA must be determined exclusively under the provisions of the FPA.

E.5.6.1. National Wild and Scenic Rivers System

The Wild and Scenic Rivers Act of 1968 (Public Law 90-542, 82 Stat. 907) was established by Congress to preserve wild, scenic, and recreational values of eligible rivers. A river can be found eligible for the National Wild and Scenic Rivers System only if it is free flowing and has outstanding scenery, recreation, geology, fish, wildlife, history, or cultural values. Rivers meeting the criteria are tentatively classified into one of three categories: 1) wild—unpolluted, free-flowing rivers that are accessible only by trail and that have surroundings essentially undisturbed by humans; 2) scenic—rivers that are accessible in places by roads and that have no impoundments or have largely undeveloped shorelines or watersheds; and 3) recreational—rivers that are readily accessible by roads or railroads and that may have some shoreline developments or may have been impounded or diverted in the past.

Once a river reach is determined eligible, measures are instituted to provide interim protection for the reach. The river is then formally evaluated for inclusion in the National Wild and Scenic Rivers System. Descriptions of river segments found suitable for inclusion in the system are forwarded to Congress for consideration and a decision. Once Congress determines that a segment is to be included in the system, the elements that make the segment outstanding and eligible for inclusion receive special protection.

Section 3 of the HCNRA Act amended the Wild and Scenic Rivers Act to add the Snake River in Idaho and Oregon to the National Wild and Scenic Rivers System. The Omnibus Oregon Wild and Scenic Act of 1988 (Public Law 100-557, 102 Stat. 2782), an amendment to the Wild and Scenic Rivers Act of 1968, designated the Imnaha River, also in the vicinity of the project, as wild and scenic (USFS 1993). Several other river segments in the vicinity of the project are designated wild and scenic, including the South Fork Imnaha River in Oregon and the Rapid River in Idaho. However, these rivers are outside the study area and are not affected by the project.

The "outstandingly remarkable values" of the Snake River corridor that contribute to its designation as a wild and scenic river include the following resources: scenic, recreational, geologic, wildlife, fisheries, cultural, botanical, and ecological (USFS 1999).

The designation of the Imnaha River resulted from Congress's finding that scenic, fisheries, and wildlife values qualified as outstandingly remarkable. Further resource assessment found five additional outstandingly remarkable values: recreation, historic/prehistoric, traditional use/ lifestyle adaptation, and vegetation/botanical resources.

E.5.6.1.1. Waterways Listed as Wild

The segment of the Snake River that forms the boundary between Idaho and Oregon from Hells Canyon Dam downstream to Pittsburg Landing was designated as wild. Figure E.6-3 shows the locations of these wild and scenic river segments; all are within the study area. These rivers are managed under the Wild and Scenic Rivers Act, but they are also subject to the conditions of the HCNRA Act.

The project provides the sole access from the south to the segment of the Snake River below Hells Canyon Dam. The project's operation affects the amount of water in the river at any given time of day.

E.5.6.1.2. Waterways Listed as Scenic

The HCNRA Act also designated the Snake River between Idaho and Oregon, from Pittsburg Landing downstream to "an eastward extension of the north boundary of Section 1, Township 5 north, Range 47 east, Willamette meridian," as a scenic river (Figure E.6-3). The project's operation affects the amount of water in the river at any given time of day.

The lower part of the Imnaha River from the Cow Creek Bridge to the Snake River (approximately 4 mi) was designated by the Omnibus Oregon Act as scenic (Figure E.6-3). No project facilities are in the area, and project operations and maintenance do not affect the river flow.

E.5.6.1.3. Waterways Listed as Recreational

The upper mainstem of the Imnaha River from just above Indian Crossing to Cow Creek Bridge (approximately 63 mi) was designated in the Omnibus Oregon Act as a recreation river (Figure E.6-3). The land along this river segment is about 70% privately owned and therefore not affected by the designation. The recreational opportunities on private land are generally limited to sightseeing and photography (USFS 1993). No project facilities occur along this river (with the exception of Line 945 along the Hells Canyon Reservoir, transmission lines are not included in this license application).

E.5.6.2. Wilderness

The Wilderness Act (16 U.S.C. section 1131) defines a wilderness as

> …an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic or historical value.

Lands suitable for wilderness classification are to be listed by the Secretaries of the Interior and Agriculture, recommended by the President, and acted on by Congress. Once a wilderness area is designated, the managing agency is responsible for maintaining the wilderness character of the area, although the President is authorized to allow some exceptions to wilderness conditions in national forests, including "establishment and maintenance of reservoirs, water-conservation works, power projects, transmission lines, and other facilities needed in the public interest…." Except as otherwise provided in the act, wilderness areas are to be devoted to "the public purposes of recreational, scenic, scientific, educational, conservation, and historical use."

The HCNRA Act provides that the HCNRA is to be managed by the Wallowa–Whitman National Forest. Section 2 of the Act also designated approximately 220,000 acres to the Hells Canyon Wilderness; the boundaries are shown in Figure E.6-3. The HCNRA Act established that the provisions of the Federal Power Act would continue to apply to existing power projects and that neither the HCNRA Act nor the Wild and Scenic Rivers Act would interfere with the existing use of water for power in the area.

E.5.6.3. Wilderness Study Areas

A wilderness study area is an area determined by the Department of the Interior or the Department of Agriculture to have wilderness characteristics. Wilderness study areas are subject to interdisciplinary analyses and public comment to determine their suitability for designation as wilderness. Areas found suitable are recommended by the Secretary of the Interior to the President and Congress for wilderness designation.

The HCNRA Act identified three wilderness study areas in or near the project area, on the Oregon side of the Snake River (Figure E.6-3). The McGraw Creek Wilderness Study Area (designated as OR-6-1) included 1,465 acres at the south end of the HCNRA, just within the Wallowa–Whitman National Forest. In 1984, 968 acres of the McGraw Creek Wilderness Study Area were designated as wilderness, leaving the remaining 497 acres as wilderness study area. (BLM 1989)

The 6,241-acre Homestead Wilderness Study Area (OR-6-2) lies northwest of Pine Creek and to the west of Oxbow dam and reservoir. The Sheep Mountain Wilderness Study Area (OR-6-3) occupies 7,070 acres from north of Brownlee Dam to the south of Oxbow Dam. The Homestead and Sheep Mountain wilderness study areas are managed by the BLM's Baker Field Office, while the McGraw Creek Wilderness Study Area is managed by the Wallowa–Whitman National Forest through a cooperative agreement with the Baker Field Office.

E.5.7. Consultation

For a summary of consultation efforts to date for the HCC, see the Consultation Appendix.

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Table E.5-1 Grouping of categories used to differentiate observed activities during recreational-use counts (from the Applicant's recreational-use surveys conducted in the HCC from 1994 through 2000)

Code	Category Type	Category Grouping
BKA	Bank angler	Bank angling
CPA	Bank angler	Bank angling
DA	Dock angler	Bank angling
DMA	Dam angler	Bank angling
FIT	Angler in transit	Bank angling
FTA	Float tube angler	Bank angling
BTA	Boat angler	Boat angling
FTP	Fishing in transit–boat–people	Boat angling
TRP	Trollers	Boat angling
HTP	Hunter–in boat	Hunting
HTR	Hunter	Hunting
SKP	Water skier	Waterskiing
JSP	Jet skier	Jet skiing
CPL	Camper–lounger	Lounging
LGR	Lounger	Lounging
PBP	Pleasure boater	Water-based miscellaneous
KYP	Kayaker	Water-based miscellaneous
BP	Boater	Water-based miscellaneous
CNP	Canoeist	Water-based miscellaneous
RFP	Rafter	Water-based miscellaneous
PDP	Paddle boater	Water-based miscellaneous
SBP	Sailboater	Water-based miscellaneous
BIP	Bicycler	Land-based miscellaneous
CPP	Picnicker	Land-based miscellaneous
CPU	Camper–load/unload	Land-based miscellaneous

Table E.5-1 Grouping of categories used to differentiate observed activities during recreational-use counts (from the Applicant's recreational-use surveys conducted in the HCC from 1994 through 2000)

Code	Category Type	Category Grouping
FC	Cleaning fish	Land-based miscellaneous
HW	Hiker/walker	Land-based miscellaneous
IDL	Interpretation observer	Land-based miscellaneous
LUB	Load-unload boat	Land-based miscellaneous
MTV	Motorcycler/ATVer	Land-based miscellaneous
PHO	Photographer	Land-based miscellaneous
PK	Picnicker	Land-based miscellaneous
SHR	Target shooter	Land-based miscellaneous
SMR	Swimmer	Land-based miscellaneous
SV	Sports viewer	Land-based miscellaneous
OTH	Other people	Land-based miscellaneous

Table E.5-2 Information for Eagle Bar (EAGL) from dispersed site surveys conducted by the Applicant in the HCC.

Site Information		Amenities
Site Name:	Eagle Bar	Improved parking
Site Code:	EAGL	Boat ramp:
Location	This site is located on the Idaho side of Hells Canyon Reservoir approximately 1.7 mi upstream from Hells Canyon Dam along the Hells Canyon Reservoir Road.	1 gravel ramp at site
Body of water:	Hells Canyon Reservoir	
County:	Adams	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	USFS	
Perimeter Area (acres):	2.82	
Number of Used Areas:	7	
Used Area Acreage:	1.95	
Additional Comments:	The two concrete slabs were part of either a mining operation or the Applicant's dam construction. There is a hand railing with concrete steps leading down to the edge of the reservoir near the middle of the site.	

Table E.5-3 Six statistics associated with counts of vehicles and camping-related equipment at Eagle Bar (EAGL)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	15	5	4	1	0	0
Camp Unit[g]	10	4	2	1	0	0
Car-Pickup	18	5	4	1	1	0
Motorhome	4	1	1	0	0	0
Tent	8	1	1	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-4 The ten sampling days with the highest camping-related equipment counts (camp total) at Eagle Bar (EAGL), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	5	17	15	4	10	1	15
2000	7	22	18	1	2	8	11
2000	5	16	5	4	4	0	8
1997	10	25	2	0	5	1	6
2000	9	2	3	1	1	4	6
1997	6	8	1	3	2	0	5
1997	6	15	1	2	2	1	5
1998	5	11	6	4	1	0	5
1998	5	23	3	1	4	0	5
2000	8	13	5	1	3	1	5

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-5 Information for Big Bar section A (BGBA) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Big Bar section A	None
Site Code:	BGBA	
Location:	This site is located on the Idaho side of Hells Canyon Reservoir approximately 8.7 mi upstream of HC Dam along the Hells Canyon Reservoir Road.	
Body of water:	Hells Canyon Reservoir	
County:	Adams	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	USFS	
Perimeter Area (acres):	9.15	
Number of Used Areas:	6	
Used Area Acreage:	1.06	
Additional Comments:	This site is primarily used for overnight camping, angling, and picnicking.	

Table E.5-6 Information for Big Bar section B (BGBB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Big Bar section B	Hitch rail
Site Code:	BGBB	Boat ramp:
Location:	This site is located on the Idaho side of Hells Canyon Reservoir approximately 9 mi upstream of HC Dam along the Hells Canyon Reservoir Road. It lies between BGBA and BGBC.	One gravel ramp
Body of water:	Hells Canyon Reservoir	
County:	Adams	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	USFS	
Perimeter Area (acres):	6.11	
Number of Used Areas:	10	
Used Area Acreage:	1.01	
Additional Comments:	This site is primarily used for overnight camping, angling, boat launching, and picnicking.	

Table E.5-7 Information for Big Bar section C (BGBC) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Big Bar section C	Vault toilet
Site Code:	BGBC	Cemetery plot
Location:	This site is located on the Idaho side of Hells Canyon Reservoir approximately 9 mi upstream of HC Dam along the Hells Canyon Reservoir Road. It lies between BGBB and BGBD.	
Body of water:	Hells Canyon Reservoir	
County:	Adams	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	USFS	
Perimeter Area (acres):	12.58	
Number of Used Areas:	6	
Used Area Acreage:	1.2	
Additional Comments:	This site is primarily used for overnight camping, angling, and picnicking.	

Table E.5-8 Information for Big Bar section D (BGBD) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Big Bar section D	Vault toilet
Site Code:	BGBD	Improved parking
Location:	This site is located on the Idaho side of Hells Canyon Reservoir approximately 9 mi upstream of HC Dam along the Hells Canyon Reservoir Road. It lies next to BGBC.	Helicopter padDock
Body of water:	Hells Canyon Reservoir	
County:	Adams	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	USFS	
Perimeter Area (acres):	6.66	
Number of Used Areas:	7	
Used Area Acreage:	2.31	
Additional Comments:	This site is primarily used for overnight camping, angling, and picnicking.	

Table E.5-9 Six statistics associated with counts of vehicles and camping-related equipment at Big Bar section A (BGBA)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	21	6	4	2	1	0
Camp Unit[g]	7	3	2	1	0	0
Car-Pickup	21	6	4	2	1	0
Motorhome	2	1	0	0	0	0
Tent	16	5	3	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-10 Six statistics associated with counts of vehicles and camping-related equipment at Big Bar section B (BGBB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	10	6	5	3	1	0
Camp Unit[g]	5	3	3	1	0	0
Car-Pickup	10	7	5	3	1	0
Motorhome	4	2	1	0	0	0
Tent	5	4	3	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-11 Six statistics associated with counts of vehicles and camping-related equipment at Big Bar section C (BGBC)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	12	6	4	2	0	0
Camp Unit[g]	9	4	2	1	0	0
Car-Pickup	12	5	4	2	0	0
Motorhome	2	1	1	0	0	0
Tent	10	4	2	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-12 Six statistics associated with counts of vehicles and camping-related equipment at Big Bar section D (BGBD)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	25	6	4	3	1	0
Camp Unit[g]	14	3	2	1	1	0
Car-Pickup	26	8	6	3	1	0
Motorhome	9	3	2	1	0	0
Tent	8	2	1	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-13 The ten sampling days with the highest camping-related equipment counts (camp total) at Big Bar section A (BGBA), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	5	27	21	0	5	16	21
1998	5	23	17	1	7	4	12
1998	5	28	17	1	7	4	12
1997	7	5	9	0	1	7	8
1997	6	15	5	0	0	7	7
1997	5	17	5	0	1	5	6
1997	6	20	1	0	0	6	6
1998	6	13	5	0	0	5	5
1998	7	30	3	0	4	1	5
2000	7	22	6	0	2	3	5

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-14 The ten sampling days with the highest camping-related equipment counts (camp total) at Big Bar section B (BGBB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	6	15	10	2	4	4	10
2000	5	27	8	2	3	4	9
1998	5	28	7	0	5	3	8
1997	6	20	5	0	5	2	7
1997	8	16	6	0	4	3	7
1997	6	14	5	2	3	1	6
1997	7	5	4	0	1	5	6
1997	7	12	7	0	1	5	6
1997	10	3	2	2	2	2	6
1997	6	13	4	2	3	0	5

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-15 The ten sampling days with the highest camping-related equipment counts (camp total) at Big Bar section C (BGBC), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	26	9	1	2	9	12
1998	5	30	12	2	0	10	12
1997	5	4	6	0	9	2	11
1998	5	23	4	2	5	0	7
1998	5	28	4	2	5	0	7
2000	5	6	4	2	4	0	6
1997	5	10	3	0	1	4	5
1997	7	5	3	0	1	4	5
1998	5	1	3	1	2	2	5
2000	5	27	6	0	2	3	5

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-16 The ten sampling days with the highest camping-related equipment counts (camp total) at Big Bar section D (BGBD), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	23	26	9	14	2	25
1998	5	28	26	9	14	2	25
2000	5	27	14	5	5	8	18
2000	5	30	3	2	1	5	8
1997	6	14	7	4	2	0	6
1997	7	4	7	2	0	4	6
1997	7	5	9	2	0	4	6
1997	6	15	7	4	1	0	5
1997	6	27	4	3	1	1	5
2000	7	8	6	1	2	2	5

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-17 Information for Eckels Creek (EKLC) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		**Amenities**
Site Name:	Eckels Creek	
Site Code:	EKLC	Dock:
Location:	This site is located on the Idaho side of Hells Canyon Reservoir approximately 9.7 mi upstream from Hells Canyon Dam along the Hells Canyon Reservoir Road.	The dock is an old metal one that needs repair.
Body of water:	Hells Canyon Reservoir	
County:	Adams	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	USFS	
Perimeter Area (acres):	0.59	
Number of Used Areas:	1	
Used Area Acreage:	0.26	
Additional Comments:	The site is primarily used for overnight camping, trailhead parking, bank and dock angling.	

Table E.5-18 Six statistics associated with counts of vehicles and camping-related equipment at Eckels Creek (EKLC)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	4	3	2	2	0	0
Camp Unit[g]	4	2	1	1	0	0
Car-Pickup	5	3	2	2	0	0
Motorhome	1	1	0	0	0	0
Tent	4	2	2	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-19 The ten sampling days with the highest camping-related equipment counts (camp total) at Eckels Creek (EKLC), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit	Tent	Camp Total
1998	5	30	4	0	4	0	4
1998	6	13	1	0	3	1	4
1998	7	19	3	0	0	4	4
1998	5	23	1	0	1	2	3
1998	5	28	1	0	1	2	3
1998	5	11	2	0	0	2	2
1998	6	1	2	0	2	0	2
1998	7	16	2	0	0	2	2
1998	10	8	1	0	0	2	2
1998	10	11	0	0	0	2	2

Table E.5-20 Information for Copper Creek (TRHD) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		**Amenities**
Site Name:	Copper Creek	Two vault toilets
Site Code:	TRHD	
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 14.7 mi upstream from Hells Canyon Dam and 4.3 mi downstream from Homestead along the Oxbow-Homestead Road.	
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	6.56	
Number of Used Areas:	2	
Used Area Acreage:	1.22	
Additional Comments:	This site is used primarily for trailhead parking, camping, and fishing access.	

Table E.5-21 Six statistics associated with counts of vehicles and camping-related equipment at Copper Creek (TRHD)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	32	5	3	2	1	0
Camp Unit[g]	7	2	1	1	0	0
Car-Pickup	41	9	4	1	1	0
Motorhome	2	1	1	0	0	0
Tent	29	5	2	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-22 The ten sampling days with the highest camping-related equipment counts (camp total) at Copper Creek (TRHD), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	5	27	31	0	3	29	32
1997	5	25	41	0	5	21	26
1998	5	23	21	1	7	15	23
1998	5	28	21	1	7	15	23
2000	9	2	5	0	0	7	7
1998	8	23	4	0	1	4	5
2000	7	22	4	0	0	5	5
1997	7	5	11	0	0	4	4
1998	5	11	0	2	2	0	4
1998	5	30	0	2	2	0	4

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-23 Information for Ashby Creek (ASHB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Ashby Creek	None
Site Code:	ASHB	
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 15.1 mi upstream from Hells Canyon Dam and 3.9 mi downstream from Homestead along the Oxbow-Homestead Road.	
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	0.91	
Number of Used Areas:	1	
Used Area Acreage:	0.18	
Additional Comments:	This site is used primarily for day use bank anglers. It used to be more of a campsite until the flood in January of 1997.	

Table E.5-24 Six statistics associated with counts of vehicles and camping-related equipment at Ashby Creek (ASHB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	4	1	0	0	0	0
Camp Unit[g]	1	0	0	0	0	0
Car-Pickup	2	1	1	0	0	0
Motorhome	0	0	0	0	0	0
Tent	4	1	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-25 The ten sampling days with the highest camping-related equipment counts (camp total) at Ashby Creek (ASHB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	7	4	2	0	0	4	4
1997	7	5	2	0	0	4	4
1998	6	13	1	0	0	3	3
1997	6	14	1	0	0	1	1
1997	6	15	1	0	0	1	1
2000	5	27	2	0	0	1	1
2000	6	25	0	0	1	0	1
2000	6	29	0	0	1	0	1
2000	7	8	0	0	1	0	1
1997	5	1	0	0	0	0	0

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-26 Information for Holbrook Creek section A (HOLA) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Holbrook Creek section A	
Site Code:	HOLA	Boat ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 19.6 mi upstream from Hells Canyon Dam and approximately 3.4 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	Two impromptu boat launches
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Private	
Perimeter Area (acres):	1.35	
Number of Used Areas:	1	
Used Area Acreage:	0.71	
Additional Comments:	The primary uses at this site are overnight camping and angling.	

Table E.5-27 Information for Holbrook Creek section B (HOLB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Holbrook Creek section B	Seasonal portable toilet
Site Code:	HOLB	Boat ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 19.9 mi upstream from Hells Canyon Dam and approximately 3.1 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	One impromptu boat ramp
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Private	
Perimeter Area (acres):	2.27	
Number of Used Areas:	2	
Used Area Acreage:	1.38	
Additional Comments:	This site is primarily used for overnight camping and angling.	

Table E.5-28 Six statistics associated with counts of vehicles and camping-related equipment at Holbrook Creek section A (HOLA)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	14	9	6	4	3	2
Camp Unit[g]	6	4	3	2	1	1
Car-Pickup	10	5	4	3	2	1
Motorhome	4	2	2	1	0	0
Tent	8	4	3	1	1	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-29 Six statistics associated with counts of vehicles and camping-related equipment at Holbrook Creek section B (HOLB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	12	9	5	3	1	0
Camp Unit[g]	11	5	4	1	0	0
Car-Pickup	11	8	6	2	1	0
Motorhome	3	1	1	0	0	0
Tent	5	3	2	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-30 The ten sampling days with the highest camping-related equipment counts (camp total) at Holbrook Creek section A (HOLA), with other equipment count categoriesfrom the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	24	10	0	6	8	14
1997	7	6	5	1	3	6	10
1997	6	14	6	2	3	4	9
1997	7	19	3	1	1	7	9
1997	7	28	0	2	2	5	9
1998	7	4	7	3	1	5	9
1997	6	15	3	1	4	3	8
1997	6	17	3	1	4	2	7
1997	6	28	2	2	4	1	7
2000	6	24	3	2	3	2	7

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-31 The ten sampling days with the highest camping-related equipment counts (camp total) at Holbrook Creek section B (HOLB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	24	11	0	11	1	12
1997	5	28	7	3	4	3	10
1997	7	6	11	0	7	3	10
1998	5	17	10	0	10	0	10
1998	7	4	9	0	5	5	10
2000	5	14	7	3	4	2	9
1997	5	18	10	0	6	2	8
1997	5	19	6	0	5	1	6
2000	5	16	3	1	4	1	6
2000	5	20	8	1	5	0	6

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-32 Information for Airstrip Site section A (AIRA) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Airstrip Site section A	Improved parking
Site Code:	AIRA	Seasonal portable toilet
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 20.2 mi upstream from Hells Canyon Dam and 2.8 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	Picnic table
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	1.51	
Number of Used Areas:	2	
Used Area Acreage:	1.12	
Additional Comments:	The site is primarily used for overnight camping and picnicking.	

Table E.5-33 Information for Airstrip Site section B (AIRB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Airstrip Site section B	
Site Code:	AIRB	Boat ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 20.3 mi upstream from Hells Canyon Dam and 2.7 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	One impromptu boat ramp
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	0.11	
Number of Used Areas:	1	
Used Area Acreage:	0.08	
Additional Comments:	This site is primarily used for overnight camping and angling.	

Table E.5-34 Six statistics associated with counts of vehicles and camping-related equipment at Airstrip Site section A (AIRA)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	14	5	4	3	1	0
Camp Unit[g]	3	2	2	1	0	0
Car-Pickup	12	3	2	1	1	0
Motorhome	2	1	0	0	0	0
Tent	10	5	4	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-35 Six statistics associated with counts of vehicles and camping-related equipment at Airstrip section B (AIRB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	4	3	3	1	1	0
Camp Unit[g]	4	2	1	0	0	0
Car-Pickup	6	2	2	1	0	0
Motorhome	1	0	0	0	0	0
Tent	4	3	2	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-36 The ten sampling days with the highest camping-related equipment counts (camp total) at Airstrip Site section A (AIRA), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	24	12	2	2	10	14
1998	7	4	6	1	3	4	8
1997	5	28	2	0	0	7	7
1998	6	7	0	0	0	7	7
1997	8	4	1	0	0	6	6
1997	5	27	2	0	1	4	5
1998	5	13	3	1	2	2	5
1998	6	2	0	0	0	5	5
1998	6	14	1	0	0	5	5
1997	7	6	2	0	2	2	4

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-37 The ten sampling days with the highest camping-related equipment counts (camp total) at Airstrip Site section B (AIRB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	5	3	2	0	2	2	4
1997	8	3	1	0	0	4	4
1998	5	1	6	0	4	0	4
1997	5	19	0	0	0	3	3
1997	6	1	0	0	0	3	3
1997	6	2	1	0	0	3	3
1997	6	14	0	0	0	3	3
1997	6	15	1	0	0	3	3
1997	6	17	0	0	0	3	3
1997	9	14	3	0	0	3	3

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-38 Information for Bob Creek section A (BOBA) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Bob Creek section A	
Site Code:	BOBA	Boat ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 20.8 mi upstream from Hells Canyon Dam and 2.2 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	Two impromptu boat launches
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	6.48	
Number of Used Areas:	1	
Used Area Acreage:	0.27	
Additional Comments:	This site is primarily used for overnight camping, boat launching, and berry picking.	

Table E.5-39 Information for Bob Creek section B (BOBB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Bob Creek section B	
Site Code:	BOBB	Boat ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 20.9 mi upstream from Hells Canyon Dam and 2.1 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	One impromptu boat ramp
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	0.56	
Number of Used Areas:	1	
Used Area Acreage:	0.3	
Additional Comments:	This site is primarily used for overnight camping and accommodating larger groups such as family reunions.	

Table E.5-40 Information for Bob Creek section C (BOBC) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		**Amenities**
Site Name:	Bob Creek section C	Vault toilet
Site Code:	BOBC	Boat ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 21.2 mi upstream from Hells Canyon Dam and 1.8 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	Two impromptu boat ramps
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	12.58	
Number of Used Areas:	2	
Used Area Acreage:	1.32	
Additional Comments:	This site is primarily used for overnight camping, boat launching, angling and picnicking.	

Table E.5-41 Six statistics associated with counts of vehicles and camping-related equipment at Bob Creek section A (BOBA)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	7	5	3	2	1	0
Camp Unit[g]	2	1	1	0	0	0
Car-Pickup	8	4	3	2	1	0
Motorhome	2	1	1	0	0	0
Tent	6	4	3	2	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-42 Six statistics associated with counts of vehicles and camping-related equipment at Bob Creek section B (BOBB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	8	5	4	2	1	0
Camp Unit[g]	4	3	2	1	0	0
Car-Pickup	9	5	3	2	1	0
Motorhome	4	2	1	0	0	0
Tent	5	3	2	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-43 Six statistics associated with counts of vehicles and camping-related equipment at Bob Creek section C (BOBC)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	21	9	6	4	0	0
Camp Unit[g]	6	3	2	1	0	0
Car-Pickup	32	8	6	3	0	0
Motorhome	5	2	1	0	0	0
Tent	15	6	5	2	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-44 The ten sampling days with the highest camping-related equipment counts (camp total) at Bob Creek section C (BOBC)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	7	4	4	1	2	4	7
2000	6	25	4	0	0	6	6
2000	6	30	3	1	0	5	6
1998	7	20	3	1	1	3	5
2000	6	14	1	1	0	4	5
2000	7	7	2	0	0	5	5
1997	5	10	4	0	1	3	4
1997	8	26	1	1	0	3	4
2000	5	20	3	0	0	4	4
2000	6	24	5	0	1	3	4

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-45 The ten sampling days with the highest camping-related equipment counts (camp total) at Bob Creek section B (BOBB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	7	25	8	1	3	4	8
1997	8	13	3	4	0	3	7
1998	7	26	9	1	2	3	6
2000	5	4	5	1	4	1	6
2000	9	10	8	2	2	2	6
1997	9	13	2	0	3	2	5
1998	6	6	1	0	0	5	5
1998	8	14	3	1	2	2	5
2000	9	9	6	2	1	2	5
1997	5	10	0	3	0	1	4

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-46 The ten sampling days with the highest camping-related equipment counts (camp total) at Bob Creek section C (BOBC), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	24	32	1	5	15	21
1998	7	4	10	2	5	6	13
2000	6	30	6	0	3	10	13
1998	6	7	9	3	3	6	12
2000	7	23	6	5	1	6	12
1998	6	6	8	2	3	4	9
1998	9	5	11	0	4	5	9
2000	8	26	4	0	2	7	9
1998	5	9	7	0	2	6	8
2000	6	18	3	1	1	6	8

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-47 Information for Westfall Site (WEST) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Westfall	Seasonal portable toilet
Site Code:	WEST	Boat Ramp:
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 21.7 mi upstream from Hells Canyon Dam and 1.3 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	One impromptu boat ramp
Body of water:	Hells Canyon Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	4.11	
Number of Used Areas:	7	
Used Area Acreage:	1.09	
Additional Comments:	This site is primarily used for overnight camping, angling, swimming and picnicking.	

Table E.5-48 Six statistics associated with counts of vehicles and camping-related equipment at Westfall Site (WEST)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	44	7	4	2	1	0
Camp Unit[g]	6	2	1	1	0	0
Car-Pickup	71	6	5	3	1	0
Motorhome	3	1	0	0	0	0
Tent	43	6	3	2	1	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-49 The ten sampling days with the highest camping-related equipment counts (camp total) at Westfall Site (WEST), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	24	71	0	1	43	44
2000	7	31	5	0	5	6	11
2000	8	1	4	0	6	4	10
1998	7	25	15	0	1	8	9
1997	7	25	5	0	1	6	7
1998	9	5	5	3	2	2	7
1997	7	19	3	0	1	5	6
1998	7	4	6	0	0	6	6
1998	7	26	12	0	1	5	6
2000	7	15	6	0	0	6	6

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-50 Information for Copperfield Boat Launch (CPBL) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Copperfield Boat Launch	Improved parking:
Site Code:	CPBL	65 parking spaces
Location:	This site is located on the Oregon side of Hells Canyon Reservoir approximately 22.3 mi upstream from Hells Canyon Dam and 0.7 mi downstream from the town of Oxbow along the Oxbow-Homestead Road.	Boat ramp:
Body of water:	Hells Canyon Reservoir	One concrete ramp
County:	Baker	Dock
State:	OR	Trash receptacle
Vehicle Access:	Motorized 2WD	Seasonal portable toilet
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	2.14	
Number of Used Areas:	1	
Used Area Acreage:	1.54	
Additional Comments:	This site is primarily used for boat launching. It is the boat ramp for Copperfield Park. It is also used for swimming and bank angling. It is a day use area only.	

Table E.5-51 Six statistics associated with counts of vehicles and camping-related equipment at Copperfield Boat Launch (CPBL)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	5	1	1	0	0	0
Camp Unit[g]	3	1	0	0	0	0
Car-Pickup	20	9	7	4	2	1
Motorhome	1	0	0	0	0	0
Tent	1	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-52 The ten sampling days with the highest camping-related equipment counts (camp total) at Copperfield Boat Launch (CPBL), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	9	13	9	1	3	1	5
1997	6	1	4	1	0	0	1
1997	6	2	3	1	0	0	1
1997	6	15	9	0	1	0	1
1997	7	15	0	0	1	0	1
1997	8	30	4	0	1	0	1
1998	5	9	5	0	1	0	1
1998	8	9	3	1	0	0	1
1998	8	29	7	0	1	0	1
1998	9	5	13	0	1	0	1

a. Combination of pickup campers and camping trailers
b. The total count of camping-related equipment

Table E.5-53 Information for Oxbow Boat Launch (OXBL) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Oxbow Boat Launch	Improved parking
Site Code:	OXBL	Boat ramp:
Location:	This site is located on the Oregon side of Oxbow Reservoir approximately 2.8 mi upstream from Oxbow Dam. This site is located directly off the Oxbow-Brownlee highway.	One gravel ramp
Body of water:	Oxbow Reservoir	Vault toilet
County:	Baker	Dock
State:	OR	Trash receptacles
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	1.03	
Number of Used Areas:	2	
Used Area Acreage:	0.78	
Additional Comments:	This area is a day use area only, specifically for launching boats on Oxbow Reservoir. It is also used for angling.	

Table E.5-54 Six statistics associated with counts of vehicles and camping-related equipment at Oxbow Launch (OXBL)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	2	1	1	0	0	0
Camp Unit[g]	2	1	0	0	0	0
Car-Pickup	16	11	9	5	3	1
Motorhome	1	1	0	0	0	0
Tent	0	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-55 The ten sampling days with the highest camping-related equipment counts (camp total) at Oxbow Boat Launch (OXBL), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	5	26	4	1	1	0	2
1997	8	23	2	0	2	0	2
2000	6	23	6	1	1	0	2
2000	7	8	11	0	2	0	2
1997	5	1	3	0	1	0	1
1997	5	10	6	0	1	0	1
1997	6	7	8	1	0	0	1
1997	6	13	1	0	1	0	1
1997	7	27	5	1	0	0	1
1998	5	23	10	0	1	0	1

a. Combination of pickup campers and camping trailers
b. The total count of camping-related equipment

Table E.5-56 Information for Carters Landing (CART) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		**Amenities**
Site Name:	Carters Landing	Vault toilet
Site Code:	CART	Boat ramp:
Location:	This site is located on the Oregon side of Oxbow Reservoir approximately 7.6 mi upstream of Oxbow Dam and 3.8 mi downstream of Brownlee Dam along the Oxbow-Brownlee Highway.	One gravel ramp, but it has not been improved recently.
Body of water:	Oxbow Reservoir	5 picnic tables
County:	Baker	5 manufactured fire grills
State:	OR	Trash receptable
Vehicle Access:	Motorized 2WD	Improved parking
Land Owner/Manager:	BLM	
Perimeter Area (acres):	2.54	
Number of Used Areas:	6	
Used Area Acreage:	1.86	
Additional Comments:	There are 5 main campsites within this site. It is a very popular camp area, often full. CART has a $3.00 per night camping fee.	

Table E.5-57 Six statistics associated with counts of vehicles and camping-related equipment at Carters Landing (CART)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	42	21	18	13	8	5
Camp Unit[g]	15	11	8	5	3	1
Car-Pickup	33	21	16	11	6	4
Motorhome	8	5	4	3	2	0
Tent	23	12	10	6	3	1

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-58 The ten sampling days with the highest camping-related equipment counts (camp total) at Carters Landing (CART), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	5	27	33	6	13	23	42
1998	5	23	23	2	15	12	29
1997	5	24	22	3	8	16	27
1998	5	24	20	2	14	6	22
2000	8	16	14	1	4	17	22
1997	6	7	21	0	5	16	21
2000	7	8	24	8	7	6	21
1998	7	27	11	5	5	10	20
2000	6	17	10	5	11	3	19
2000	7	30	11	4	5	10	19

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-59 Information for Old Carters Landing (OCAR) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Old Carters Landing	Seasonal portable toilet
Site Code:	OCAR	Boat ramp:
Location:	This site is located on the Oregon side of Oxbow Reservoir approximately 8 mi upstream from Oxbow Dam and 3.4 mi downstream from Brownlee Dam along the Oxbow-Brownlee Highway.	One impromptu boat ramp.
Body of water:	Oxbow Reservoir	Trash receptacles
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	0.67	
Number of Used Areas:	1	
Used Area Acreage:	0.57	
Additional Comments:	This is a very popular area. It is used as an overnight camping and fishing area.	

Table E.5-60 Six statistics associated with counts of vehicles and camping-related equipment at Old Carters Landing (OCAR)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	10	7	5	4	2	1
Camp Unit[g]	10	4	3	2	1	0
Car-Pickup	16	10	8	5	3	1
Motorhome	3	2	2	1	0	0
Tent	6	3	2	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-61 The ten sampling days with the highest camping-related equipment counts (camp total) at Old Carters Landing (OCAR), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1997	5	24	4	0	10	0	10
1998	5	23	13	1	3	6	10
1998	7	5	3	3	5	0	8
2000	7	30	6	1	3	4	8
1998	5	24	16	1	1	5	7
1998	7	18	5	1	4	2	7
1997	9	5	1	2	3	1	6
1997	9	6	5	2	3	1	6
2000	7	28	6	0	4	2	6
2000	8	1	7	0	4	2	6

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-62 Information for Sag Road (SAGR) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Sag Road	Improved parking
Site Code:	SAGR	Boat ramp:
Location:	This site is located on the north shore of the Powder River approximately 3.3 mi upstream from the mouth of the Powder River and 4.7 mi downstream from Hewitt Park. This site can be accessed by taking Sag Road out of Richland.	One paved ramp
Body of water:	Powder River Arm, Brownlee Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant and PRIVATE	
Perimeter Area (acres):	0.53	
Number of Used Areas:	4	
Used Area Acreage:	0.38	
Additional Comments:	This site is primarily used for angling, boat launching, and trailer parking. The access from HWY 86 is gated at present.	

Table E.5-63 Six statistics associated with counts of vehicles and camping-related equipment at Sag Road (SAGR)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	1	0	0	0	0	0
Camp Unit[g]	1	0	0	0	0	0
Car-Pickup	6	2	1	0	0	0
Motorhome	0	0	0	0	0	0
Tent	1	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-64 The ten sampling days with the highest camping-related equipment counts (camp total) at Sag Road (SAGR), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	6	27	1	0	0	1	1
1998	10	9	2	0	1	0	1
1998	5	3	0	0	0	0	0
1998	5	15	0	0	0	0	0
1998	5	23	0	0	0	0	0
1998	5	28	0	0	0	0	0
1998	5	29	0	0	0	0	0
1998	5	31	0	0	0	0	0
1998	6	14	0	0	0	0	0
1998	6	18	1	0	0	0	0

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-65 Information for Private Dudes Cove (PDCV) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Private Dudes Cove	Dock
Site Code:	PDCV	Private outhouse
Location:	This site is located on the Oregon side of Brownlee Reservoir approximately 27.2 mi downstream from Spring Recreation Site and 24.3 mi upstream from Brownlee Dam along the Huntington-Richland Road.	Two private cabins on site
Body of water:	Brownlee Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Private, BLM, & Applicant	
Perimeter Area (acres):	35.5	
Number of Used Areas:	6	
Used Area Acreage:	1.55	
Additional Comments:	This site is primarily used for overnight camping and angling.	

Table E.5-66 Six statistics associated with counts of vehicles and camping-related equipment at Private Dudes Cove (PDCV)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	10	4	3	1	0	0
Camp Unit[g]	3	2	1	0	0	0
Car-Pickup	10	6	4	2	0	0
Motorhome	1	0	0	0	0	0
Tent	9	3	2	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-67 The ten sampling days with the highest camping-related equipment counts (camp total) at Private Dudes Cove (PDCV), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	5	27	7	0	1	9	10
1998	5	8	5	1	3	1	5
1998	6	6	5	0	0	5	5
2000	5	28	10	0	0	4	4
2000	6	16	3	0	1	3	4
1998	6	21	6	0	2	1	3
2000	5	22	3	0	0	3	3
2000	6	10	3	0	0	3	3
2000	6	11	4	0	0	3	3
2000	9	2	3	1	0	2	3

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-68 Information for Swedes Landing (SWLD) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Swedes Landing	3 vault toilets
Site Code:	SWLD	Boat ramp:
Location:	This site is located on the Oregon side of Brownlee Reservoir approximately 26.3 mi downstream from Spring Recreation Site and 25.2 mi upstream from Brownlee Dam along the Huntington-Richland Road.	One impromptu boat ramp
Body of water:	Brownlee Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	2.32	
Number of Used Areas:	6	
Used Area Acreage:	1.39	
Additional Comments:	This site is primarily used for overnight camping, boat launching, trailer parking, and angling. This site receives a great deal of use.	

Table E.5-69 Six statistics associated with counts of vehicles and camping-related equipment at Swedes Landing (SWLD) (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	22	11	9	5	2	1
Camp Unit[g]	8	6	4	2	1	0
Car-Pickup	31	17	10	5	3	1
Motorhome	4	3	2	1	0	0
Tent	13	5	4	2	1	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-70 The ten sampling days with the highest camping-related equipment counts (camp total) at Swedes Landing (SWLD), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	5	27	31	3	6	13	22
2000	5	28	21	3	3	12	18
1997	7	6	13	1	4	8	13
1997	6	12	8	1	7	3	11
1997	6	14	23	3	5	3	11
1998	6	19	5	3	3	5	11
1998	7	5	16	2	2	7	11
2000	5	20	17	3	4	4	11
1997	6	13	8	1	7	2	10
1997	9	20	18	2	8	0	10

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-71 Information for Connor Creek (CONN) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Connor Creek	None
Site Code:	CONN	
Location:	This site is located on the Oregon side of Brownlee Reservoir approximately 15 mi downstream from Spring Recreation Site and 36.5 mi upstream from Brownlee Dam along the Huntington-Richland Road.	
Body of water:	Brownlee Reservoir	
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant, BLM, & PRIVATE	
Perimeter Area (acres):	5.78	
Number of Used Areas:	3	
Used Area Acreage:	0.2	
Additional Comments:	This site is primarily used by boat anglers.	

Table E.5-72 Six statistics associated with counts of vehicles and camping-related equipment at Connor Creek (CONN)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	0	0	0	0	0	0
Camp Unit[g]	0	0	0	0	0	0
Car-Pickup	6	2	1	0	0	0
Motorhome	0	0	0	0	0	0
Tent	0	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-73 The ten sampling days with the highest camping-related equipment counts (camp total) at Connor Creek (CONN), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	8	0	0	0	0	0
1998	5	9	6	0	0	0	0
1998	5	10	0	0	0	0	0
1998	5	19	0	0	0	0	0
1998	5	27	0	0	0	0	0
1998	5	30	1	0	0	0	0
1998	6	7	1	0	0	0	0
1998	6	10	1	0	0	0	0
1998	6	14	0	0	0	0	0
1998	6	18	0	0	0	0	0

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-74 Information for Hibbard Landing (HIBB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Hibbards Landing	Improved parking
Site Code:	HIBB	Boat ramp:
Location:	This site is located on the Oregon side of Brownlee Reservoir approximately 11.5 mi downstream from Spring Recreation Site and 40 mi upstream from Brownlee Dam along the Huntington-Richland Road.	One impromptu boat ramp
Body of water:	Brownlee Reservoir	Seasonal portable toilet
County:	Baker	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant & PRIVATE	
Perimeter Area (acres):	11.46	
Number of Used Areas:	8	
Used Area Acreage:	3.23	
Additional Comments:	This area is a popular camping, fishing, hunting location.	

Table E.5-75 Six statistics associated with counts of vehicles and camping-related equipment at Hibbard Landing (HIBB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	24	15	11	6	3	1
Camp Unit[g]	10	6	5	3	1	0
Car-Pickup	21	16	11	6	3	1
Motorhome	17	7	5	3	1	0
Tent	6	5	2	1	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-76 The ten sampling days with the highest camping-related equipment counts (camp total) at Hibbard Landing (HIBB), with other equipment count categaroies from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	5	9	20	12	10	2	24
1997	6	14	17	17	1	0	18
1997	5	31	19	9	6	2	17
1998	7	5	13	6	6	5	17
2000	5	27	21	5	7	5	17
1997	5	23	11	9	6	0	15
2000	5	28	18	5	4	5	14
2000	6	3	14	8	4	1	13
1997	6	27	13	6	6	0	12
1997	7	6	17	6	4	2	12

a. Combination of pickup campers and camping trailers
b. The total count of camping-related equipment

Table E.5-77 Information for Jennifers Alluvial Fan (JFAN) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Jennifers Alluvial Fan	None
Site Code:	JFAN	
Location:	This site is located on the Idaho side of Brownlee Reservoir approximately 3.7 mi downstream from Steck Park and 55.8 mi upstream from Brownlee Dam along Olds Ferry Road (unmaintained portion).	
Body of water:	Brownlee Reservoir	
County:	Washington	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	6.34	
Number of Used Areas:	2	
Used Area Acreage:	0.42	
Additional Comments:	This site is primarily used for overnight camping and angling.	

Table E.5-78 Six statistics associated with counts of vehicles and camping-related equipment at Jennifers Alluvial Fan (JFAN)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	3	1	0	0	0	0
Camp Unit[g]	1	0	0	0	0	0
Car-Pickup	3	2	2	1	0	0
Motorhome	0	0	0	0	0	0
Tent	3	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-79 The ten sampling days with the highest camping-related equipment counts (camp total) at Jennifers Alluvial Fan (JFAN), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	6	25	2	0	0	3	3
2000	5	23	1	0	1	0	1
2000	6	20	1	0	0	1	1
2000	9	3	2	0	1	0	1
1998	5	3	0	0	0	0	0
1998	5	11	0	0	0	0	0
1998	5	16	0	0	0	0	0
1998	5	21	0	0	0	0	0
1998	5	28	0	0	0	0	0
1998	5	31	0	0	0	0	0

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-80 Information for Kevins Alluvial Fan (KFAN) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Kevins Alluvial Fan	Seasonal portable toilet
Site Code:	KFAN	
Location:	This site is located on the Idaho side of Brownlee Reservoir approximately 1.5 mi downstream from Steck Park and 58 mi upstream from Brownlee Dam along Olds Ferry Road (unmaintained portion).	
Body of water:	Brownlee Reservoir	
County:	Washington	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant & PRIVATE	
Perimeter Area (acres):	8.3	
Number of Used Areas:	10	
Used Area Acreage:	1.73	
Additional Comments:	This site is primarily used for overnight camping, angling and parking for hunters.	

Table E.5-81 Six statistics associated with counts of vehicles and camping-related equipment at Kevins Alluvial Fan (KFAN)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	5	3	3	1	0	0
Camp Unit[g]	2	1	1	0	0	0
Car-Pickup	8	6	5	2	1	0
Motorhome	1	1	0	0	0	0
Tent	3	3	2	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-82 The ten sampling days with the highest camping-related equipment counts (camp total) at Kevins Alluvial Fan (KFAN), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	6	2	4	1	1	3	5
2000	6	25	8	1	0	3	4
1998	7	19	2	0	1	2	3
1998	7	25	8	0	0	3	3
1998	8	29	6	1	0	2	3
2000	5	6	4	1	1	1	3
2000	5	7	3	1	0	2	3
2000	7	21	1	0	0	3	3
1998	5	3	4	0	2	0	2
1998	7	12	5	0	0	2	2

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-83 Information for Weiser Sand Dunes (DUNE) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Weiser Sand Dunes	Seasonal portable toilet
Site Code:	DUNE	
Location:	This site is located on the Idaho side of Brownlee Reservoir approximately 6.5 mi upstream from Steck Park and 67 mi upstream from Brownlee Dam along Olds Ferry Road.	
Body of water:	Brownlee Reservoir	
County:	Washington	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	1.53	
Number of Used Areas:	1	
Used Area Acreage:	2.85	
Additional Comments:	This site is primarily used for overnight camping and day use parking for sand dune recreation.	

Table E.5-84 Six statistics associated with counts of vehicles and camping-related equipment at Weiser Sand Dunes (DUNE)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	24	4	1	0	0	0
Camp Unit[g]	11	1	0	0	0	0
Car-Pickup	21	7	5	0	0	0
Motorhome	13	2	0	0	0	0
Tent	4	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-85 The ten sampling days with the highest camping-related equipment counts (camp total) at Weiser Sand Dunes (DUNE), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	6	18	21	11	11	2	24
1998	5	24	0	13	0	0	13
1997	7	5	7	2	1	3	6
2000	5	6	6	1	4	0	5
2000	5	28	7	2	1	2	5
1997	9	27	2	0	0	4	4
2000	9	24	6	3	1	0	4
2000	9	22	3	2	1	0	3
2000	9	30	6	1	2	0	3
1997	5	10	7	1	0	1	2

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-86 Information for Weiser Sand Dunes section A (DUNA) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Weiser Sand Dunes section A	There are many ATV trails at this site.
Site Code:	DUNA	
Location:	This site is located on the Idaho side of Brownlee Reservoir approximately 9.7 mi upstream from Steck Park and 69.2 mi upstream from Brownlee Dam along Olds Ferry Road.	
Body of water:	Brownlee Reservoir	
County:	Washington	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	8.53	
Number of Used Areas:	6	
Used Area Acreage:	0.71	
Additional Comments:	This site is used for overnight camping, angling, and ATV use. The area along the railroad track is privately owned.	

Table E.5-87 Information for Weiser Sand Dunes section B (DUNB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Weiser Sand Dunes section B	None
Site Code:	DUNB	
Location:	This site is located on the Idaho side of Brownlee Reservoir approximately 9.9 mi upstream from Steck Park and 69.4 mi upstream from Brownlee Dam along Olds Ferry Road.	
Body of water:	Brownlee Reservoir	
County:	Washington	
State:	ID	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	Applicant	
Perimeter Area (acres):	7.64	
Number of Used Areas:	3	
Used Area Acreage:	0.15	
Additional Comments:	This site is mainly used for overnight camping and angling. There is a trail through the site that leads from the main access road to the reservoir's edge.	

Table E.5-88 Six statistics associated with counts of vehicles and camping-related equipment at Weiser Sand Dunes section A (DUNA)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	4	2	1	0	0	0
Camp Unit[g]	2	1	1	0	0	0
Car-Pickup	5	2	1	1	0	0
Motorhome	1	0	0	0	0	0
Tent	3	1	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-89 Six statistics associated with counts of vehicles and camping-related equipment at Weiser Sand Dunes section B (DUNB)(from recretional use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	1	0	0	0	0	0
Camp Unit[g]	1	0	0	0	0	0
Car-Pickup	2	1	1	0	0	0
Motorhome	0	0	0	0	0	0
Tent	0	0	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-90 The ten sampling days with the highest camping-related equipment counts (camp total) at Weiser Sand Dunes section A (DUNA), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	7	26	5	0	1	3	4
2000	5	7	2	0	2	1	3
1998	5	23	1	0	2	0	2
1998	8	9	2	0	1	1	2
2000	6	10	0	1	1	0	2
1998	5	20	2	0	1	0	1
1998	5	24	0	0	0	1	1
1998	7	3	1	0	0	1	1
2000	6	11	1	0	1	0	1
2000	8	13	1	0	1	0	1

a. Combination of pickup campers and camping trailers
b. The total count of camping-related equipment

Table E.5-91 The ten sampling days with the highest camping-related equipment counts (camp total) at Weiser Sand Dunes section B (DUNB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
1998	6	18	0	0	1	0	1
1998	6	20	1	0	1	0	1
1998	8	7	0	0	1	0	1
1998	5	3	0	0	0	0	0
1998	5	5	0	0	0	0	0
1998	5	20	0	0	0	0	0
1998	5	23	0	0	0	0	0
1998	5	24	1	0	0	0	0
1998	5	25	0	0	0	0	0
1998	6	7	0	0	0	0	0

a. Combination of pickup campers and camping trailers

b. The total count of camping-related equipment

Table E.5-92 Information for Cobb Rapids section B (COBB) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Cobb Rapids section B	None
Site Code:	COBB	
Location:	This site is located on the Oregon side of Brownlee Reservoir approximately 8.2 mi upstream from Farewell Bend State Park and 68.2 mi upstream from Brownlee Dam along Highway 201.	
Body of water:	Brownlee Reservoir	
County:	Malheur	
State:	OR	
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	3.6	
Number of Used Areas:	5	
Used Area Acreage:	1.63	
Additional Comments:	This site is primarily used for overnight camping and angling.	

Table E.5-93 Six statistics associated with counts of vehicles and camping-related equipment at Cobb Rapids section B (COBB)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	16	10	7	5	3	1
Camp Unit[g]	8	5	4	2	1	0
Car-Pickup	13	6	6	5	2	1
Motorhome	8	6	4	3	2	0
Tent	2	1	0	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-94 The ten sampling days with the highest camping-related equipment counts (camp total) at Cobb Rapids section B (COBB), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit	Tent	Camp Total
2000	6	10	12	8	8	0	16
2000	5	26	13	4	7	2	13
2000	6	2	6	8	4	0	12
1998	6	7	7	6	4	0	10
2000	6	5	6	4	5	0	9
2000	5	12	6	6	2	0	8
2000	5	21	5	5	3	0	8
2000	5	7	5	3	4	0	7
2000	5	18	5	5	2	0	7
1998	6	20	6	3	3	0	6

Table E.5-95 Information for Oasis (OASC) from dispersed site surveys conducted by the Applicant in the HCC

Site Information		Amenities
Site Name:	Oasis	Vault toilet
Site Code:	OASC	Boat ramp:
Location:	This site is located on the Oregon side of Brownlee Reservoir approximately 7.7 mi upstream from Farewell Bend State Park and 68.7 mi upstream from Brownlee Dam along Highway 201.	One gravel ramp
Body of water:	Brownlee Reservoir	Trash receptacles
County:	Malheur	One manufactured fire grill
State:	OR	Two picnic tables
Vehicle Access:	Motorized 2WD	
Land Owner/Manager:	BLM	
Perimeter Area (acres):	0.99	
Number of Used Areas:	1	
Used Area Acreage:	0.91	
Additional Comments:	This area is predominantly used as a boat launching and parking area. Day use angling also occurs here.	

Table E.5-96 Six statistics associated with counts of vehicles and camping-related equipment at Oasis (OASC)(from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Statistic:	Maximum	P95[a]	P90[b]	Q3[c]	Median[d]	Q1[e]
Equipment Type						
Camp Total[f]	31	11	7	3	0	0
Camp Unit[g]	13	5	3	1	0	0
Car-Pickup	24	6	5	3	1	0
Motorhome	15	6	4	1	0	0
Tent	5	2	1	0	0	0

a. The 95th percentile
b. The 90th percentile
c. The third quartile (75th percentile)
d. The median (50th percentile)
e. The first quartile (25th percentile)
f. The total count of camping-related equipment
g. Combination of pickup campers and camping trailers

Table E.5-97 The ten sampling days with the highest camping-related equipment counts (camp total) at Oasis (OASC), with other equipment count categories from the same days (from recreational use counts conducted by the Applicant during 1997, 1998, and 2000)

Year	Month	Day	Car-pickup	Motorhome	Campunit[a]	Tent	Camp Total[b]
2000	6	24	24	15	13	3	31
2000	7	1	24	9	7	5	21
2000	6	14	10	10	6	0	16
1998	6	9	4	7	5	1	13
1998	6	10	5	6	4	1	11
1998	6	12	7	4	6	1	11
1998	6	13	8	3	6	2	11
1997	6	21	4	8	2	0	10
1998	6	14	4	3	5	2	10

a. Combination of pickup campers and camping trailers
b. The total count of camping-related equipment

Table E.5-98 Percentage of visitors who were male (from on-site interviews and 2000 mail survey)

Category	1994[a]	1995	1996	1997	1998	2000 on Site	2000 Mail
Hells Canyon Tailrace	—	67	68	74	61	66	—
Hells Canyon Reservoir	58	66	62	60	63	61	66
Oxbow Tailrace	—	w/ HCR[b]	71	79	73	78	w/ HCR
Oxbow Reservoir	62	72	68	65	69	66	68
Brownlee Reservoir	64	68	69	68	68	69	71

a. In 1994, gender estimates were based on the percentage identifying at least one person in each party to age group and gender class; for other years, estimates are gender proportions among respondents only.

b. Data for this area were included with the Hells Canyon Reservoir data.

Table E.5-99 Percentage of visitors who were retired (from information from on-site interviews)

Location	1994	1995	1996	1997	1998	2000
Hells Canyon Tailrace	—	17	18	—	34	15
Hells Canyon Reservoir	—	28	32	—	27	26
Oxbow Tailrace	—	w/ HCR[a]	30	—	23	23
Oxbow Reservoir	—	28	29	—	28	24
Brownlee Reservoir	—	32	32	—	27	28

a. Data for this area were included with the Hells Canyon Reservoir data.

Table E.5-100 Visitor age structure (percentage of respondents) by reservoir area and year (from on-site interviews, 1995–2000, and 2000 mail survey)

Category	1995	1996	1997	1998	2000 on Site	2000 Mail
Hells Canyon Reservoir + Oxbow Tailwater						
Under 25	15	11	—	18	24	6
25 to 34	15	13	—	14	12	10
35 to 44	20	19	—	18	19	21
45 to 54	17	18	—	17	16	22
55 to 64	17	19	—	17	17	24
65 and over	15	20	—	15	13	18
Oxbow Reservoir						
Under 25	17	11	—	17	23	3
25 to 34	15	14	—	14	12	10
35 to 44	20	19	—	19	18	21
45 to 54	17	21	—	17	18	24
55 to 64	16	18	—	15	18	25
65 and over	16	17	—	18	12	16
Brownlee Reservoir						
Under 25	11	13	—	18	19	3
25 to 34	13	14	—	14	13	11
35 to 44	19	18	—	17	17	18
45 to 54	19	18	—	18	17	22
55 to 64	19	19	—	18	19	25
65 and over	18	17	—	15	15	21

Table E.5-101 Visitor age structure (percentage), by gender and reservoir

Category	Males	Females
Hells Canyon Reservoir		
Under 20	18	12
21 to 30	11	6
31 to 40	22	17
41 to 50	29	19
51 and over	46	33
Oxbow Reservoir		
Under 20	19	11
21 to 30	9	7
31 to 40	25	13
41 to 50	26	14
51 and over	48	31
Brownlee Reservoir		
Under 20	15	9
21 to 30	9	6
31 to 40	25	12
41 to 50	32	17
51 and over	43	24

Table E.5-102 Average age of visitors by reservoir area and year (from on-site interviews)

Category	1995	1996	1997	1998	2000
Hells Canyon Tailrace	42.4	42.9	—	47.3	40.3
Hells Canyon Reservoir	44.4	47.4	—	43.0	41.4
Oxbow Tailrace	w/ HCR[a]	48.3	—	45.4	37.7
Oxbow Reservoir	44.2	46.6	—	44.0	41.6
Brownlee Reservoir	46.9	46.2	—	43.6	43.7

a. Data for this area were included with the Hells Canyon Reservoir data.

Table E.5-103 Percentage of visitors by ethnic category (from on-site interviews)

Category	1994	1995	1996	1997	1998	2000
Hells Canyon Reservoir + Oxbow tailwater						
White	95	94	95	89	93	95
African American	2	1	2	1	<1	1
Native American	0	<1	<1	<1	<1	<1
Latino	1	1	1	1	1	1
Asian American	1	1	2	3	2	1
Other/refused	2	3	1	5	3	2
Oxbow Reservoir						
White	94	91	89	85	95	93
African American	<1	2	1	1	0	1
Native American	<1	1	<1	<1	<1	<1
Latino	2	2	3	3	1	3
Asian American	1	1	5	3	3	2
Other/refused	2	3	2	7	2	1
Brownlee Reservoir						
White	84	91	88	88	90	90
African American	9	2	4	2	2	3
Native American	0	<1	<1	<1	<1	<1
Latino	1	2	4	6	5	4
Asian American	3	2	2	1	2	2
Other/refused	2	2	2	4	1	1

Table E.5-104 Percentage of users by state of residence (all reservoirs combined from on-site interviews)

State	1994	1995	1996	1997	1998	2000
Idaho	38	41	35	43	40	36
Oregon	41	45	49	44	46	41
Washington	7	6	7	7	7	7
California	3	2	3	2	2	2
Nevada	1	1	1	1	1	1
Utah	1	1	<1	1	<1	1
Other/No Answer	9	5	4	3	4	12

Table E.5-105 Percentage of users by state of residence (by reservoir from on-site interviews in 1994, 1995, and 1996)

State	1994			1995			1996		
	HC	OX	BR	HC	OX	BR	HC	OX	BR
Idaho	24	48	42	37	40	43	29	38	38
Oregon	52	34	36	49	50	44	53	49	46
Washington	8	5	9	5	5	6	8	6	7
California	3	2	3	2	2	2	4	2	3
Nevada	<1	1	<1	1	1	1	1	1	1
Utah	<1	<1	1	1	<1	1	<1	<1	1
Other	11	9	8	5	2	3	4	3	4

Table E.5-106 Percentage of users by state of residence (by reservoir from on-site interviews in 1997, 1998, and 2000)

State	1997			1998			2000		
	HC	OX	BR	HC	OX	BR	HC	OX	BR
Idaho	33	44	46	31	38	45	27	39	40
Oregon	52	43	41	55	48	42	50	37	38
Washington	7	8	6	6	6	7	6	6	7
California	3	2	2	3	1	3	2	2	2
Nevada	1	1	1	1	1	1	<1	1	1
Utah	<1	1	1	<1	1	1	<1	0	1
Other	3	2	3	3	5	1	15	15	11

Table E.5-107 Percentage of day users, park overnight visitors, and dispersed campers from onsite interviews, 1995–2000

Category	1995	1996	1997	1998	2000
Hells Canyon Tailrace (TR) Only					
Day Users	37	55	67	53	52
Overnight in Parks	14	19	13	27	13
Overnight in Dispersed Areas	49	26	20	20	34
Hells Canyon Reservoir + Oxbow TR					
Day Users	13	14	12	6	11
Overnight in Parks	45	49	52	55	62
Overnight in Dispersed Areas	42	37	36	39	27
Oxbow Reservoir					
Day Users	12	23	14	15	17
Overnight in Parks	51	49	64	53	57
Overnight in Dispersed Areas	36	28	22	33	26
Brownlee Reservoir					
Day Users	21	26	27	23	27
Overnight in Parks	49	46	44	43	48
Overnight in Dispersed Areas	30	28	29	34	25
All Three Reservoirs (+ HC TR)					
Day Users	19	23	23	18	22
Overnight in Parks	46	47	48	47	52
Overnight in Dispersed Areas	35	30	30	35	26

Table E.5-108 Percentage of users reporting activities as their "top three" primary activities (all reservoirs together, from on-site interviews, 1995–2000)

Category	1995	1996	1998	2000
Fishing	81	82	79	73
Lounging	11	7	3	16
Water Skiing and Jet Skiing	5	3	5	8
Nature Watching	1	<1	3	6
Swimming	4	3	2	6
Boating	6	4	3	6
Camping	51	54	72	6
Picnicking	3	1	1	4
Partying	1	<1	<1	3
Hunting	2	3	2	2
Hiking	4	2	2	2
ATV Use	<1	1	1	1
Playing Sports	<1	<1	0	1
Jetboating (in HCNRA)	<1	<1	<1	1
Rafting/Kayaking (in HCNRA)	1	<1	1	1
Biking	1	<1	<1	1
Photographing	<1	<1	<1	<1
Driving for Pleasure	<1	0	0	<1
Berry Picking	<1	<1	<1	<1
Rock Climbing	<1	<1	<1	<1

Table E.5-109 Percentage of users reporting activities as their single primary activity (all reservoirs together, from on-site interviews, 1995–2000)

Category	1995	1996	1998	2000
Fishing	74	74	72	67
Lounging	4	5	2	8
Water Skiing and Jet Skiing	2	2	4	5
Nature Watching	< 1	< 1	2	2
Swimming	1	2	1	2
Boating	2	2	2	3
Camping	7	8	13	2
Picnicking	1	1	1	1
Partying	< 1	< 1	< 1	1
Hunting	1	2	2	2
Hiking	1	1	< 1	1
ATV Use	< 1	<1	< 1	1

Table E.5-110 Percentage of users reporting activities as one of their three primary activities, by year and reservoir (from on-site interviews, 1995–2000)

Category	1995			1996			1998			2000		
	HC	OX	BR	HC	OX	BR	HC	OX	BR	HC	OX	BR
Fishing	80	93	83	76	87	82	72	84	83	52	70	75
Lounging	12	10	12	10	5	6	2	4	3	10	9	8
Water/Jet Skiing	12	2	4	5	1	3	10	5	4	8	5	4
Nature Watching	1	1	1	1	1	<1	5	2	1	5	1	1
Swimming	6	5	3	5	3	3	2	1	2	4	2	1
Boating	8	7	5	5	7	2	5	4	2	6	3	2
Camping	58	56	51	54	50	56	86	78	66	2	2	2
Picnicking	1	1	3	1	1	1	<1	1	1	1	1	1
Partying	2	2	1	1	0	<1	<1	<1	1	1	1	1
Hunting	3	2	1	2	4	3	3	<1	2	2	2	2
Hiking	5	3	3	4	1	2	2	<1	1	1	1	1
ATV Use	0	0	1	1	0	1	<1	<1	1	<1	0	2

Table E.5-111 Percentage of users, by type, reporting activities as their primary activity (all reservoirs together, from 1994 on-site interviews)

Category	Park Users (Group)	Park Users (Respondent)	Nonpark/ Nonangler Users (Group)	Nonpark/ Nonanglers (Respondent)
Fishing	66	59	46	43
Lounging	4	9	7	7
Water Skiing and Jet Skiing	3	3	12	12
Nature Watching	6	6	6	7
Swimming	1	1	1	1
Boating	3	3	4	5
Camping	9	9	9	7
Picnicking	1	2	0	0
Partying	<1	<1	0	0
Hunting	1	<1	1	1
Hiking	1	3	1	3
ATV Use	0	0	0	0
Playing Sports	0	0	0	0
Jetboating (in HCNRA)	<1	<1	0	0
Rafting/Kayaking (in HCNRA)	<1	<1	0	0
Biking	<1	1	1	0
Photographing	<1	<1	0	0
Driving for Pleasure	<1	<1	0	0
Berry Picking	<1	<1	1	1
Rock Climbing	<1	<1	0	0

Table E.5-112 Percentage of users reporting that they engaged in different activities (from 2000 mail survey)

Item	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir	All Visitors
Fishing	75	89	88	84
Camping	77	76	68	72
Wildlife Viewing	51	53	38	45
Sightseeing	53	44	31	40
Powerboating	31	35	30	31
Photography	40	32	23	30
Walking	35	28	24	28
Swimming	34	24	17	24
Picnicking	28	27	20	24
Cultural or Historic Sites	20	8	6	11
Hiking	12	7	5	7
Hunting	3	6	4	4
Packing Stock	<1	0	<1	<1
Other	21	10	11	13

Table E.5-113 Percentage of general management comments by major category and by reservoir area (from on-site interviews, 1994–2000, and 2000 mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General (Positive)	34	28	33	23	19	23
General (Negative)	4	3	1	2	2	3
Facility Development (Positive)	20	16	14	16	14	15
Facility Development (Negative)	9	17	16	17	10	13
Maintenance (Positive)	10	10	4	7	6	7
Maintenance (Negative	1	4	1	3	3	3
Angling (Positive)	1	1	2	2	2	2
Angling (Negative)	2	3	6	4	7	5
Water Levels (Positive)	<1	<1	1	<1	1	1
Water Levels (Negative)	7	4	7	7	20	13
Access (Positive)	1	1	0	0	1	1
Access (Negative)	3	4	4	4	6	5
Visitor Impacts (Litter, Interaction)	3	3	5	3	3	3
Fees	<1	3	<1	5	2	3
Angling Regulations	<1	1	1	2	1	1
Enforcement/ Regulations	1	2	2	1	1	<1
Commercial Services	1	<1	<1	1	1	1
Hunting	0	<1	0	<1	<1	<1
Agency Evaluation	2	1	0	1	1	1
Total	100	100	100	100	100	100

Table E.5-114 Subcategory percentages for "general" comments by reservoir area (from interviews and mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Area Compliment	83	80	91	83	78	80
Specific Area Compliment	8	10	6	9	12	10
Weather Compliment	0	0	0	0	1	1
General Area Criticism	1	1	0	<1	1	1
Specific Area Criticism	0	<1	0	<1	1	1
Weather Criticism	1	1	0	1	2	2
"Leave It As It Is"	5	6	3	4	4	4
Snakes, Other Hazards	<1	<1	0	<1	<1	<1
Cattle Grazing Criticism	0	0	0	<1	<1	<1
Fish Kill Criticism	0	<1	0	<1	<1	<1
General Request for Information	3	2	1	1	2	2
Subtotal Compliment	91	90	96	92	90	91
Subtotal Criticism	6	8	3	6	8	7
Subtotal Other	3	2	1	1	2	2
Total Within Category	100	100	100	100	100	100
Total Among all Comments	38	31	34	25	21	26

Table E.5-115 Common locations, by reservoir, for "specific area compliment" subcategory of "general" comments (numbers in parentheses are raw numbers of responses)

Subcategory	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir
Specific Area Compliment	Hells Canyon Park (116)	McCormick Park (30)	Woodhead Park (69)
	Copperfield Park (96)	No others > 10	Farewell Bend State Park (54)
	No Others > 10[a]		No Others > 10

a. No others > 10 = no other categories of comments were given by more than 10 people.

Table E.5-116 Subcategory percentages for "facility development" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Development Praise	64	49	38	46	50	49
Number of Facilities is Okay	0	<1	0	1	1	1
Number of Restrooms is Okay	1	1	7	2	1	1
Improvements are Positive	4	2	1	3	6	4
Park is Well Designed	<1	1	1	1	1	1
General Development Criticism	6	9	5	9	8	8
Not Enough Facilities	7	5	4	5	6	5
Not Enough Restrooms	6	10	32	9	7	9
Not Enough Picnic Tables	2	3	0	3	1	2
Sites are Too Small	<1	1	1	1	1	1
Not Enough Sites/Tent Sites	1	3	0	3	2	3
Not Enough Parking	<1	1	0	1	1	1
Improvements are Negative	<1	1	0	1	1	1
Need Hookups	2	3	2	4	4	4
Need Fish-Cleaning Stations	<1	3	2	3	1	2
Need Interpretive Kiosks	1	<1	0	0	<1	<1
Need Swimming Docks/ Areas	0	1	0	1	1	1
Need Garbage Cans	<1	2	2	2	1	2
Need More Shade/Trees	2	2	2	3	6	4

Table E.5-116 Subcategory percentages for “facility development” comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Poor Design	0	2	0	2	1	2
Overall Poor Site Quality	1	1	1	1	<1	1
Subtotal Compliment	69	79	47	53	58	55
Subtotal Criticism	31	21	53	47	42	45
Total Within Category	100	100	100	100	100	100
Total Among all Comments	29	33	30	33	24	28

Table E.5-117 Common locations, by reservoir, for key "facility development" subcategories (numbers in parentheses are raw numbers of responses)

Subcategory	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir
Not Enough Facilities	Hells Canyon Park (38)	McCormick Park (12)	Woodhead Park (37)
	Copperfield Park (19)	Section 1 (39)	Farewell Bend State Park (14)
	Section 1 (25)	Section 2 (15)	Section 5 (24)
	Section 2 (16)		Section 4 (13)
Not Enough Shade/Add Trees	Copperfield Park (22)	McCormick Park (15)	Section 5 (20)
			Section 1 (20)
			Section 4 (14)
			Farewell Bend State Park (12)
			Hewitt/Holcomb parks (10)
Not Enough Restrooms	Hells Canyon Park (136)	McCormick Park (26)	Hewitt/Holcomb parks (65)
	Section 1 (33)	Carters Landing (17)	Spring Rec.Site (12)
	Section 2 (65)		Steck Rec. Site (11)
			Section 5 (25)
			Section 3 (23)
			Section 7 (16)
			Section 4 (15)
			Section 6 (14)

Table E.5-118 Subcategory percentages for "maintenance/service" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Praise for Park Upkeep	17	14	46	9	11	12
Maintenance Praise	61	40	15	40	30	36
Service Praise	10	11	23	9	8	10
Clean Restrooms	5	4	0	10	10	8
Tree and Lawn Praise	0	1	0	2	1	1
Reservation System Praise	0	1	0	1	1	1
General Criticism of Park Upkeep	1	6	0	6	10	7
Service Criticism	3	7	8	8	4	6
Restrooms Criticism	0	3	0	1	7	4
Trees and Lawn Criticism	0	<1	0	4	3	2
Poor Garbage Service	0	1	0	1	2	1
Too Many Weeds	1	1	0	1	2	2
Too Many Insects/Spray More	0	3	0	3	6	4
Poor Reservation System	1	2	0	1	1	1
Criticism of 14-Day Limit	0	2	8	<1	1	1
Subtotal Compliment	94	75	84	75	64	72
Subtotal Criticism	6	25	16	25	36	28
Total Within Category	100	100	100	100	100	100
Total Among all Comments	11	14	5	10	9	10

Table E.5-119 Common locations, by reservoir, for key "maintenance/service" subcategories (numbers in parentheses are raw numbers of responses)

Subcategory	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir
Maintenance Praise	Copperfield Park (201)	McCormick Park (92)	Woodhead Park (201)
	Hells Canyon Park (134)		Farewell Bend State Park (102)
			Steck Rec. Site (35)
			Spring Rec. Site (10)
General Upkeep Criticism	Hells Canyon Park (13)	McCormick Park (10)	Hewitt/Holcomb parks (26)
	Copperfield Park (12)		Spring Rec. Site (22)
			Farewell Bend State Park (11)

Table E.5-120 Subcategory percentages for "angling" comments by reservoir area (from interviews and mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Praise for Fishing	22	21	18	25	17	19
Praise for Bass Fishing	0	2	0	3	1	1
Praise for Catfish Fishing	0	1	0	1	2	2
General Criticism of Fishing	17	28	27	27	26	27
Criticism of Crappie Fishing	4	2	0	3	4	3
Criticism of Other Fishing	4	<1	<1	<1	<1	1
Prefer More Fish	17	11	18	15	10	11
Prefer Bigger Fish	0	5	0	1	2	2
Need to Introduce New Species	9	2	0	2	1	1
Need Salmon Above Dams	0	0	0	0	<1	<1
Reduce Carp Population	4	9	18	1	1	2
Water Fluctuations Hurt Fishing	17	17	14	18	34	28
Other Fishing Criticisms	4	1	0	3	1	1
Subtotal Compliment	22	24	18	29	20	22
Subtotal Criticism	78	76	82	71	80	78
Total Within Category	100	100	100	100	100	100
Total Among all Comments	3	4	8	6	9	7

Table E.5-121 Subcategory percentages for "angling regulation" comments by reservoir area (from interviews and mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Regulation Praise	0	0	0	2	1	1
Regulations Should be Changed	100	59	0	29	40	40
License Fees are Too High	0	4	0	2	2	3
Add Slot Limits	0	4	100	7	14	11
Slot Limits Should be Changed	0	4	0	7	13	9
Slot Limits Praise	0	0	0	18	0	6
Limit Catfish	0	0	0	14	13	11
Limit Crappie	0	19	0	13	11	12
Other Critiques	0	11	0	7	6	7
Total Within Category	100	100	100	100	100	100
Total Among all Comments	<1	1	<1	2	1	1

Table E.5-122 Subcategory percentages for "water operations and reservoir level" comments by reservoir area (from interviews and mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Praise Water Levels	2	1	5	1	2	2
Praise for Specific Levels	2	2	0	1	2	2
General Support for Dams	0	1	0	2	1	1
General Criticism Water Levels	5	4	19	10	10	10
Criticism of Low Level; Prefer High	3	14	0	15	26	23
Prefer Full Pool	0	1	0	1	6	5
Criticism of High Level; Prefer Low	5	5	10	7	2	3
Need Information on Levels	6	5	0	2	3	3
Levels and Biological Issues	34	19	29	16	13	14
Water Quality Criticism	2	6	14	2	5	5
Remove the Dams	25	5	0	1	1	2
Stop Fluctuations	19	33	24	42	30	31
Subtotal Compliment	4	3	5	2	4	4
Subtotal Criticism	96	97	95	98	96	96
Total Within Category	100	100	100	100	100	100
Total Among all Comments	7	4	8	8	21	14

Table E.5-123 Subcategory percentages for "access" comments by reservoir area (from interviews and mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Access Praise	3	3	0	2	2	2
Praise for Docks	0	5	0	1	3	3
Praise for Boat Ramps	3	2	0	1	3	3
Land Access Praise	16	5	0	5	2	3
Need More Boat Ramps	0	10	23	13	7	9
Need Longer Boat Ramps	0	1	0	1	9	6
Other Boat Dock Issues	3	5	0	16	5	7
Improve or Add Docks/ Moorings	10	29	8	19	10	15
Other Boat Dock Issues	0	3	0	0	5	4
Need More Hazard Buoys	0	1	0	1	<1	1
Other Boat Access Issues	0	2	0	3	3	3
Improve or Add Roads	19	11	15	12	25	20
Improve or Add Turnouts	0	6	8	6	4	5
Other Land Access Issues	42	15	31	19	16	17
Improve/Add Handicap Access	3	3	15	2	4	3
Subtotal Compliment	22	15	0	9	10	11
Subtotal Criticism	78	85	100	91	90	89
Total Within Category	100	100	100	100	100	100
Total Among all Comments	4	5	4	4	7	6

Table E.5-124 Common locations, by reservoir, for key "access" subcategories (numbers in parentheses are raw numbers of responses)

Subcategory	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir
Longer Boat Ramps	None > 10	None > 10	Spring Rec. Site (17)
			Woodhead Park (12)
			Steck Rec. Site (11)
			Hewitt/Holcomb parks (8)
			Section 2 (12)
			Section 3 (11)
Improve Docks	Hells Canyon Park (49)	None > 10	Woodhead Park (41)
	No others > 10		No others > 10
Improve Roads	Section 2 (19)	McCormick Park (13)	Steck Rec. Site (88)
			Section 5 (23)
			Section 6 (19)
			Section 7 (17)
			Section 4 (16)
			Section 6 (19)

Table E.5-125 Subcategory percentages for "visitor impact" comments by reservoir area (from interviews and mail survey)

Category	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
General Litter Comment	6	15	23	21	30	24
Improve Pickup/ Maintenance	6	5	23	9	10	9
Enforce Litter Laws	0	5	8	10	16	11
Too Crowded	53	36	15	30	13	24
Conflicts with Other Users	0	4	0	2	2	3
Report of a Discourteous Group	6	2	0	3	4	3
No/Few Crowding Problems	6	2	0	6	5	4
No Conflicts/Praise of Other Users	6	6	0	5	4	5
Other Interaction Comments	6	12	8	7	8	9
Subtotal Compliment or No Problems	12	4	0	11	9	9
Subtotal Criticism	88	96	100	89	91	91
Total Within Category	100	100	100	100	100	100
Total Among all Comments	3	3	5	3	3	3

Table E.5-126 Common locations, by reservoir, for key "visitor impact" subcategories (numbers in parentheses are raw numbers of responses)

Subcategory	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir
Litter	Section 2 (20)	Section 1 (21)	Section 4 (13)
	Section 1 (5)		Section 5 (13)
			Section 7 (12)
Too Crowded	Section 1 (25)	McCormick Park (13)	None > 10
	Section 2 (20)		

Table E.5-127 Subcategory percentages for "fees" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Praise for Overall Fees	0	7	0	3	6	5
Praise for Specific Fees	40	9	0	9	8	9
Fees are Too High	60	43	50	53	50	48
Don't Raise Fees	0	11	17	8	4	7
Need Senior Fee Discounts	0	13	17	11	5	9
General Opposition to Fees	0	18	17	16	27	21
Subtotal Compliment	40	16	0	12	14	14
Subtotal Criticism	60	84	100	88	86	86
Total Within Category	100	100	100	100	100	100
Total Among all Comments	<1	3	2	5	2	3

Table E.5-128 Common locations, by reservoir, for "fees too high" subcategory of "fees" comments (numbers in parentheses are raw numbers of responses)

Subcategory	Hells Canyon Reservoir	Oxbow Reservoir	Brownlee Reservoir
Fees Too High	Copperfield Park (31)	McCormick Park (59)	Farewell Bend State Park (91)
	Hells Canyon Park (16)		Hewitt/Holcomb parks (34)
			Woodhead Park (10)

Table E.5-129 Subcategory percentages for "enforcement and general regulation" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Enforcement Praise	0	0	0	7	0	1
Regulations Praise	8	1	0	2	1	2
No-Wake Zone Praise	0	2	0	0	0	1
Other Praise	0	2	0	2	2	2
Need More Enforcement	0	31	25	46	35	34
Need Less Enforcement	0	0	0	2	2	1
Need More Regulations	0	18	25	11	24	18
Need Less Regulations	17	17	50	21	21	20
Ban Jet Skiing or Water Skiing	0	9	0	2	4	5
Ban or Control Jetboats	75	7	0	0	0	6
More Jet Skiing Regulations	0	5	0	2	1	3
More No-Wake Zones	0	2	0	0	6	3
Other Social Problems	0	5	0	5	4	4
Subtotal Compliment	8	5	0	11	3	6
Subtotal Criticism	92	95	100	89	97	94
Total Within Category	100	100	100	100	100	100
Total Among all Comments	1	2	2	1	1	<1

Table E.5-130 Subcategory percentages for "commercial service" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Praise for Commercial Services	0	0	0	0	2	1
Specific Services Praised	14	0	0	0	2	2
Criticism of Commercial Services	0	0	0	0	5	3
Specific Services Criticized	0	5	100	0	7	6
Need Ice Services	0	23	0	7	8	10
Need Gas Services	14	0	0	0	15	9
Need Food Services	57	73	0	73	56	61
Need Other Services	0	0	0	13	3	4
Subtotal Compliment	14	0	0	0	4	3
Subtotal Criticism	86	100	100	100	96	97
Total Within Category	100	100	100	100	100	100
Total Among all Comments	<1	<1	<1	<1	<1	<1

Table E.5-131 Subcategory percentages for "hunting" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Hunting Praise	0	0	0	0	86	25
Hunting Criticism	0	100	0	100	14	75
Total Within Category	0	100	0	100	100	100
Total Among all Comments	0	<1	0	<1	<1	<1

Table E.5-132 Subcategory percentages for "agency evaluation" comments by reservoir area (from interviews and mail survey)

Subcategory	Hells Canyon Tailwater	Hells Canyon Reservoir	Oxbow Tailwater	Oxbow Reservoir	Brownlee Reservoir	All Areas
Idaho Power Praise	64	46	0	57	46	50
Idaho Power Criticism	18	29	0	24	19	22
IDFG Praise	0	0	0	0	0	0
IDFG Criticism	0	4	0	14	2	4
Federal Agency Praise	18	4	0	0	5	5
Federal Agency Criticism	0	7	0	5	13	9
Other Agency Praise	0	7	0	0	5	4
Other Agency Criticism	0	4	0	0	10	6
Subtotal Compliment	64	56	0	57	56	59
Subtotal Criticism	36	44	0	43	44	41
Total Within Category	100	100	0	100	100	100
Total Among all Comments	2	1	0	1	1	1

Table E.5-133 The Applicant's existing measures, costs, and implementation schedules based on the 30-year license period

PM&E Measure	Section	Capital Costs ($)	O&M Costs ($)	Total Measure Cost ($)
Monitors for Flow Information Downstream of Hells Canyon Dam	E.5.4.1.1.	Not applicable	50,000 annually	1,500,000
Memorandum of Understanding between the USFS and the Applicant	E.5.4.1.2.	Not applicable	80,000 annually	2,400,000
Continuation of Litter and Sanitation Plan	E.5.4.3.1.1.	Not applicable	25,000 annually	750,000
Continuation of Public Safety Program	E.5.4.3.1.2.	Not applicable	10,000 annually	300,000
Continuation of Aid to Local Law Enforcement	E.5.4.3.1.3.	Not applicable	60,000 annually	1,800,000
Continuation of Road Maintenance	E.5.4.3.1.4.	Not applicable	100,000 annually	3,000,000
Continuation of O&M of Applicant-Managed Parks and Recreation Facilities	E.5.4.4.2.1.	Not applicable	600,000 annually	18,000,000

Table E.5-134 Applicant-proposed PM&E measures, costs, and implementation schedules based on 30-year license period

PM&E Measure	Section Number	Total Capital Costs ($)	Total O&M Costs ($)	Total PM&E Cost ($)
Provision of Boat Moorage on HCC Reservoirs	E.5.4.4.1.1.	180,000 (years 3–5)	120,000 (24,000 every 6th year)	300,000
Enhancement of Litter and Sanitation Plan	E.5.4.4.1.2.	60,000 (year 1)	1,650,000 (55,000 annually)	1,710,000
Information and Education Plan	E.5.4.4.1.3.	1,380,000 (years 1–6)	720,000 (30,000 years 7–30)	2,100,000
Law Enforcement Program	E.5.4.4.1.4.		450,000 (15,000 annually)	450,000
Recreation Adaptive Management Plan	E.5.4.4.1.5.	1,200,000 (300,000 every 6th year, years 9–27)	1,800,000 (450,000 every 6th year, years 6–24)	3,000,000
Enhancement of Road Maintenance	E.5.4.4.1.6.	20,000 (years 1–2)	840,000 (30,000 years 3–30)	860,000
Performance of O&M at Applicant-Enhanced BLM and USFS Reservoir-Related Recreation Sites	E.5.4.4.1.7.		2,800,000 (100,000 years 3–30)	2,800,000
Enhancement of Eagle Bar Dispersed Recreation Site	E.5.4.4.2.1.	150,000 (years 1–3)	See section E.5.4.4.1.7.	150,000
Development of Site Plan for Big Bar Recreation Site	E.5.4.4.2.2.	50,000 (years 1–2)	Not applicable	50,000
Enhancement of Boat Ramp and Associated Facilities at Big Bar Section D Recreation Site	E.5.4.4.2.3.	250,000 (years 1–4)	See section E.5.4.4.1.7.	250,000

Table E.5-134 Applicant-proposed PM&E measures, costs, and implementation schedules based on 30-year license period

PM&E Measure	Section Number	Total Capital Costs ($)	Total O&M Costs ($)	Total PM&E Cost ($)
Development of Site Plan and Enhancement of Eckels Creek Dispersed Recreation Site	E.5.4.4.2.4.	30,000 (years 1–3)	See section E.5.4.4.1.7.	30,000
Enhancement of O&M at Applicant-Managed Parks and Recreation Facilities	E.5.4.4.3.1.		2,800,000 (100,000 years 3–30)	2,800,000
Enhancement of Copper Creek Dispersed Recreation Site	E.5.4.4.3.2.	50,000 (years 1–3)	See section E.5.4.4.1.7.	50,000
Reconstruction of Hells Canyon Park	E.5.4.4.3.3.	2,000,000 (years 3–5)	See section E.5.4.3.2.1. and E.5.4.4.3.1.	2,000,000
Development of Airstrip A&B Dispersed Recreation Site	E.5.4.4.3.4.	40,000 (years 3–5)	See section E.5.4.4.1.7.	40,000
Enhancement of Bob Creek Section A Dispersed Recreation Site	E.5.4.4.3.5.	50,000 (years 1–3)	See section E.5.4.4.3.1.	50,000
Enhancement of Bob Creek B Dispersed Recreation Site	E.5.4.4.3.6.	25,000 (years 1–3)	See section E.5.4.4.3.1.	25,000
Enhancement of Bob Creek Section C Dispersed Recreation Site	E.5.4.4.3.7.	50,000 (years 1–3)	See section E.5.4.4.1.7.	50,000
Enhancement of Westfall Dispersed Recreation Site	E.5.4.4.3.8.	60,000 (years 1–3)	See section E.5.4.4.1.7.	60,000
Enhancement of Copperfield Boat Launch	E.5.4.4.3.9.	100,000 (year 3)	See section E.5.4.3.2.1. and E.5.4.4.3.1.	100,000

Table E.5-134 Applicant-proposed PM&E measures, costs, and implementation schedules based on 30-year license period

PM&E Measure	Section Number	Total Capital Costs ($)	Total O&M Costs ($)	Total PM&E Cost ($)
Enhancement of Oxbow Boat Launch	E.5.4.4.3.10.	80,000 (years 1–3)	See section E.5.4.3.2.1. and E.5.4.4.3.1.	80,000
Enhancement of Carters Landing and Old Carters Landing Recreation Sites	E.5.4.4.3.11.	80,000 (years 1–3)	See section E.5.4.3.2.1. and E.5.4.4.3.1.	80,000
Reconstruction of McCormick Park	E.5.4.4.3.12.	3,000,000 (years 3–5)	See section E.5.4.3.2.1. and E.5.4.4.3.1.	3,000,000
Enhancement of Hewitt and Holcomb Parks	E.5.4.4.4.1.	100,000 (years 1–3)	Not applicable	100,000
Development of Low-Water Boat Launch at or near Swedes Landing	E.5.4.4.5.1.	250,000 (years 1–3)	See section E.5.4.4.1.7.	250,000
Enhancement of Swedes Landing	E.5.4.4.5.2.	75,000 (years 2–4)	See section E.5.4.4.1.7.	75,000
Enhancement of Spring Recreation Site	E.5.4.4.5.3.	500,000 (years 2–4)	Not applicable	500,000

Table E.5-135 Actions and schedule for recreation adaptive management plan

Major Categories/ Possible Actions	Monitoring Format/ Schedule	Reporting Format	Responsible Party
Sanitation • Maintain Status Quo • Add Portable Toilets • Add Vaults • Increase Scheduled Pumping • Decrease Scheduled Pumping • Close Area • Move Toward Incorporating ADA Specifications	Pumping activity data/ April 1–October 1 (based on use)	Annual and 6-year comprehensive reports	IPC and other managing entities (OME)
	Observations from IPC contractor at IPC facilities/ongoing	Annual and 6-year comprehensive reports	IPC and OME
	On-site observations, litter program/annual	Annual and 6-year comprehensive reports	IPC and OME
	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
	General recreational-use survey/6 years	6-year comprehensive report	IPC
Litter • Maintain Status Quo • Increase Pickup • Decrease Pickup • Expand Coverage Area • Add Trash Cans • Increase Education	Annual amount of pickup data	Annual and 6-year comprehensive reports	IPC
	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
	On-site observations, litter program/ongoing	Annual and 6-year comprehensive reports	IPC and OME
	General recreation use survey/6 years	6-year comprehensive report	IPC and OME
Roads and Access • Maintain Status Quo • Improve • Make Closures • Establish Safety Measures • Construct New Road • Change Ownership • Acquire Land/Set Up Easement	Traffic counter data/ ongoing	Annual and 6-year comprehensive reports	IPC
	Minutes from annual law enforcement meeting/annual	Annual and 6-year comprehensive reports	IPC
	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
	General recreational-use survey/6 years	6-year comprehensive report	IPC (coordinate data from OME)

Table E.5-135 Actions and schedule for recreation adaptive management plan

Major Categories/ Possible Actions	Monitoring Format/ Schedule	Reporting Format	Responsible Party
Hells Canyon Visitors Center	MOU is in place (renew in 2005)/annual	Annual meeting with USFS	IPC and USFS
• Maintain Status Quo • Increase Participation • Decrease Participation	USFS forest plan data/ USFS discretion	USFS discretion	USFS
	General recreational-use survey/6 years	6-year comprehensive report	IPC (coordinate data from USFS)
	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
HCC Dispersed Sites • Maintain Status Quo • Create New Sites • Close Sites	Social indicator survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
• Make Improvements • Change Regulations	General recreational-use survey/6 years	6-year comprehensive report	IPC (coordinate data from OME)
• Change Ownership • Establish MOU	On-site observations, litter program/annual	Annual and 6-year comprehensive reports	IPC
• Change Developed Site • Change Fee	Fee report/6 years	6-year comprehensive report	IPC and OME
• Acquire Land/Set Up Easement	Sanitation data/annual	Annual and 6-year comprehensive reports	IPC
HCNRA Dispersed Sites • Maintain Status Quo • Rehabilitate/ Revegetate • Close Sites • Change Regulation • Change MOU	To be determined through consultation with USFS		

Table E.5-135 Actions and schedule for recreation adaptive management plan

Major Categories/ Possible Actions	Monitoring Format/ Schedule	Reporting Format	Responsible Party
HCC Developed Sites • Maintain Status Quo • Create New Sites • Close Sites • Expand Sites • Improve Sites • Change Regulation • Change Ownership • Establish MOU • Change Fee • Acquire Land/Set Up Easement	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
	General recreational-use survey/6 years	6-year comprehensive report	IPC and OME
	Fee report/6 years	6-year comprehensive report	IPC and OME
	IPC developed site conditions report/ 6 years	6-year comprehensive report	IPC
	OME developed site conditions report/ 6 years	6-year comprehensive report	OME
Trailheads • Maintain Status Quo • Close • Relocate • Improve • Change Regulation • Educate Users/Put Up Signs • Acquire Land/Set Up Easement	Trail registration form and use/USFS discretion	USFS discretion	USFS responsibility in the future
	On-site observations, litter program/annual	Annual and 6-year comprehensive reports	IPC
	Social indicators survey (trail registration form)/ 6 years	6-year comprehensive report	IPC and USFS
Trails • Maintain Status Quo • Close • Relocate • Improve • Change Regulation • Educate Users/Put Up Signs • Acquire Land/Set Up Easement	Trail registration form and use/USFS discretion	USFS discretion	USFS responsibility in the future
	On-site observations of conditions/USFS discretion	USFS discretion	USFS
	Social indicators survey/USFS discretion	USFS discretion	USFS
	Social indicators survey (trail registration form)/ 6 years	6-year comprehensive report	IPC and USFS

Table E.5-135 Actions and schedule for recreation adaptive management plan

Major Categories/ Possible Actions	Monitoring Format/ Schedule	Reporting Format	Responsible Party
I&E Plan • Maintain Status Quo • Replace • Remove • Change Medium • Add Locations • Expand at Locations • Evaluate New Technologies	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
	General recreational-use survey/6 years	6-year comprehensive report	IPC
	On-site observations, litter program/annual	Annual and 6-year comprehensive reports	IPC
Law Enforcement • Maintain Status Quo • Increase Resources • Decrease Resources • Change Type • Train • Educate • Change Regulation	Social indicators survey (if determined necessary through consultation)/6 years	6-year comprehensive report	IPC
	General recreational-use survey/6 years	6-year comprehensive report	IPC
	Law enforcement annual forum meeting minutes/ongoing	Annual and 6-year comprehensive reports	IPC provides forum for law enforcement agencies

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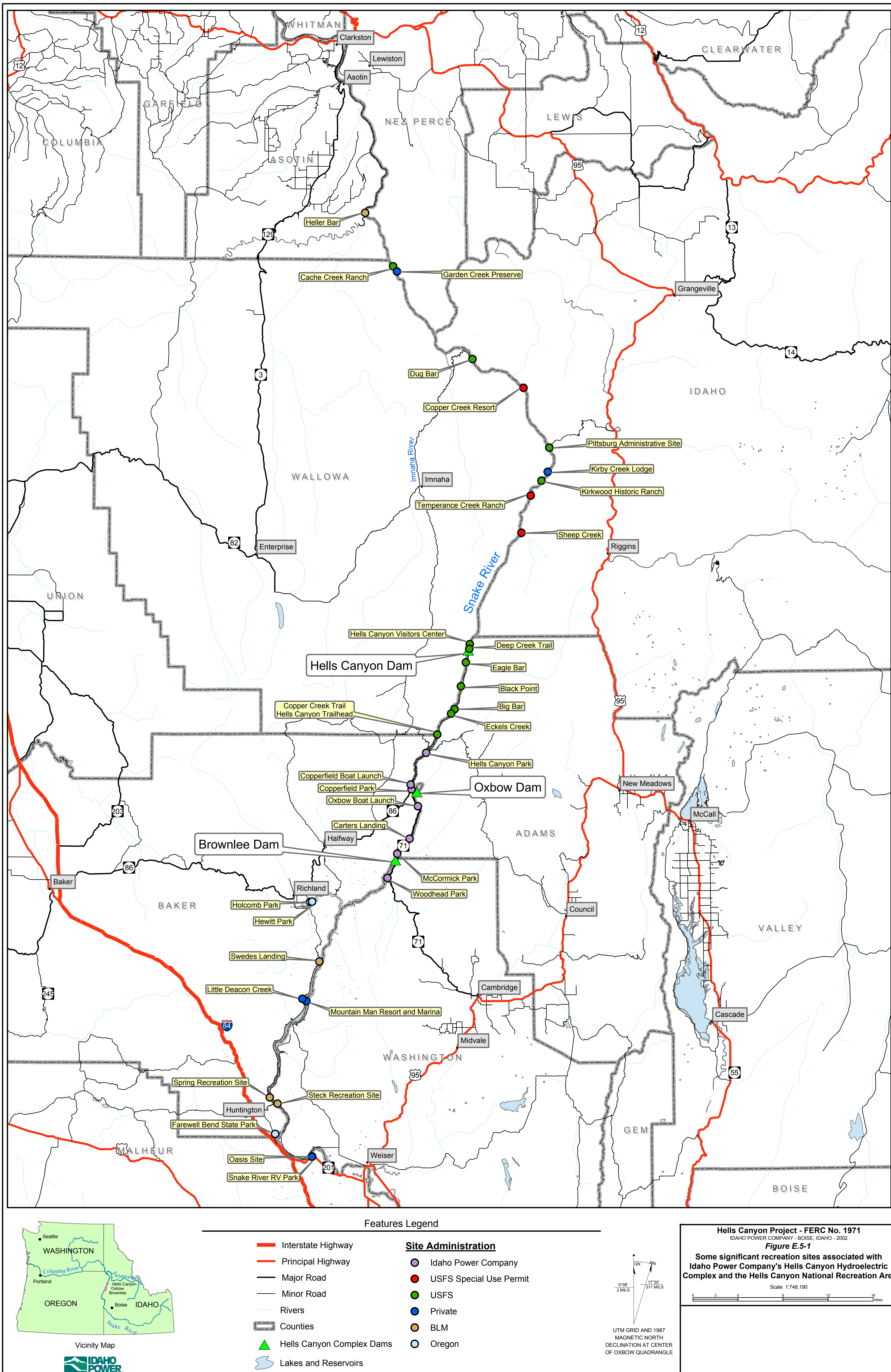

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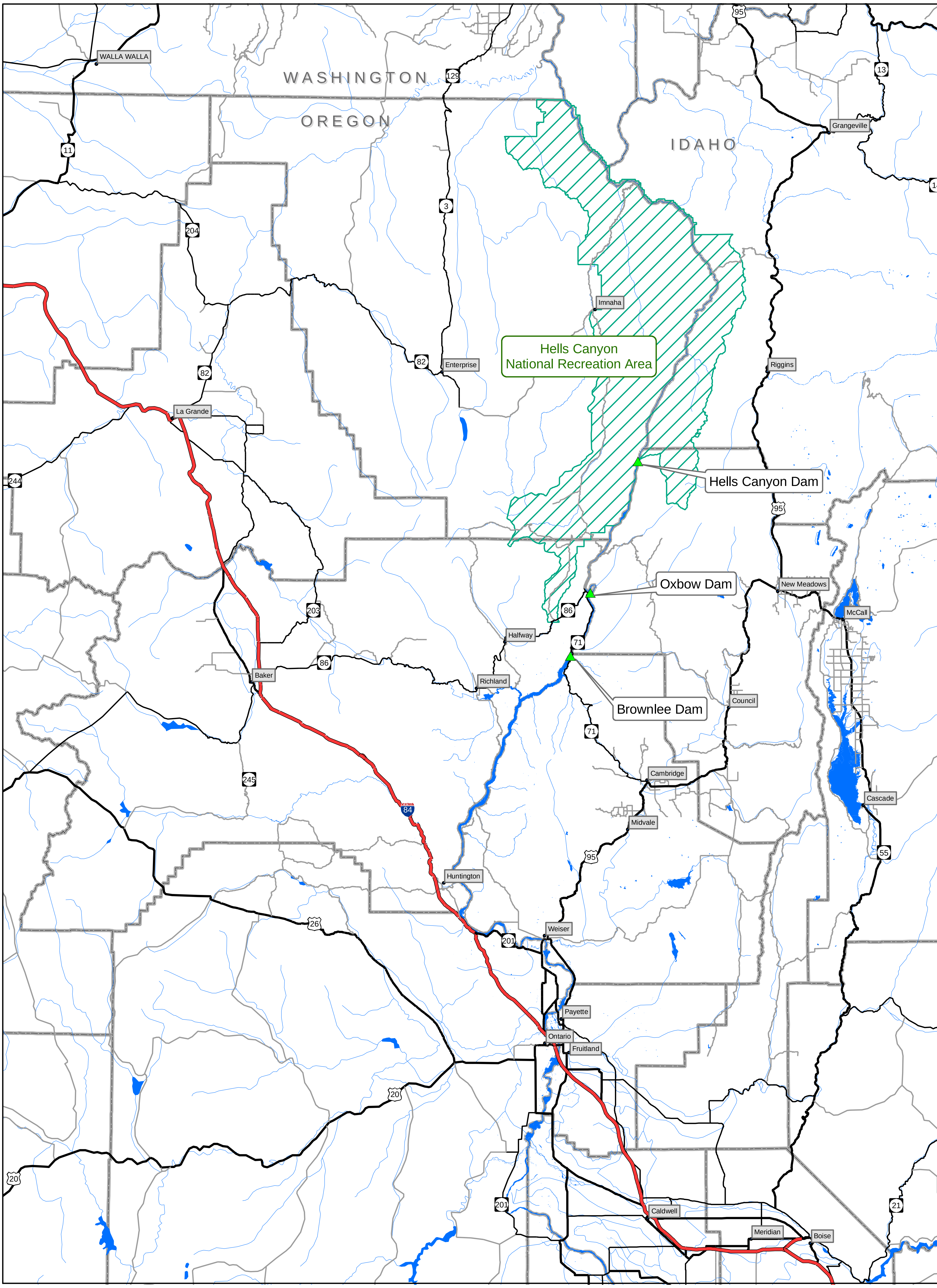
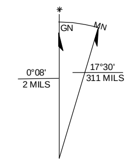


Features Legend

- Primary Route
- Secondary Route
- Major Road
- Minor Road
- Rivers
- County
- Hells Canyon Complex Dams
- Lakes

Vicinity Map



UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-2

Map of regional location of IPC study area

Scale 1:862,877

7 3.5 0 7 14 21 Miles

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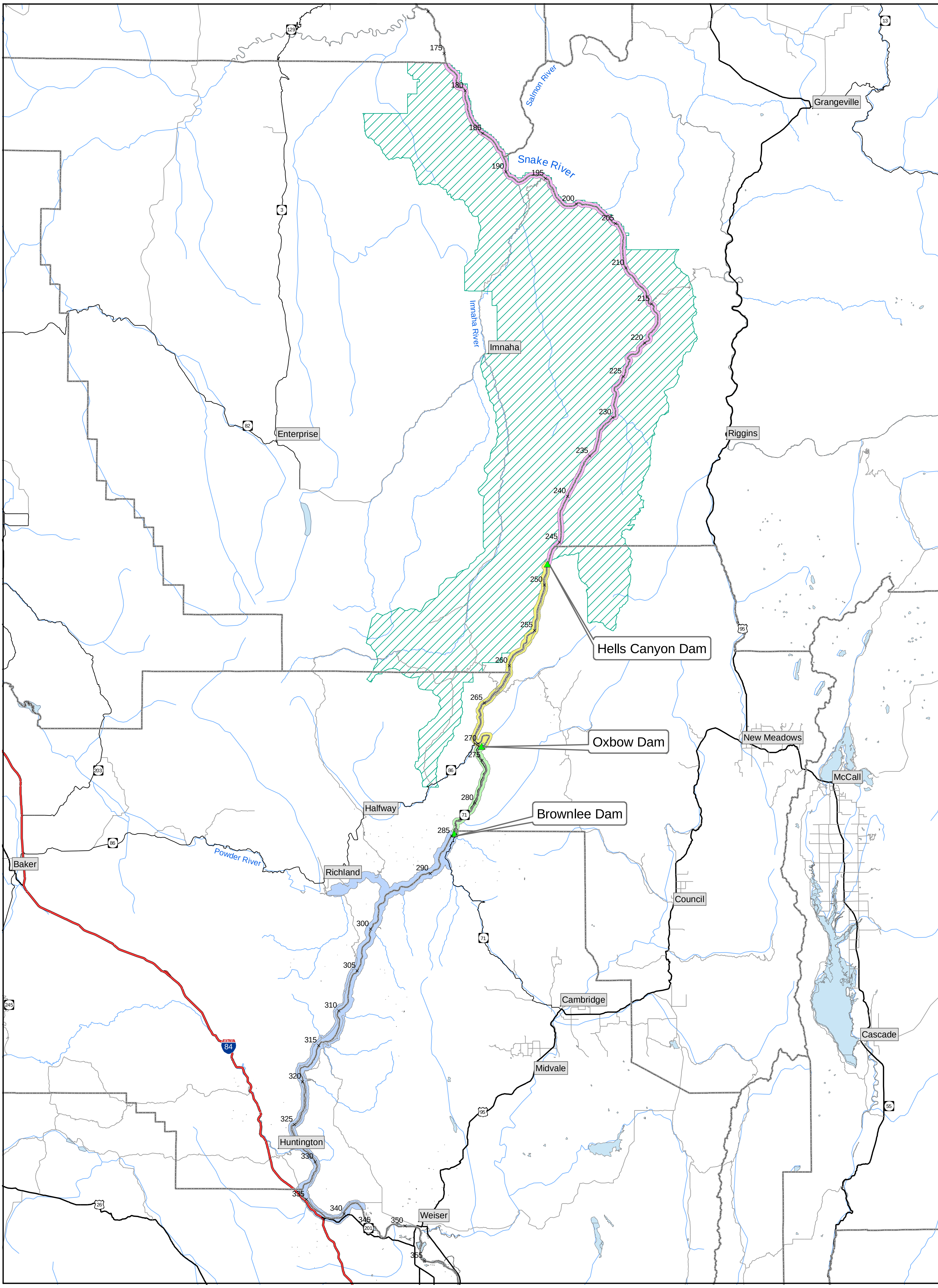

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Primary Route
- Secondary Route
- Major Road
- Minor Road
- Rivers
- County
- Brownlee Reservoir Reach
- Oxbow Reservoir Reach
- Hells Canyon Reservoir Reach
- HCNRA Reach
- Hells Canyon National Recreation Area
- Lakes and Reservoirs

GN
MN
0°08'
2 MILS
17°30'
311 MILS

UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-3

Map of total extent of the IPC recreation-related study area and four distinct river reaches within the study area

Scale 1:621,518

5 2.5 0 5 10 15 Miles

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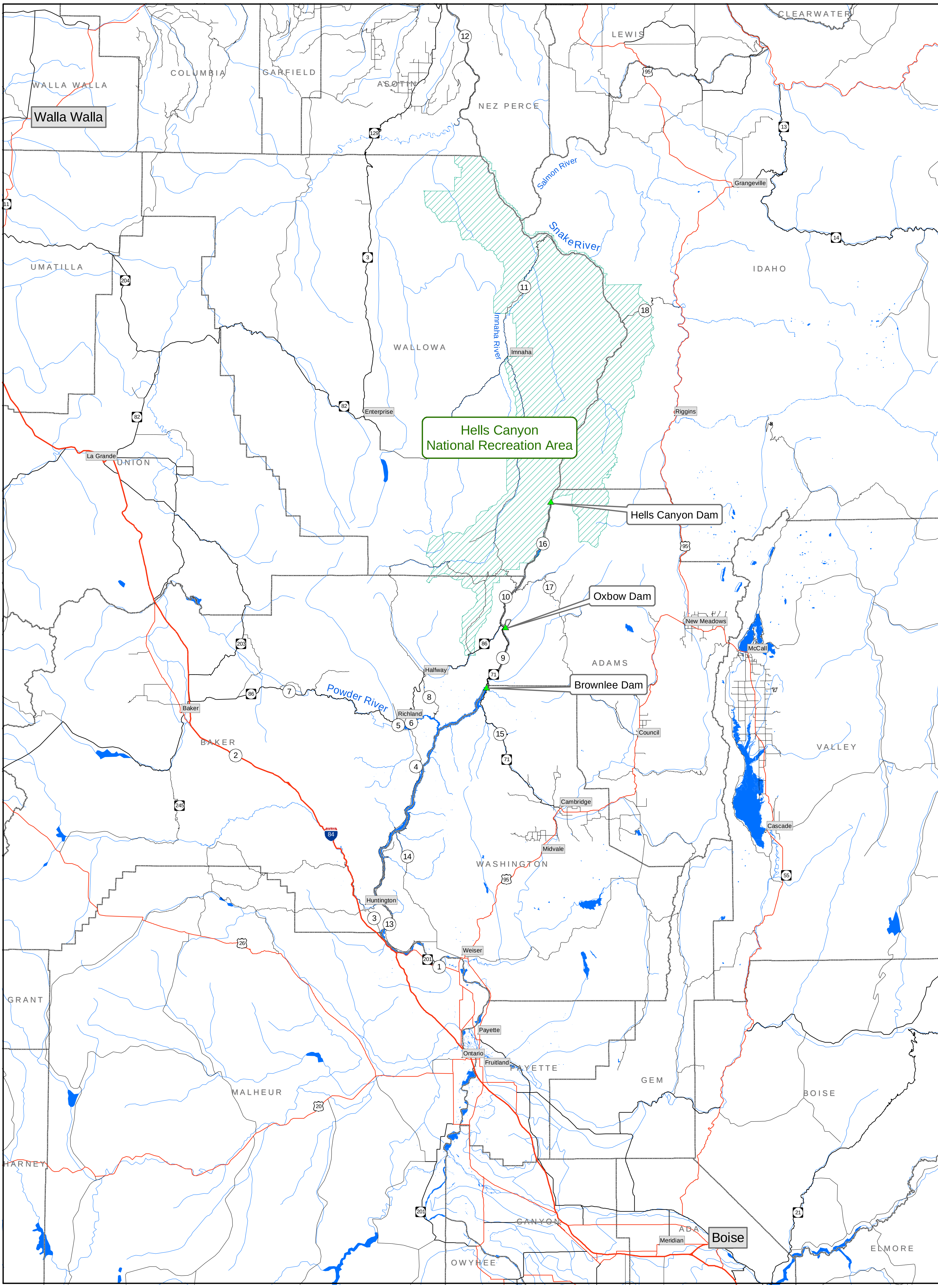

Features Legend

- Interstate Highway
- Principal Highway
- Major Road
- Minor Road
- Rivers
- Counties
- Lakes and Reservoirs

1. Olds Ferry-Ontario Highway
2. Interstate 84
3. Huntington Highway
4. Snake River Road (OR)
5. Powder River Arm
6. Sullivan Road
7. State Highway 86
8. Sag Road
9. Oxbow-Brownlee Road
10. Homestead Road
11. Dug Bar Road
12. Snake River Road (WA)
13. Olds Ferry Road
14. Rock Creek Road
15. State Highway 71
16. Hells Canyon Road
17. Kleinschmidt Road
18. Pittsburg Landing Road

Vicinity Map

IDAHO POWER
An IDACORP Company

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002
Figure E.5-4
Map of communities, political boundaries, and access roads near the IPC recreation study area
Scale 1:902,922

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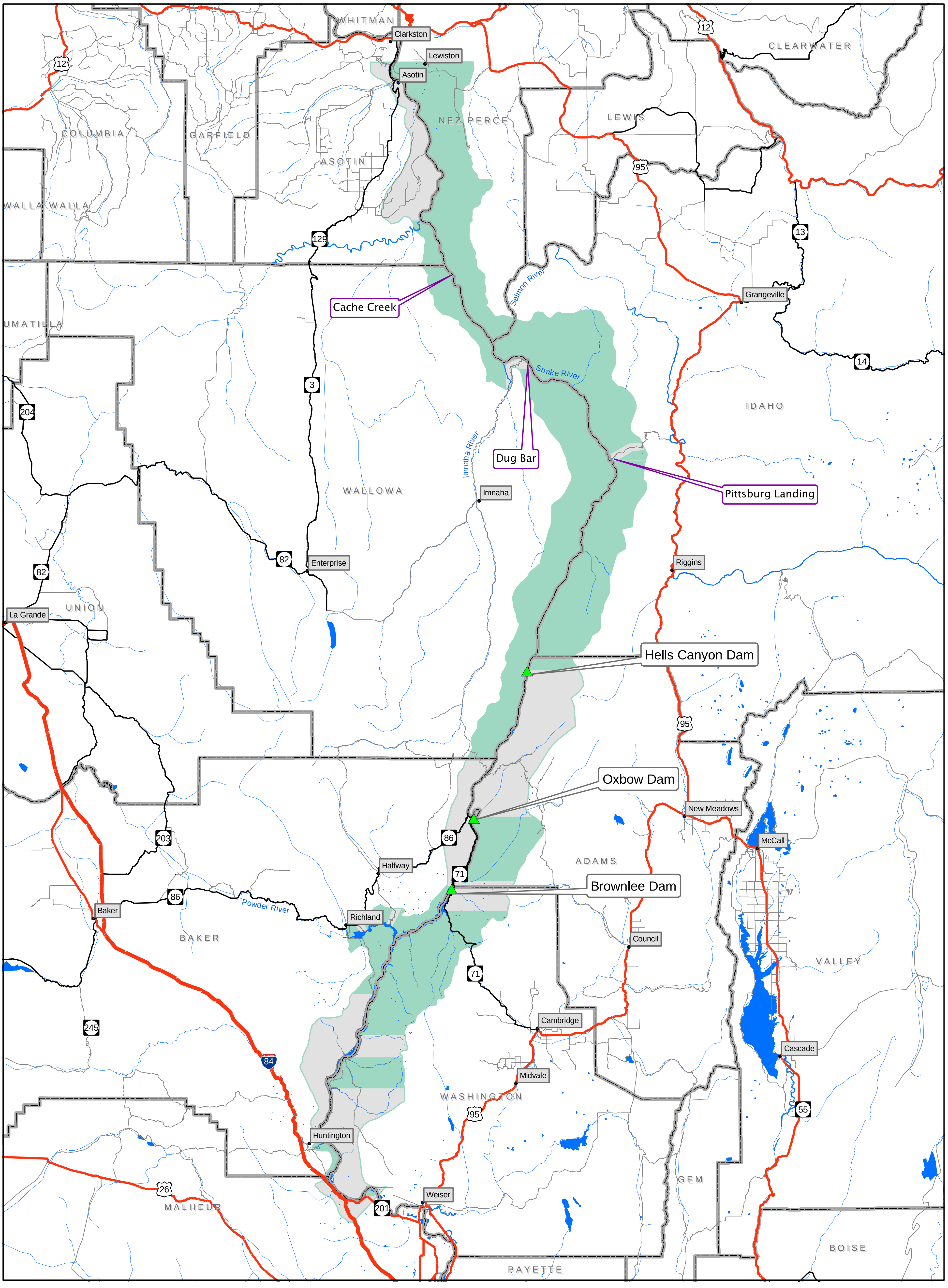

Vicinity Map

IDAHO POWER
An IDACORP Company

Hells Canyon Project - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-5

Map of roadless areas adjacent to the Snake and Powder Rivers within the IPC recreation study area

Scale 1:768,009

6 3 0 6 12 18 Miles

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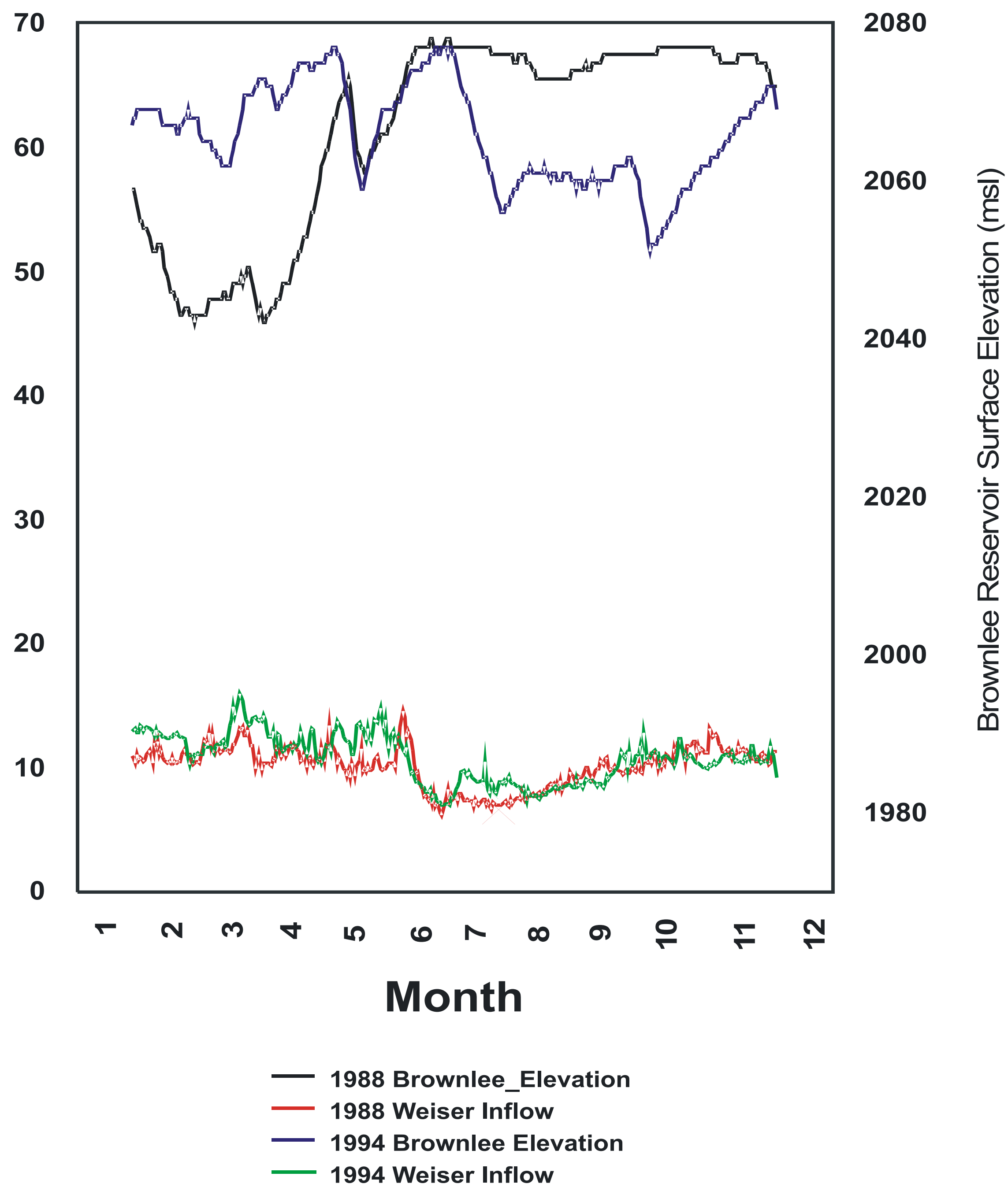

Figure E.5-6 **Examples of annual changes in Brownlee Reservoir elevation and Snake River (at Weiser) hydrographs from two low-flow years, one before and one after initiation of changes in annual patterns of fluctuations in Brownlee Reservoir elevations**

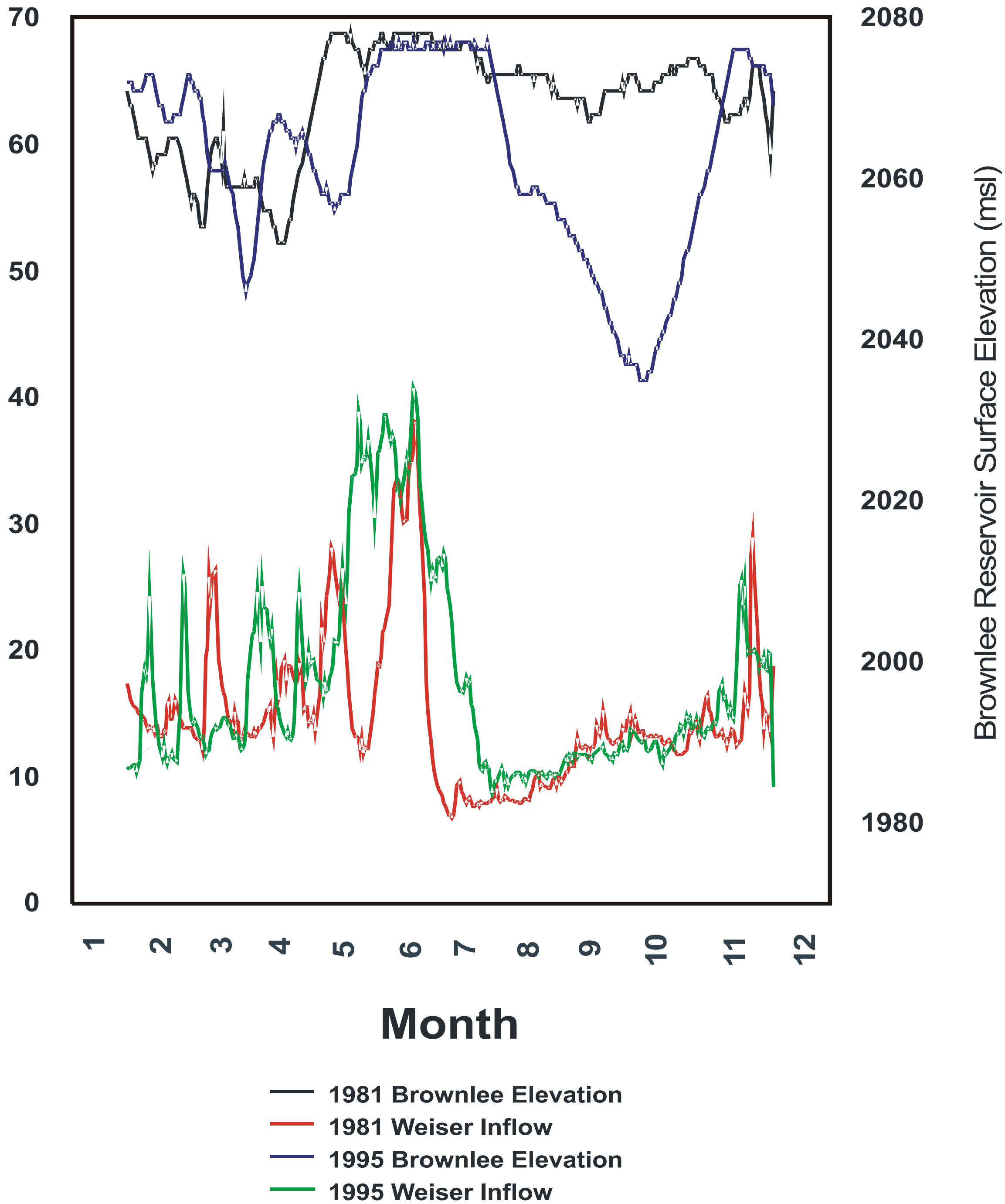

Figure E.5-7 **Examples of annual changes in Brownlee Reservoir elevation and Snake River (at Weiser) hydrographs from two medium-flow years, one before and one after initiation of changes in annual patterns of fluctuations in Brownlee Reservoir elevations**

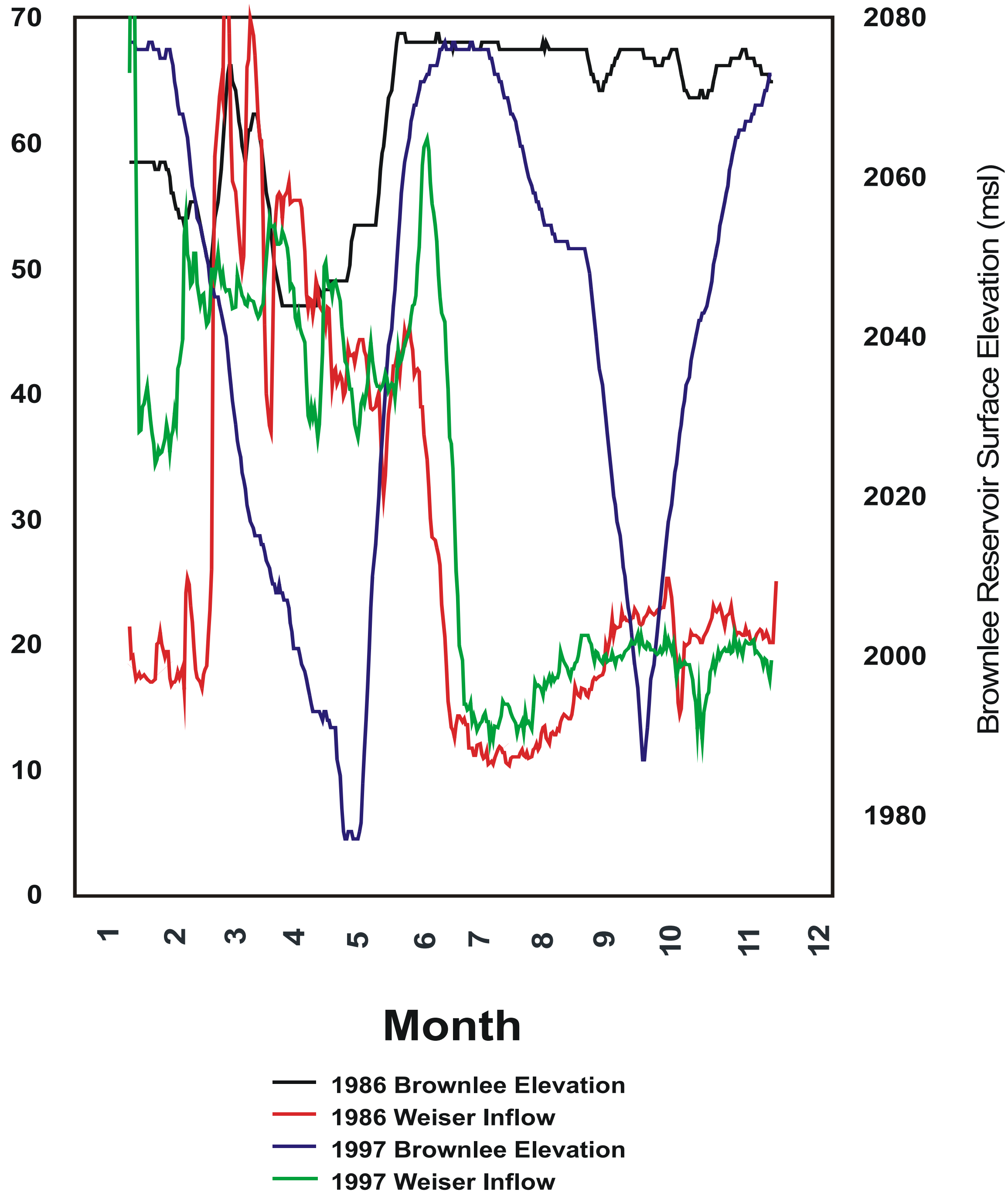

Figure E.5-8 **Examples of annual changes in Brownlee Reservoir elevation and Snake River (at Weiser) hydrographs from two high-flow years, one before and one after initiation of changes in annual patterns of fluctuations in Brownlee Reservoir elevations**

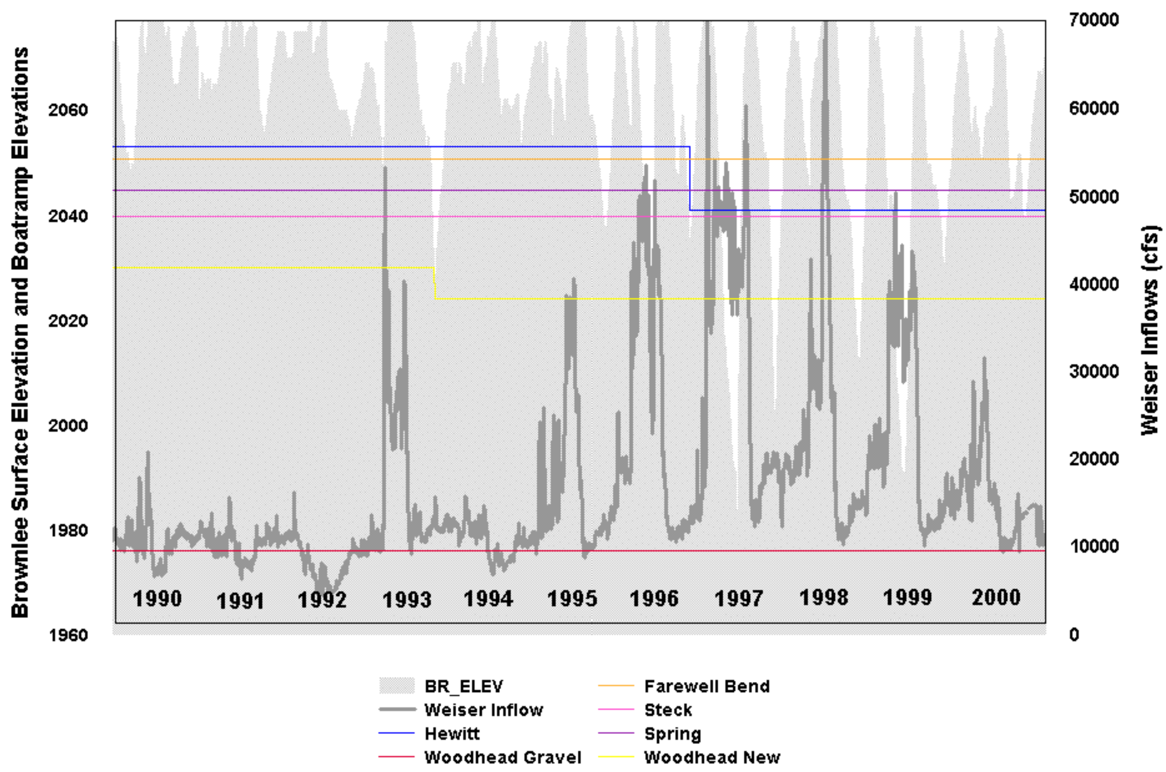

Figure E.5-9 Brownlee Reservoir elevations, 1990–2000, and major boat ramp toe elevations

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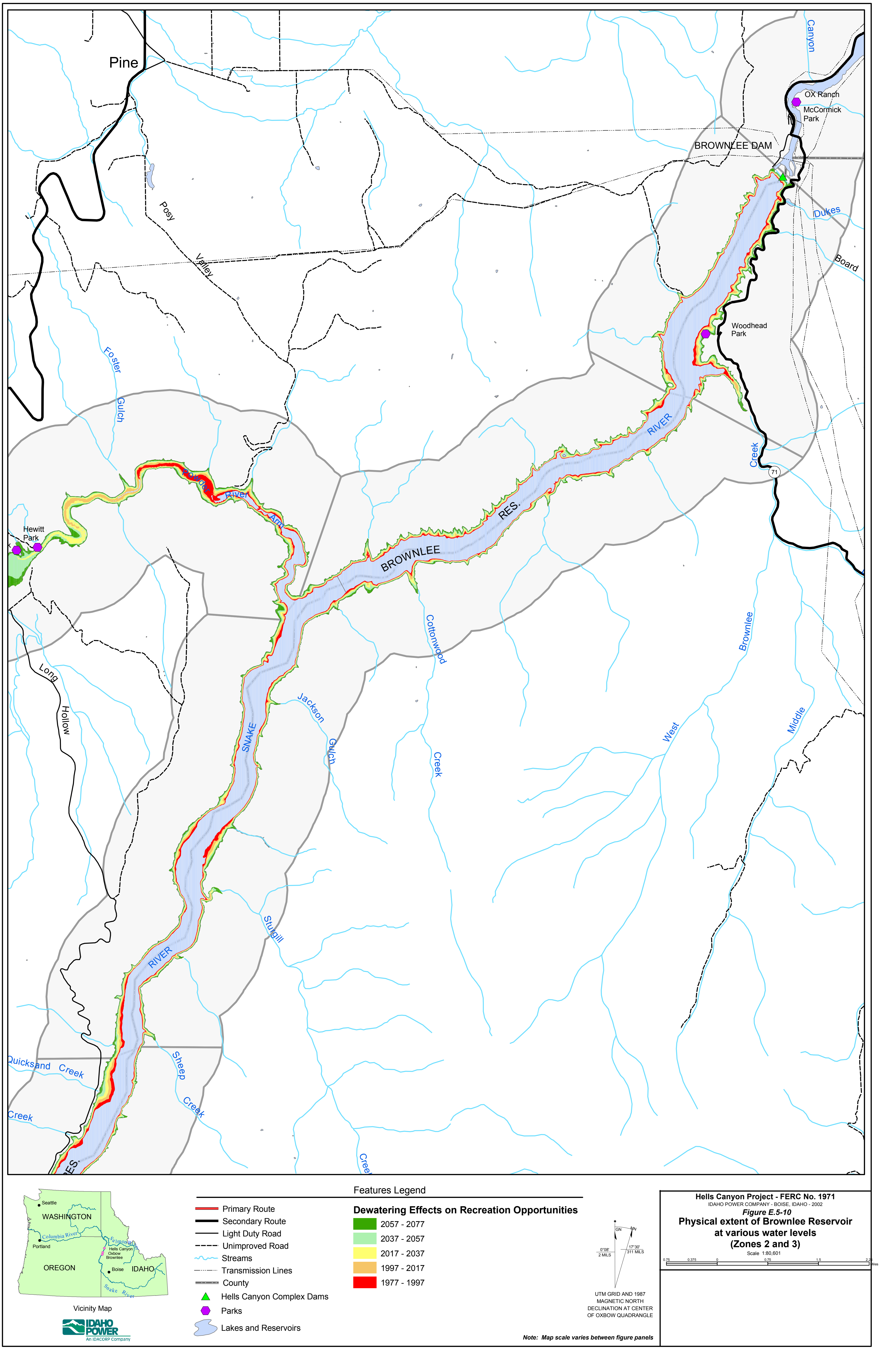

Note: Map scale varies between figure panels

Hells Canyon Project - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-10

Physical extent of Brownlee Reservoir at various water levels (Zones 2 and 3)

Scale 1:80,601

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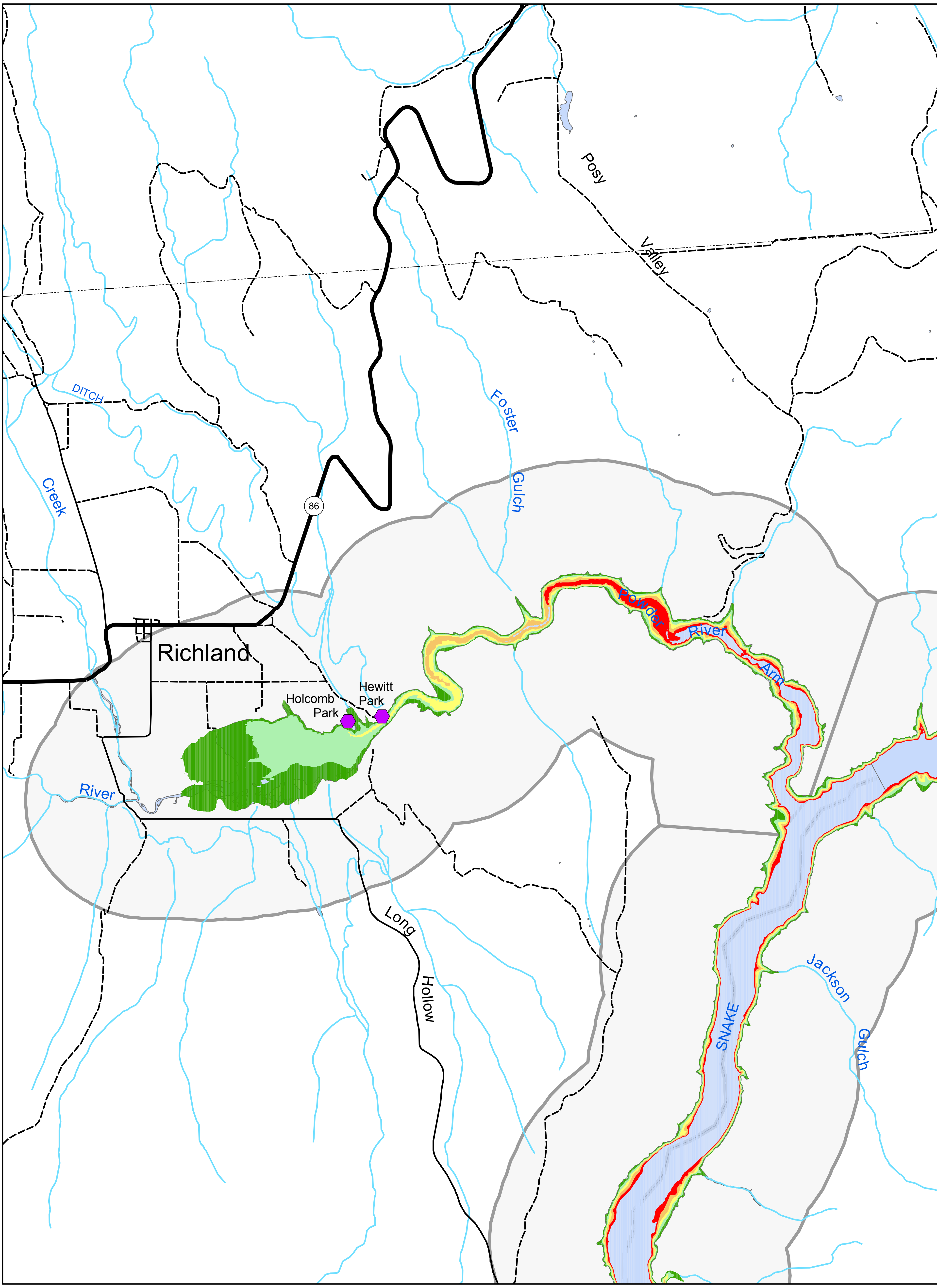

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Streams
- Transmission Lines
- County
- Hells Canyon Complex Dams
- Parks
- Lakes and Reservoirs

Dewatering Effects on Recreation Opportunities

- 2057 - 2077
- 2037 - 2057
- 2017 - 2037
- 1997 - 2017
- 1977 - 1997

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Note: Map scale varies between figure panels

Hells Canyon Project - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-10

Physical extent of Brownlee Reservoir at various water levels (Zone 4)

Scale 1:54,317

0.5 0.25 0 0.5 1 1.5 Miles

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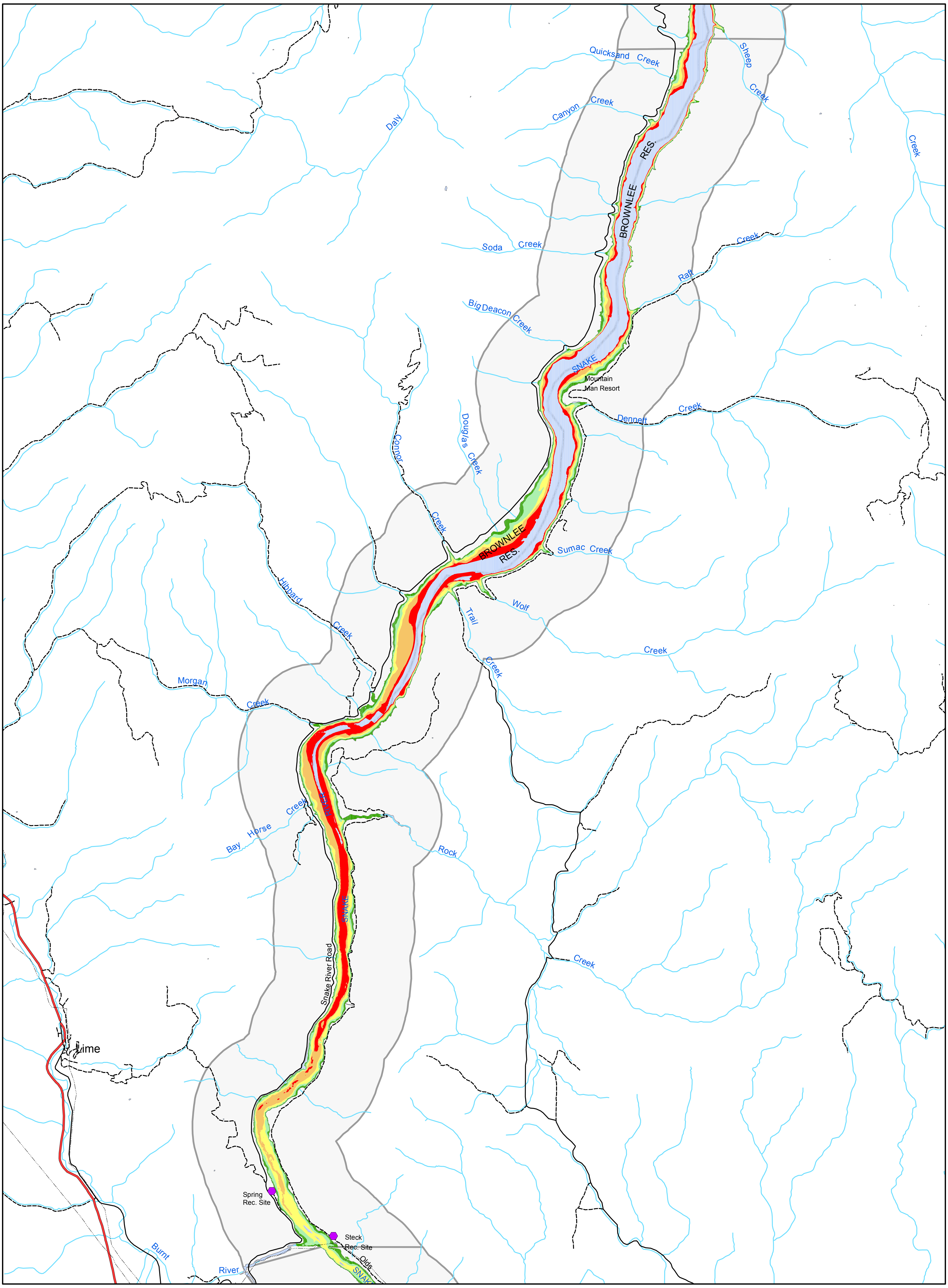

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Streams
- Transmission Lines
- County
- Hells Canyon Complex Dams
- Parks
- Lakes and Reservoirs

Dewatering Effects on Recreation Opportunities

- 2057 - 2077
- 2037 - 2057
- 2017 - 2037
- 1997 - 2017
- 1977 - 1997

GN
MN
0°08'
2 MILS
17°30'
311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Note: Map scale varies between figure panels

Hells Canyon Project - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-10

Physical extent of Brownlee Reservoir at various water levels (Zone 5)

Scale 1:98,182

0.8 0.4 0 0.8 1.6 2.4 Miles

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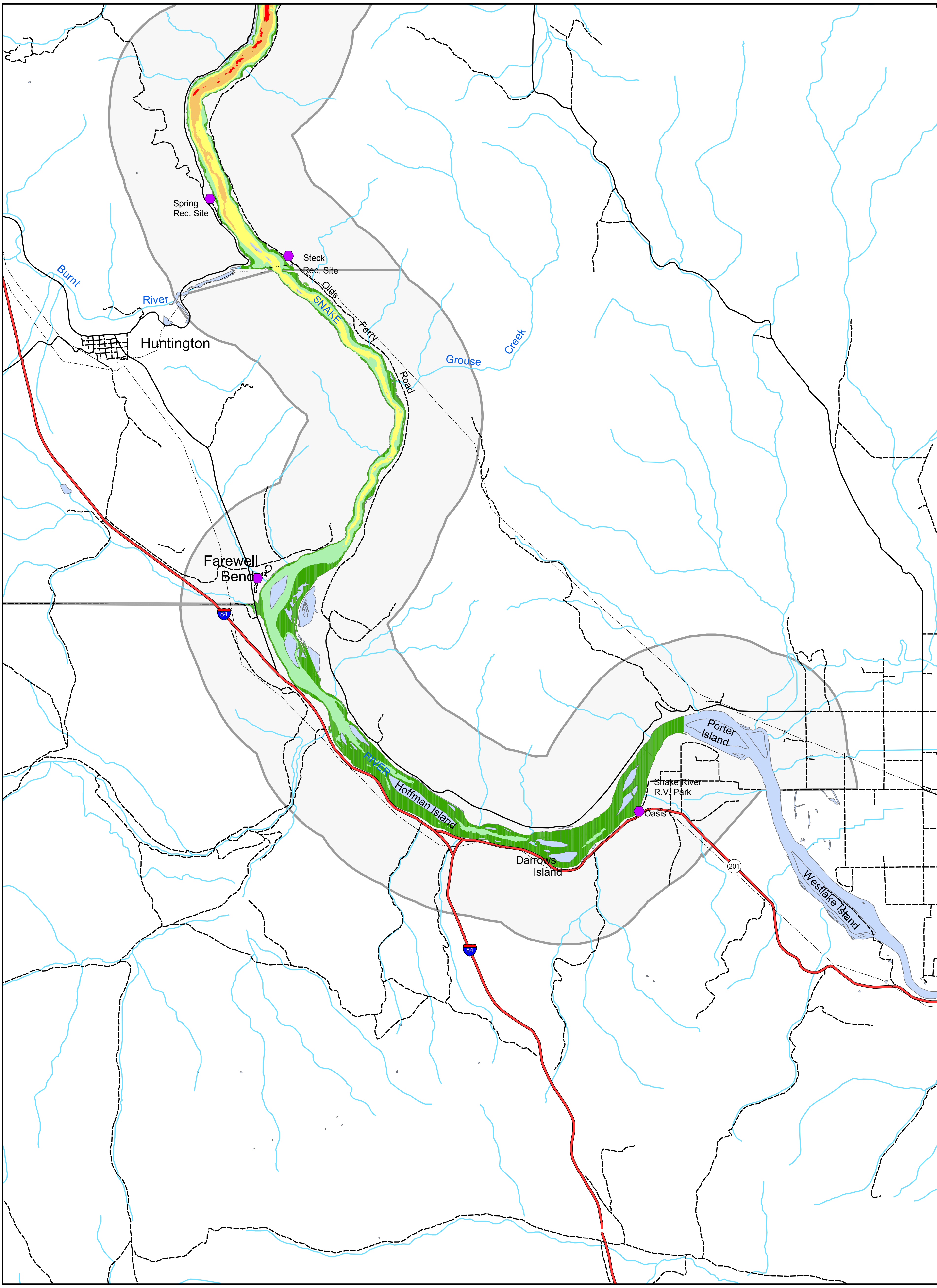

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Streams
- Transmission Lines
- County
- Hells Canyon Complex Dams
- Parks
- Lakes and Reservoirs

Dewatering Effects on Recreation Opportunities

- 2057 - 2077
- 2037 - 2057
- 2017 - 2037
- 1997 - 2017
- 1977 - 1997

UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Note: Map scale varies between figure panels

Hells Canyon Project - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5-10

Physical extent of Brownlee Reservoir at various water levels (Zone 6)

Scale 1:77,190

0.6 0.3 0 0.6 1.2 1.8 Miles

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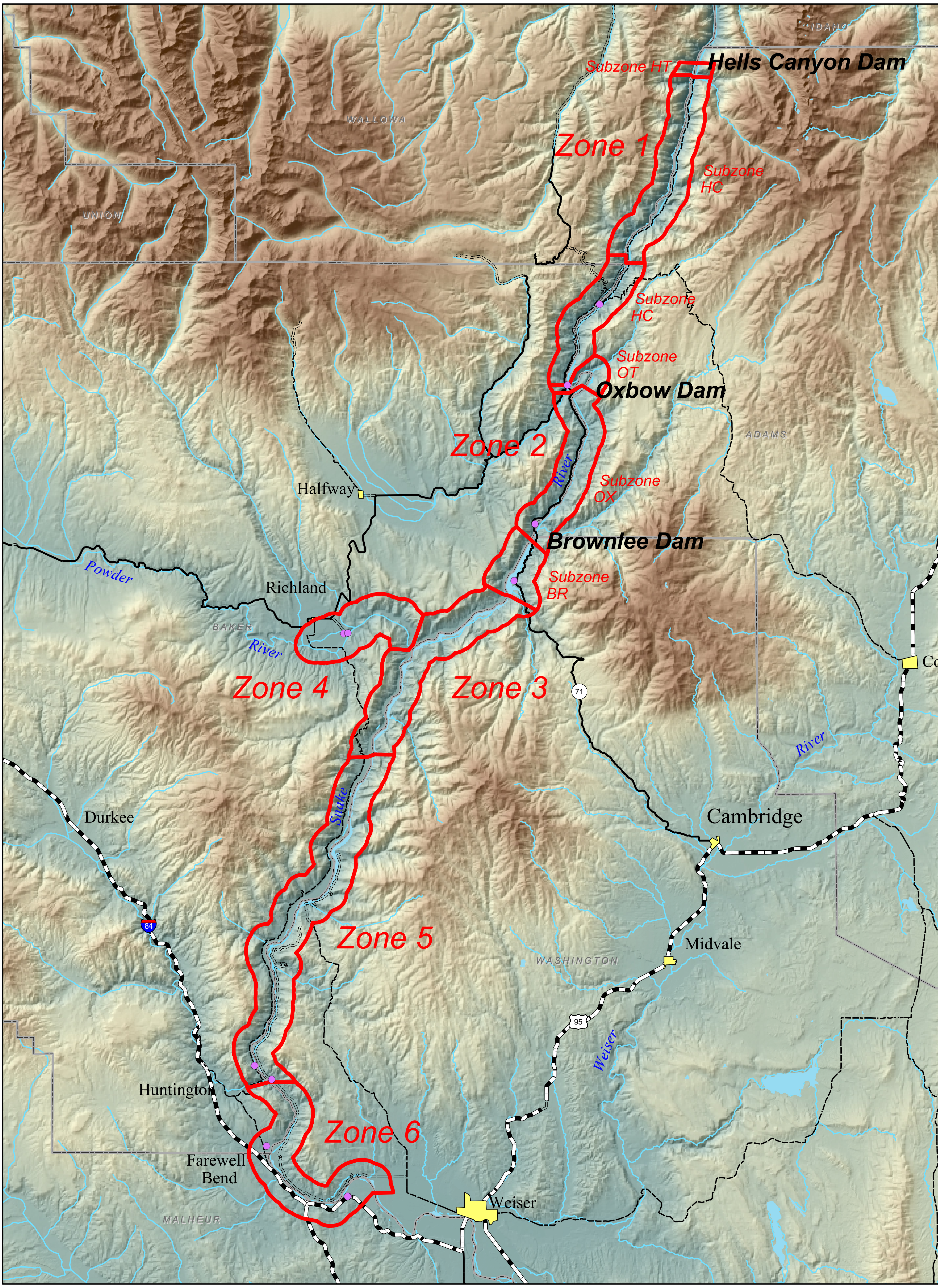

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Highway
- Primary
- Secondary
- Light Duty
- Rivers and Streams
- County Boundaries
- Urban Areas
- Management Zones
- Lakes and Reservoirs
- Developed Recreation Site

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002
Figure E.5-11

Map of management zones and subzones in IPC's Hell Canyon Complex

Scale 1:362,070

3 1.5 0 3 6 9 Miles

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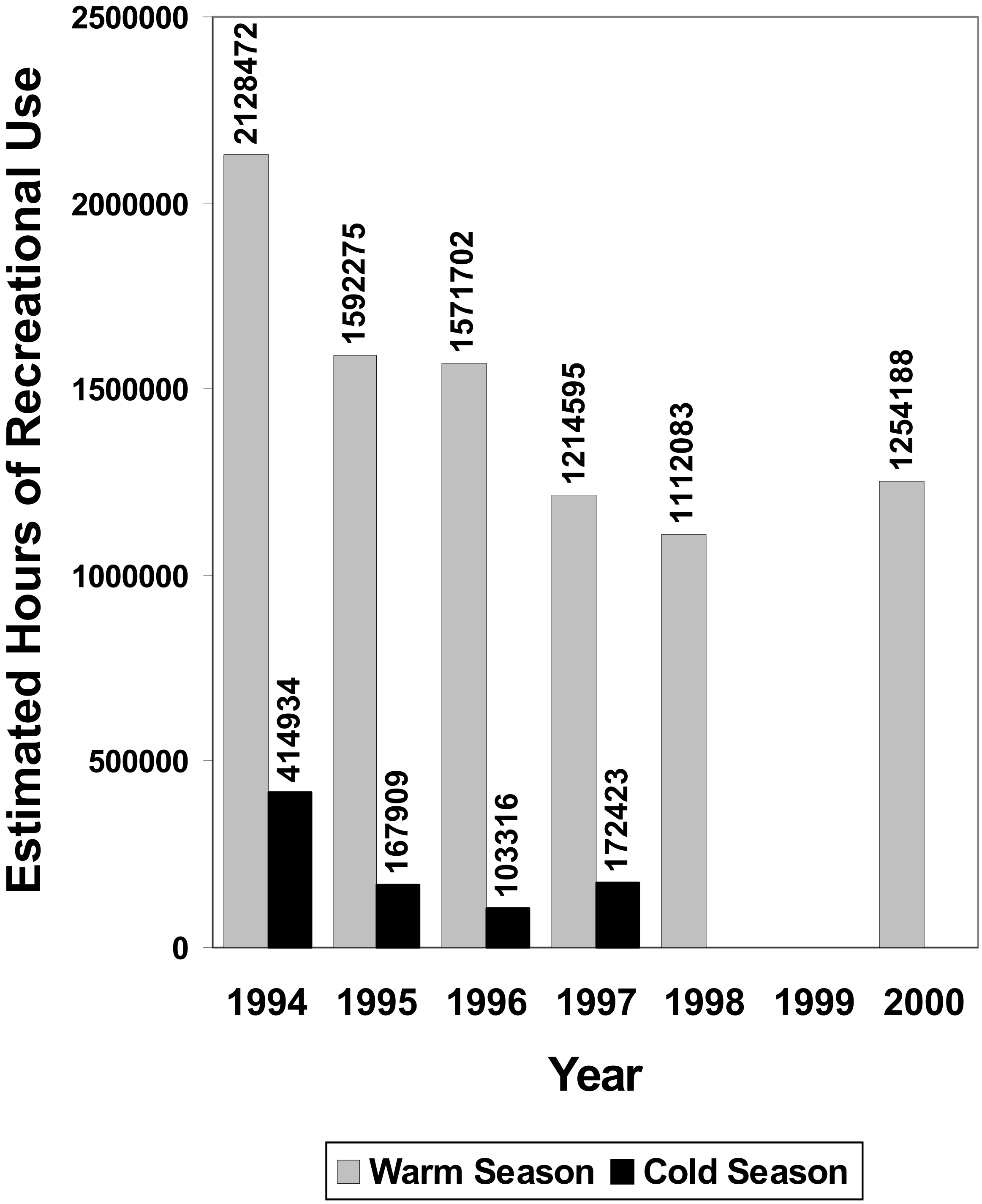

Figure E.5-12 Estimated hours of recreational use, by year and season, in the HCC (from the Applicant's recreational-use surveys)

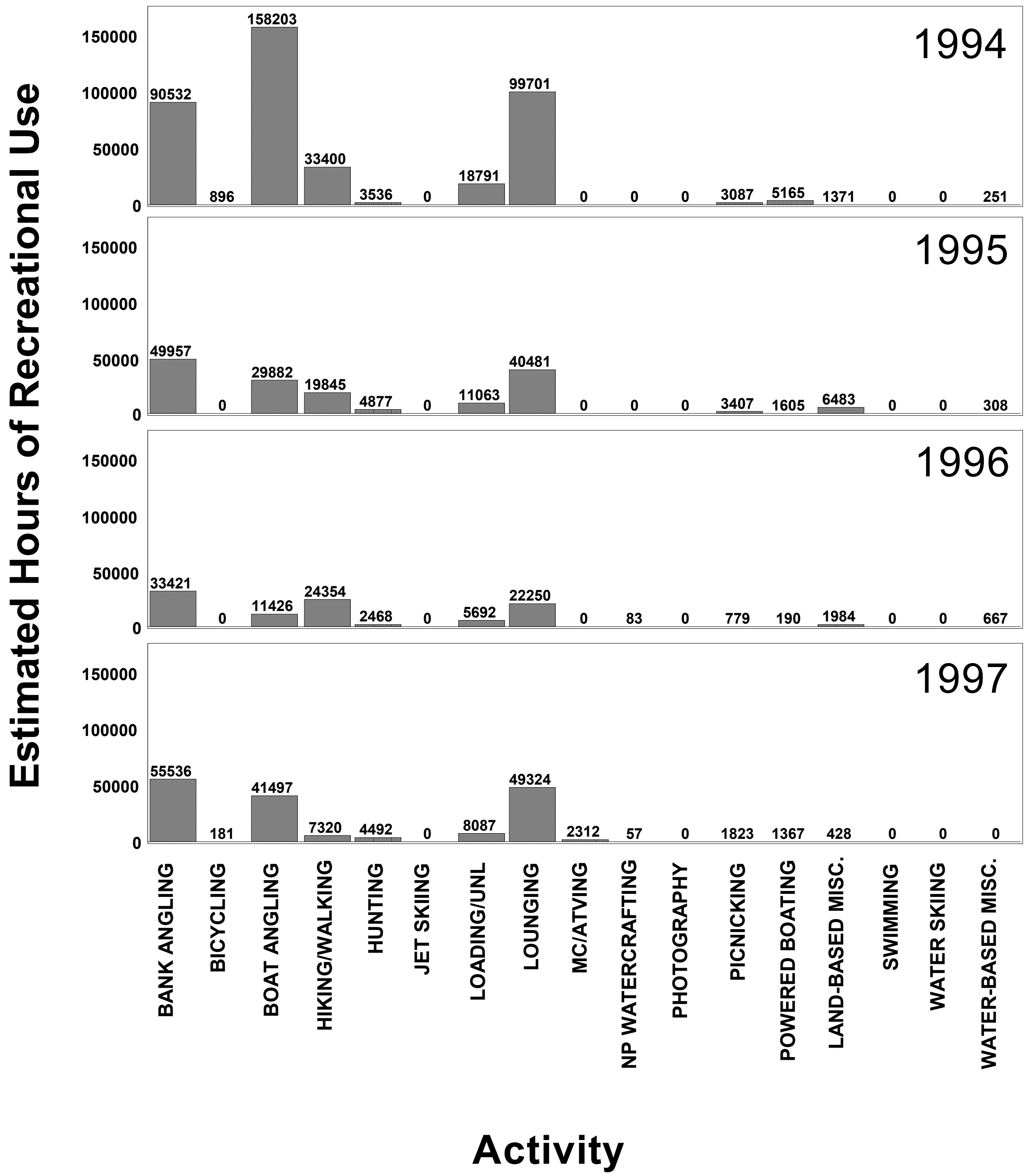

Figure E.5-13 Estimated hours of recreational use, by year and activity, for cold season in the HCC (from the Applicant's recreational-use surveys)

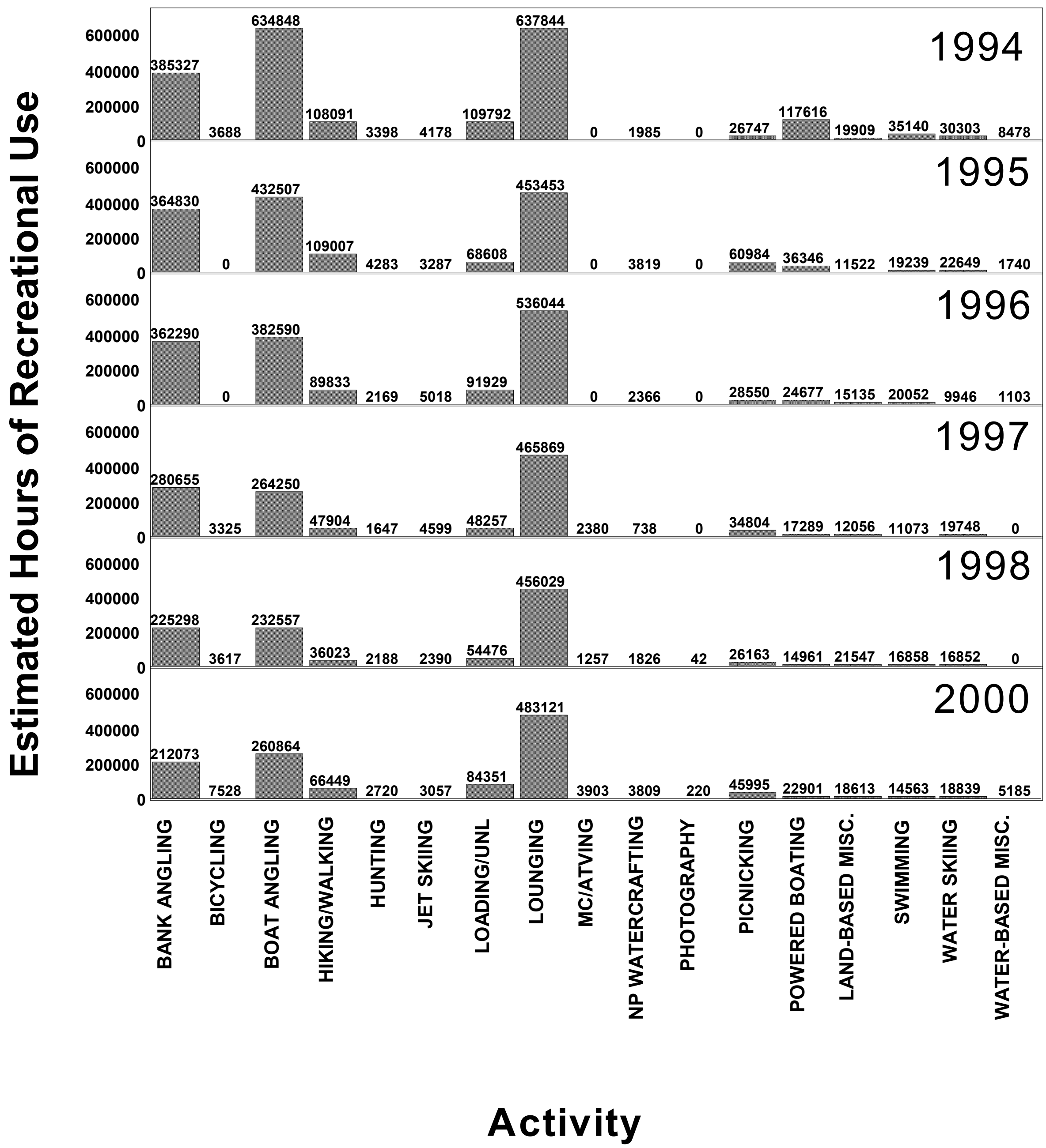

Figure E.5-14 Estimated hours of recreational use, by year and activity, for warm season in the HCC (from the Applicant's recreational-use surveys)

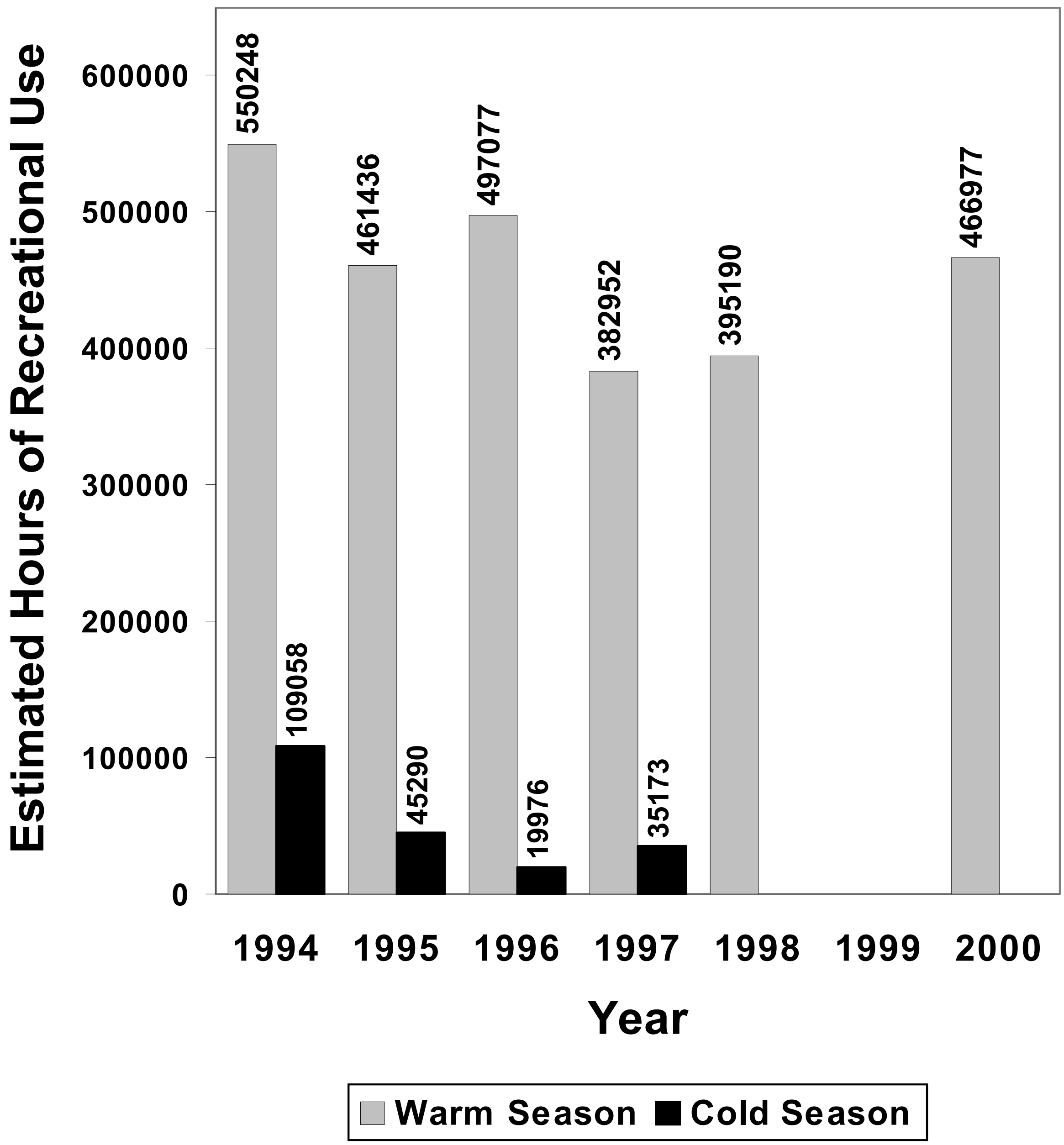

Figure E.5-15 Estimated hours of recreational use, by year and season, for all parks combined in the HCC (from the Applicant's recreational-use surveys)

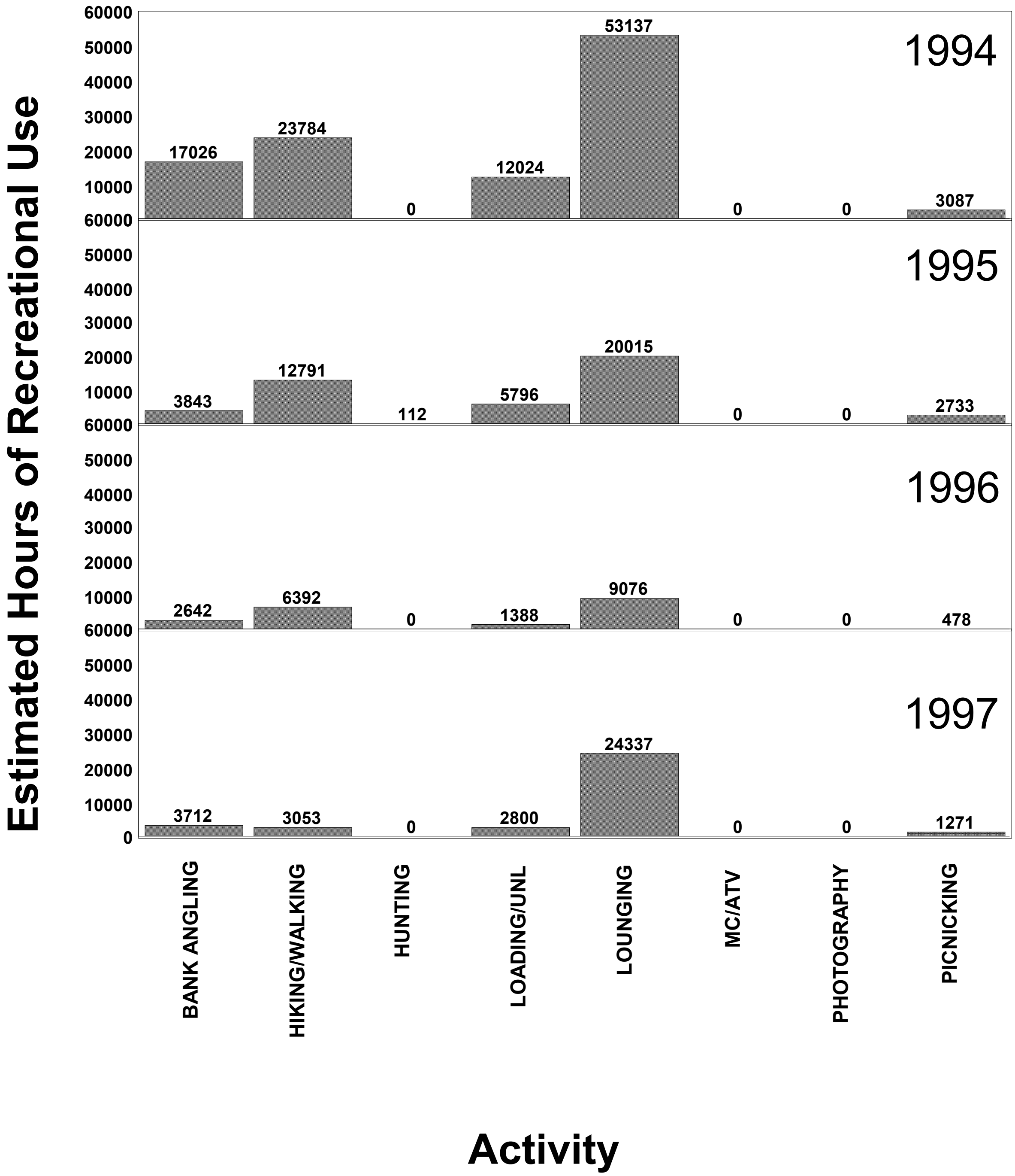

Figure E.5-16 Estimated hours of recreational use, by year and activity, for cold season at all parks combined in the HCC (from the Applicant's recreational-use surveys)

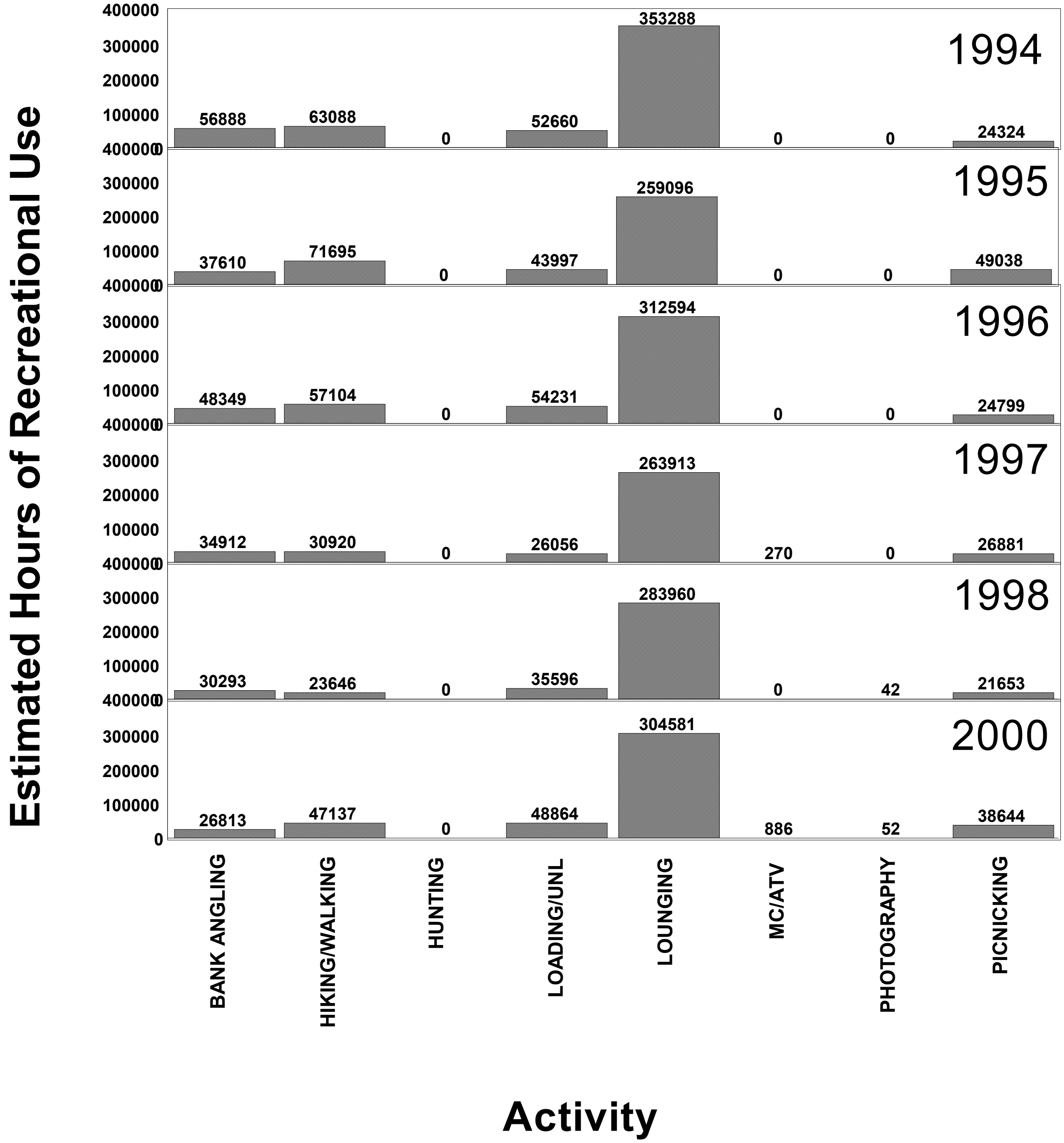

Figure E.5-17 Estimated hours of recreational use, by year and activity, for warm season at all parks combined in the HCC (from the Applicant's recreational-use surveys)

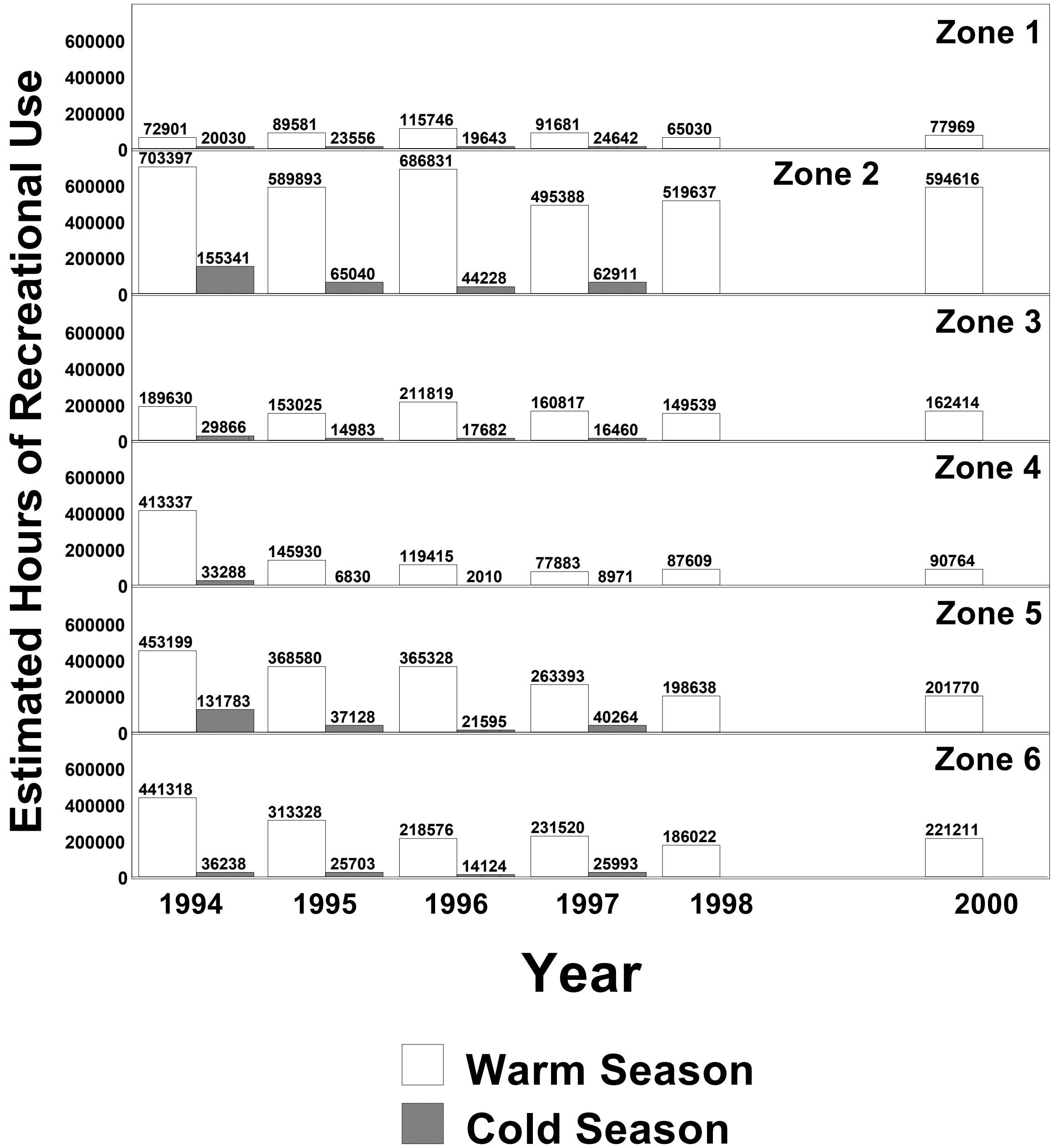

Figure E.5-18 Estimated hours of recreational use, by year, season, and zone in the HCC (from the Applicant's recreational-use surveys)

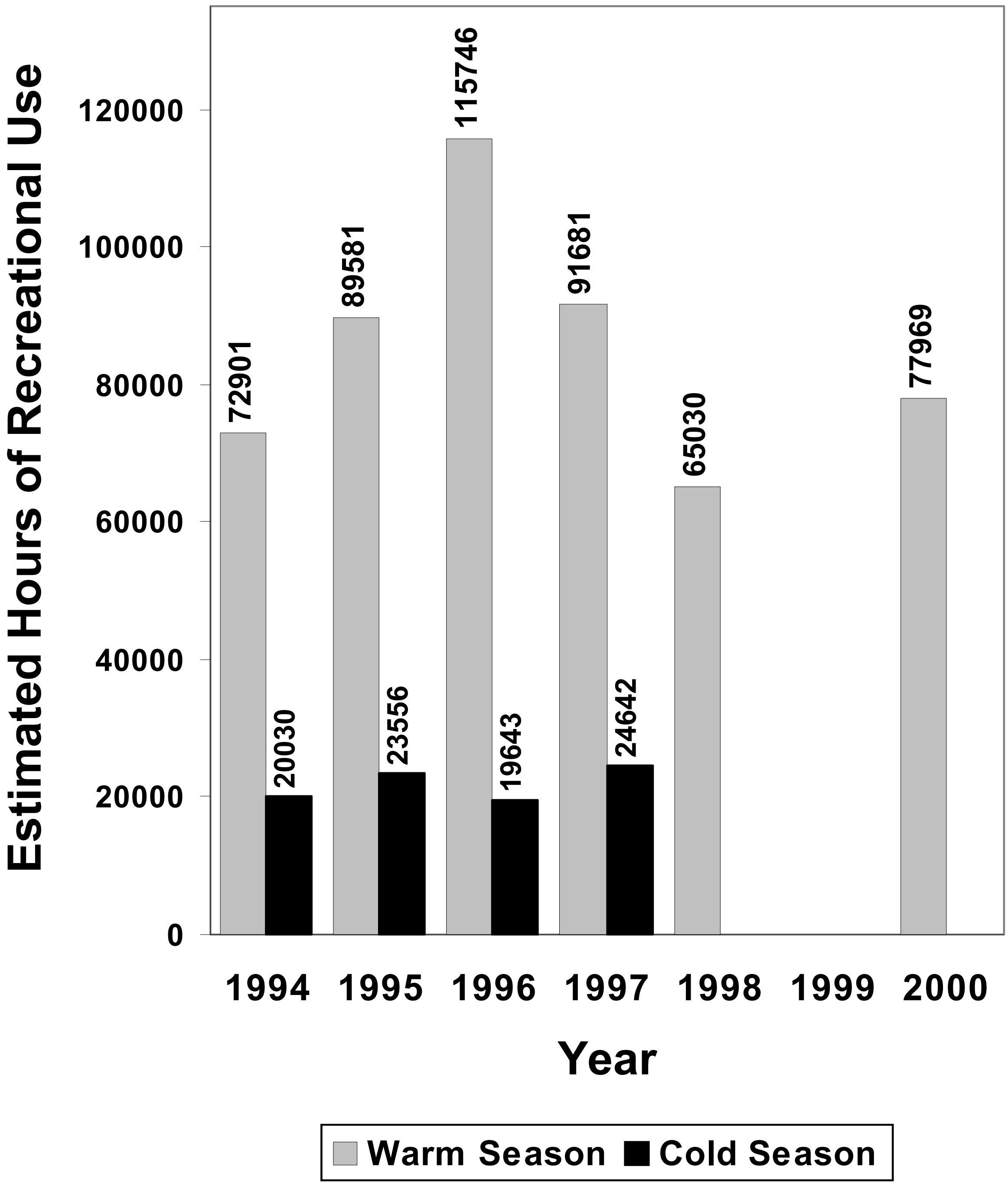

Figure E.5-19 Overall estimated hours of recreational use, by year and season, in Zone 1 of the HCC (from the Applicant's recreational-use surveys)

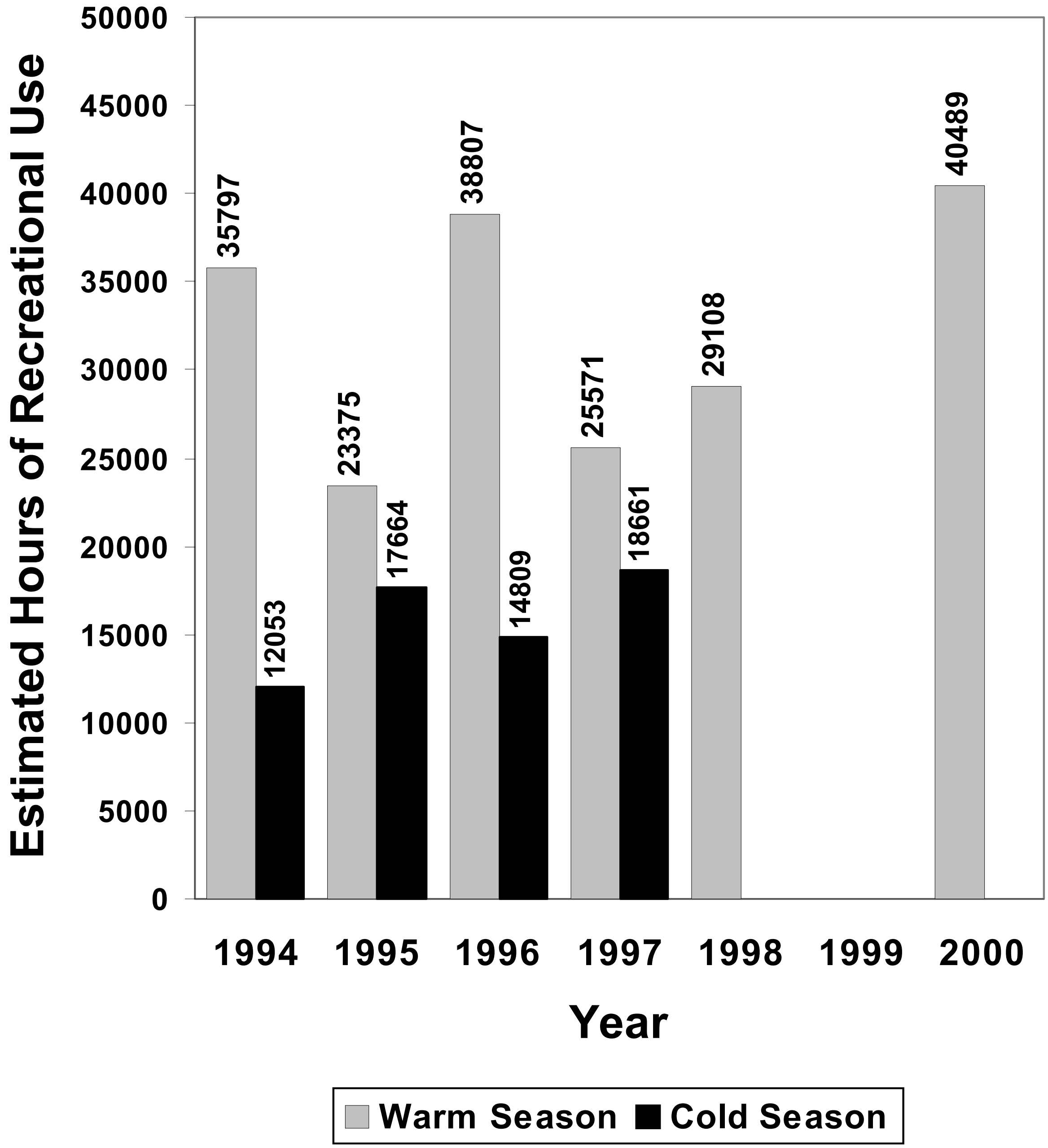

Figure E.5-20 Estimated hours of recreational use, by year and season, in Zone 1, subzone HT of the HCC (from the Applicant's recreational-use surveys)

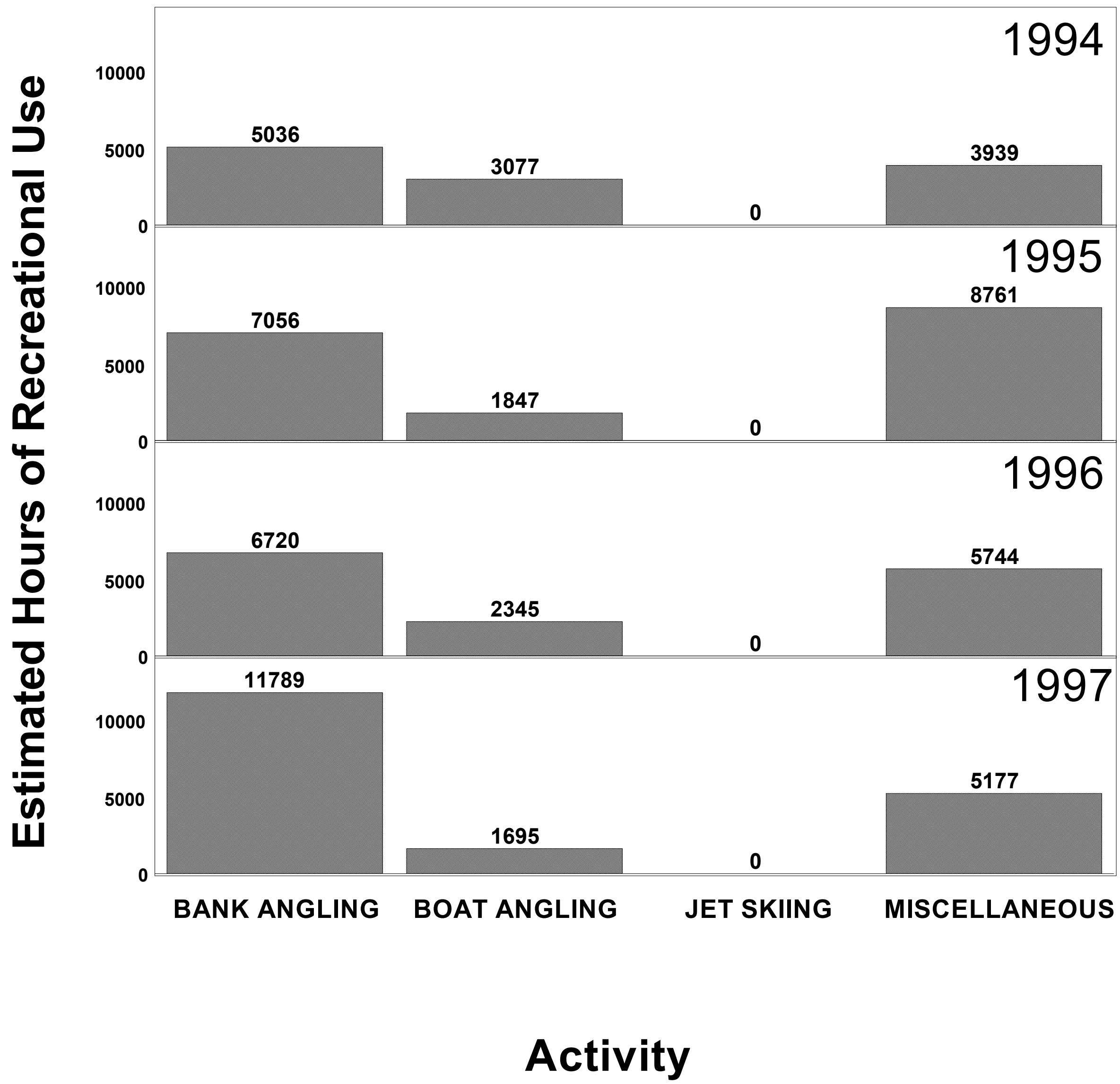

Figure E.5-21 Estimated hours of recreational use during the cold season, by year and activity, in Zone 1, subzone HT of the HCC (from the Applicant's recreational-use surveys)

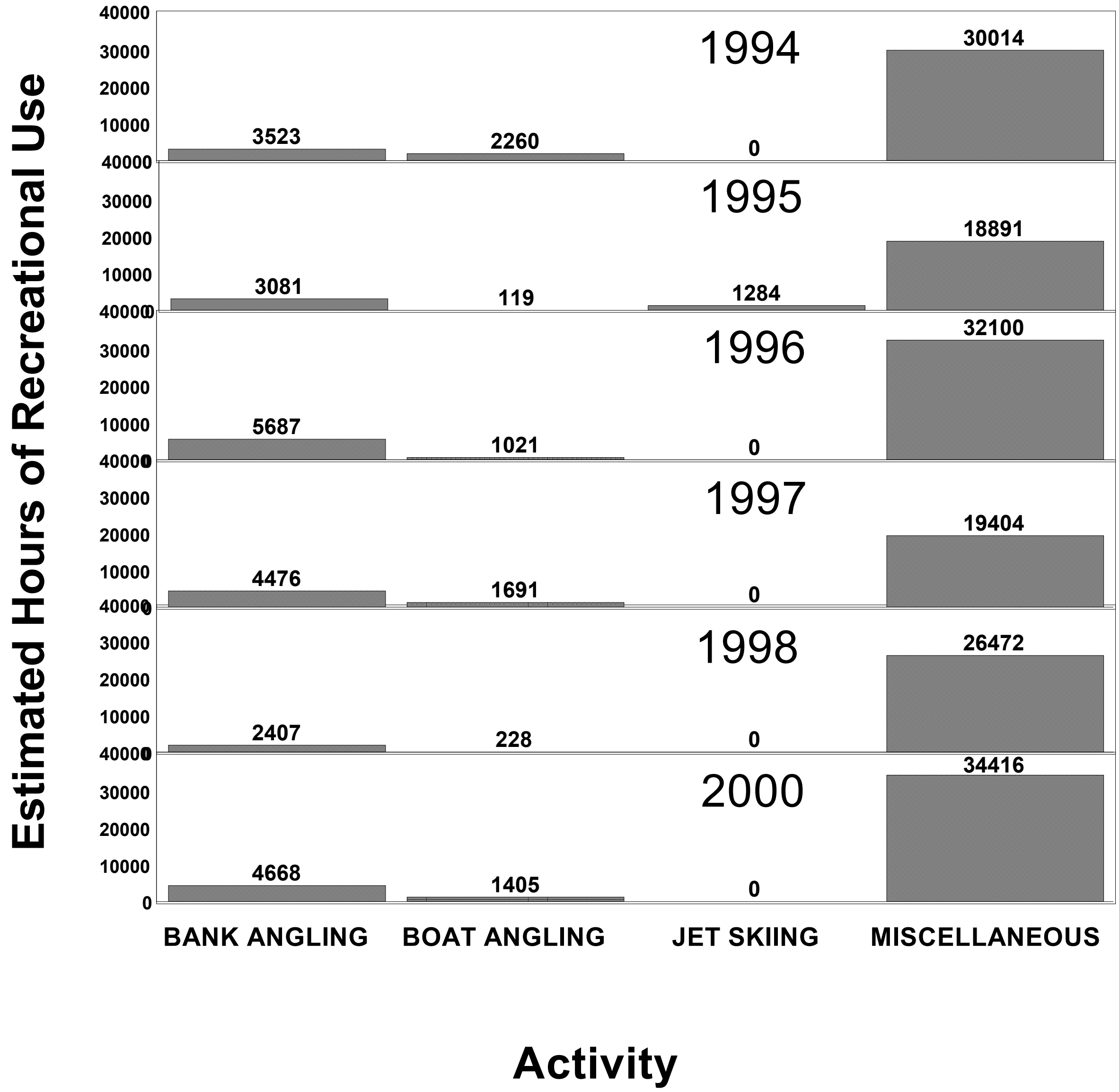

Figure E.5-22 Estimated hours of recreational use during the warm season, by year and activity, in Zone 1, subzone HT of the HCC (from the Applicant's recreational-use surveys)

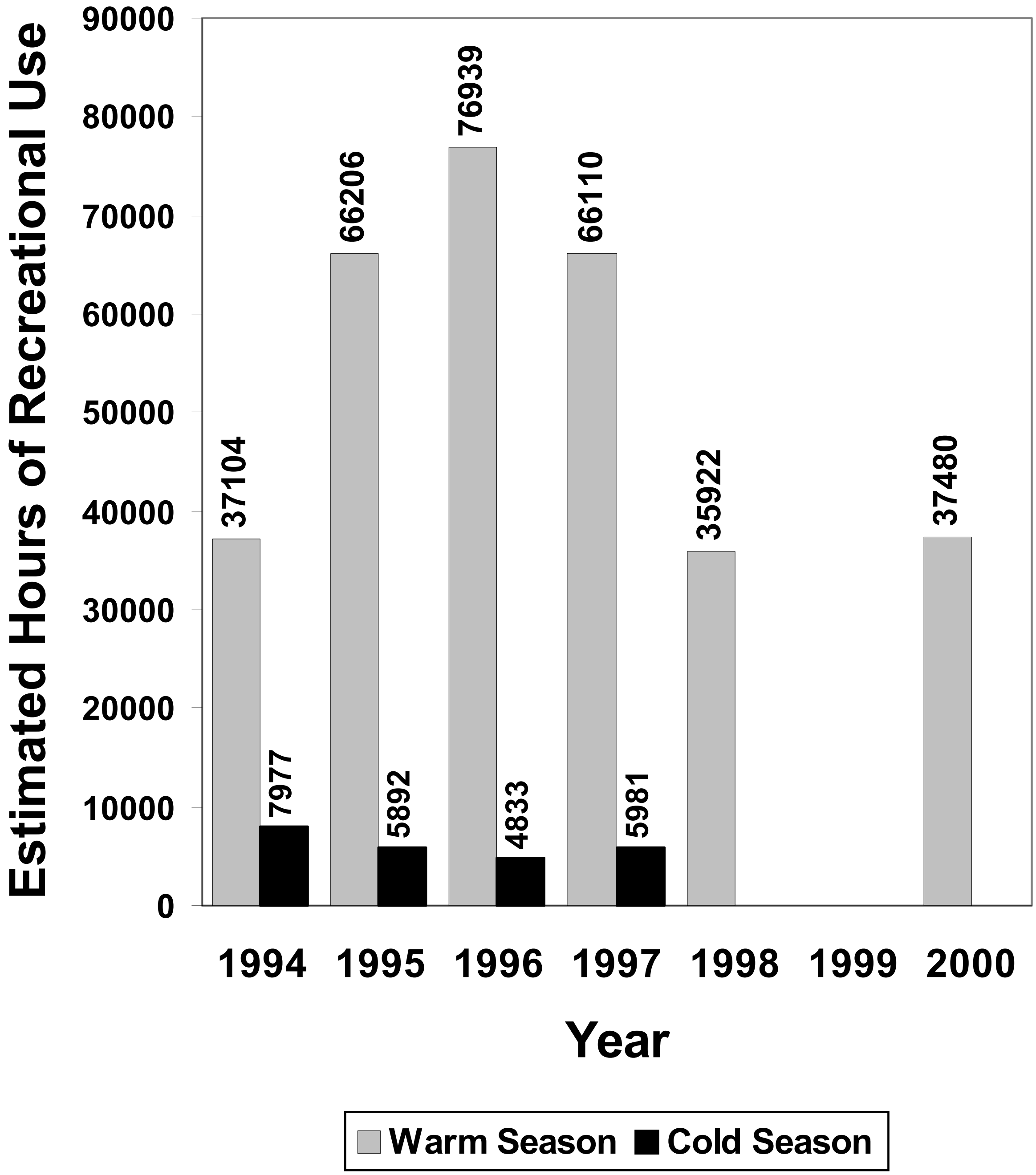

Figure E.5-23 Estimated hours of recreational use, by year and season, in Zone 1, subzone HC of the HCC (from the Applicant's recreational-use surveys)

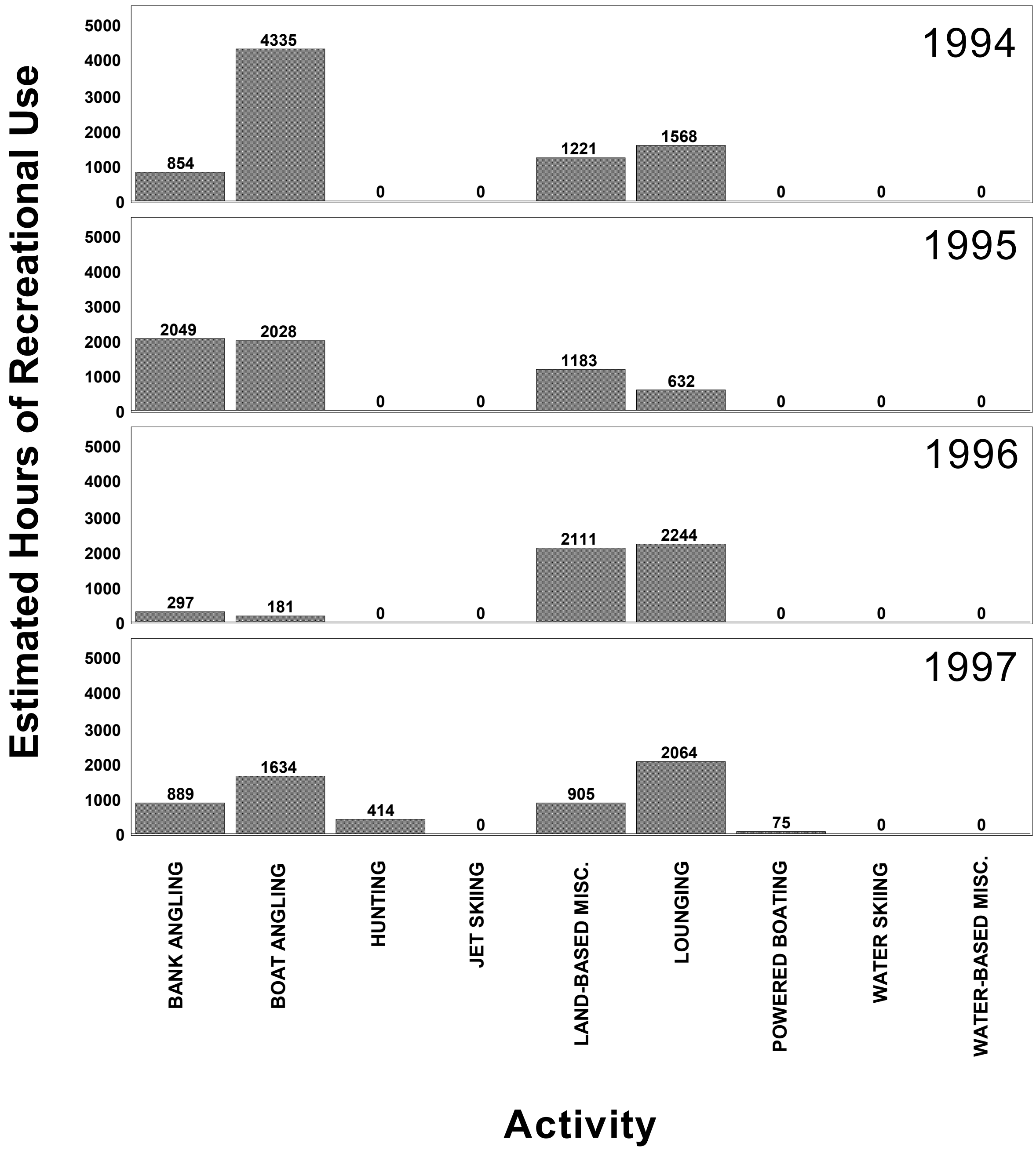

Figure E.5-24 Estimated hours of recreational use during the cold season, by year and activity, in Zone 1, subzone HC of the HCC (from the Applicant's recreational-use surveys)

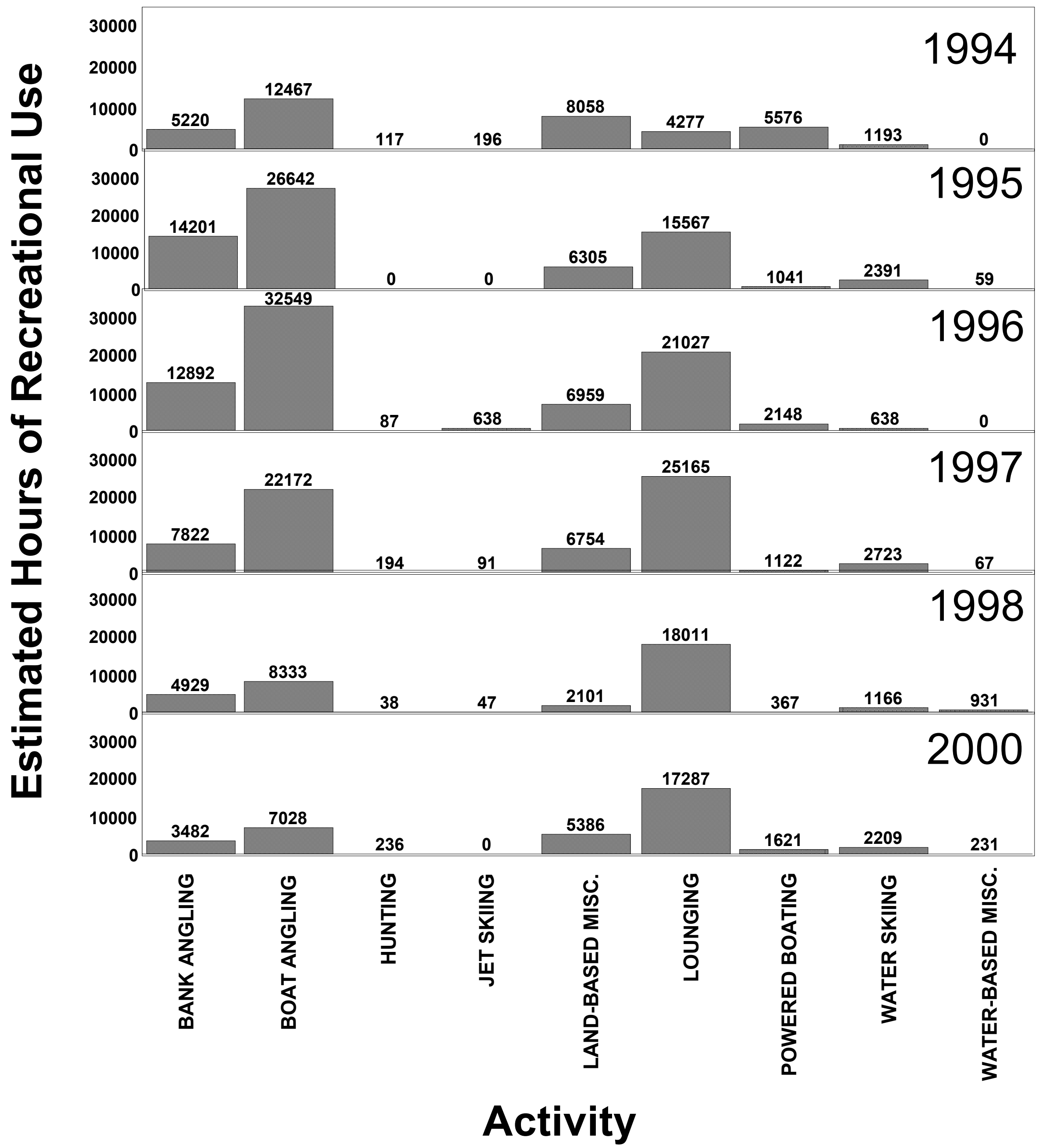

Figure E.5-25 Estimated hours of recreational use during the warm season, by year and activity, in Zone 1, subzone HC of the HCC (from the Applicant's recreational-use surveys)

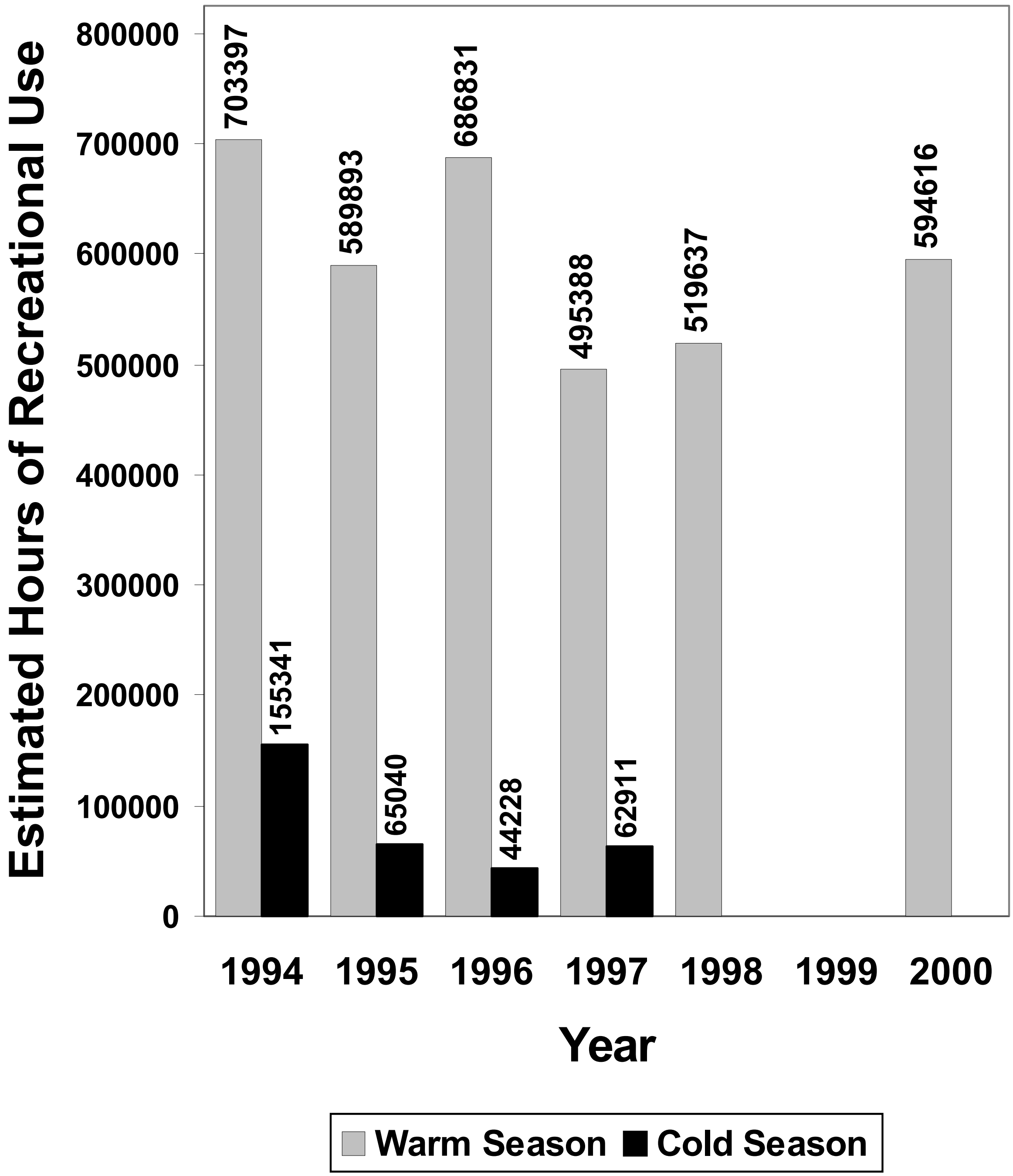

Figure E.5-26 Overall estimated hours of recreational use, by year and season, in Zone 2 of the HCC (from the Applicant's recreational-use surveys)

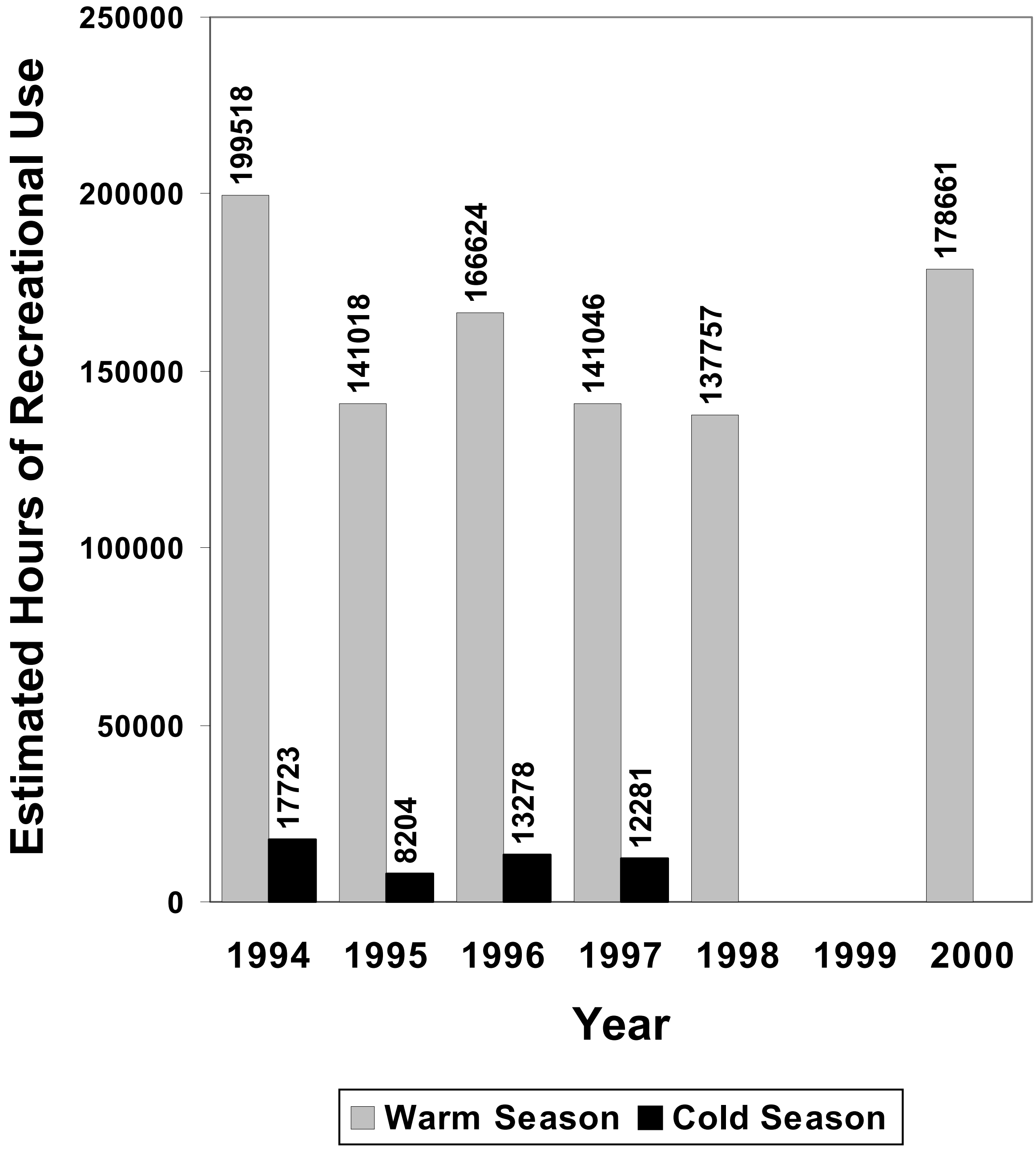

Figure E.5-27 Estimated hours of recreational use, by year and season, in Zone 2, subzone HC of the HCC (from the Applicant's recreational-use surveys)

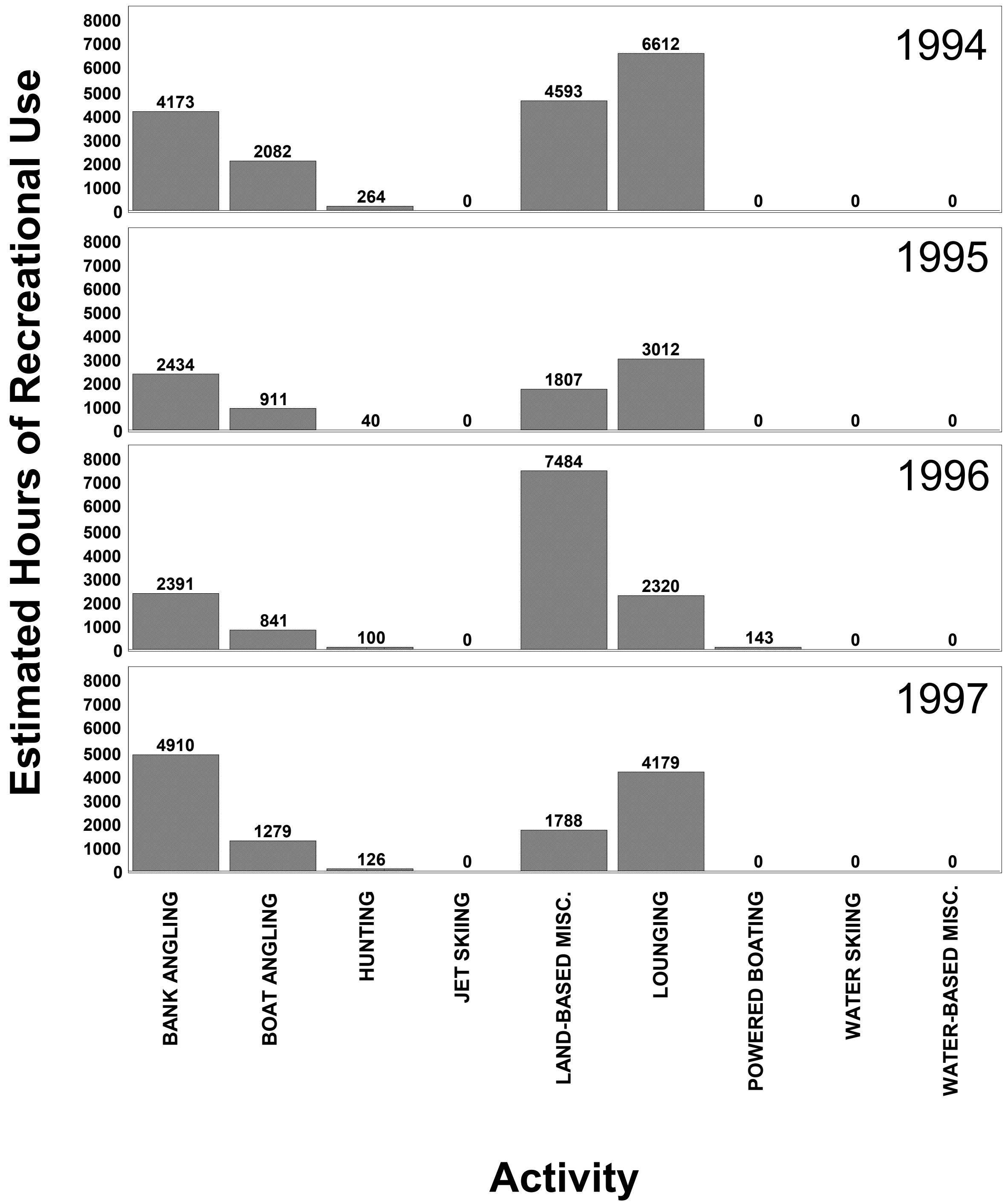

Figure E.5-28 Estimated hours of recreational use during the cold season, by year and activity, in Zone 2, subzone HC of the HCC (from the Applicant's recreational-use surveys)

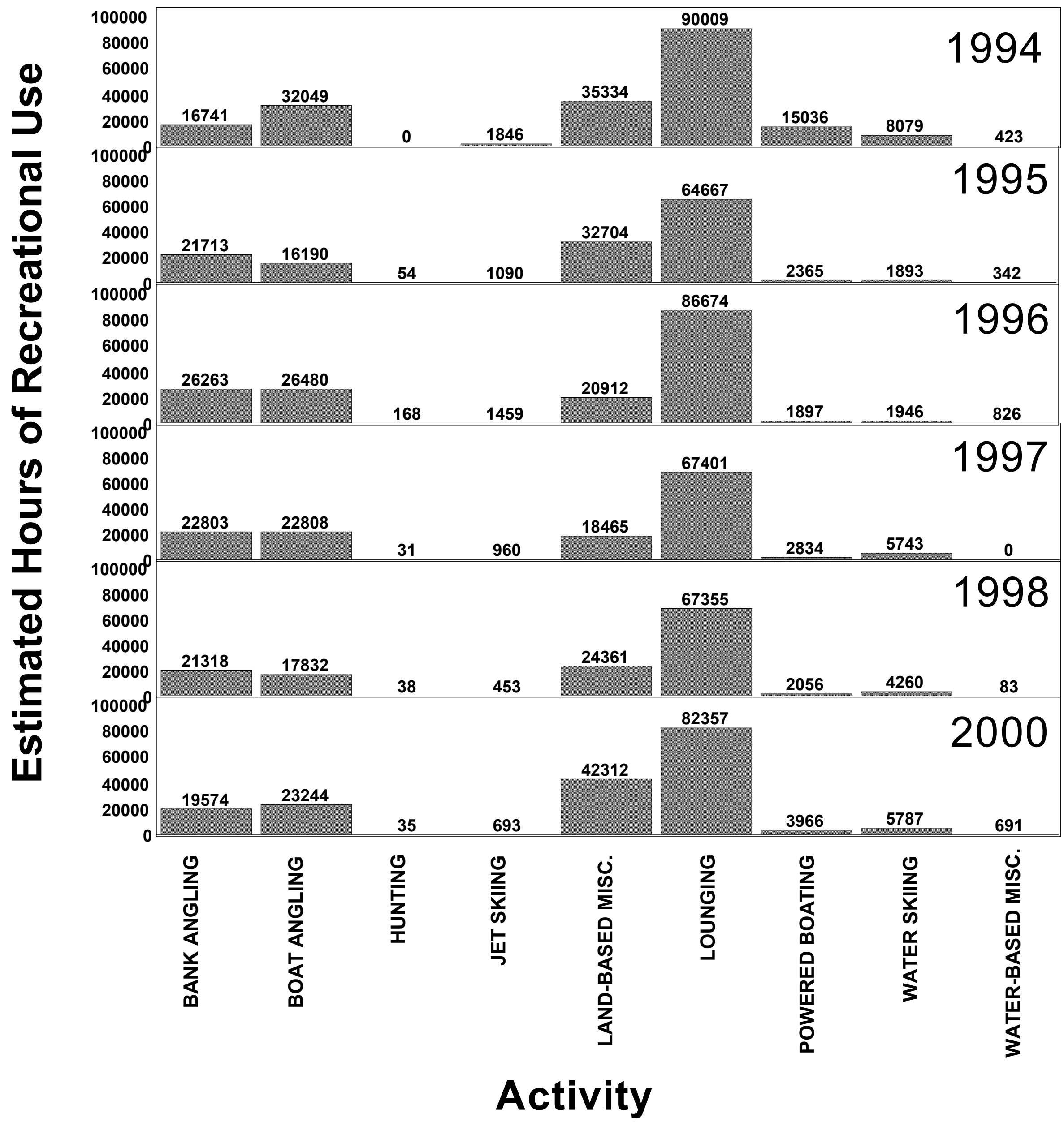

Figure E.5-29 Estimated hours of recreational use during the warm season, by year and activity, in Zone 2, subzone HC of the HCC (from the Applicant's recreational-use surveys)

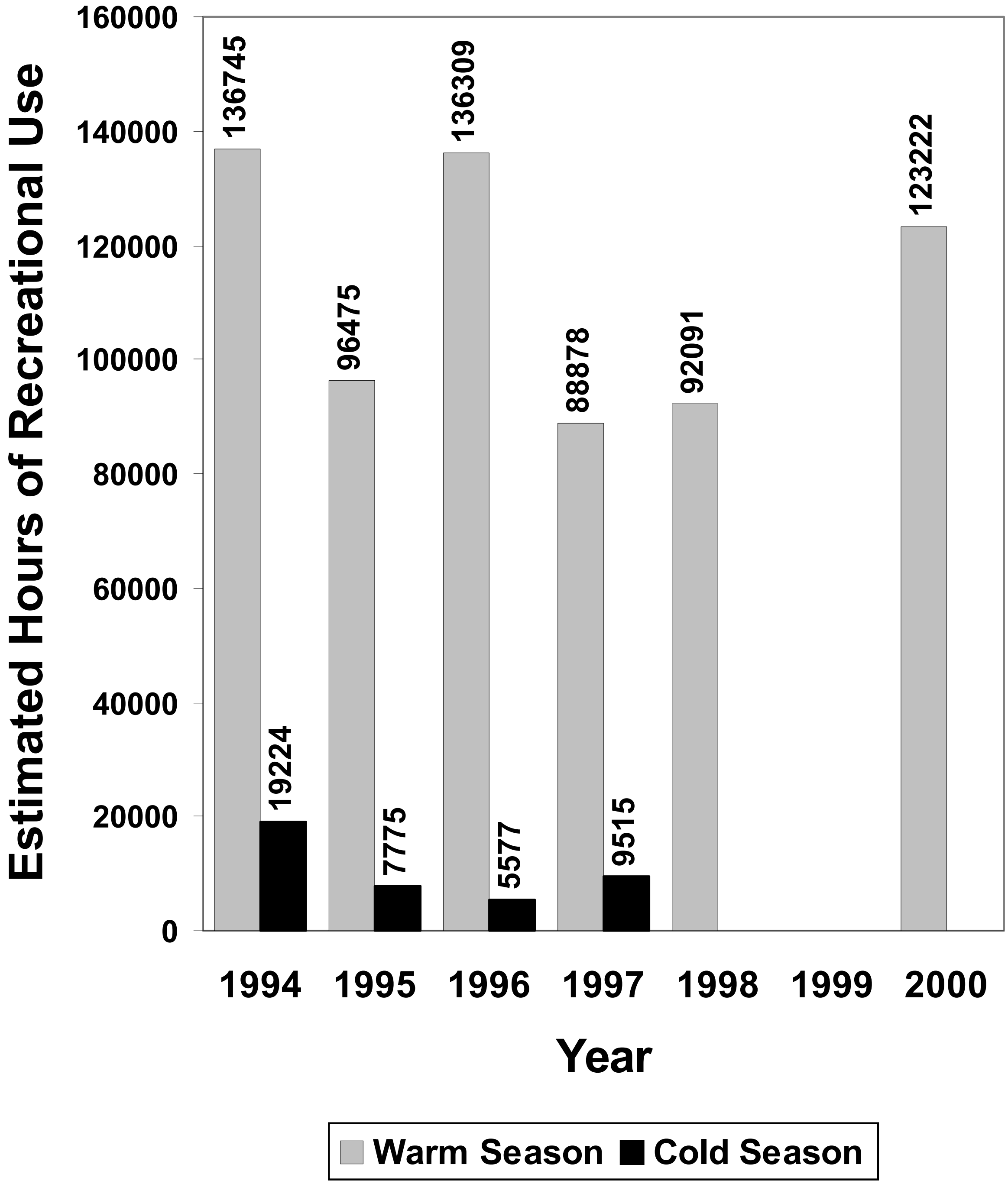

Figure E.5-30 Overall estimated hours of recreational use, by year and season, in Zone 2 subzone OT of the HCC (from the Applicant's recreational-use surveys)

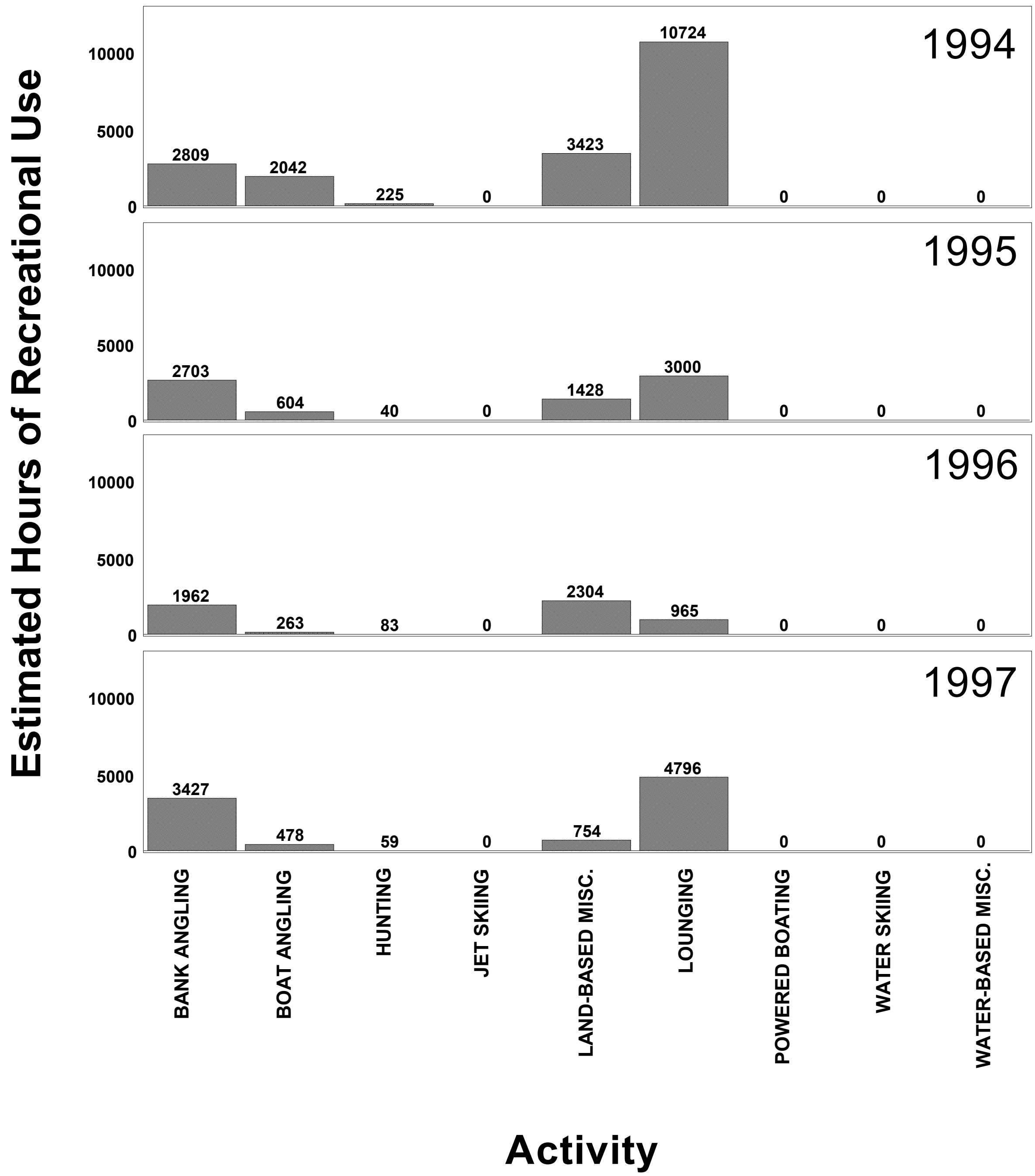

Figure E.5-31 Estimated hours of recreational use during the cold season, by year and activity, in Zone 2, subzone OT of the HCC (from the Applicant's recreational-use surveys)

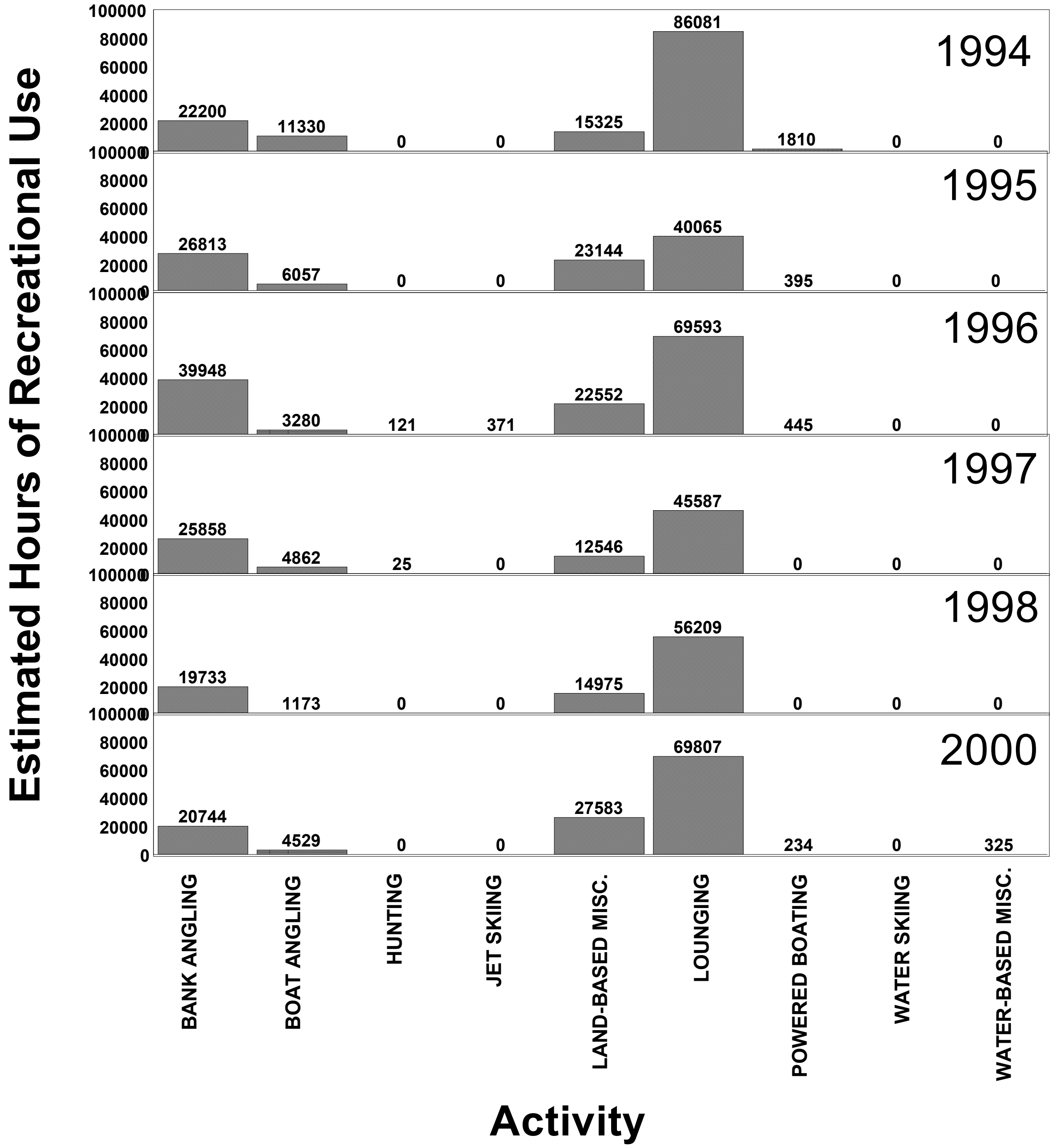

Figure E.5-32 Estimated hours of recreational use during the warm season, by year and activity, in Zone 2, subzone OT of the HCC (from the Applicant's recreational-use surveys)

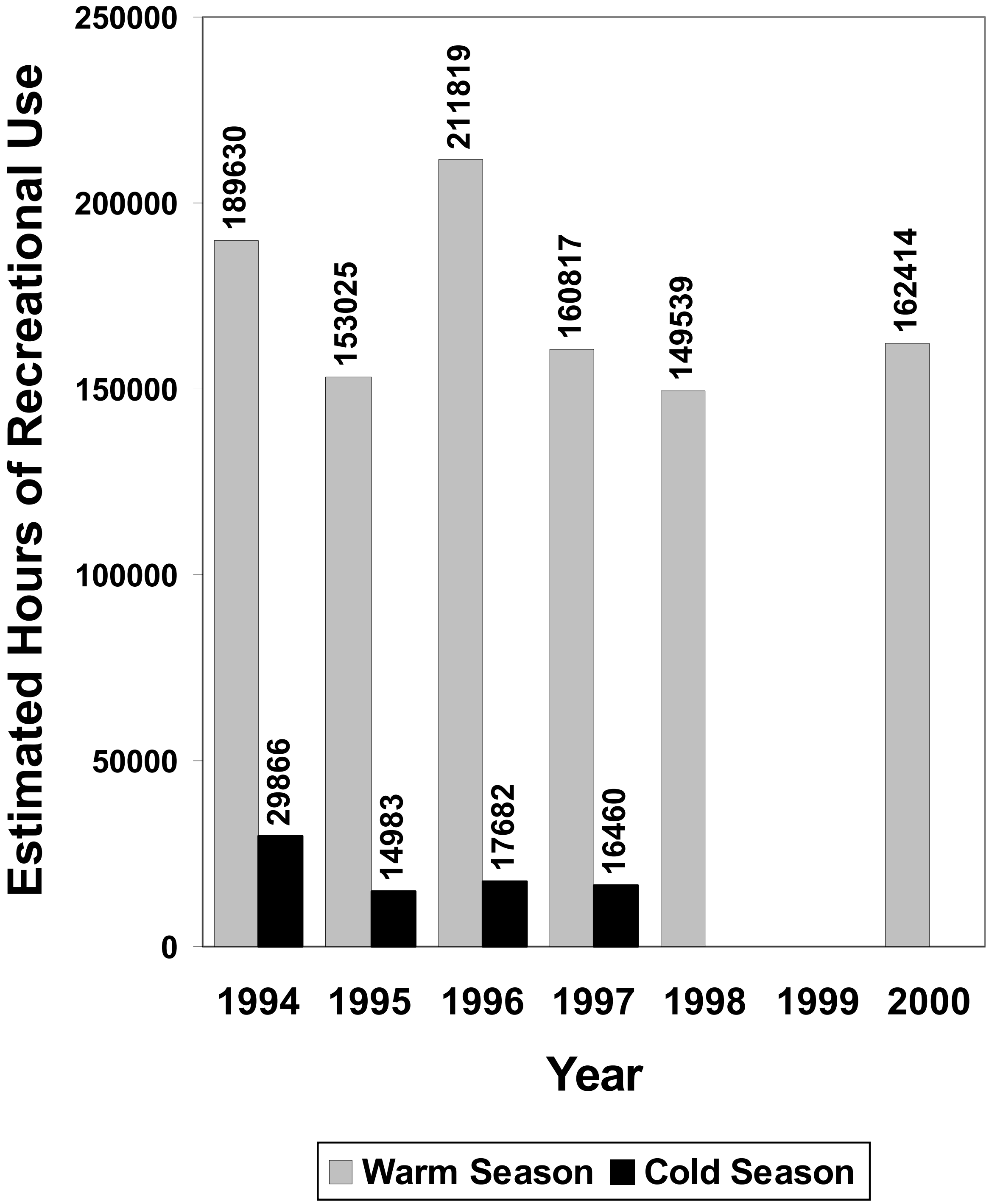

Figure E.5-33 Overall estimated hours of recreational use, by year and season, in Zone 2, subzone OX of the HCC (from the Applicant's recreational-use surveys)

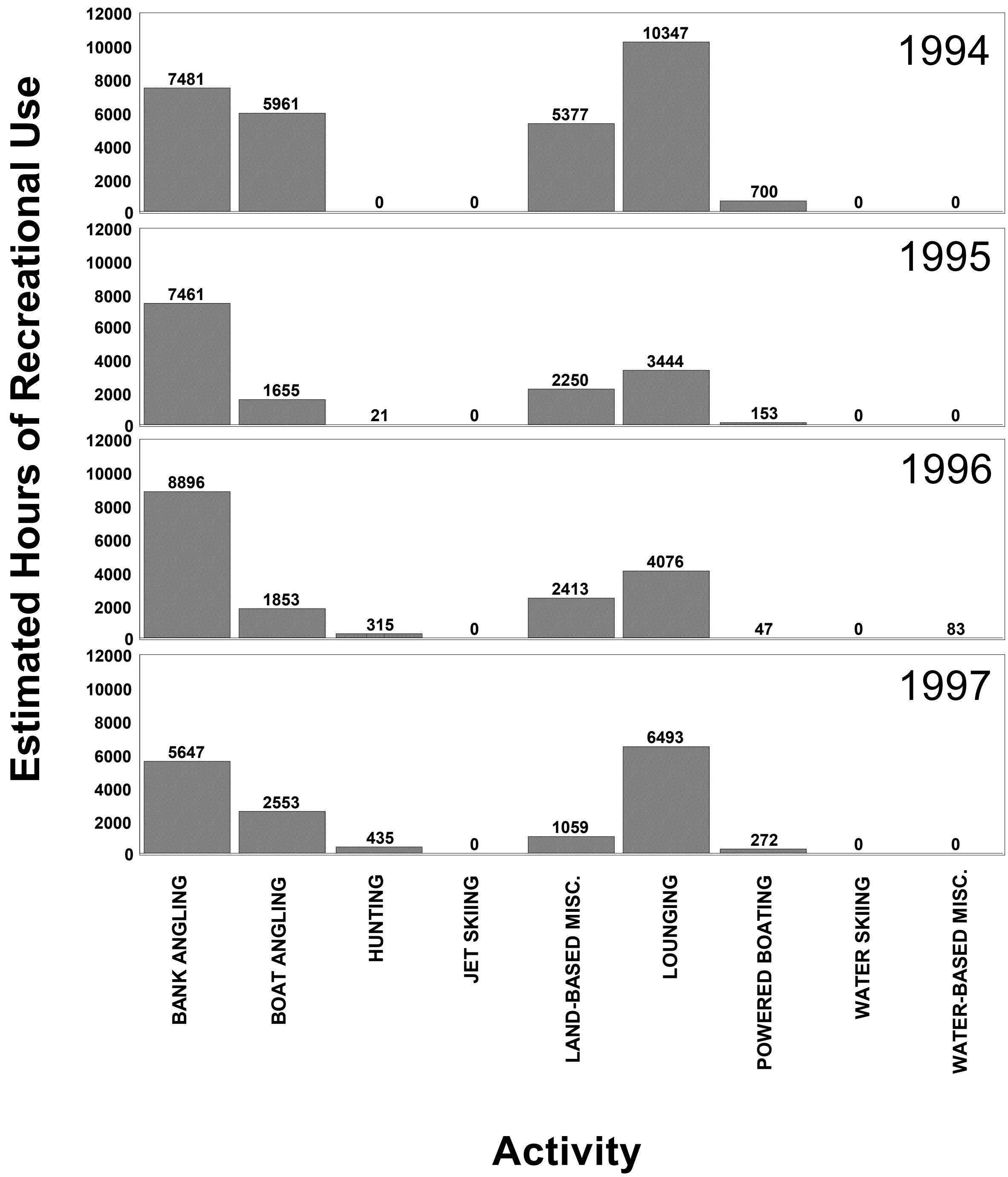

Figure E.5-34 Estimated hours of recreational use during the cold season, by year and activity, in Zone 2, subzone OX of the HCC (from the Applicant's recreational-use surveys)

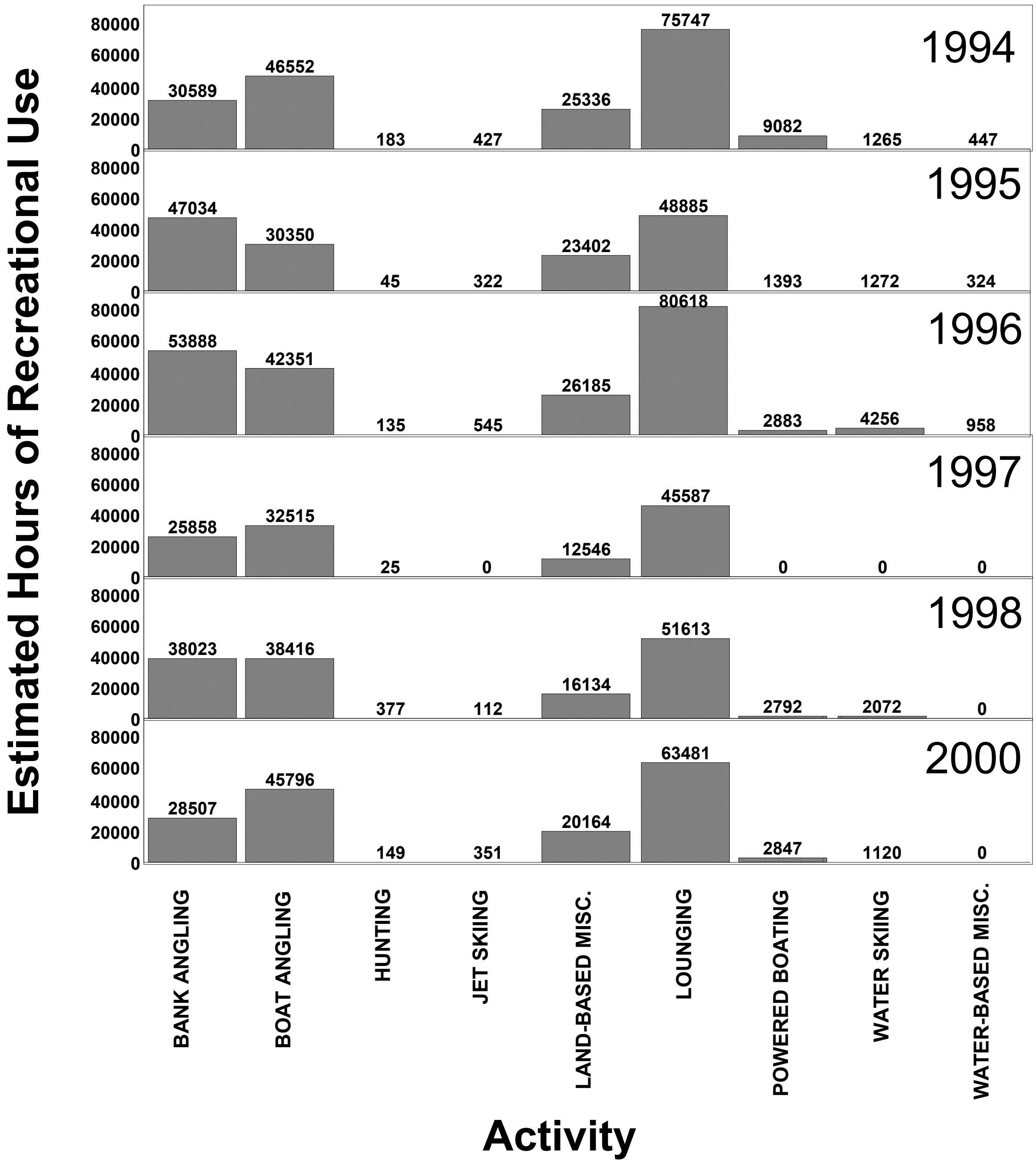

Figure E.5-35 Estimated hours of recreational use during the warm season, by year and activity, in Zone 2, subzone OX of the HCC (from the Applicant's recreational-use surveys)

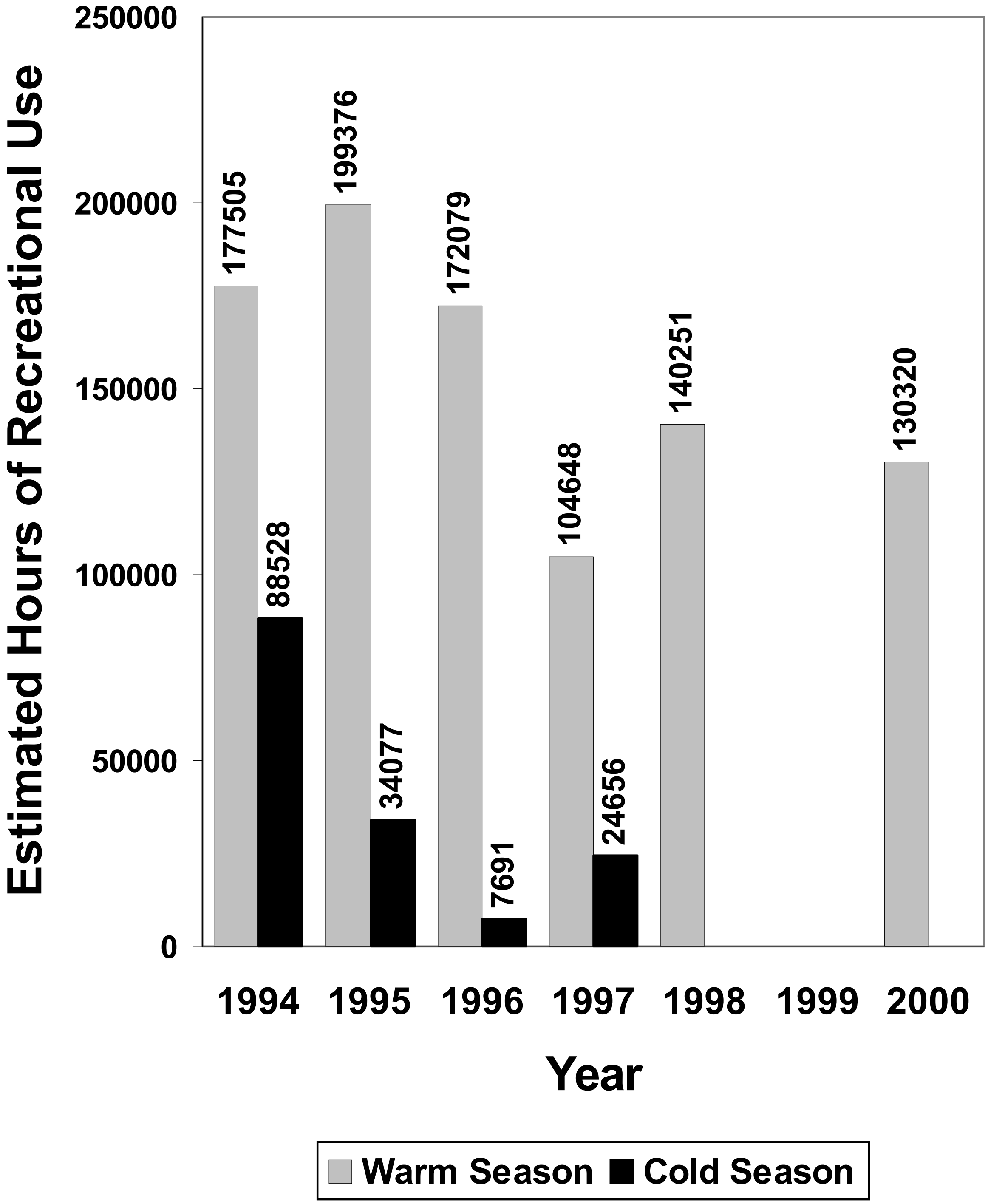

Figure E.5-36 Overall estimated hours of recreational use, by year and season, in Zone 2 subzone BR of the HCC (from the Applicant's recreational-use surveys)

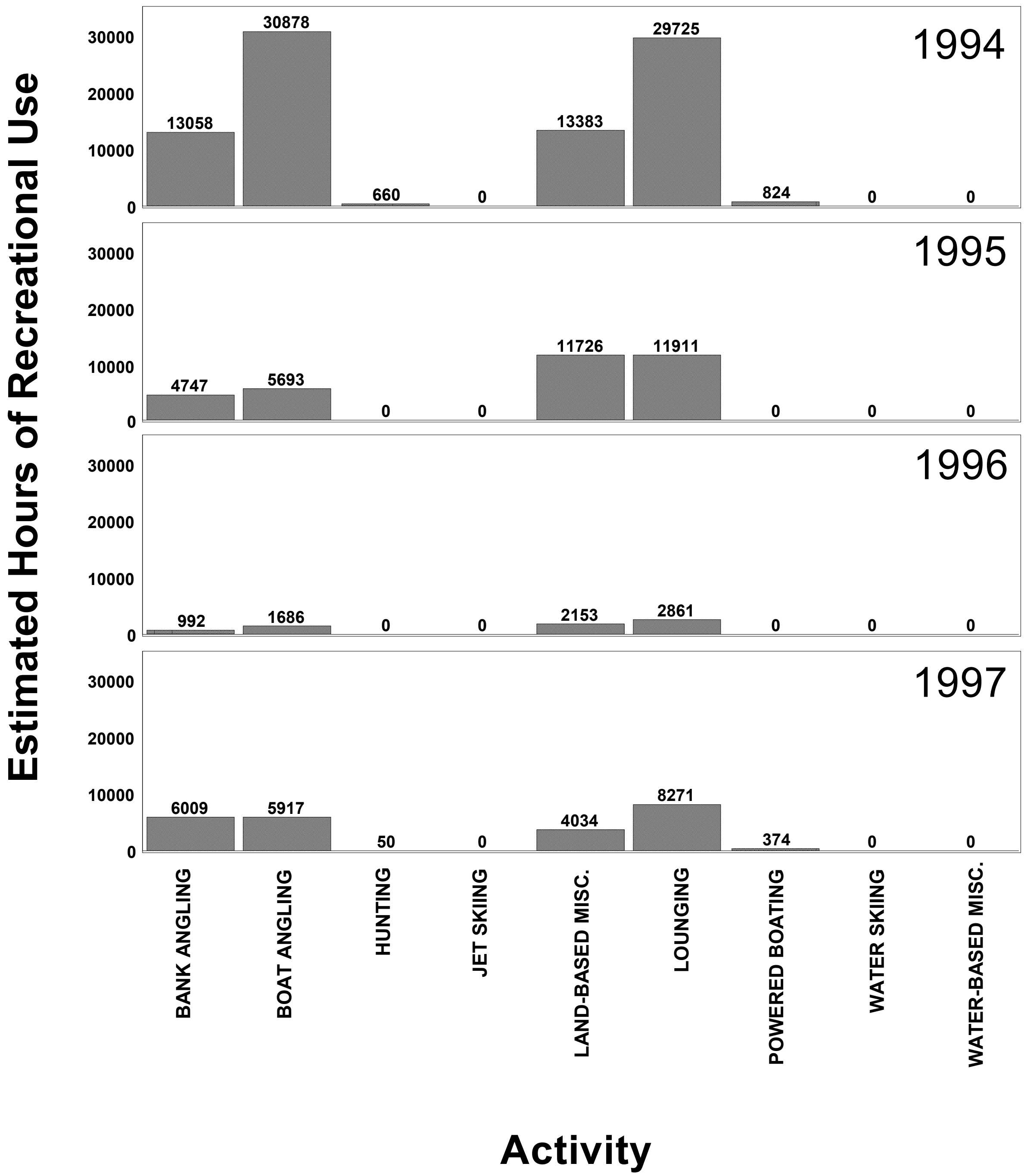

Figure E.5-37 Estimated hours of recreational use during the cold season, by year and activity, in Zone 2, subzone BR of the HCC (from the Applicant's recreational-use surveys)

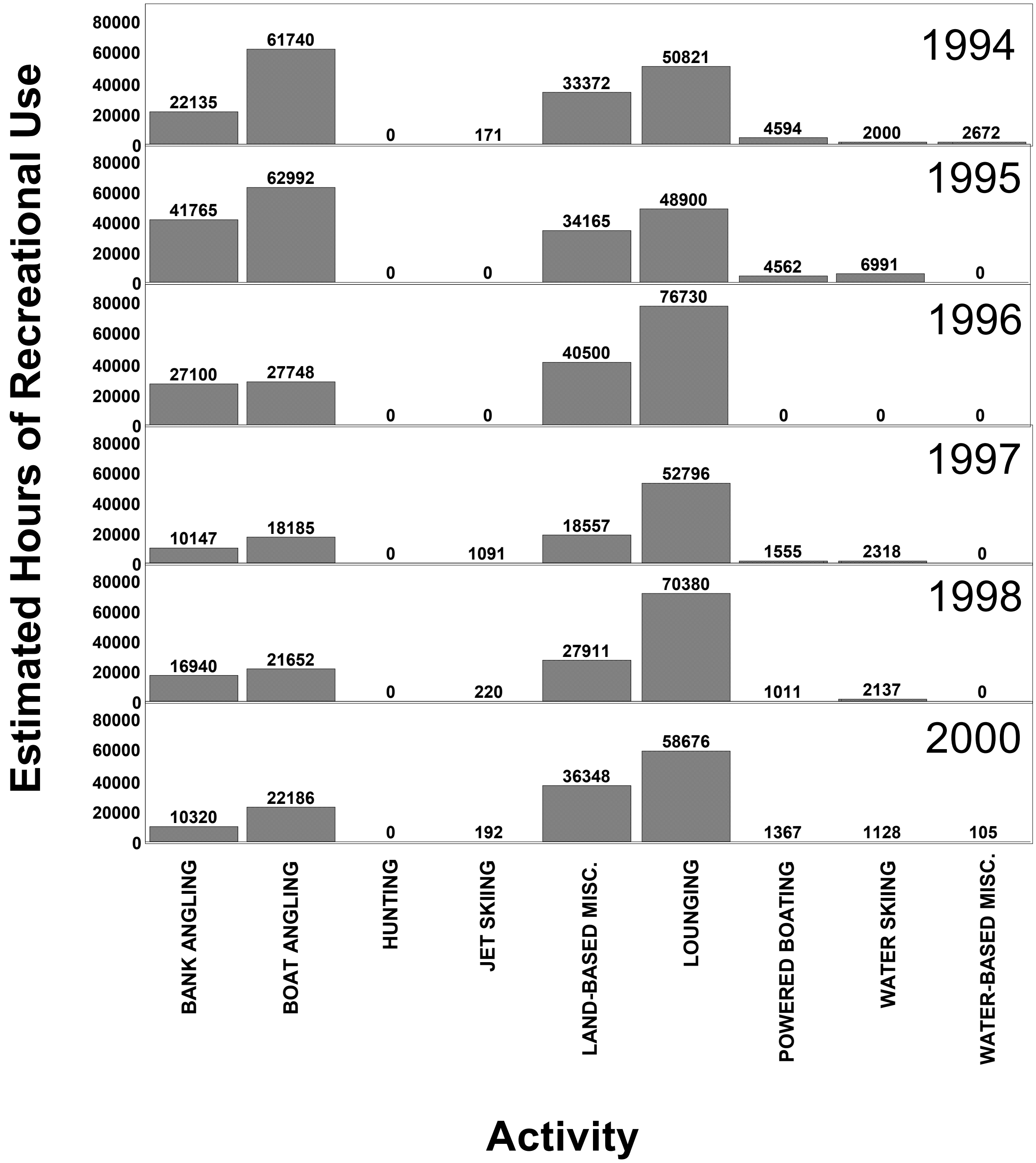

Figure E.5-38 Estimated hours of recreational use during the warm season, by year and activity, in Zone 2, subzone BR of the HCC (from the Applicant's recreational-use surveys)

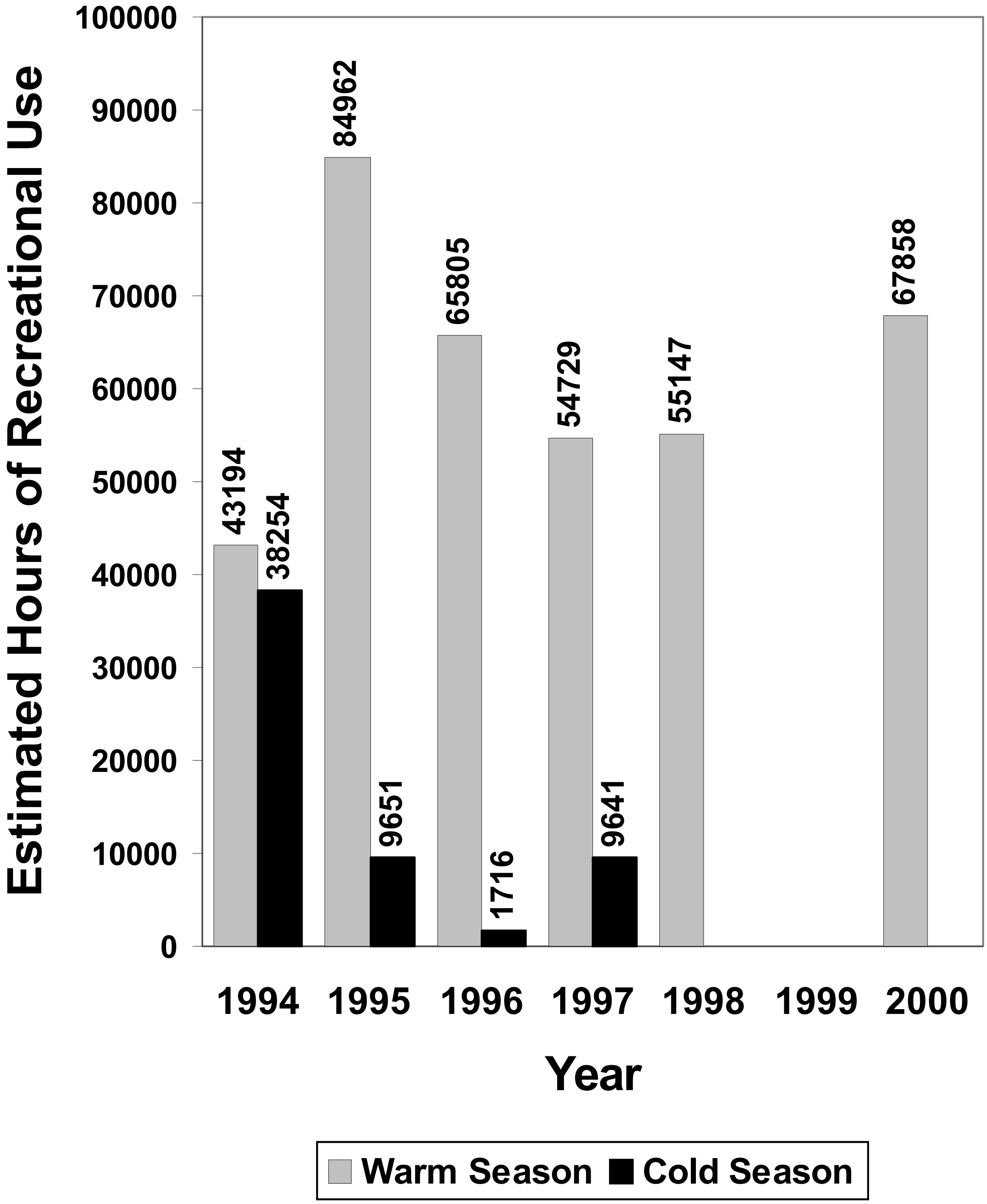

Figure E.5-39 Overall estimated hours of recreational use, by year and season, in Zone 3 of the HCC (from the Applicant's recreational-use surveys)

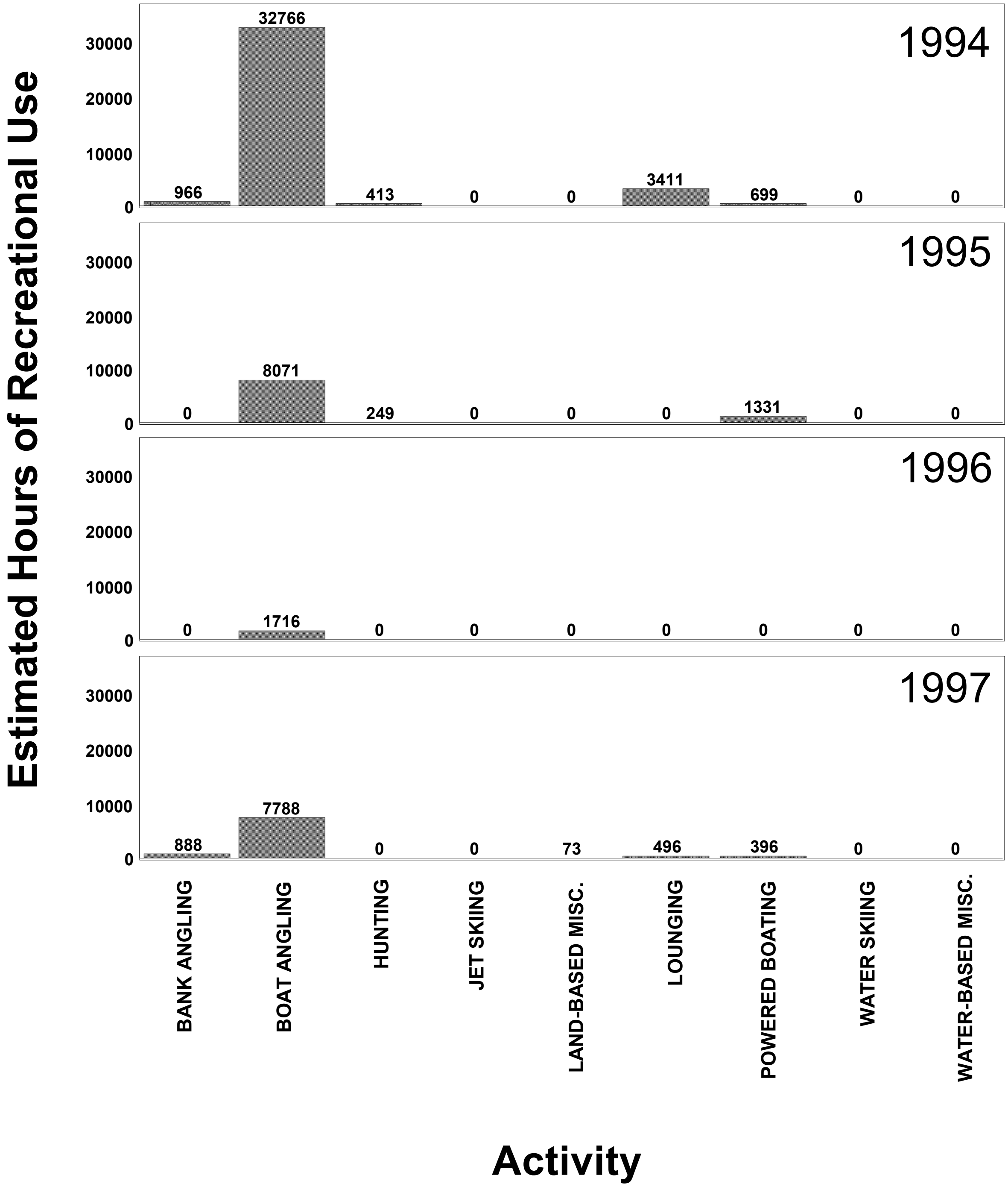

Figure E.5-40 Estimated hours of recreational use during the cold season, by year and activity, in Zone 3 of the HCC (from the Applicant's recreational-use surveys)

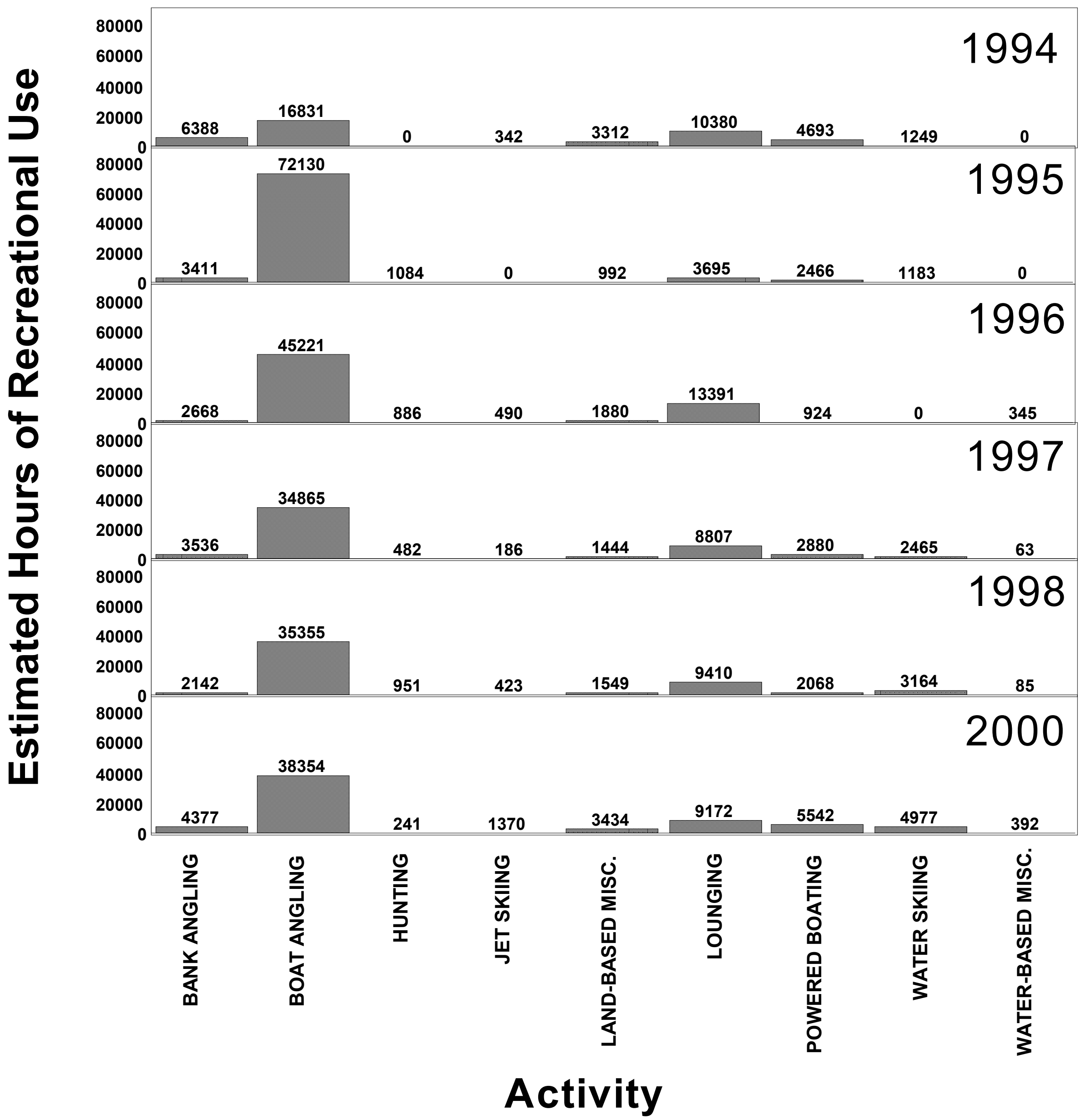

Figure E.5-41 Estimated hours of recreational use during the warm season, by year and activity, in Zone 3 of the HCC (from the Applicant's recreational-use surveys)

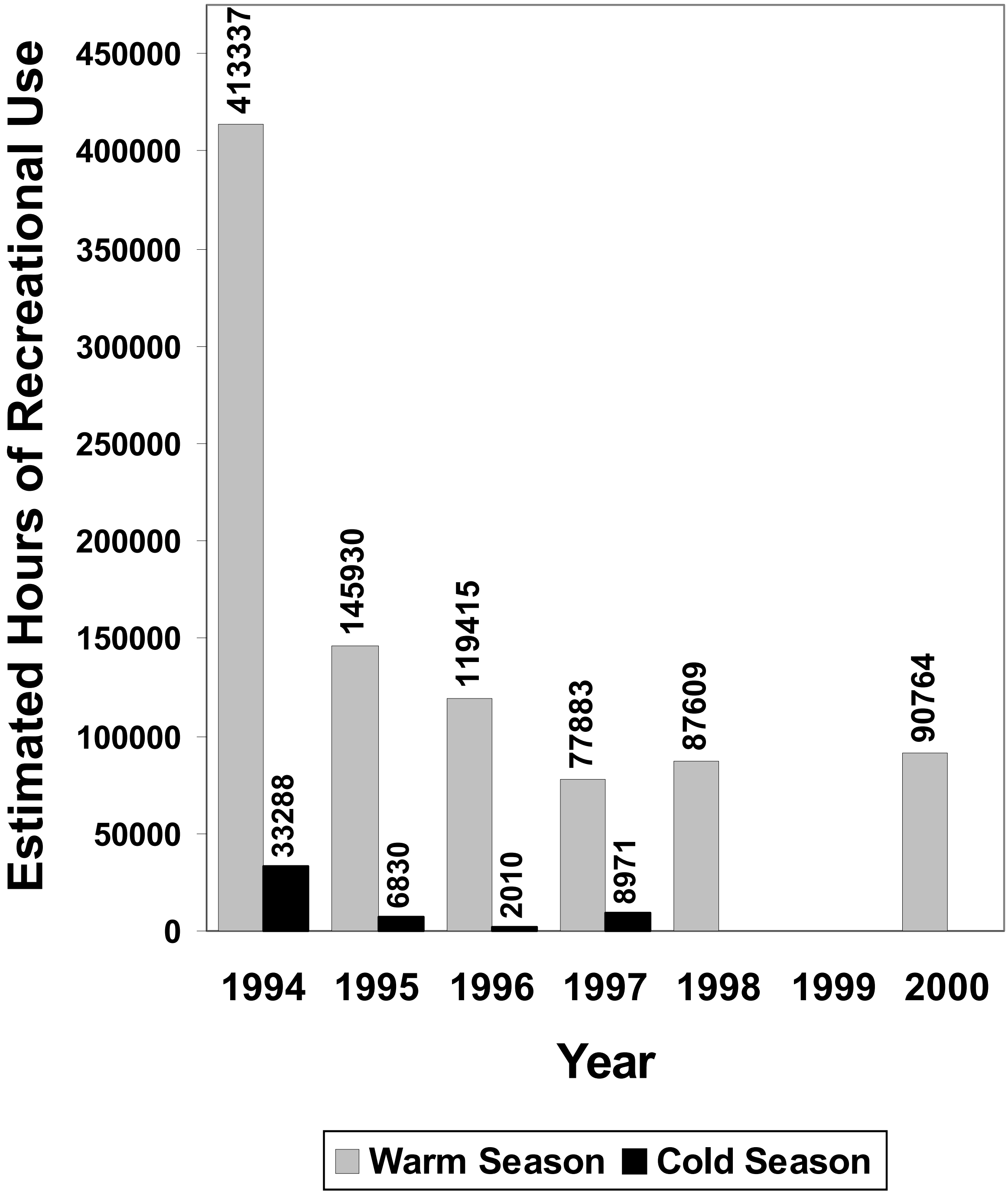

Figure E.5-42 **Overall estimated hours of recreational use, by year and season, in Zone 4 of the HCC (from the Applicant's recreational-use surveys)**

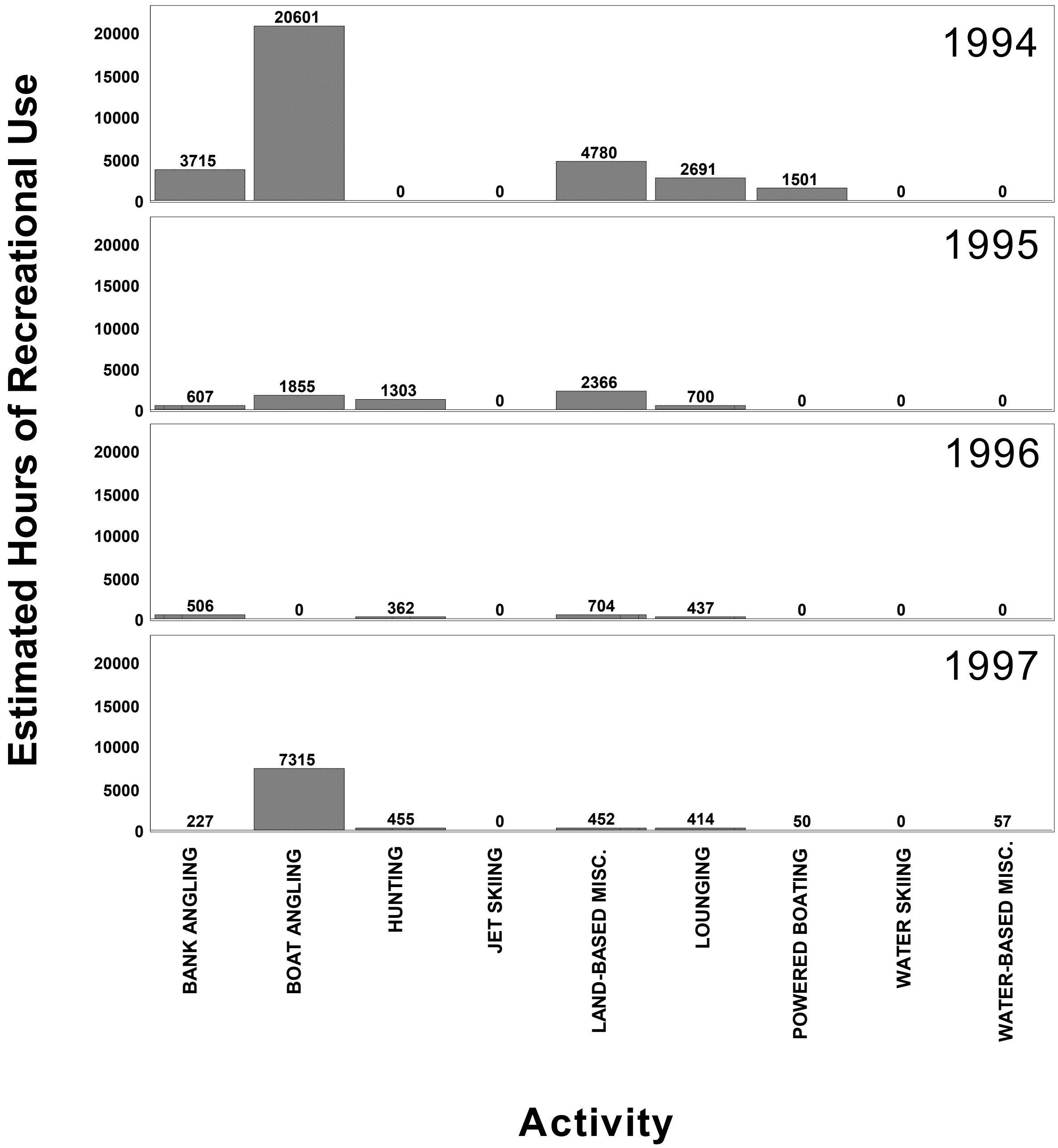

Figure E.5-43 Estimated hours of recreational use during the cold season, by year and activity, in Zone 4 of the HCC (from the Applicant's recreational-use surveys)

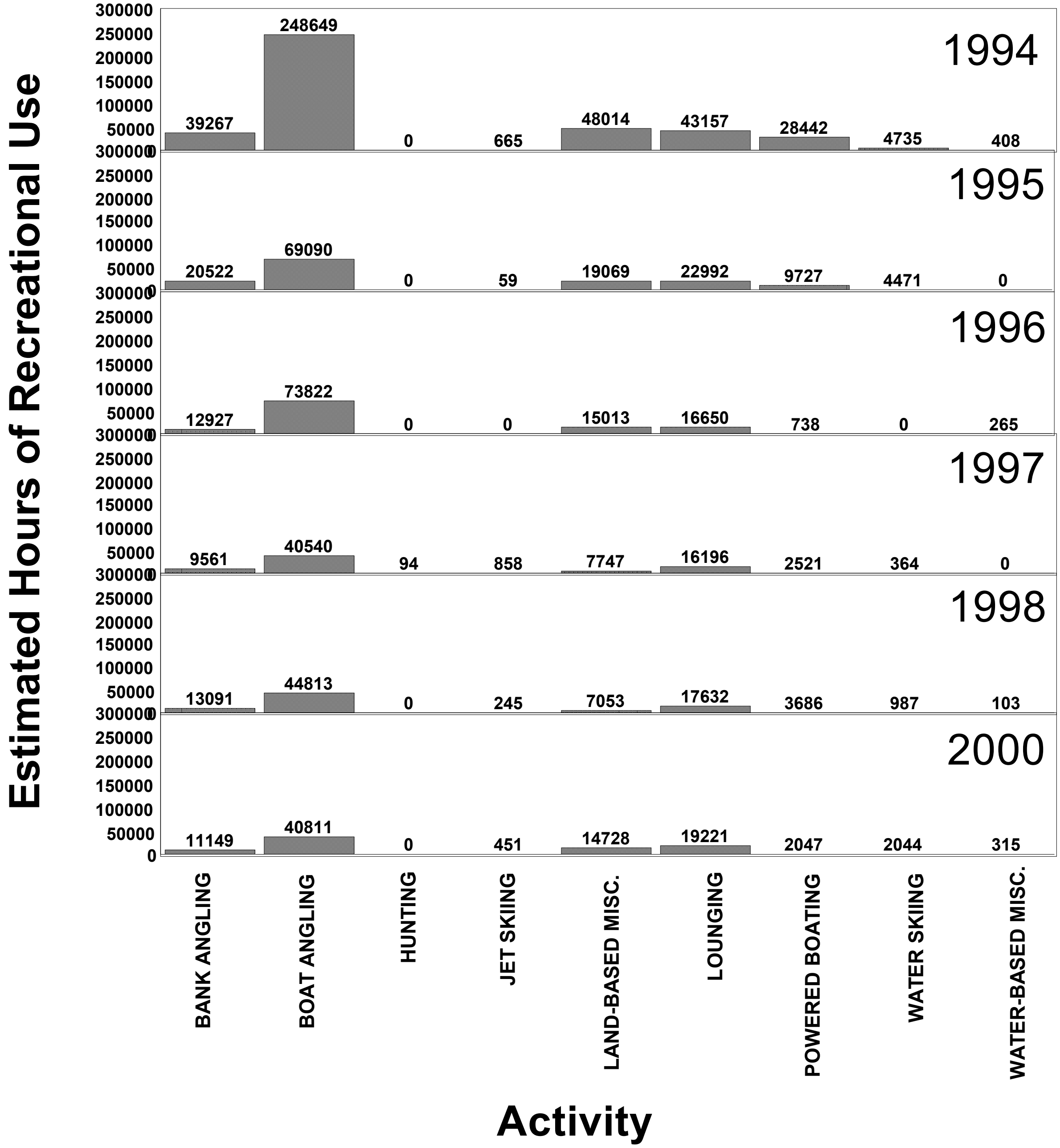

Figure E.5-44 Estimated hours of recreational use during the warm season, by year and activity, in Zone 4 of the HCC (from the Applicant's recreational-use surveys)

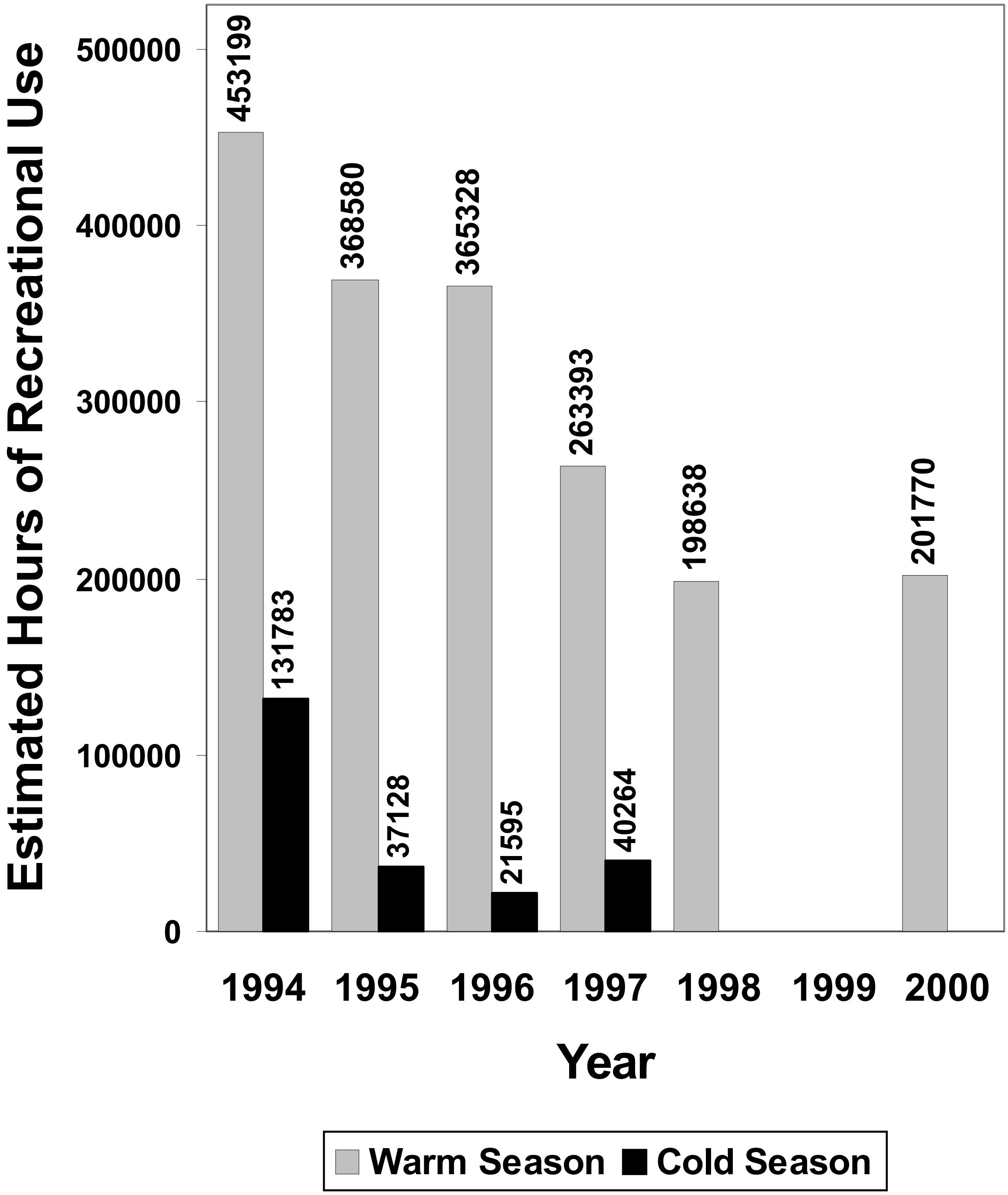

Figure E.5-45 Overall estimated hours of recreational use, by year and season, in Zone 5, of the HCC (from the Applicant's recreational-use surveys)

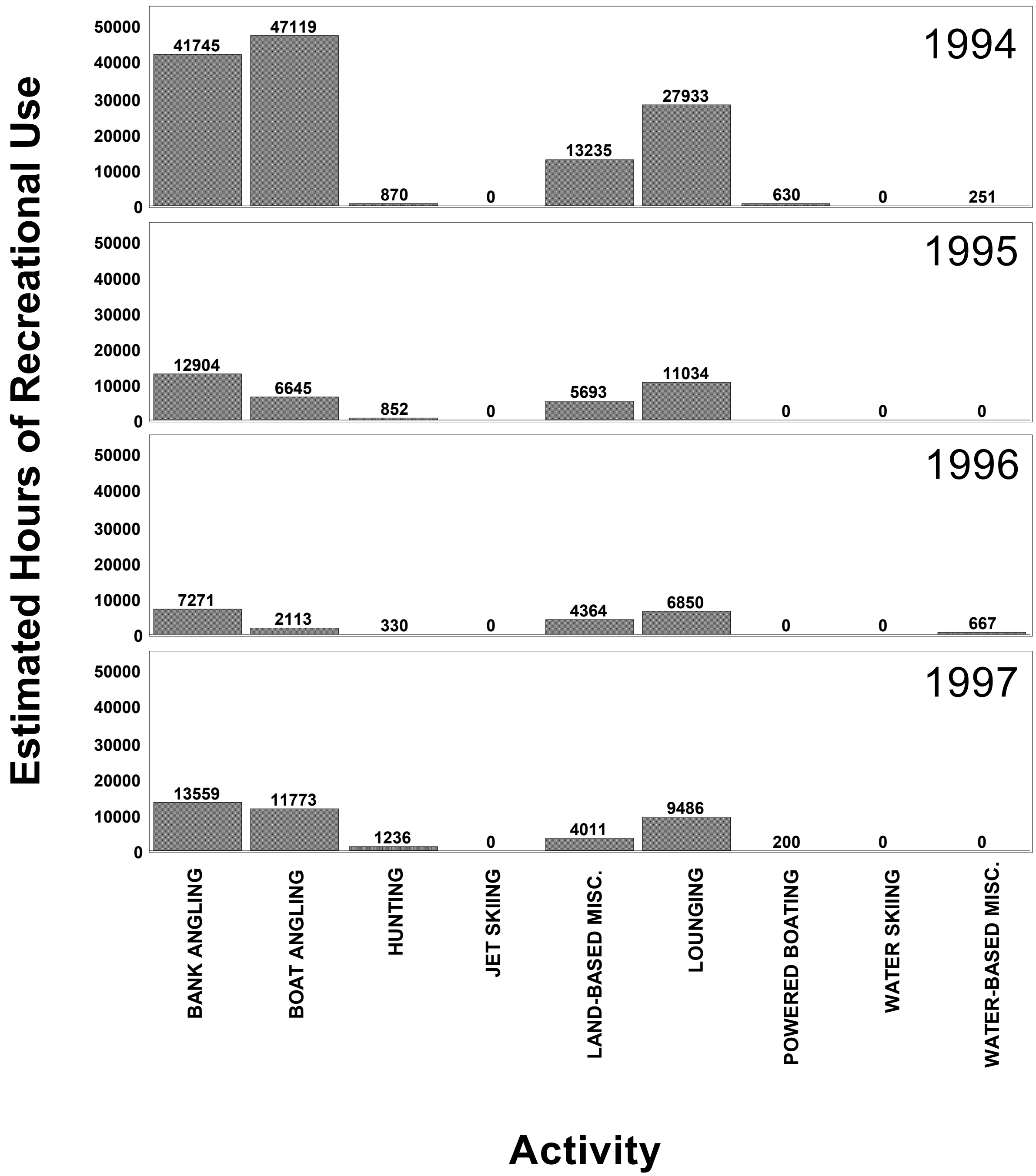

Figure E.5-46 Estimated hours of recreational use during the cold season, by year and activity, in Zone 5, of the HCC (from the Applicant's recreational-use surveys)

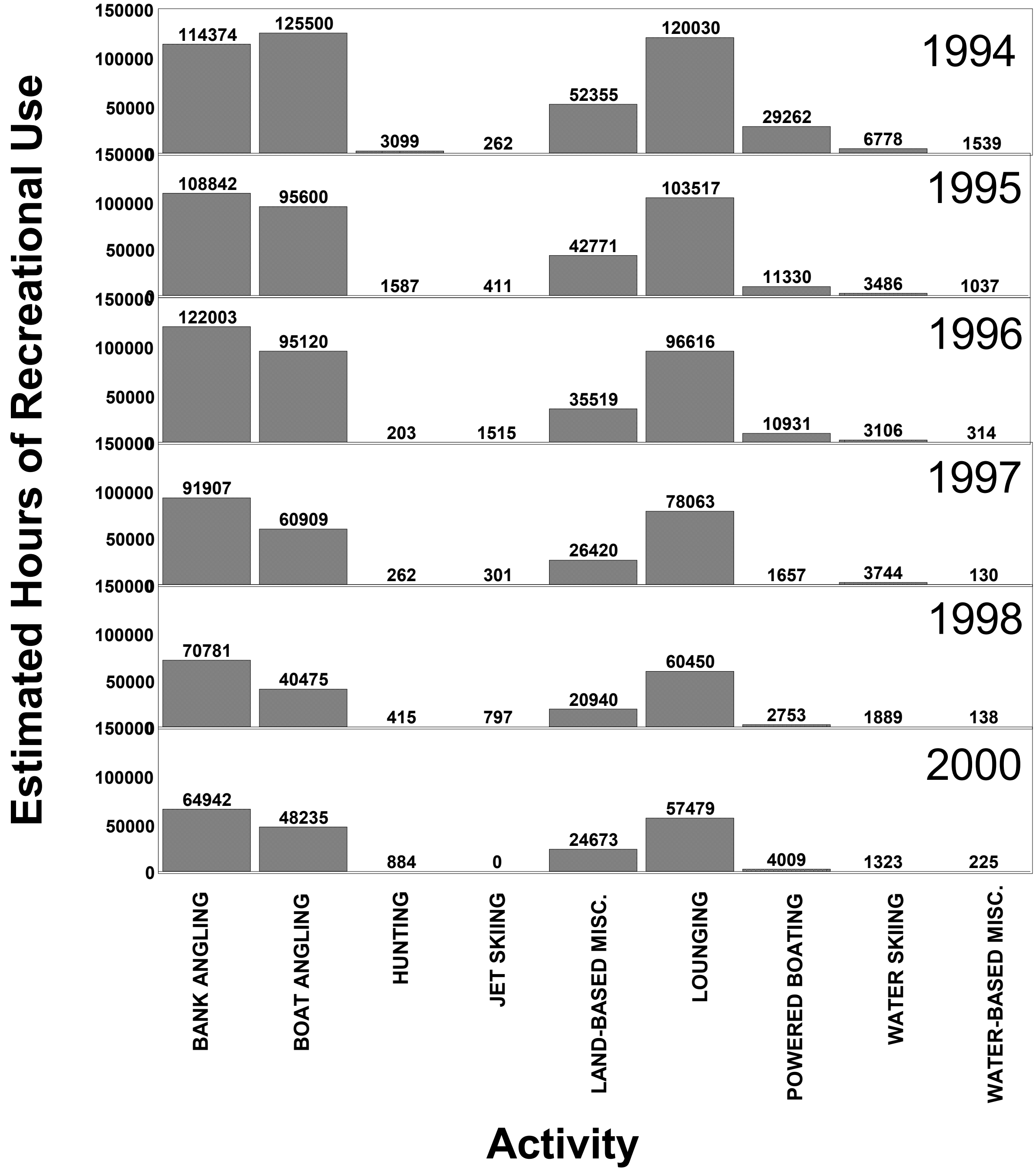

Figure E.5-47 Estimated hours of recreational use during the warm season, by year and activity, in Zone 5 of the HCC (from the Applicant's recreational-use surveys)

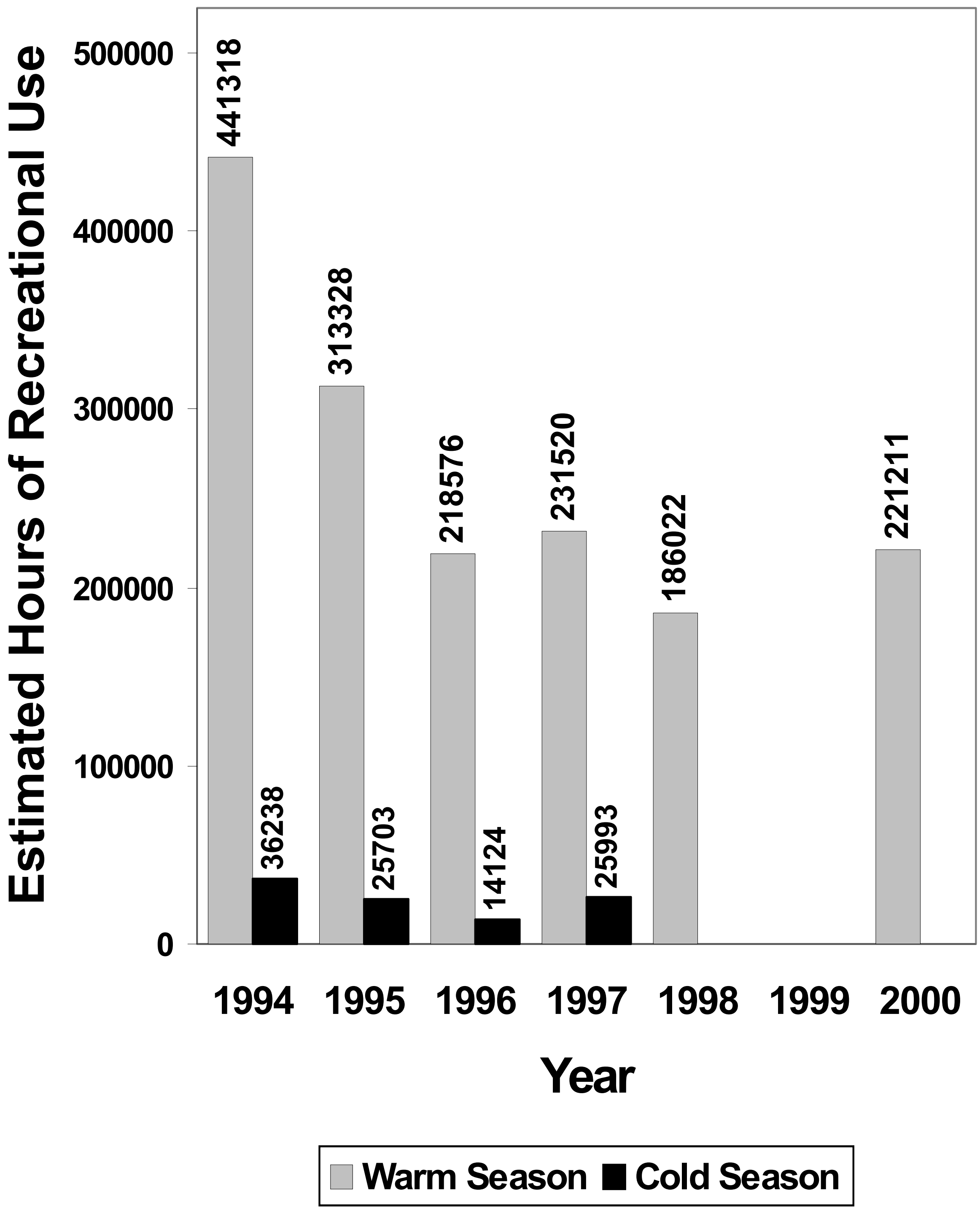

Figure E.5-48 Overall estimated hours of recreational use, by year and season, in Zone 6 of the HCC (from the Applicant's recreational-use surveys)

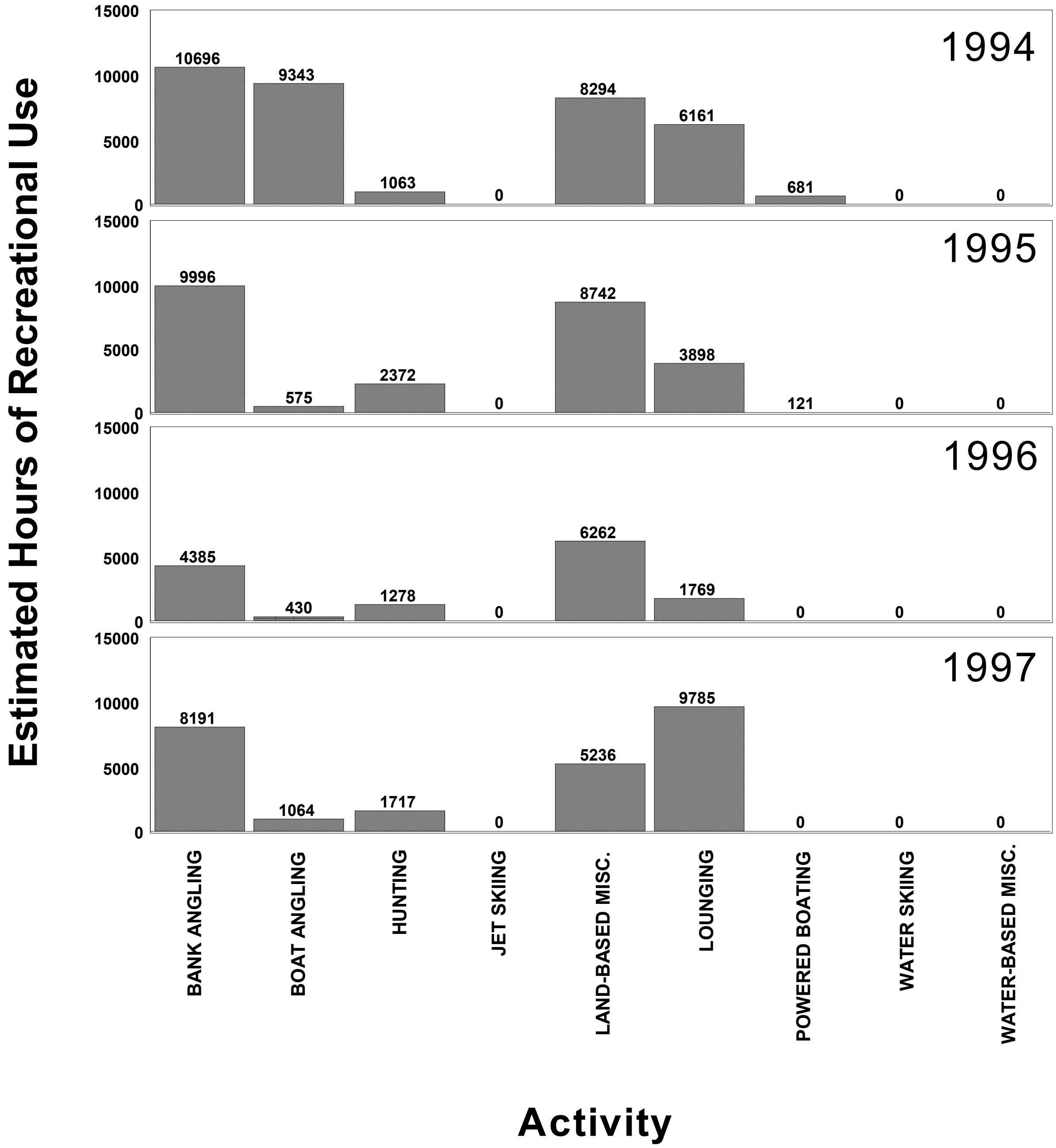

Figure E.5-49 Estimated hours of recreational use during the cold season, by year and activity, in Zone 6 of the HCC (from the Applicant's recreational-use surveys)

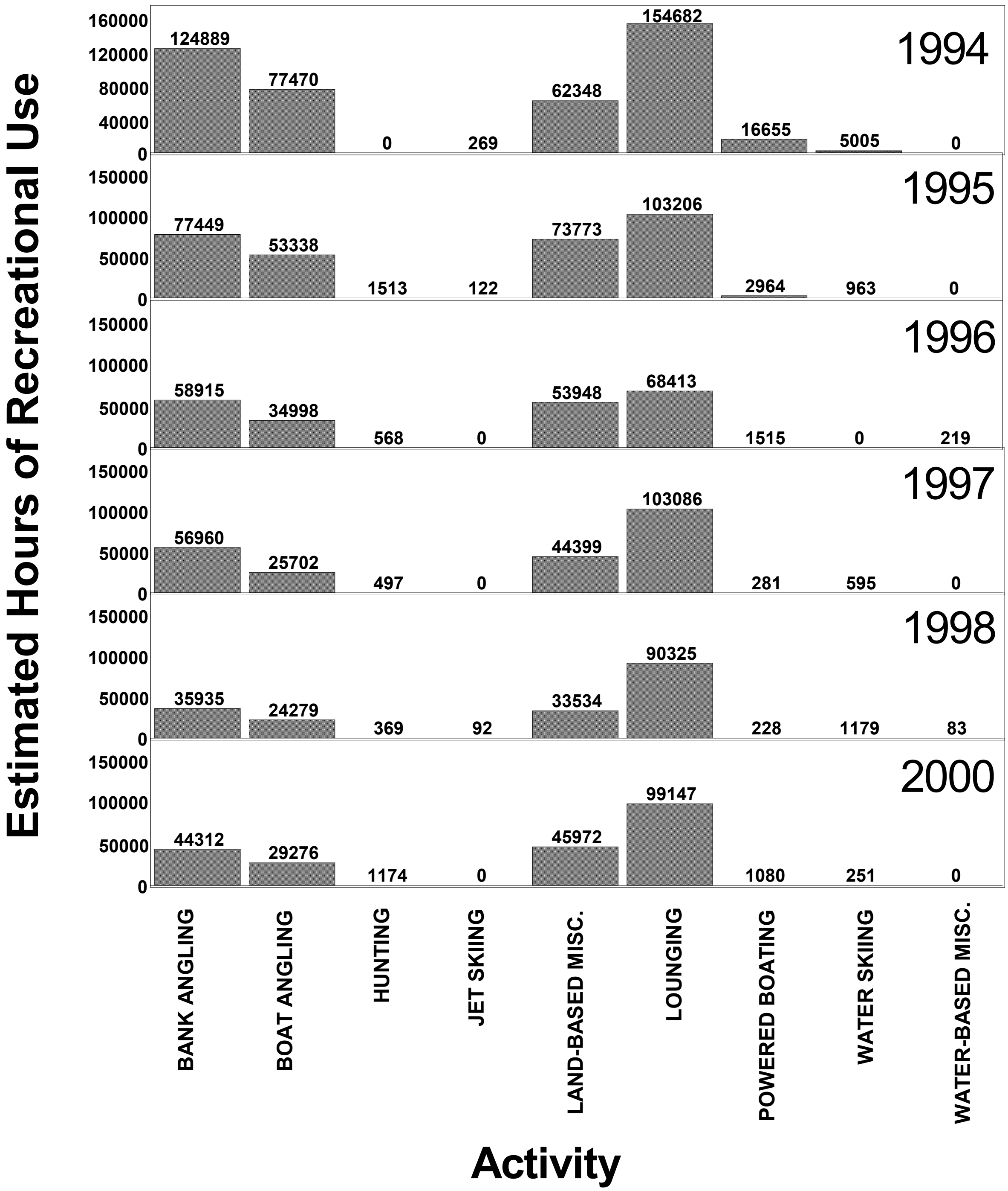

Figure E.5-50 Estimated hours of recreational use during the warm season, by year and activity, in Zone 6 of the HCC (from the Applicant's recreational-use surveys)

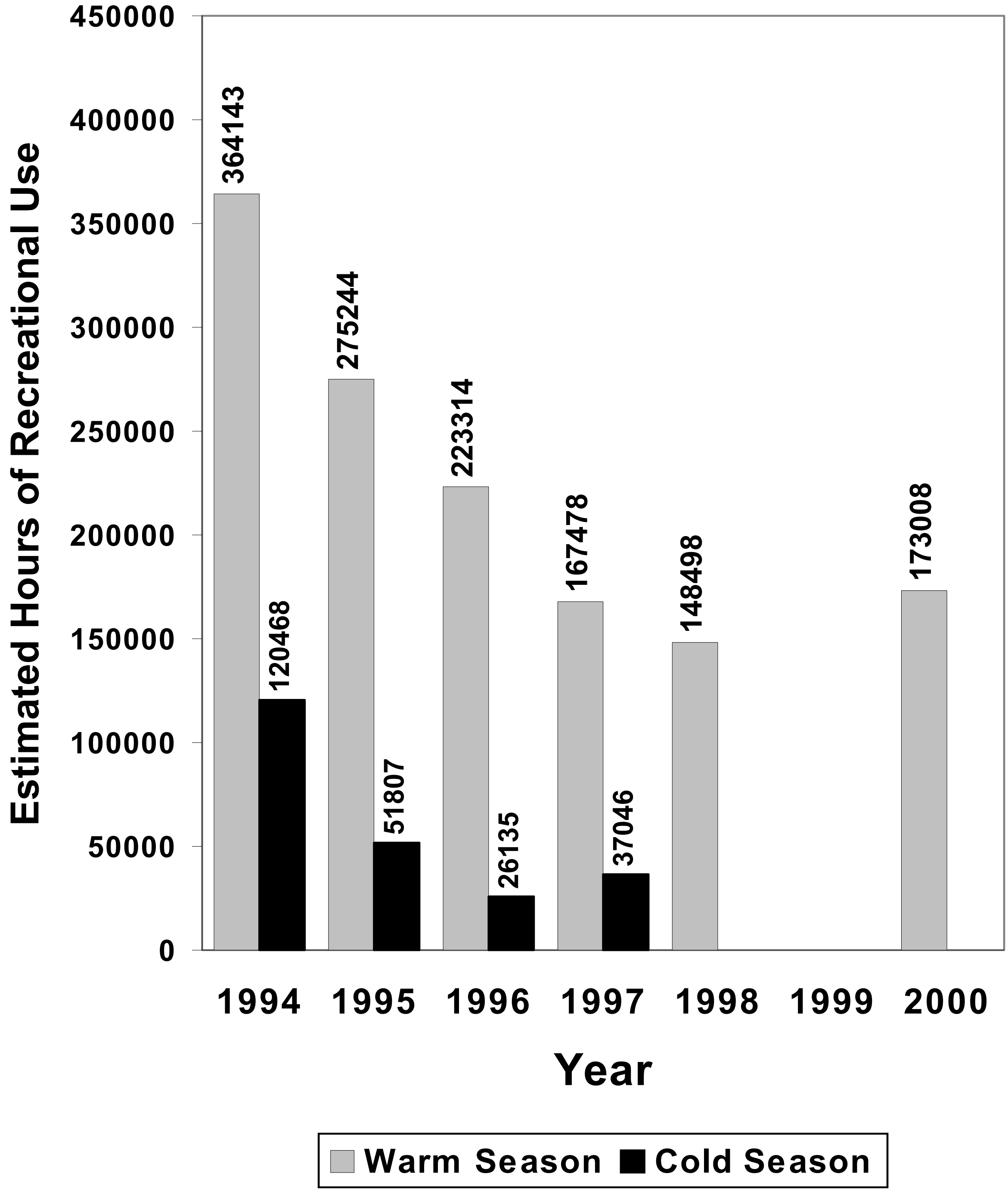

Figure E.5-51 **Estimated number of recreation days, by year and season, in the HCC (from the Applicant's recreational-use surveys)**

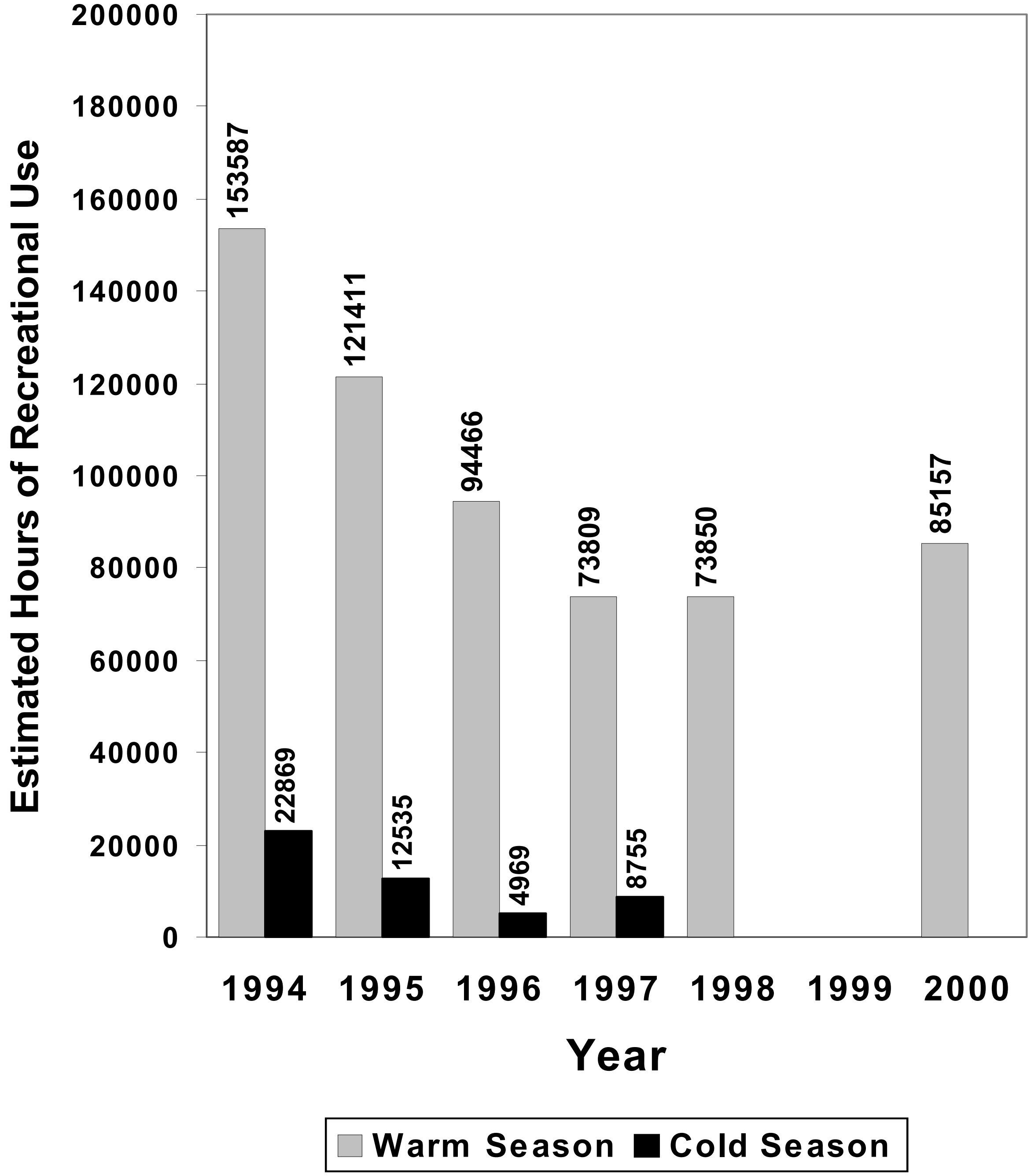

Figure E.5-52 Estimated number of recreation nights, by year and season, in the HCC (from the Applicant's recreational-use surveys)

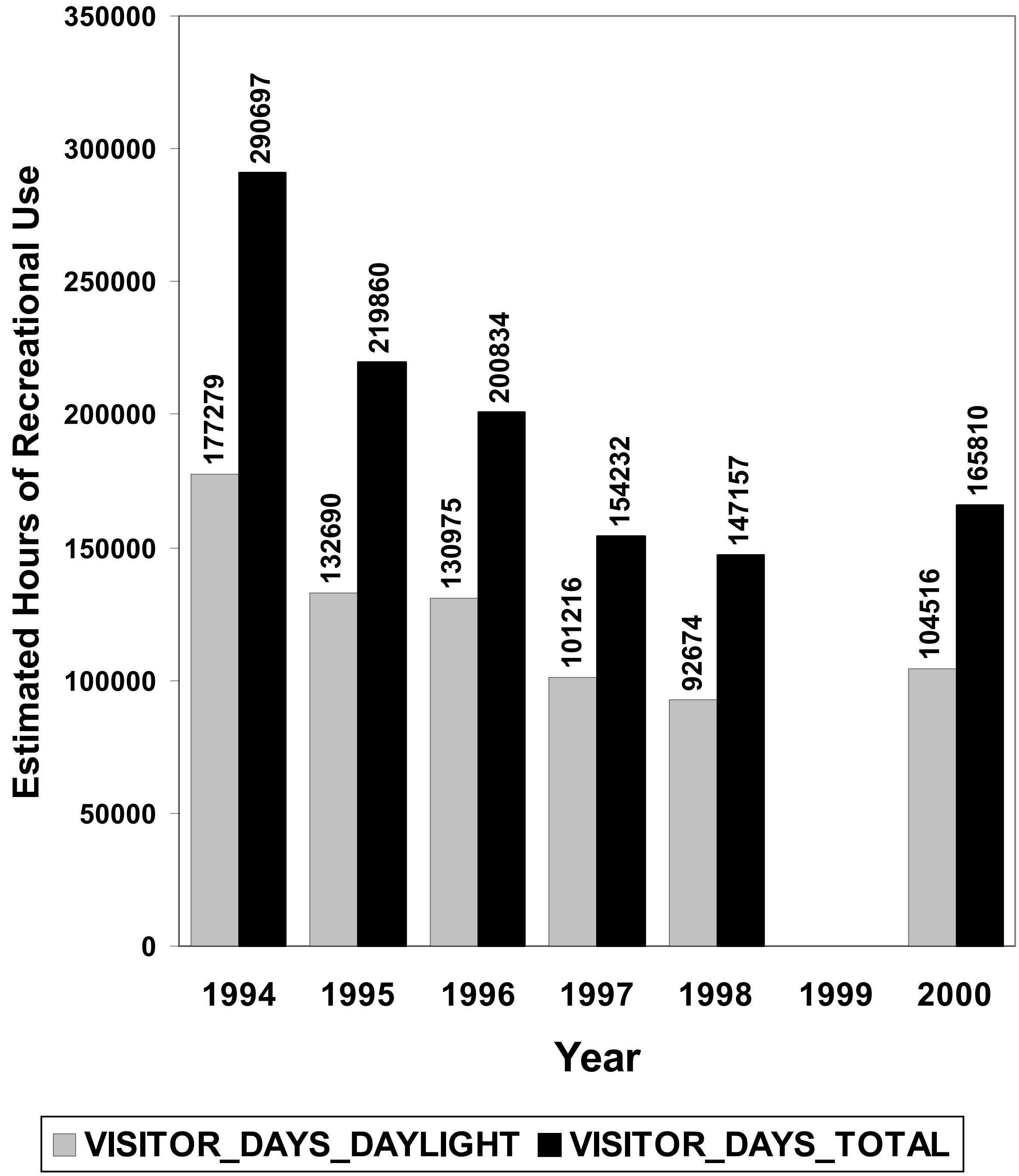

Figure E.5-53 Estimated number of warm-season daylight visitor days and visitor days total, by year, in the HCC (from the Applicant's recreational-use surveys)

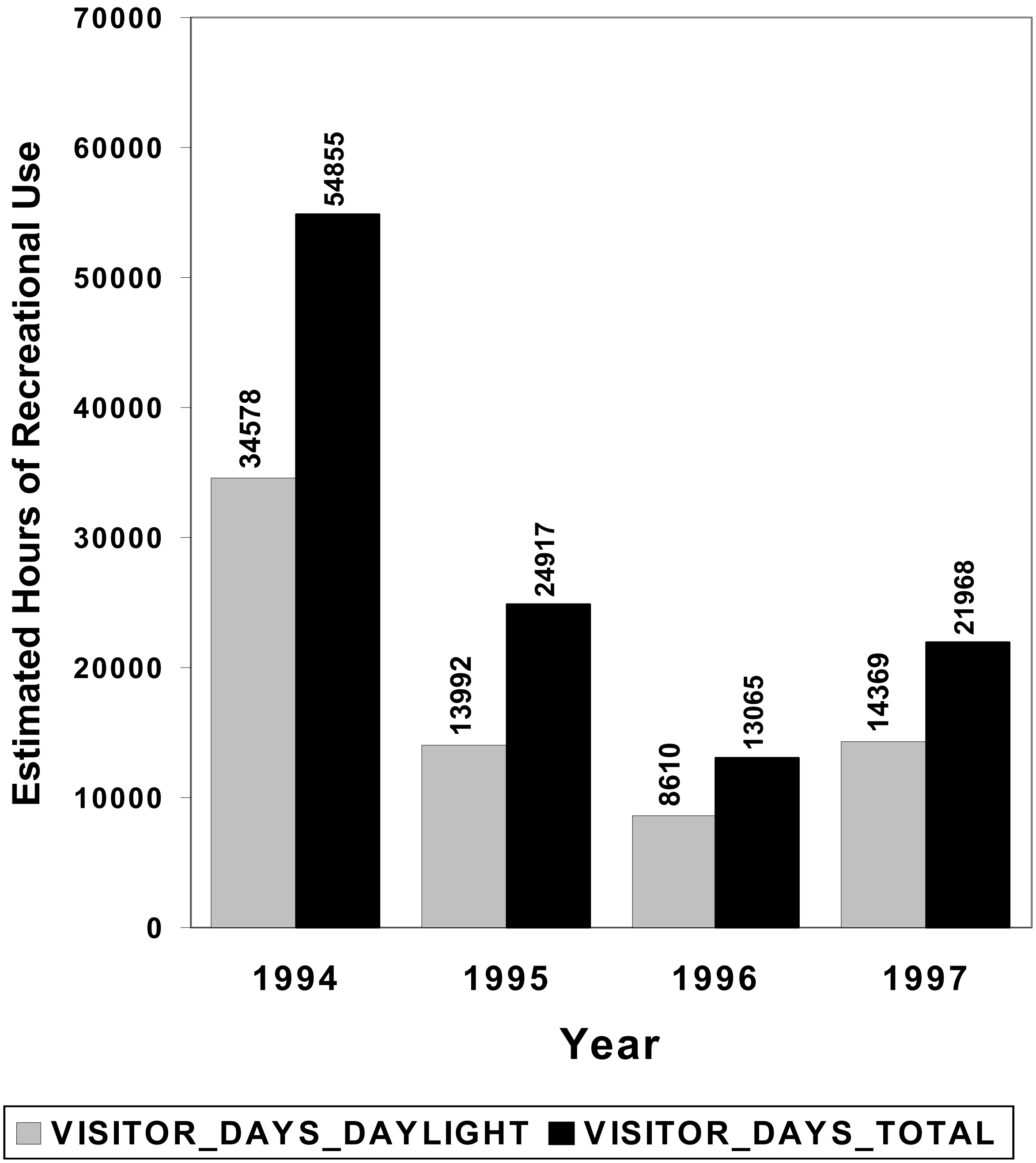

Figure E.5-54 Estimated number of cold-season daylight visitor days and visitor days total, by year, in the HCC (from the Applicant's recreational-use surveys)

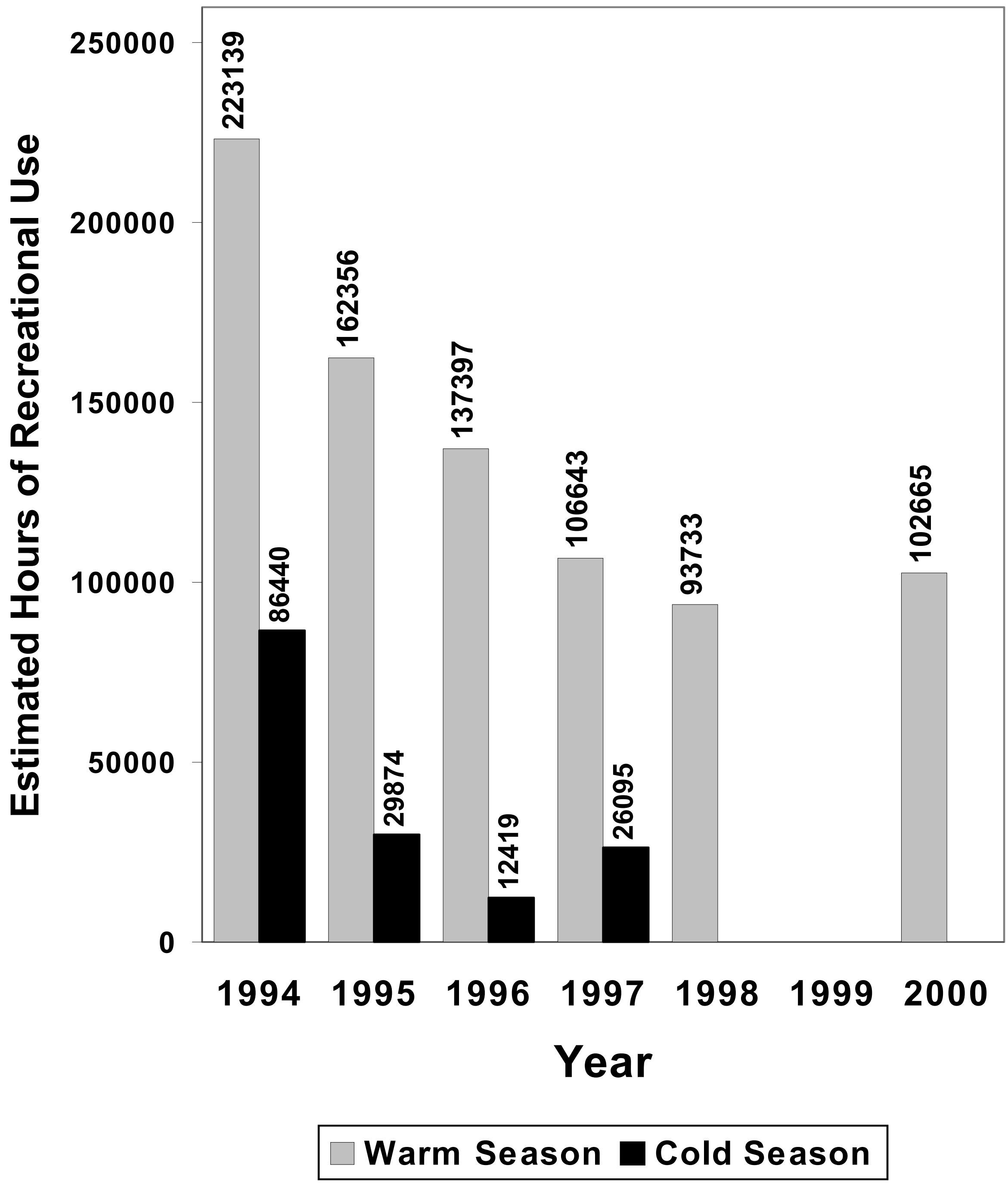

Figure E.5-55 Estimated number of recreation days, by year and season, at Brownlee Reservoir (from the Applicant's recreational-use surveys)

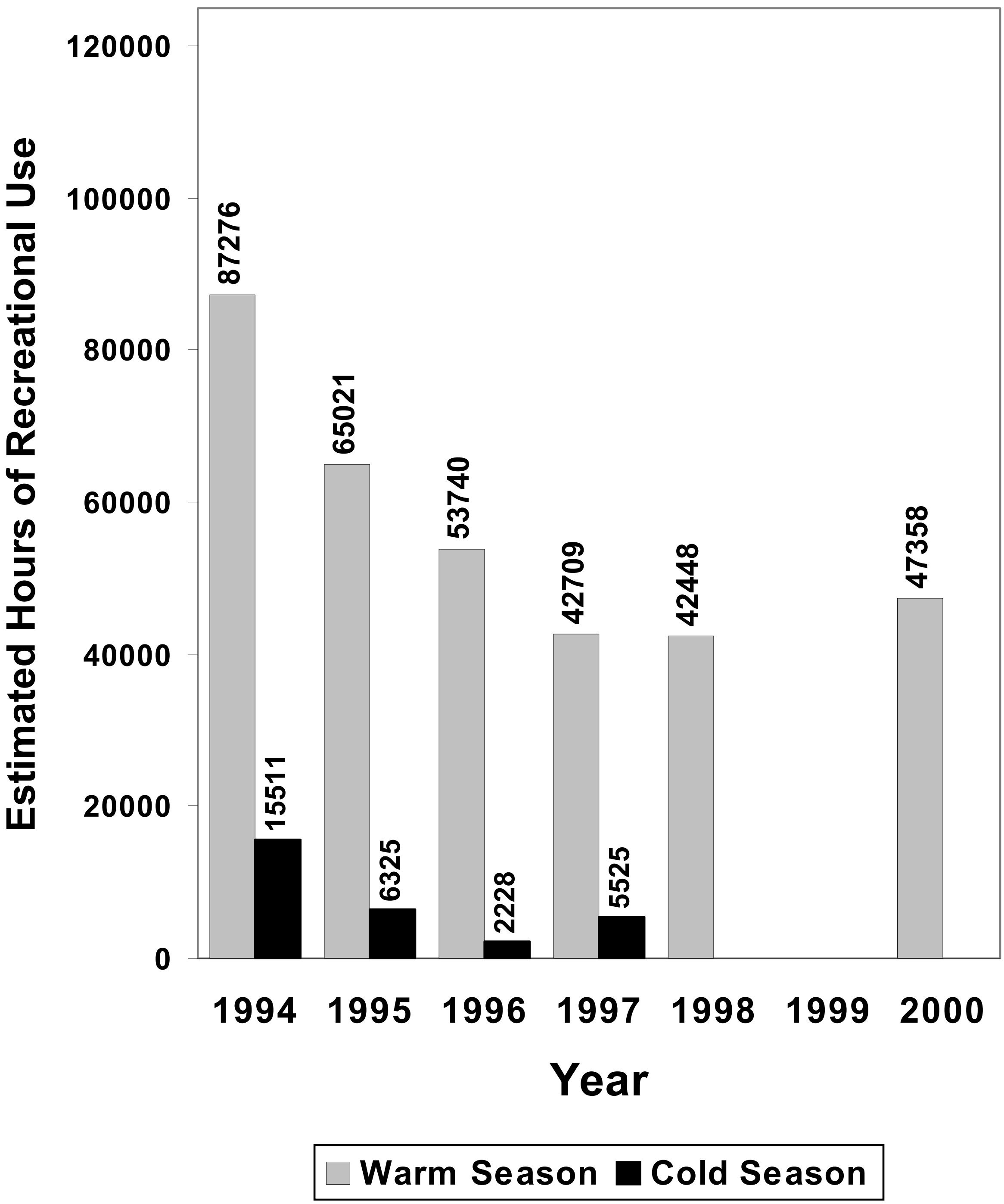

Figure E.5-56 Estimated number of recreation nights, by year and season, at Brownlee Reservoir (from the Applicant's recreational-use surveys)

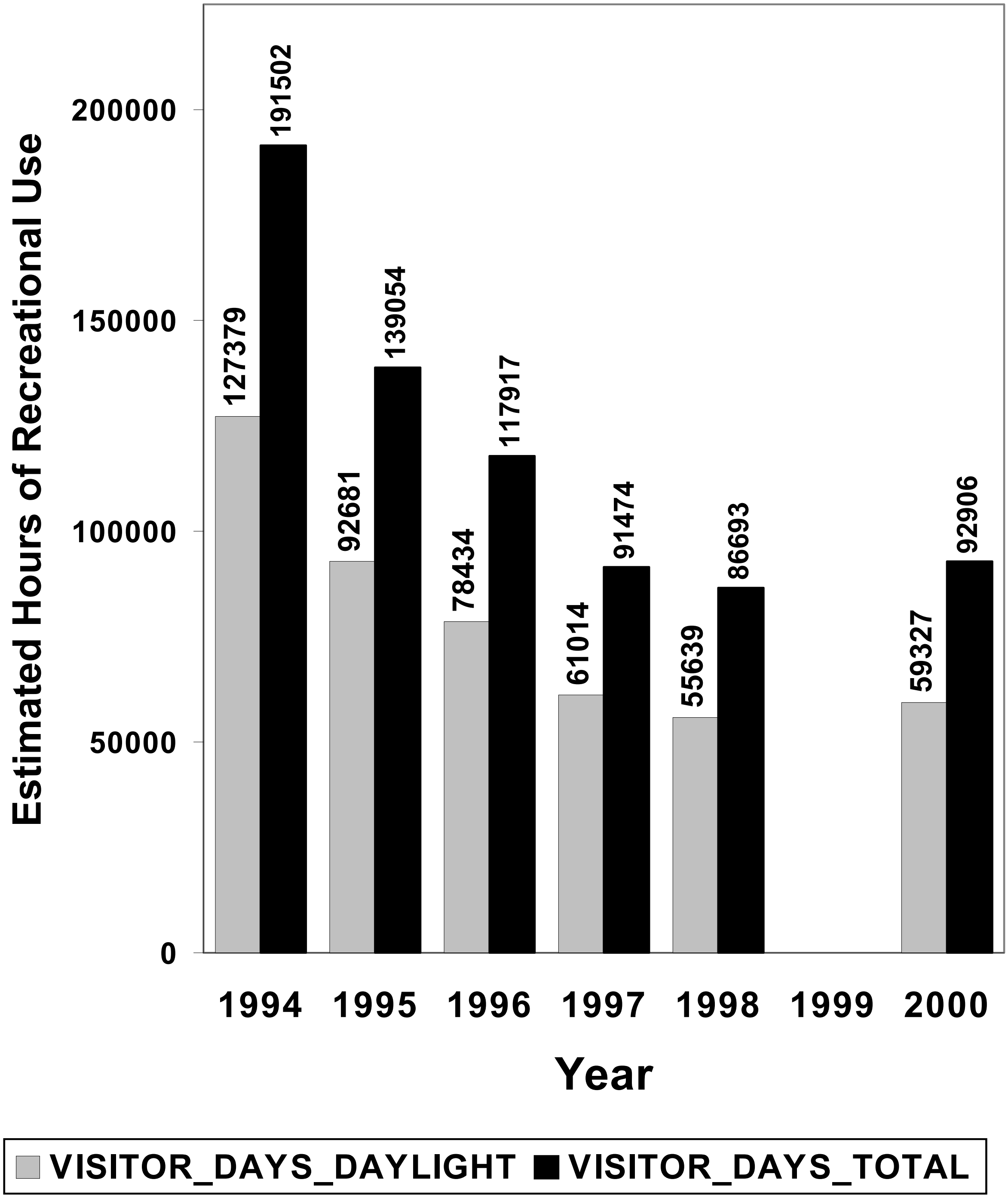

Figure E.5-57 Estimated number of warm-season daylight visitor days and visitor days total, by year, at Brownlee Reservoir (from the Applicant's recreational-use surveys)

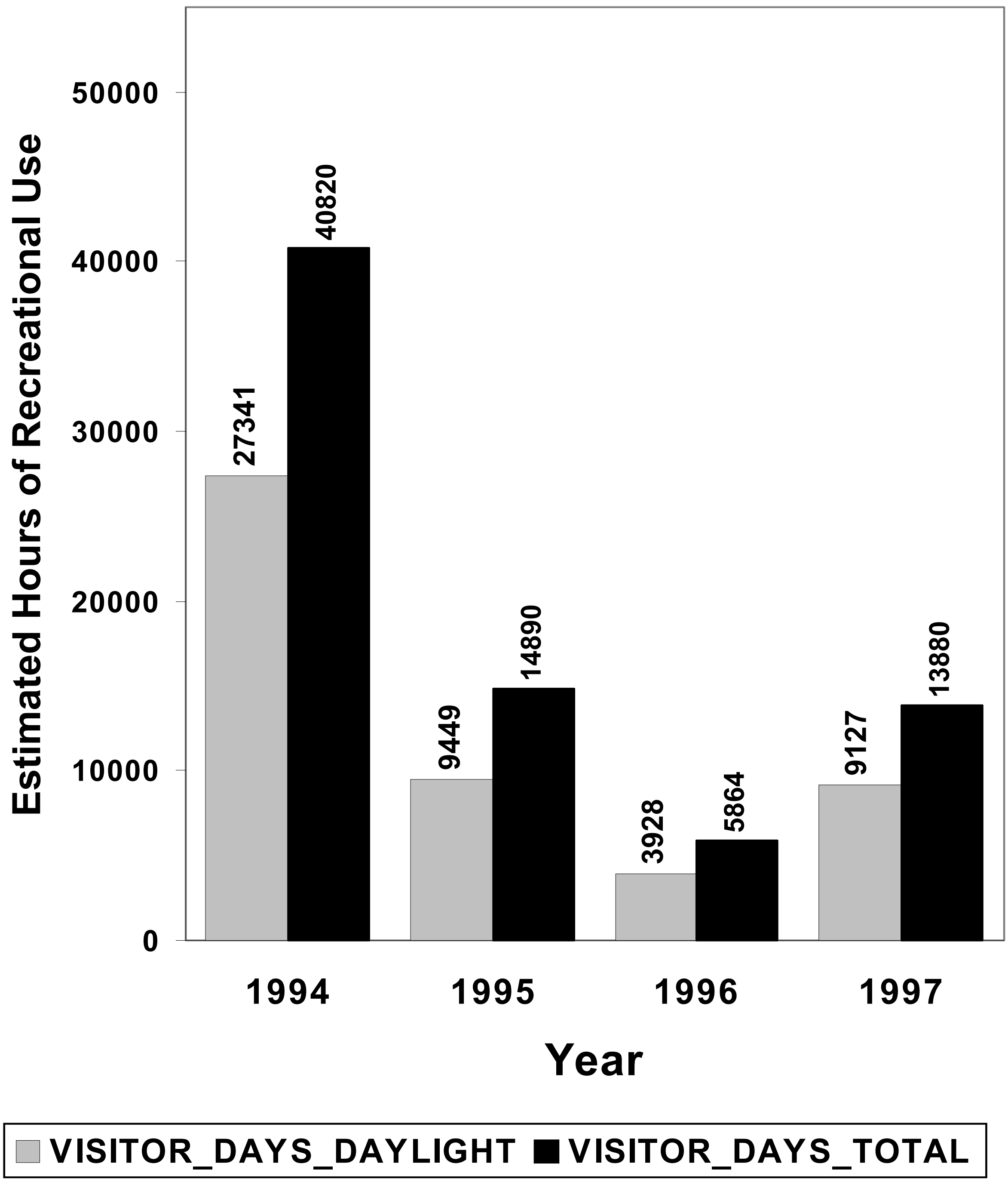

Figure E.5-58 Estimated number of cold-season daylight visitor days and visitor days total, by year, at Brownlee Reservoir (from the Applicant's recreational-use surveys)

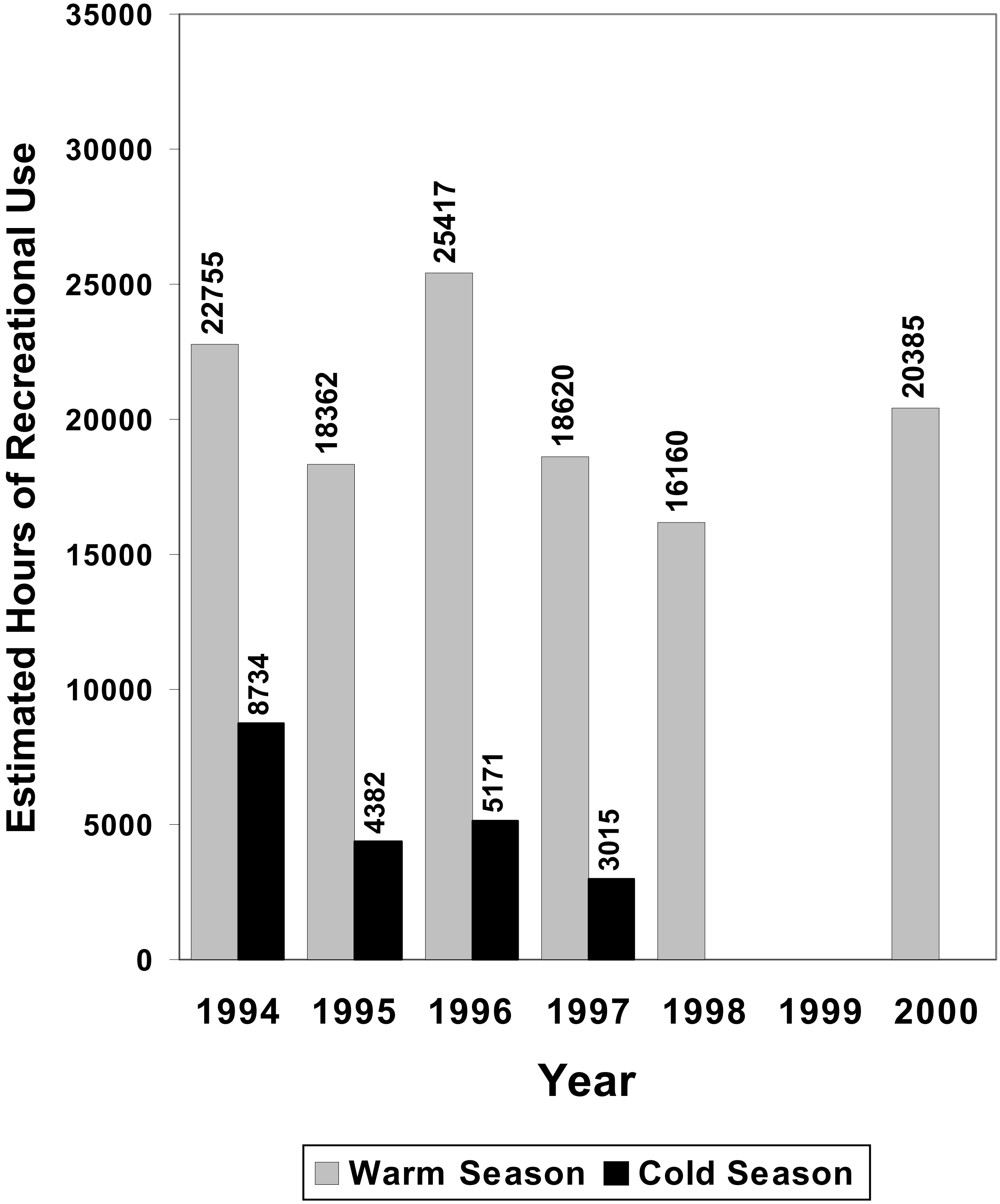

Figure E.5-59 Estimated number of recreation days, by year and season, at Oxbow Reservoir (from the Applicant's recreational-use surveys)

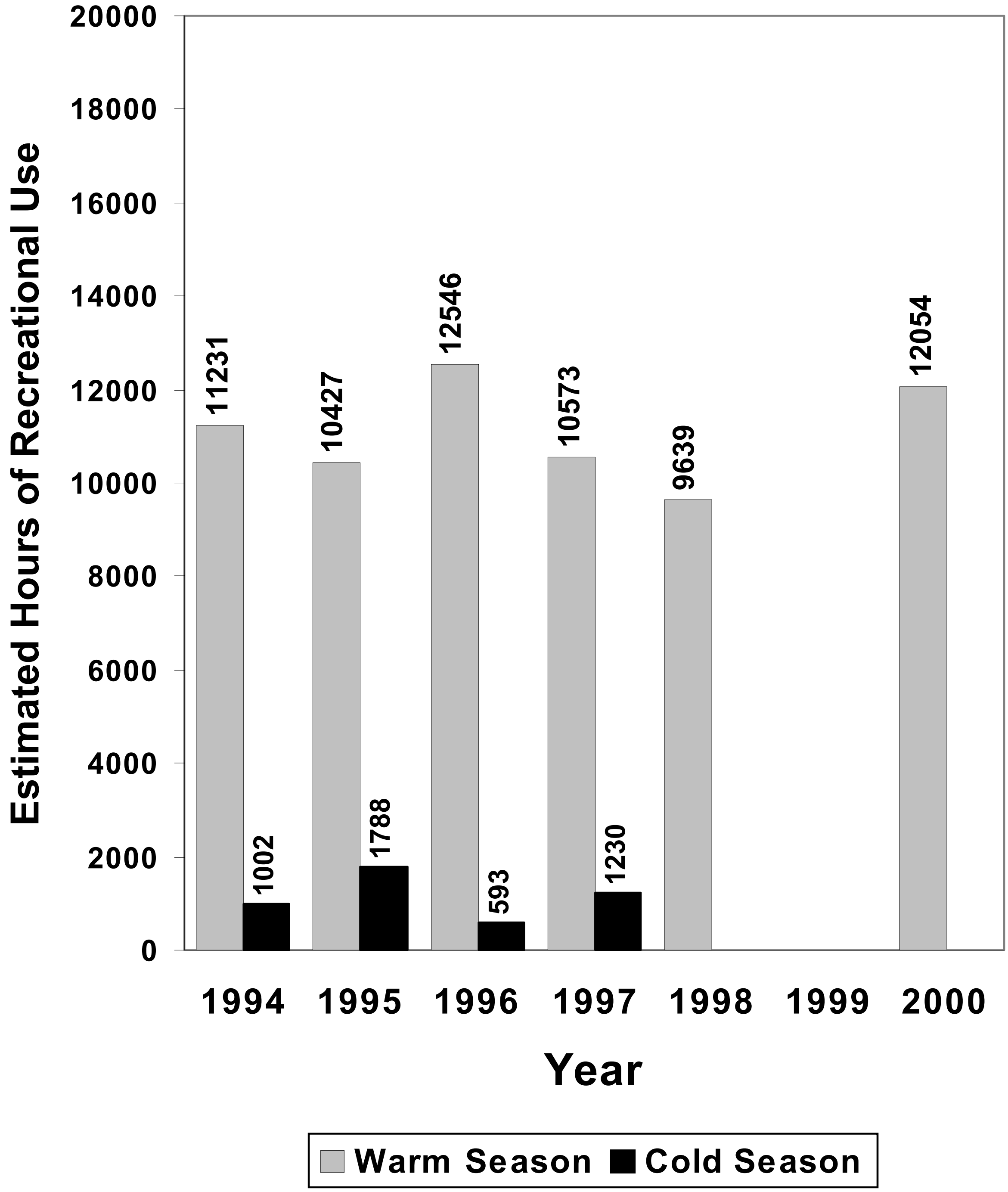

Figure E.5-60 Estimated number of recreation nights, by year and season, at Oxbow Reservoir (from the Applicant's recreational-use surveys)

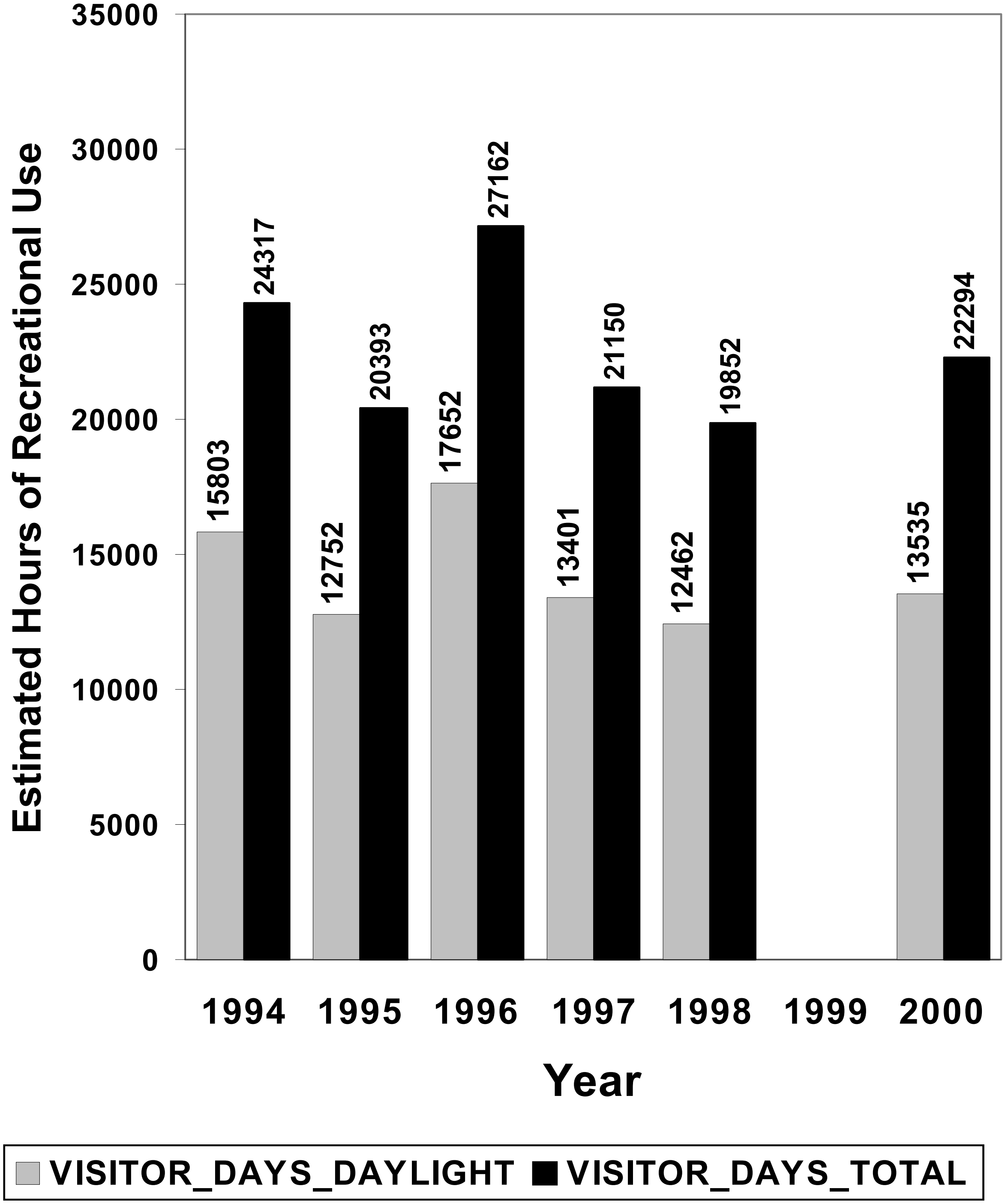

Figure E.5-61 **Estimated number of warm-season daylight visitor days and visitor days total, by year, at Oxbow Reservoir (from the Applicant's recreational-use surveys)**

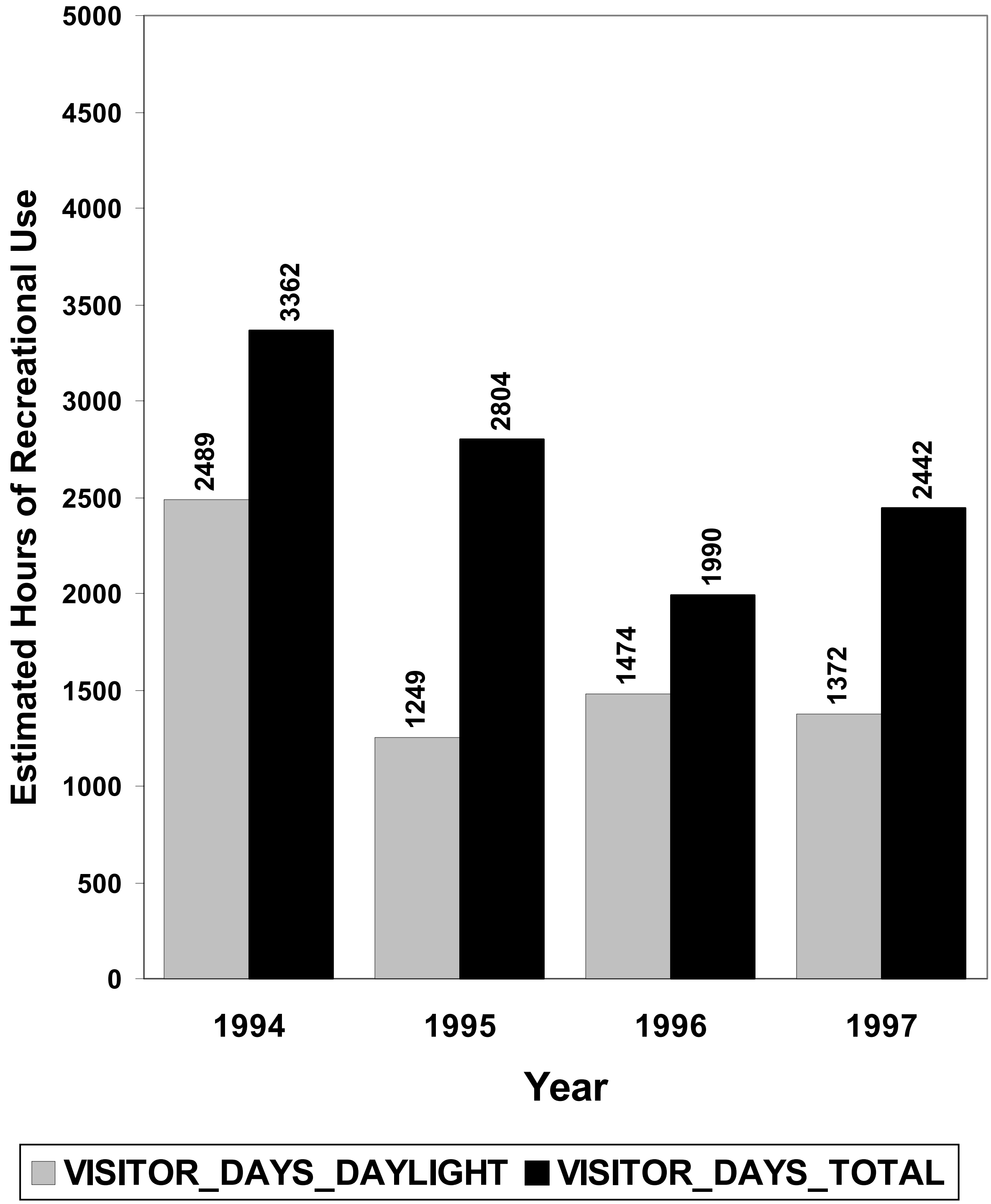

Figure E.5-62 Estimated number of cold-season daylight visitor days and visitor days total, by year, at Oxbow Reservoir (from the Applicant's recreational-use surveys)

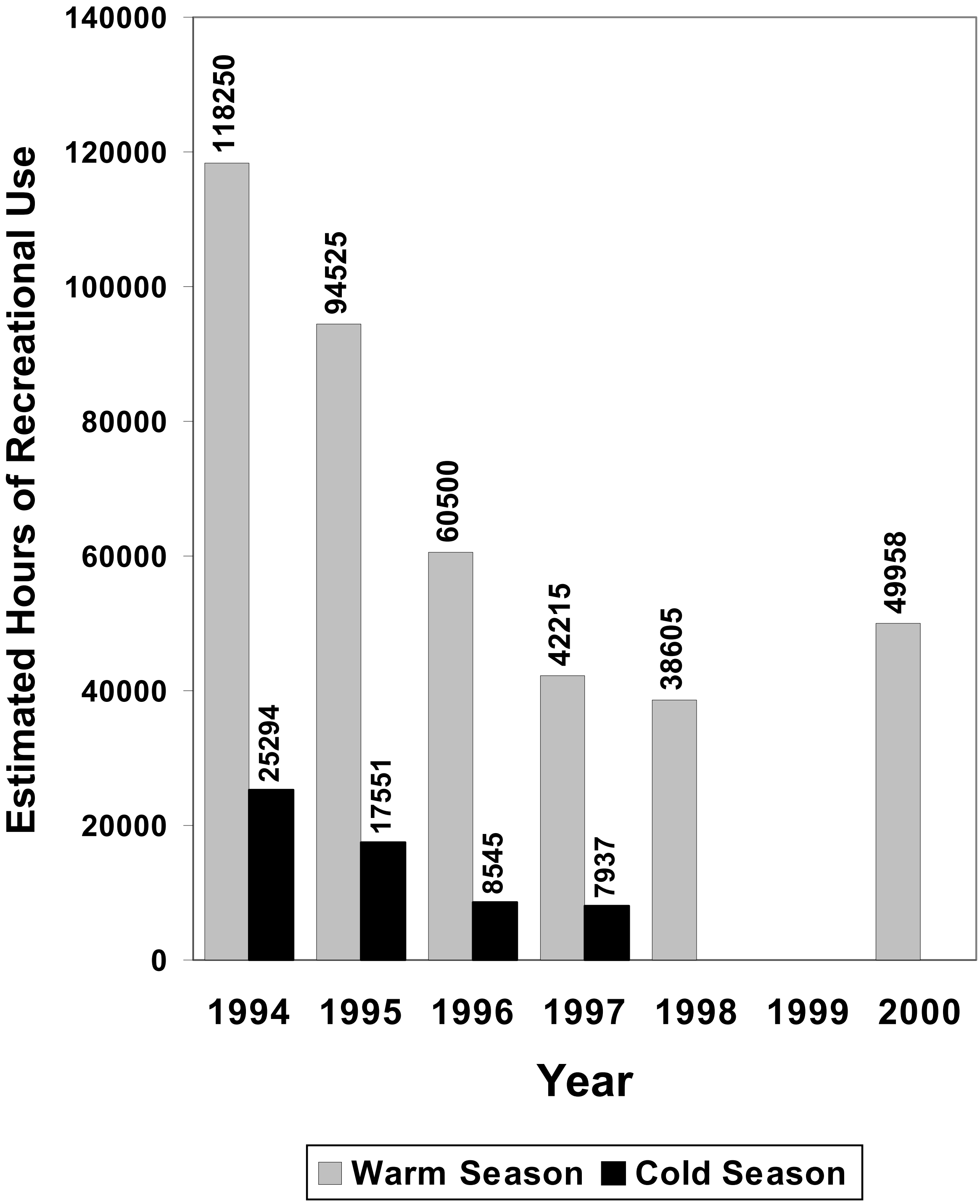

Figure E.5-63 Estimated number of recreation days, by year and season, at Hells Canyon Reservoir (from the Applicant's recreational-use surveys)

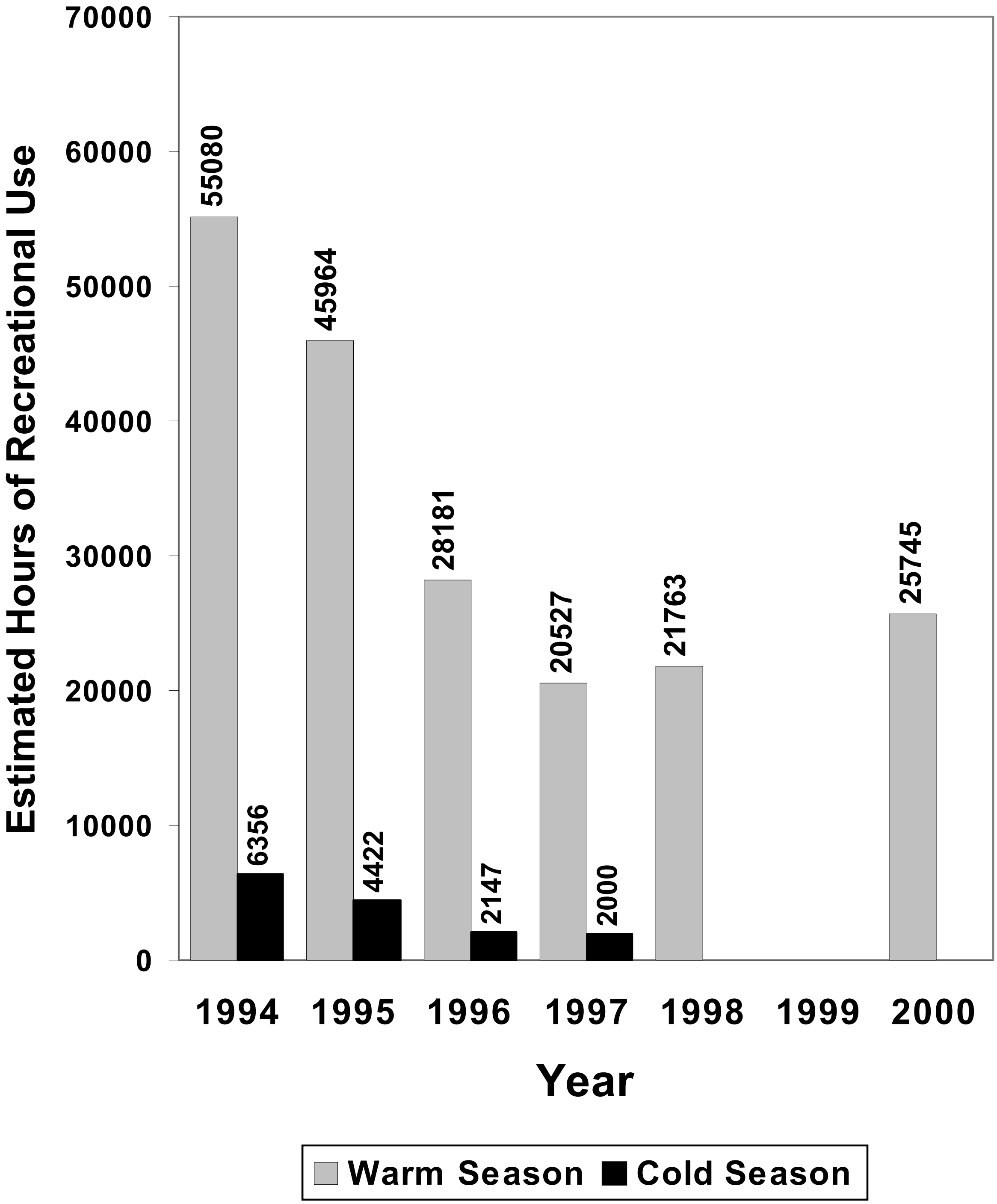

Figure E.5-64 Estimated number of recreation nights, by year and season, at Hells Canyon Reservoir (from the Applicant's recreational-use surveys)

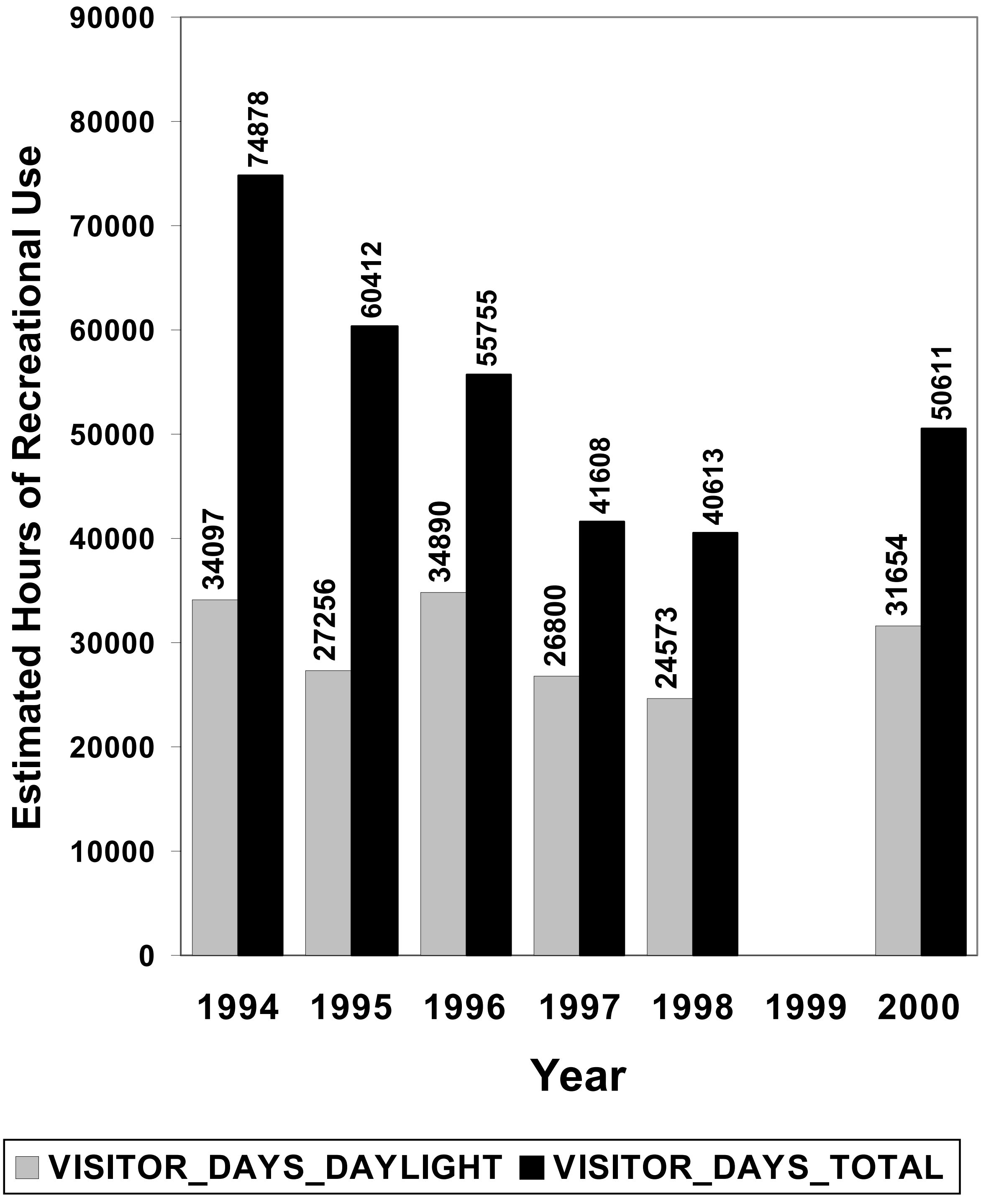

Figure E.5-65 Estimated number of warm-season daylight visitor days and visitor days total, by year, at Hells Canyon Reservoir (from the Applicant's recreational-use surveys)

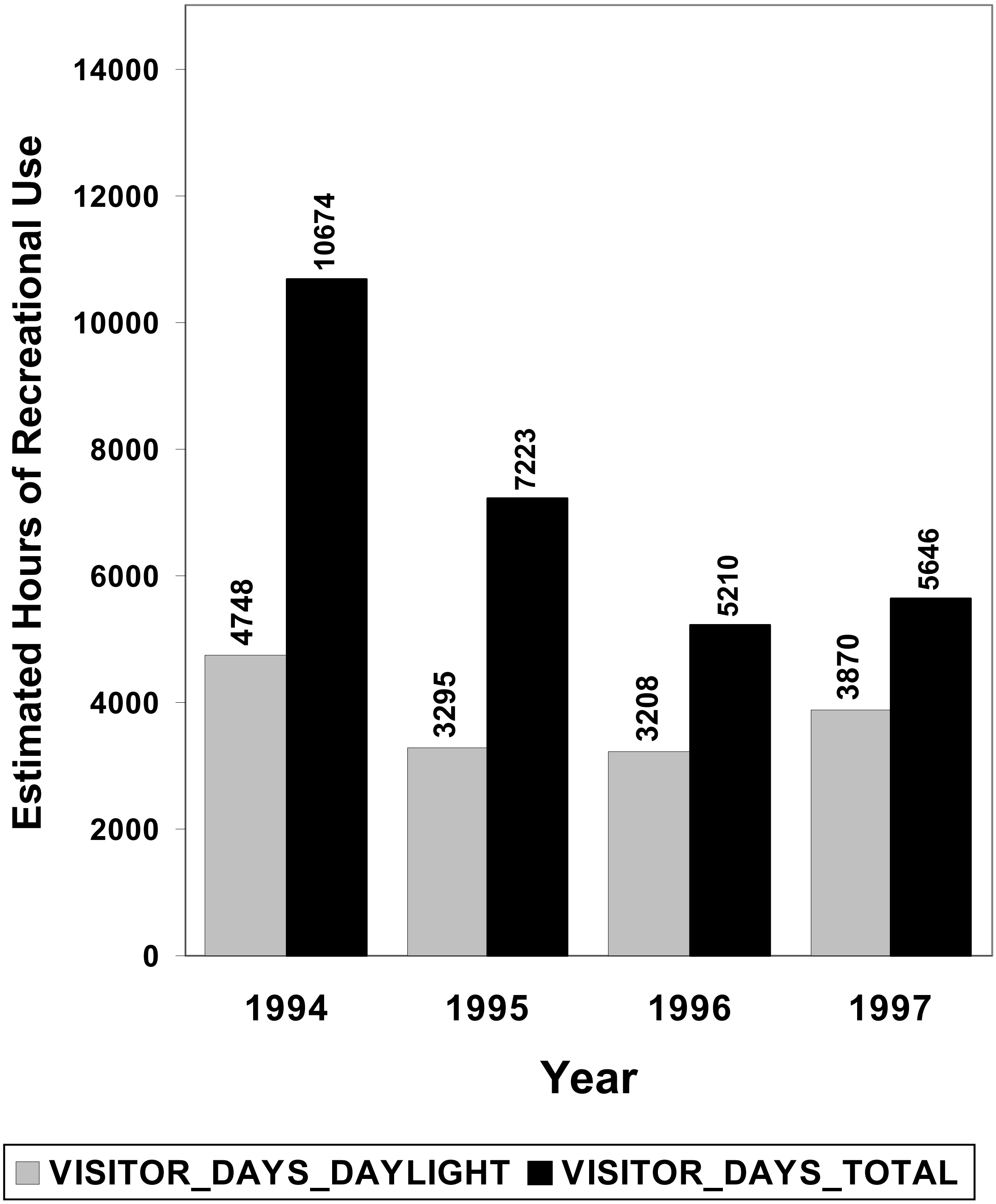

Figure E.5-66 Estimated number of cold-season daylight visitor days and visitor days total, by year, at Hells Canyon Reservoir (from the Applicant's recreational-use surveys)

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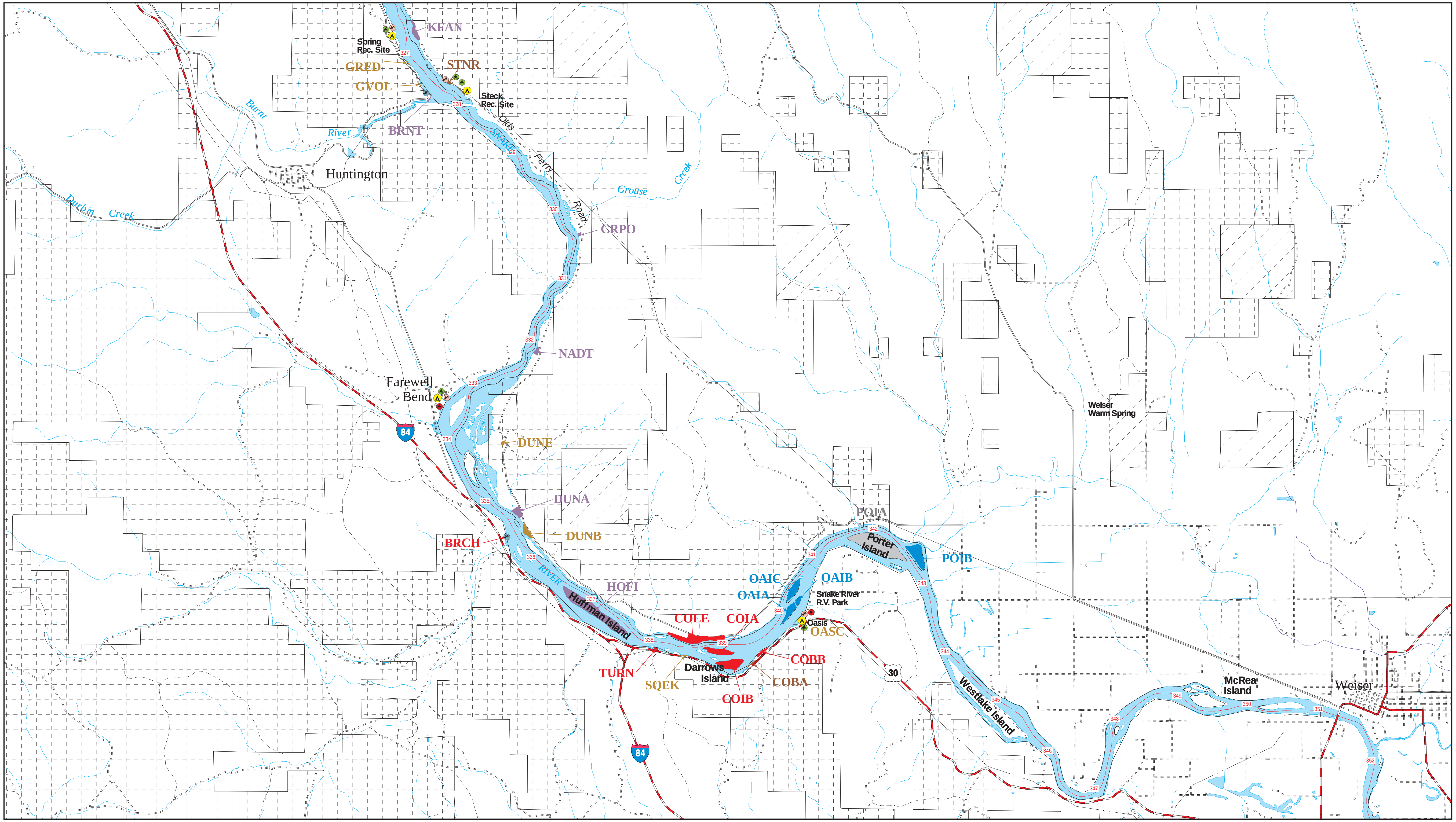
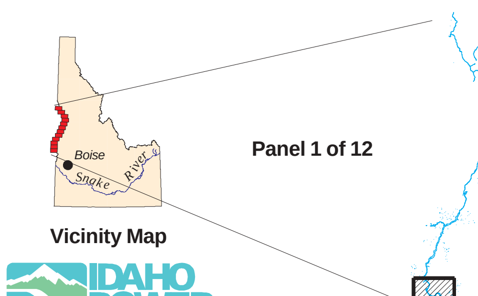


Panel 1 of 12



Vicinity Map

IDAHO POWER
Geographic Information Services

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

Base Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
- Perennial River or Stream
- Intermittent River or Stream
- Ditch or Canal
- Water Body

Thematic Features Legend

- Bureau of Land Management
- Private
- State Lands
- U.S. Forest Service
- Unimproved Boat Ramp
- Improved Boat Ramp
- Parks
- Vault/Pit Restrooms
- Shower Facility
- Rivermile

Dispersed Site Ownership Classes

- Bureau of Land Management
- Idaho Power Company
- U.S. Forest Service
- Private
- Multiple Ownerships
- State of Idaho
- State of Oregon

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5 - 67

Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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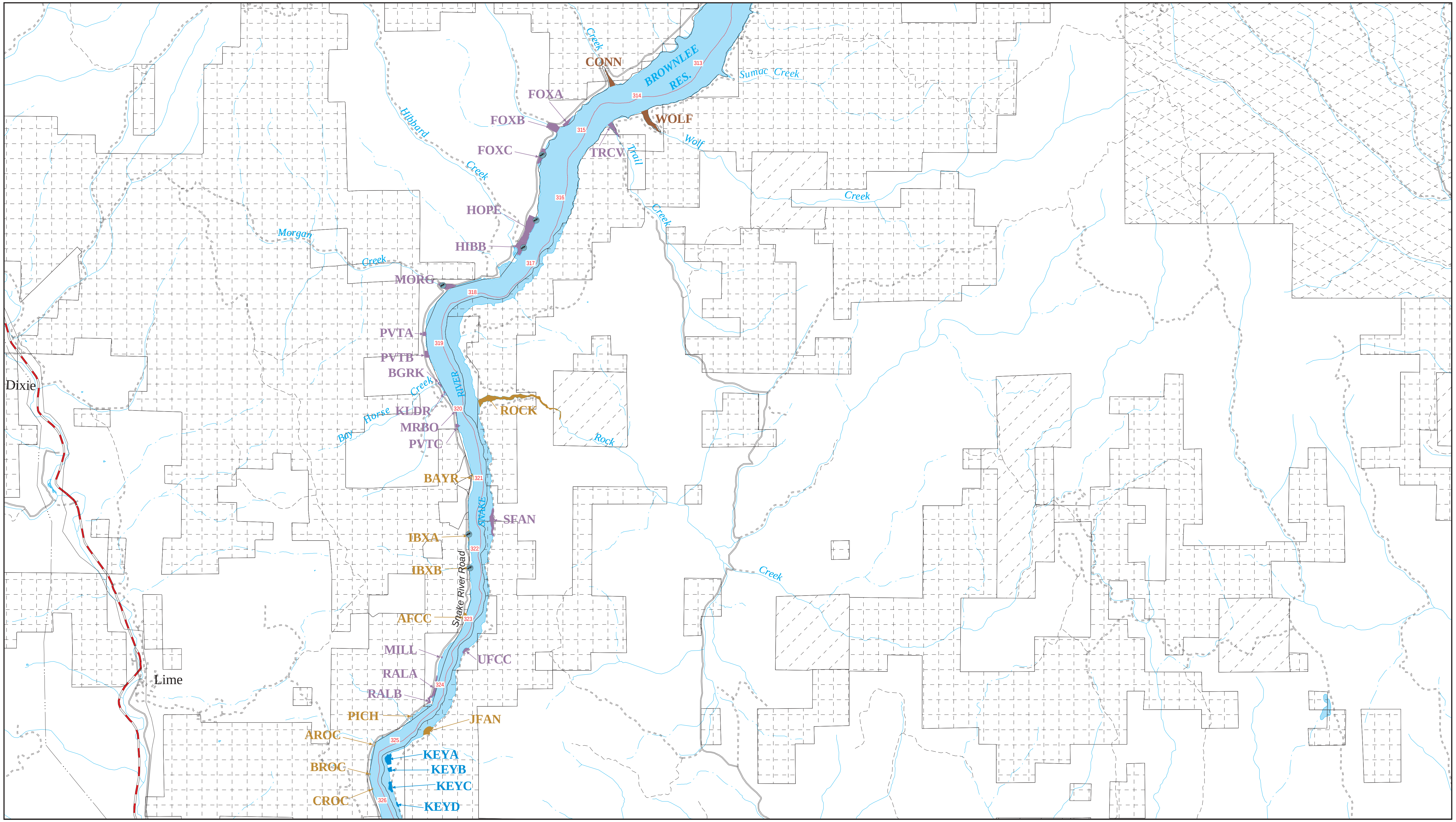
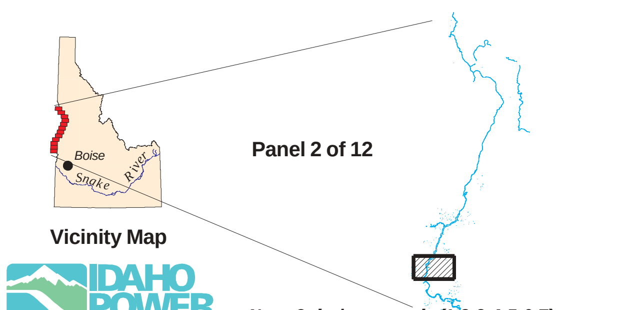




Panel 2 of 12

Vicinity Map

IDAHO POWER
Geographic Information Services

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

Base Features Legend

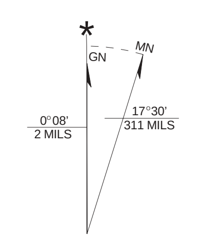
- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
- Perennial River or Stream
- Intermittent River or Stream
- Ditch or Canal
- Water Body

Thematic Features Legend

- Bureau of Land Management
- Private
- State Lands
- U.S. Forest Service
- Unimproved Boat Ramp
- Improved Boat Ramp
- Parks
- Vault/Pit Restrooms
- Shower Facility
- Rivermile

Dispersed Site Ownership Classes

- Bureau of Land Management
- Idaho Power Company
- U.S. Forest Service
- Private
- Multiple Ownerships
- State of Idaho
- State of Oregon



UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5 - 67

Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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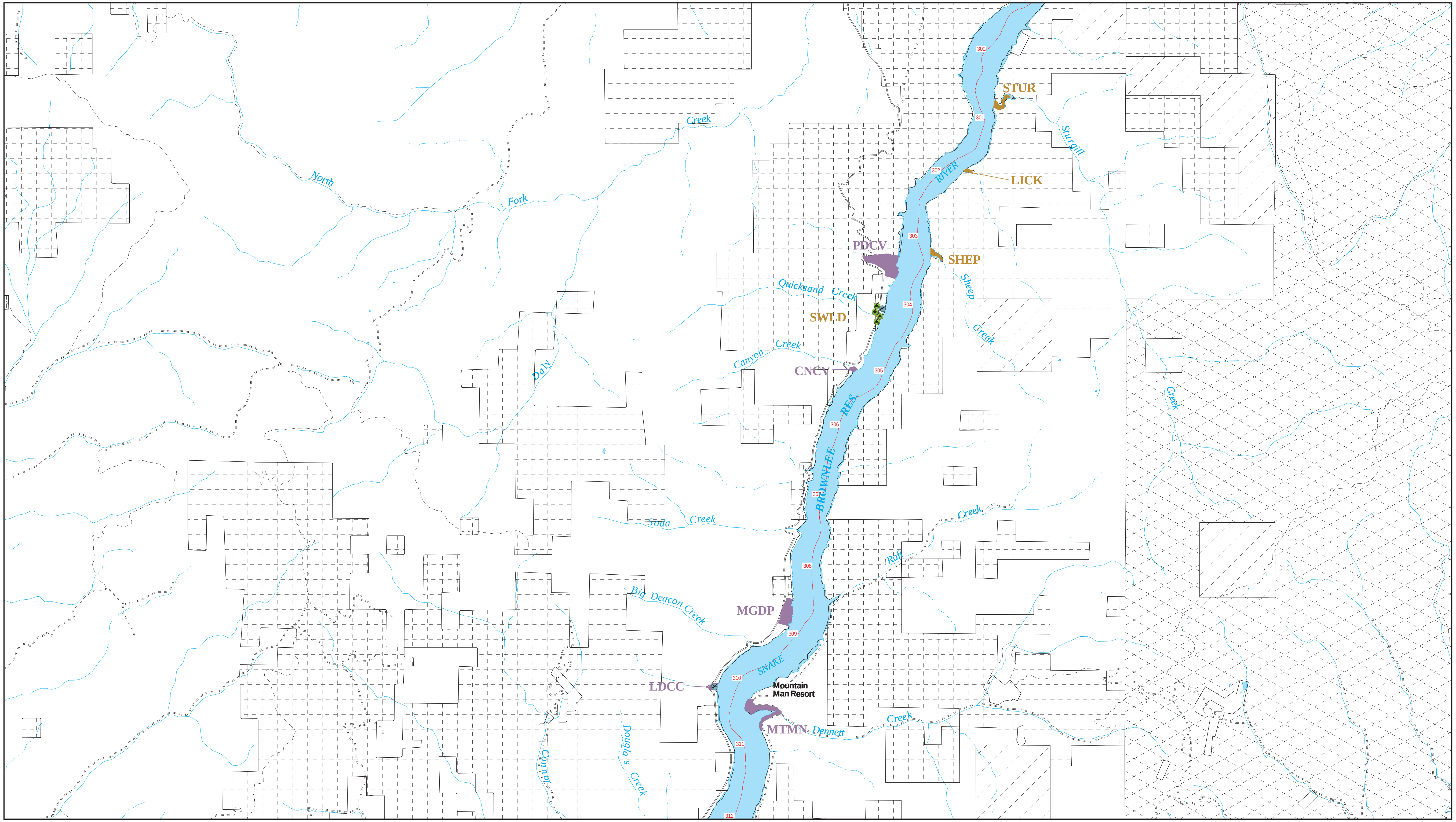

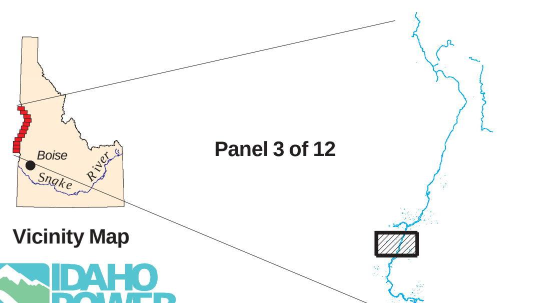

Vicinity Map

Panel 3 of 12

IDAHO POWER
Geographic Information Services

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

Base Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
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- Intermittent River or Stream
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- Water Body

Thematic Features Legend

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- State of Idaho
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GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5 - 67

Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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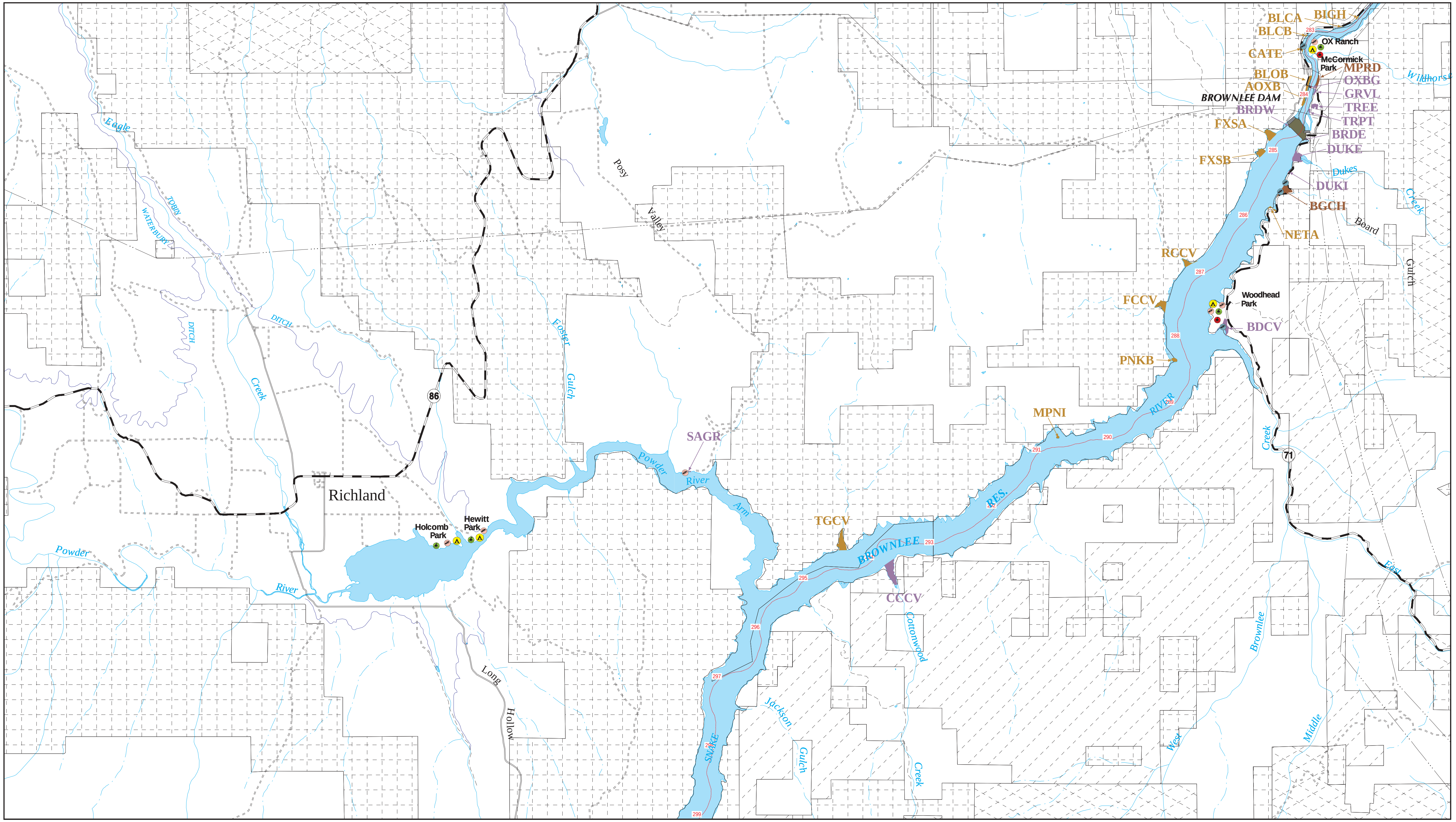
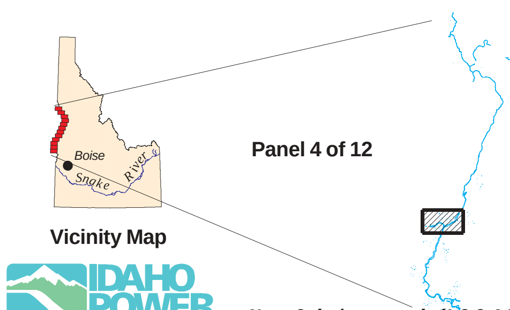




Panel 4 of 12

Vicinity Map

IDAHO POWER
Geographic Information Services

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

Base Features Legend

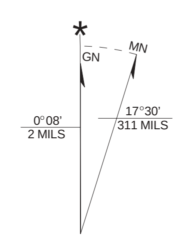
- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
- Perennial River or Stream
- Intermittent River or Stream
- Ditch or Canal
- Water Body

Thematic Features Legend

- Bureau of Land Management
- Private
- State Lands
- U.S. Forest Service
- Unimproved Boat Ramp
- Improved Boat Ramp
- Parks
- Vault/Pit Restrooms
- Shower Facility
- Rivermile

Dispersed Site Ownership Classes

- Bureau of Land Management
- Idaho Power Company
- U.S. Forest Service
- Private
- Multiple Ownerships
- State of Idaho
- State of Oregon



UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5 - 67

Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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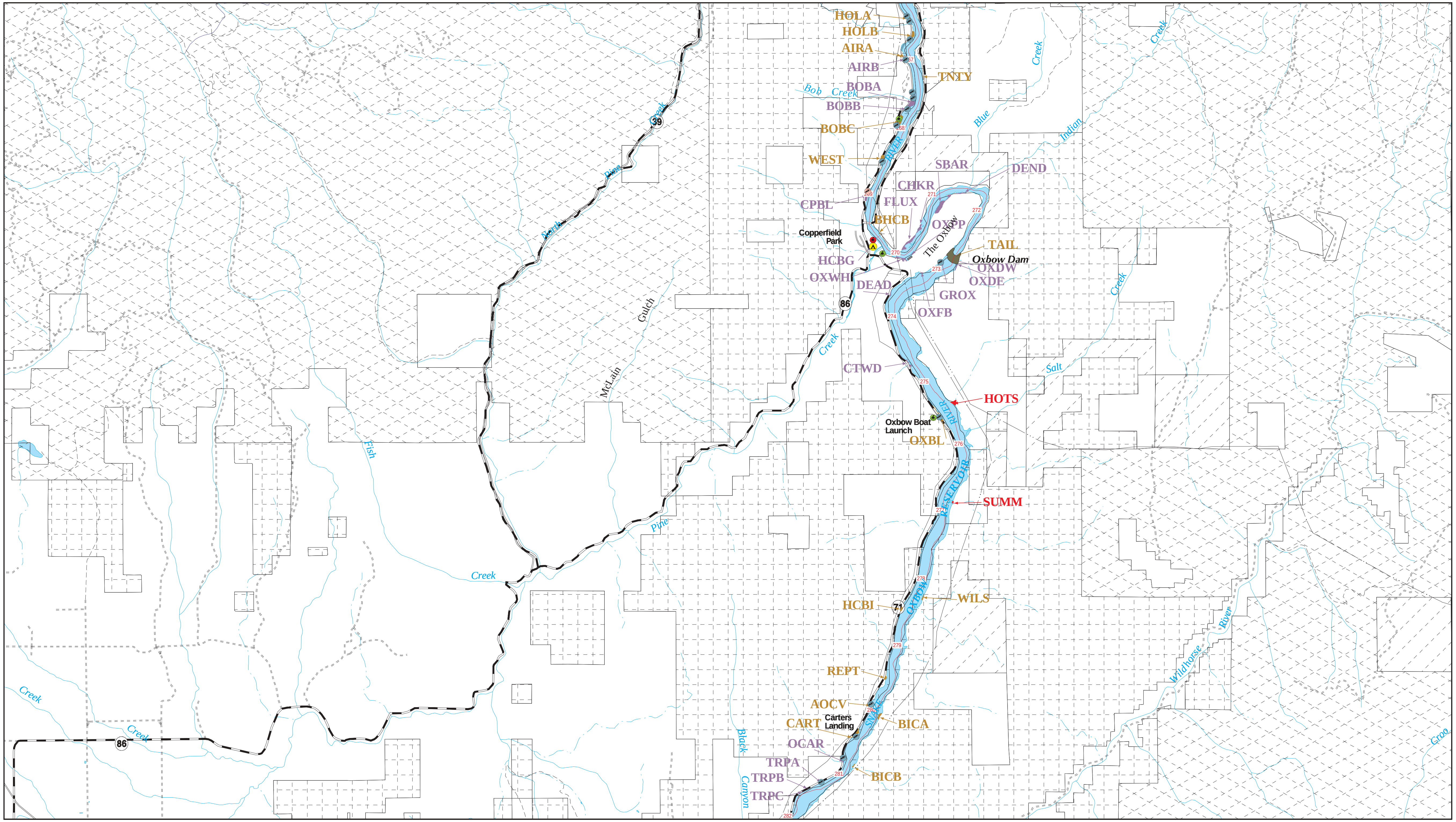

Vicinity Map

Panel 5 of 12

IDAHO POWER
Geographic Information Services

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

Base Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
- Perennial River or Stream
- Intermittent River or Stream
- Ditch or Canal
- Water Body

Thematic Features Legend

- Bureau of Land Management
- Private
- State Lands
- U.S. Forest Service
- Unimproved Boat Ramp
- Improved Boat Ramp
- Parks
- Vault/Pit Restrooms
- Shower Facility
- Rivermile

Dispersed Site Ownership Classes

- Bureau of Land Management
- Idaho Power Company
- U.S. Forest Service
- Private
- Multiple Ownerships
- State of Idaho
- State of Oregon

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5 - 67

Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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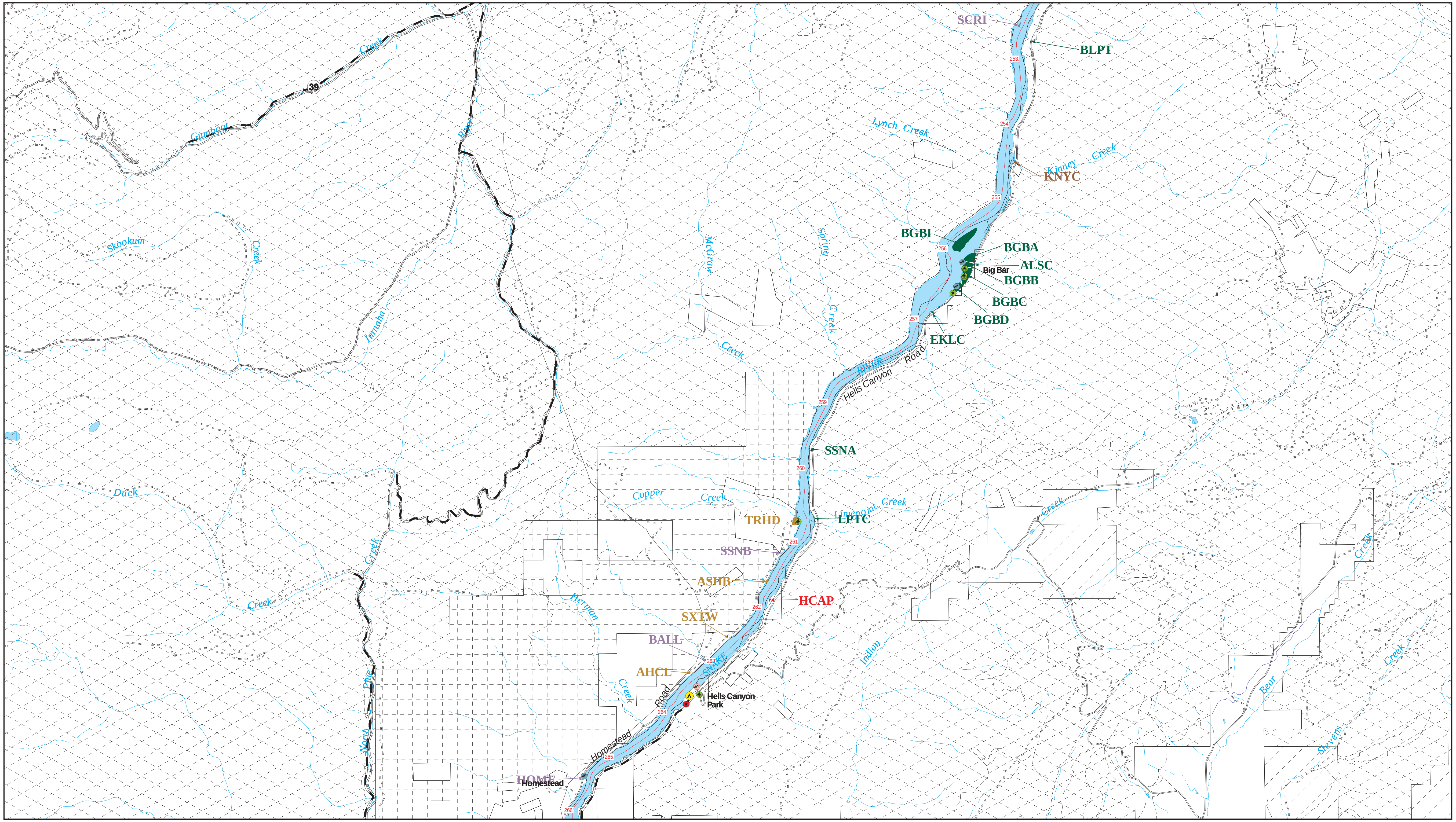

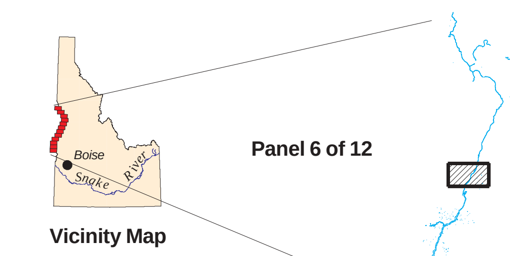

Vicinity Map

Panel 6 of 12

IDAHO POWER
Geographic Information Services

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

Base Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
- Perennial River or Stream
- Intermittent River or Stream
- Ditch or Canal
- Water Body

Thematic Features Legend

- Bureau of Land Management
- Private
- State Lands
- U.S. Forest Service
- Unimproved Boat Ramp
- Improved Boat Ramp
- Parks
- Vault/Pit Restrooms
- Shower Facility
- Rivermile

Dispersed Site Ownership Classes

- Bureau of Land Management
- Idaho Power Company
- U.S. Forest Service
- Private
- Multiple Ownerships
- State of Idaho
- State of Oregon

GN MN
0°08' 2 MILS
17°30' 311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

Figure E.5 - 67

Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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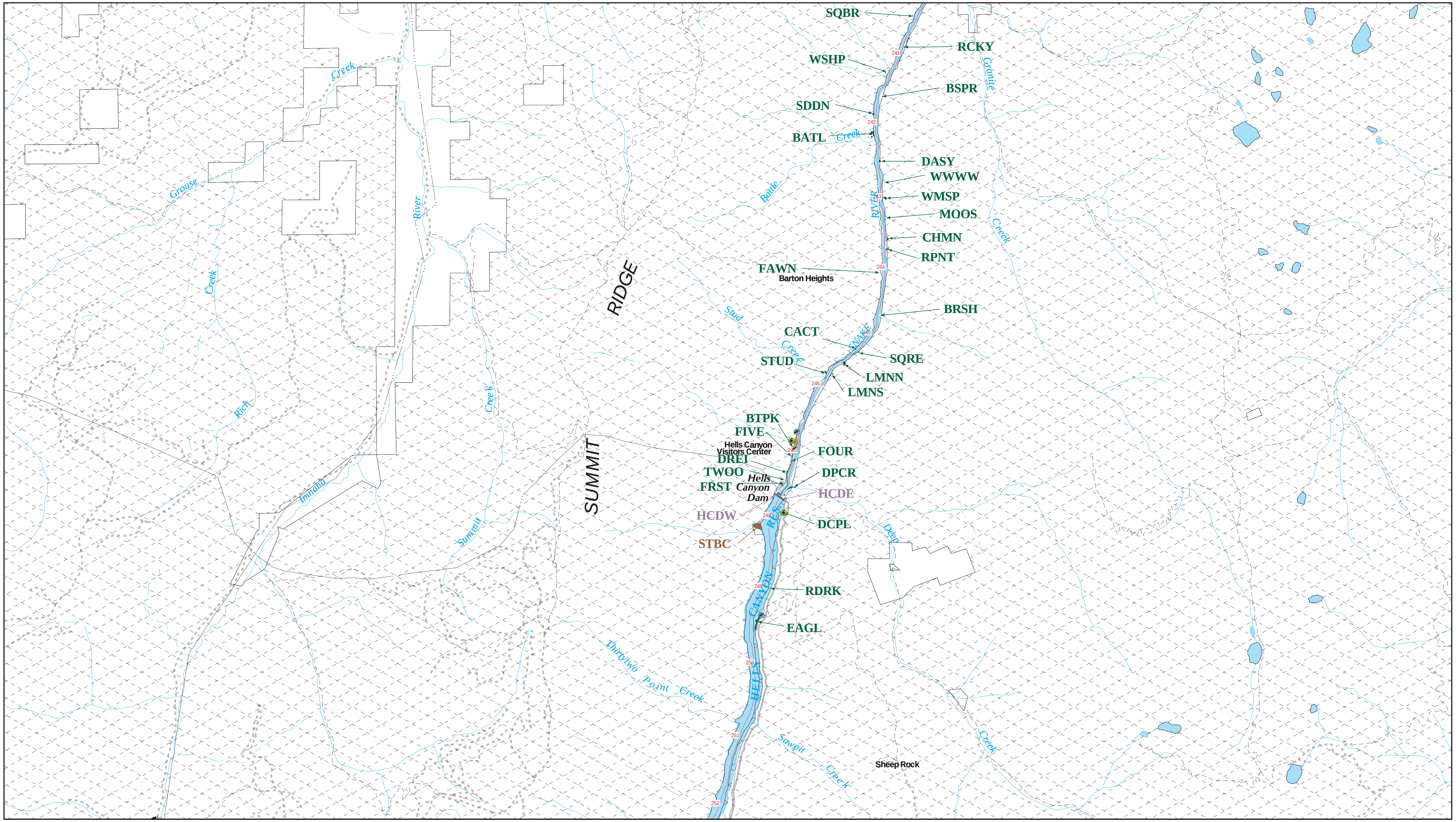

Vicinity Map

Panel 7 of 12

Note: Only those panels (1,2,3,4,5,6,7) that contain thematic data are mapped

IDAHO POWER
Geographic Information Services

Base Features Legend

- Primary Route
- Secondary Route
- Light Duty Road
- Unimproved Road
- Trail
- Railroad
- Transmission Line
- Perennial River or Stream
- Intermittent River or Stream
- Ditch or Canal
- Water Body

Thematic Features Legend

- Bureau of Land Management
- Private
- State Lands
- U.S. Forest Service
- Unimproved Boat Ramp
- Improved Boat Ramp
- Parks
- Vault/Pit Restrooms
- Shower Facility
- Rivermile

Dispersed Site Ownership Classes

- Bureau of Land Management
- Idaho Power Company
- U.S. Forest Service
- Private
- Multiple Ownerships
- State of Idaho
- State of Oregon

GN
MN
0°08'
2 MILS
17°30'
311 MILS

UTM GRID AND 1987
MAGNETIC NORTH DECLINATION
AT CENTER OF OXBOW QUADRANGLE

HELLS CANYON PROJECT - FERC No. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002
Figure E.5 - 67
Nonpark recreational-use sites sampled during use surveys

1 .5 0 1 MILES

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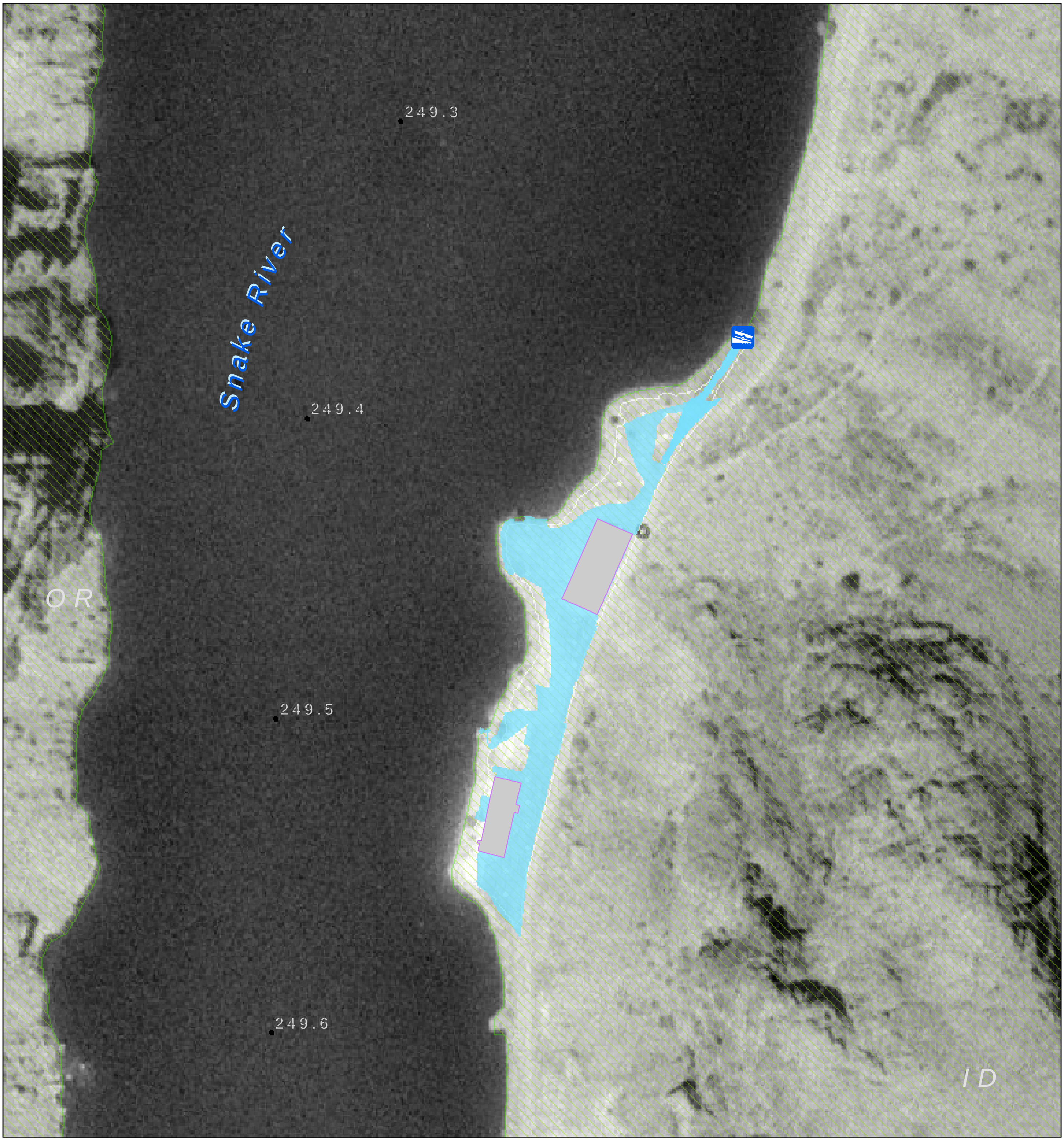

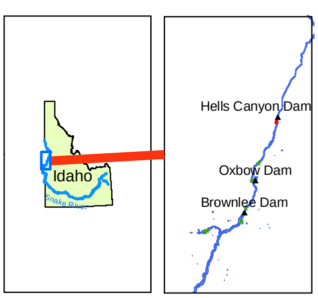

Feature Legend

- Impromptu Boat Ramp
- River Mile
- Used Area
- Parking Area
- Dispersed Site Area
- USFS Land

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971
Idaho Power Company - Boise, Idaho - 2003

Figure E.5-68

Eagle Bar (EAGL)
Hells Canyon Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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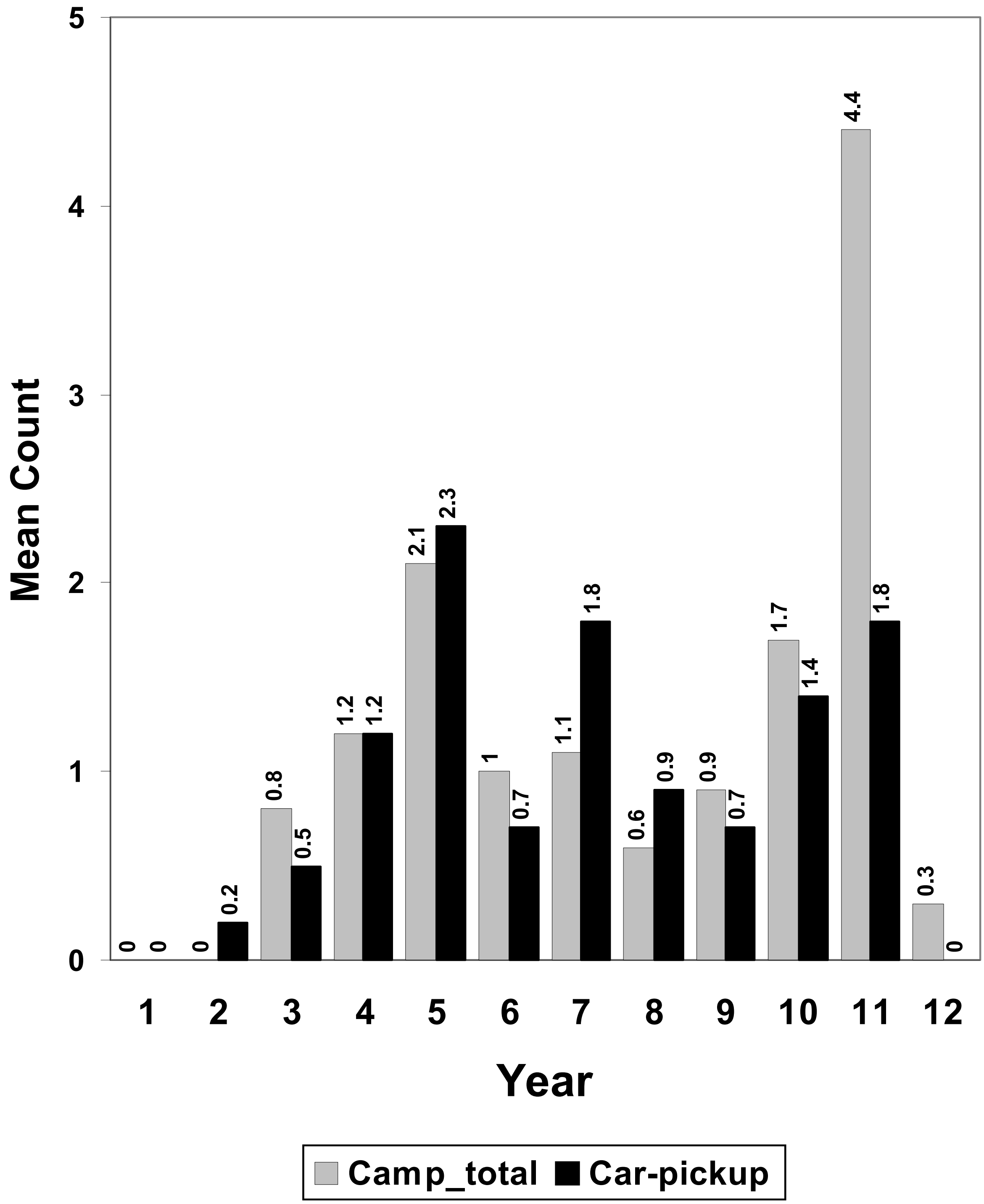

Figure E.5-69 Eagle Bar—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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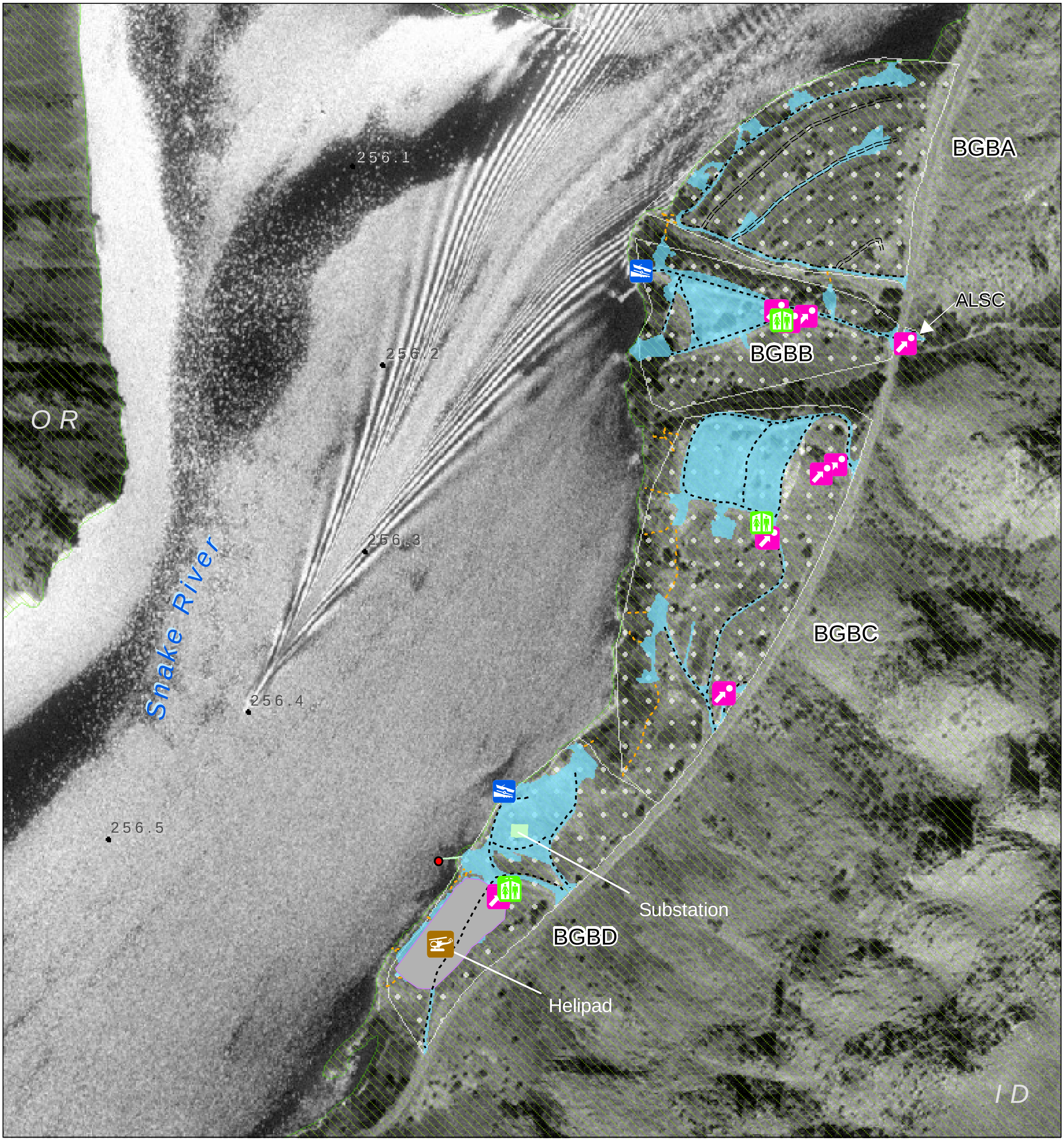

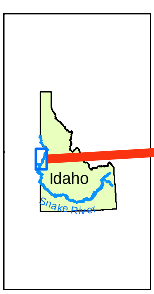

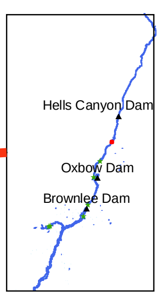

Features Legend

- Sign
- Vault/Pit Toilet
- Impromptu Boat Ramp
- Boat Dock
- River Mile

Site Specific Roads

- - - - - - Gravel
- ===== Unimproved
- - - - - - Trail

- Parking Area
- Used Area
- Dispersed Site Area
- USFS Land

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971

Idaho Power Company - Boise, Idaho - 2003

Figure E.5-70

Big Bar (BGBA, BGBB, BGBC, BGBD)

Hells Canyon Reservoir

Scale 1: 5,000

50 25 0 50 100 150 Meters

IDAHO POWER
An IDACORP Company

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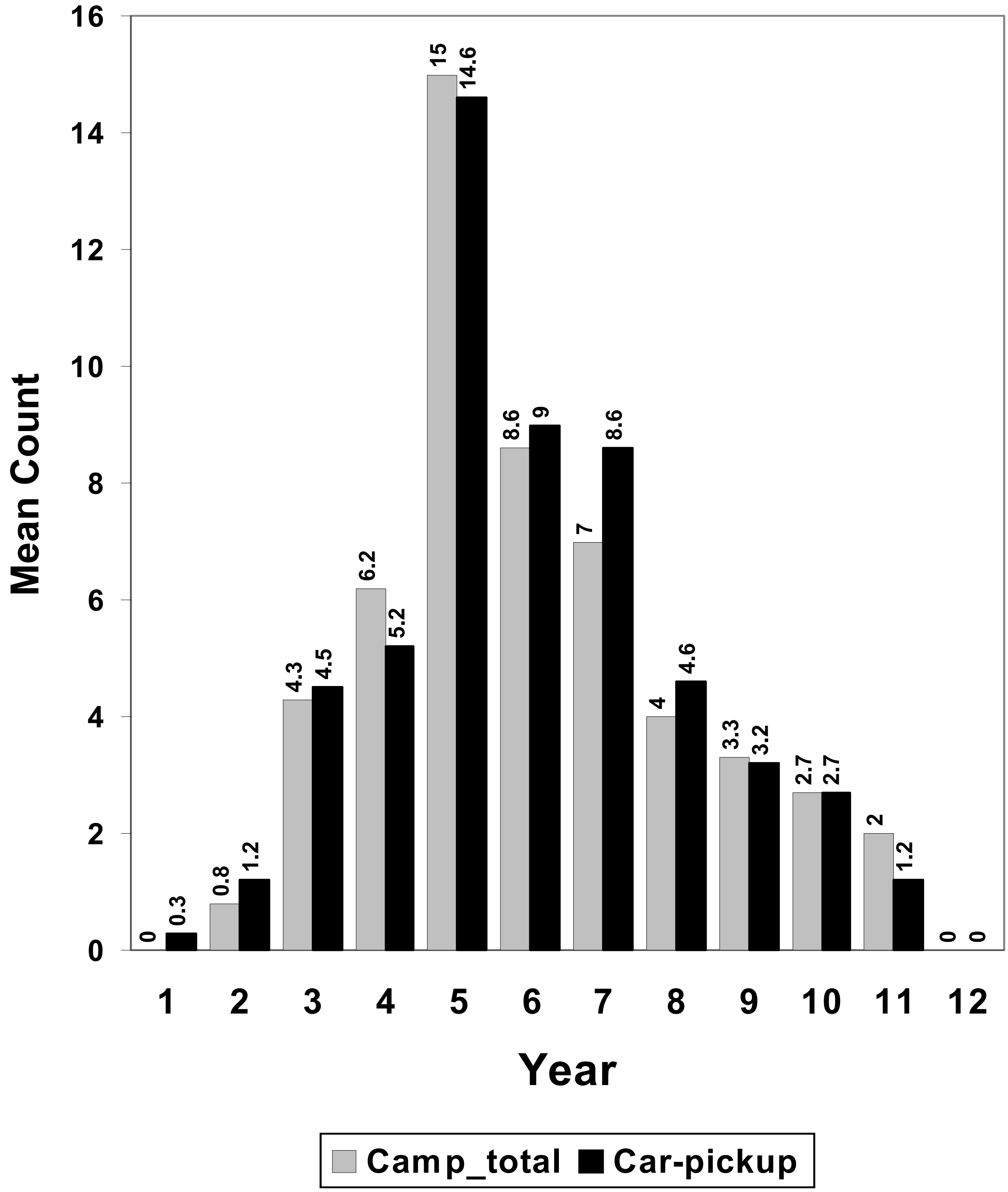


Figure E.5-71 Big Bar (all sites combined)—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

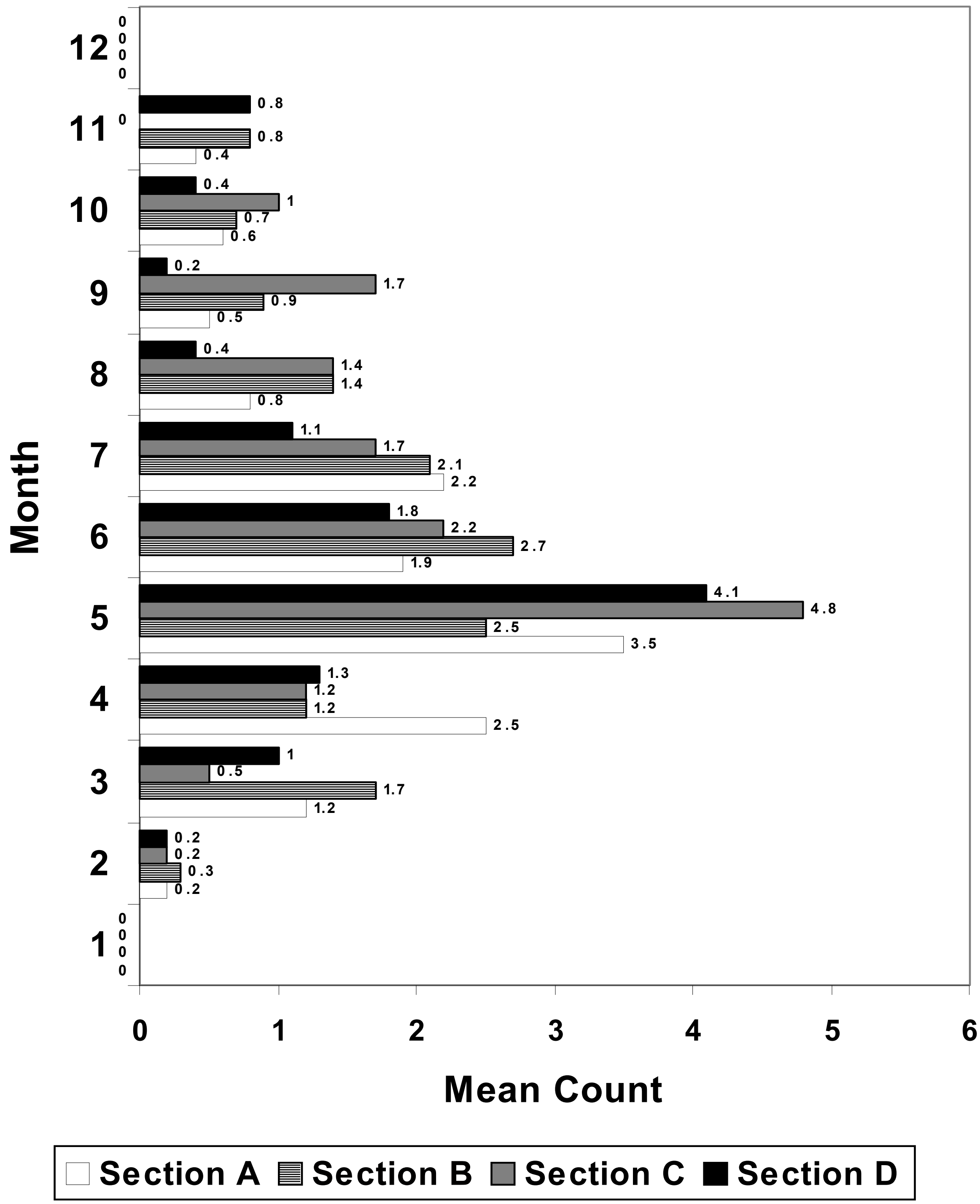
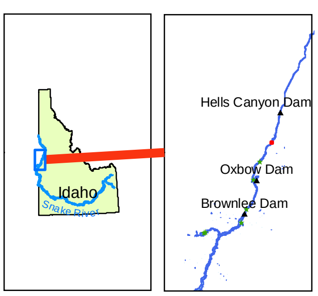


Figure E.5-72 Big Bar, sections A through D—Mean daily count of camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000



Feature Legend

- Sign
- River Mile

Site Specific Roads

- Gravel
- Trail

- Used Area
- Dispersed Site Area
- USFS Land

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971
Idaho Power Company - Boise, Idaho - 2003

Figure E.5-73

Eckels Creek (EKLC)
Hells Canyon Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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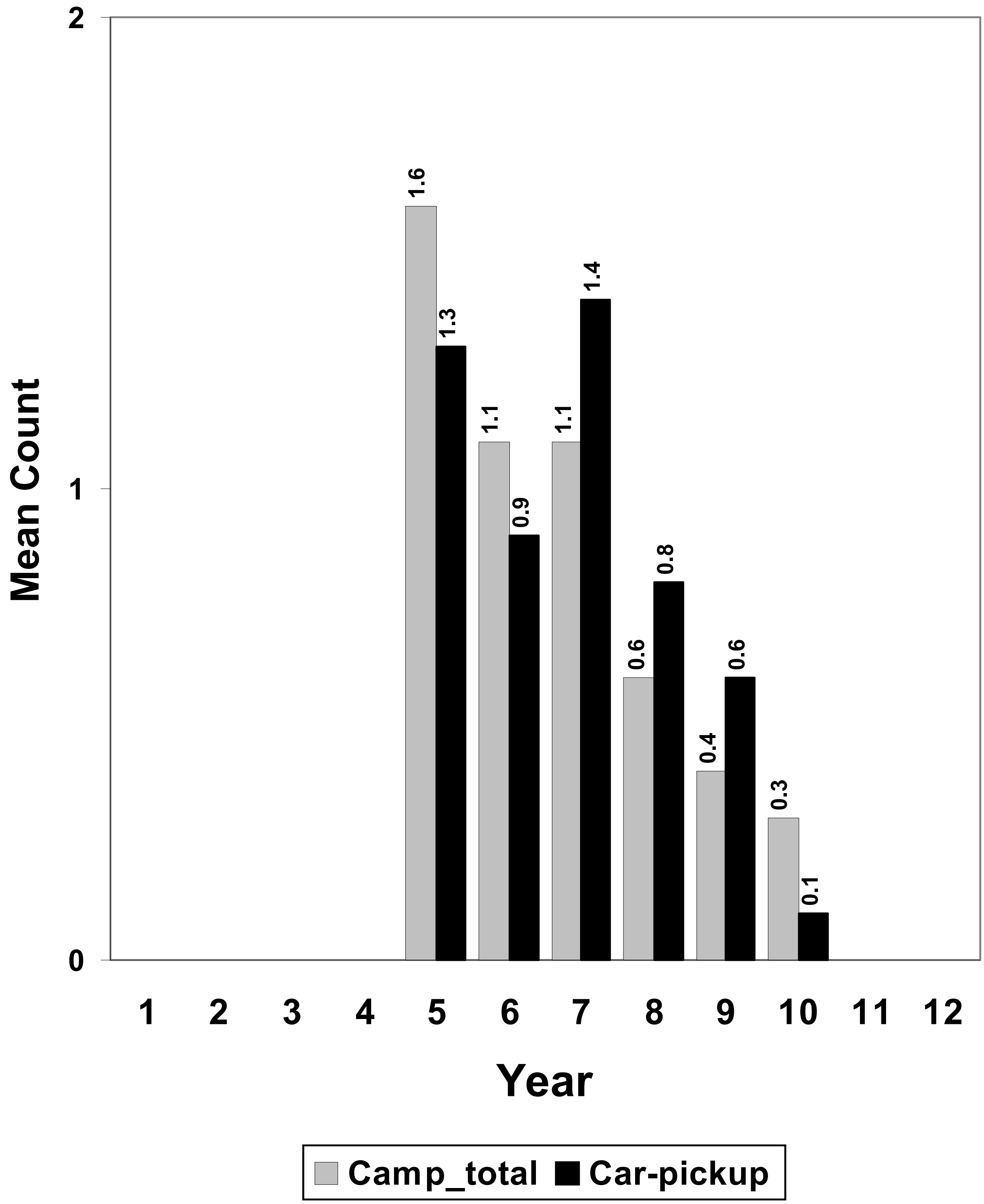

Figure E.5-74 Eckels Creek—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. Eckels Creek was not included in sampling as a distinct site during a year when winter sampling occurred

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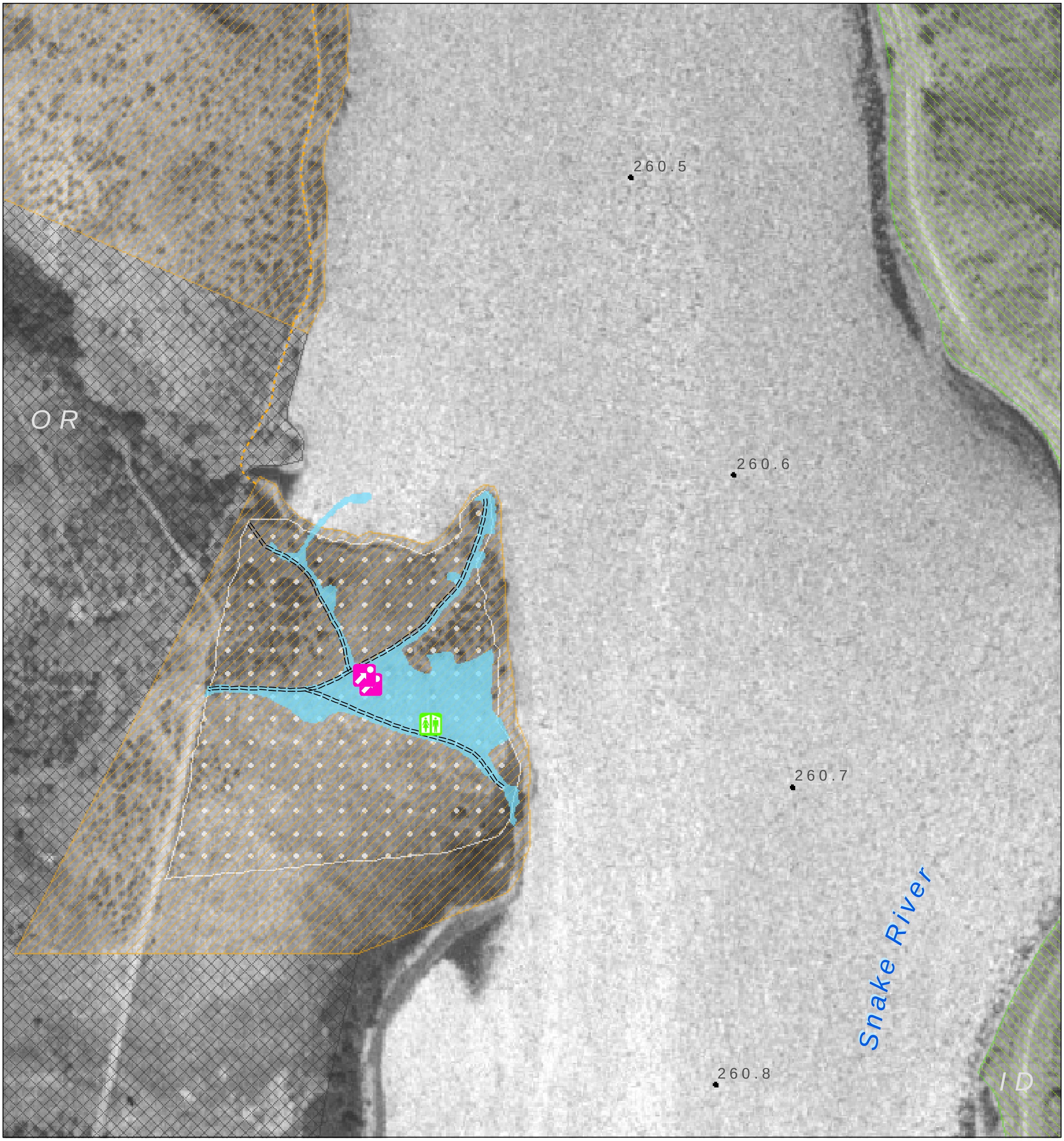

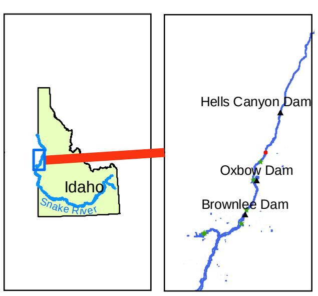

Feature Legend

Sign	Sign
Vault/Pit Toilet	Vault/Pit Toilet
•	River Mile
======	Site Specific Roads: Unimproved
------	Trail
Used Area	Used Area
Dispersed Site Area	Dispersed Site Area
BLM	BLM
Private	Private
USFS	USFS

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971
Idaho Power Company - Boise, Idaho - 2003

Figure E.5-75

Copper Creek (TRHD)
Hells Canyon Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

IDAHO POWER
An IDACORP Company

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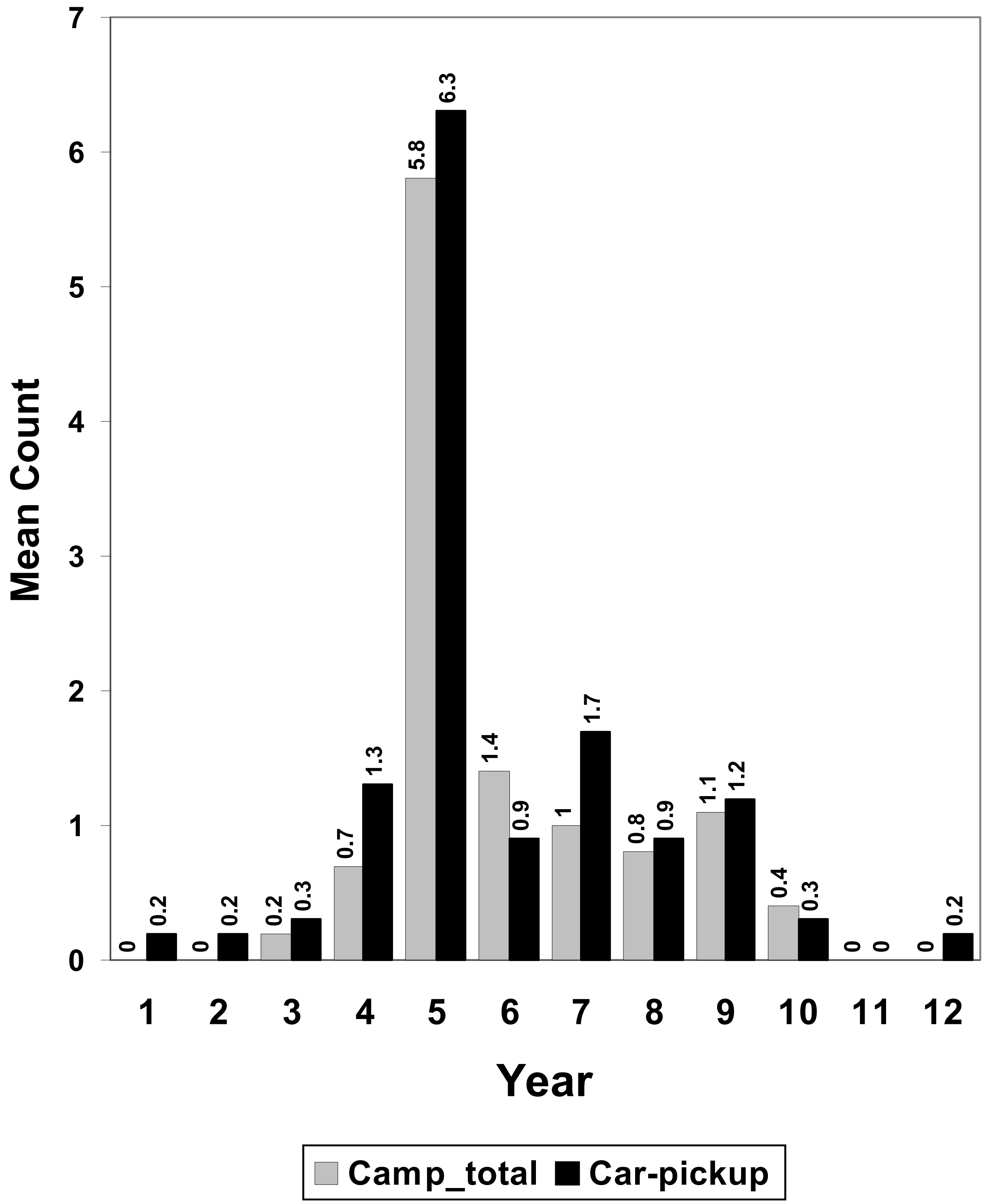

Figure E.5-76 Copper Creek—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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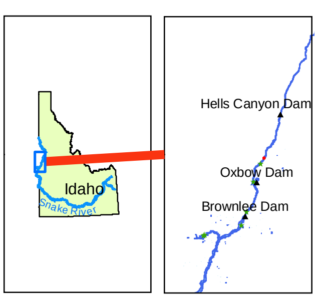

Features Legend

•	River Mile		Used Area
			Dispersed Site Area
			BLM

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971
Idaho Power Company - Boise, Idaho - 2003

Figure E.5-77

Ashby Creek (ASHB)
Hells Canyon Reservoir

Scale 1: 1,500

10 5 0 10 20 30 Meters

IDAHO POWER
An IDACORP Company

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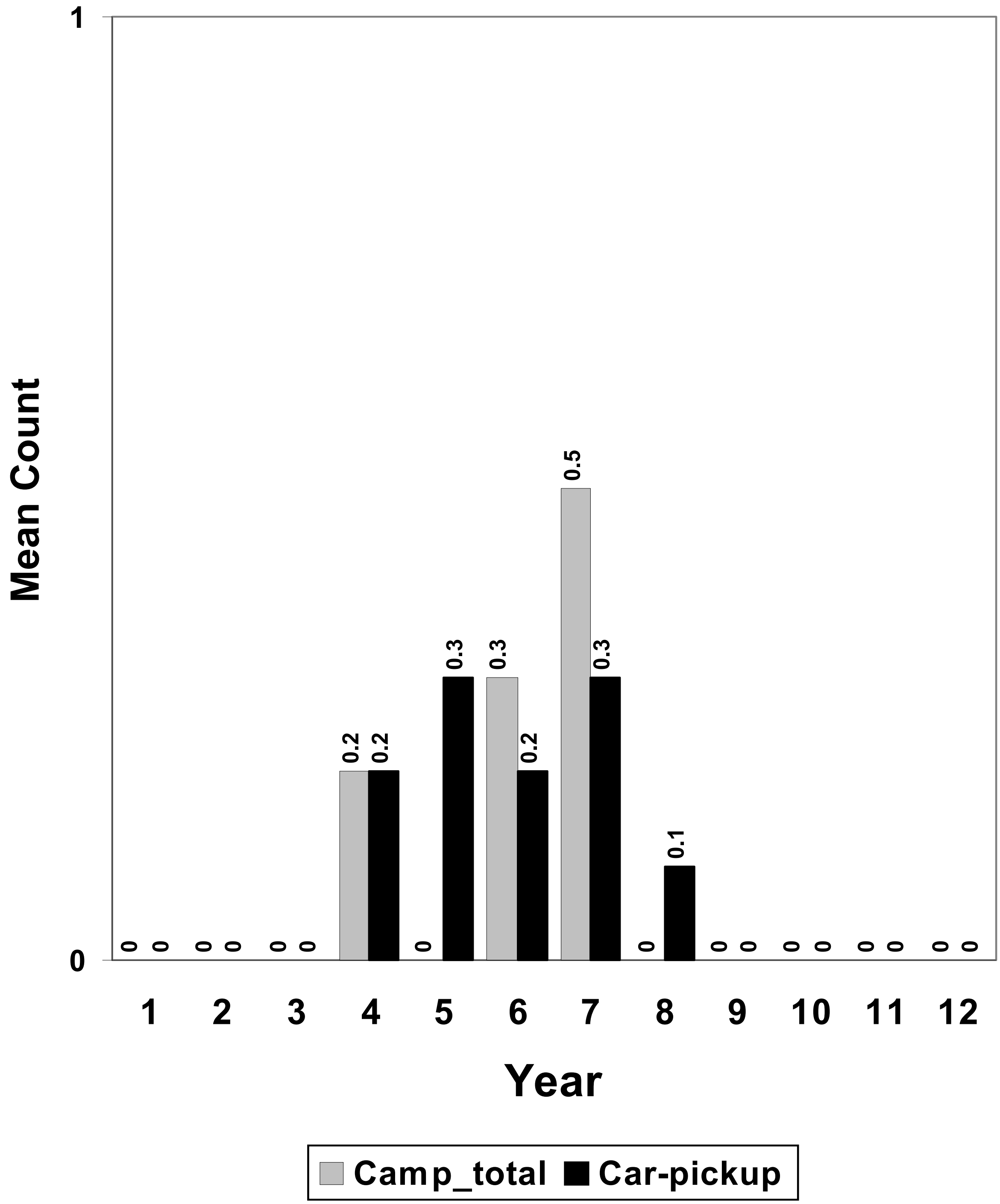

Figure E.5-78 Ashby Creek—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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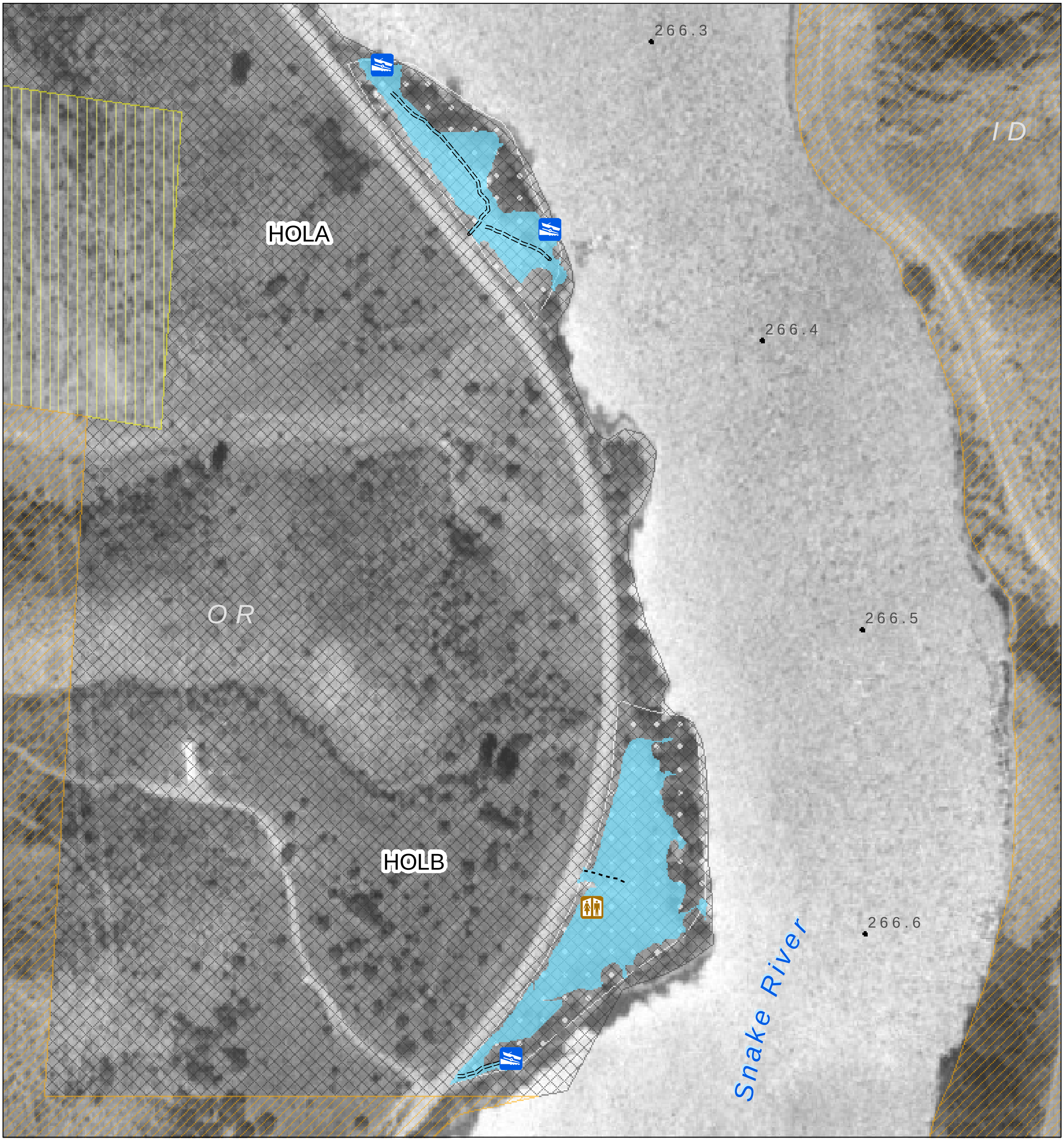

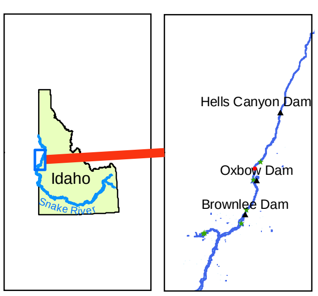

Feature Legend

- Port-A-Potty
- River Mile
- Impromptu Boat Ramp

Site Specific Roads

- Gravel
- Unimproved

- Used Area
- Dispersed Site Area
- Baker County
- BLM
- Private

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971
Idaho Power Company - Boise, Idaho - 2003

Figure E.5-79

Holbrook Creek (HOLA, HOLB)
Hells Canyon Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

IDAHO POWER
An IDACORP Company

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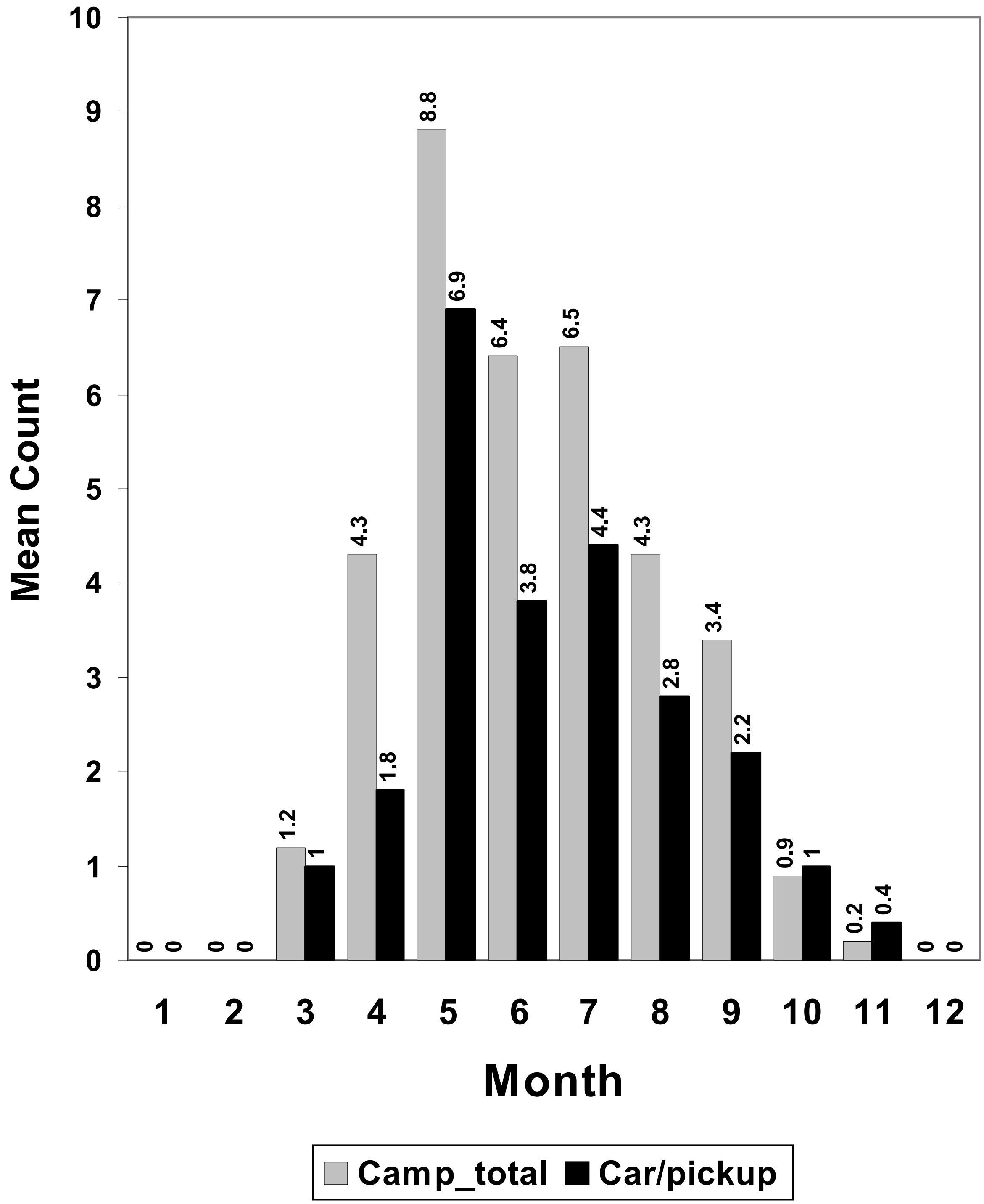


Figure E.5-80 Holbrook Creek, sections A and B combined—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

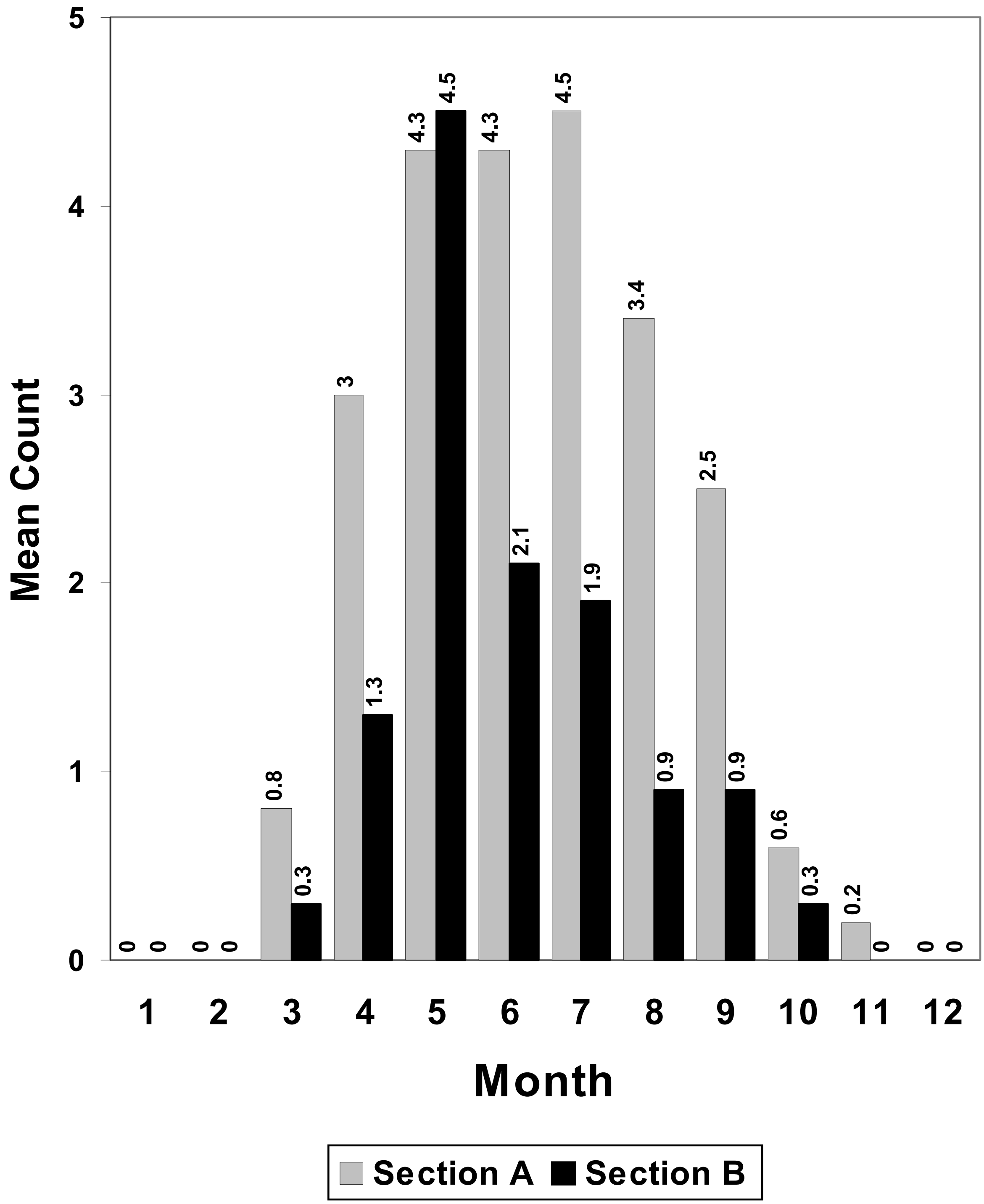
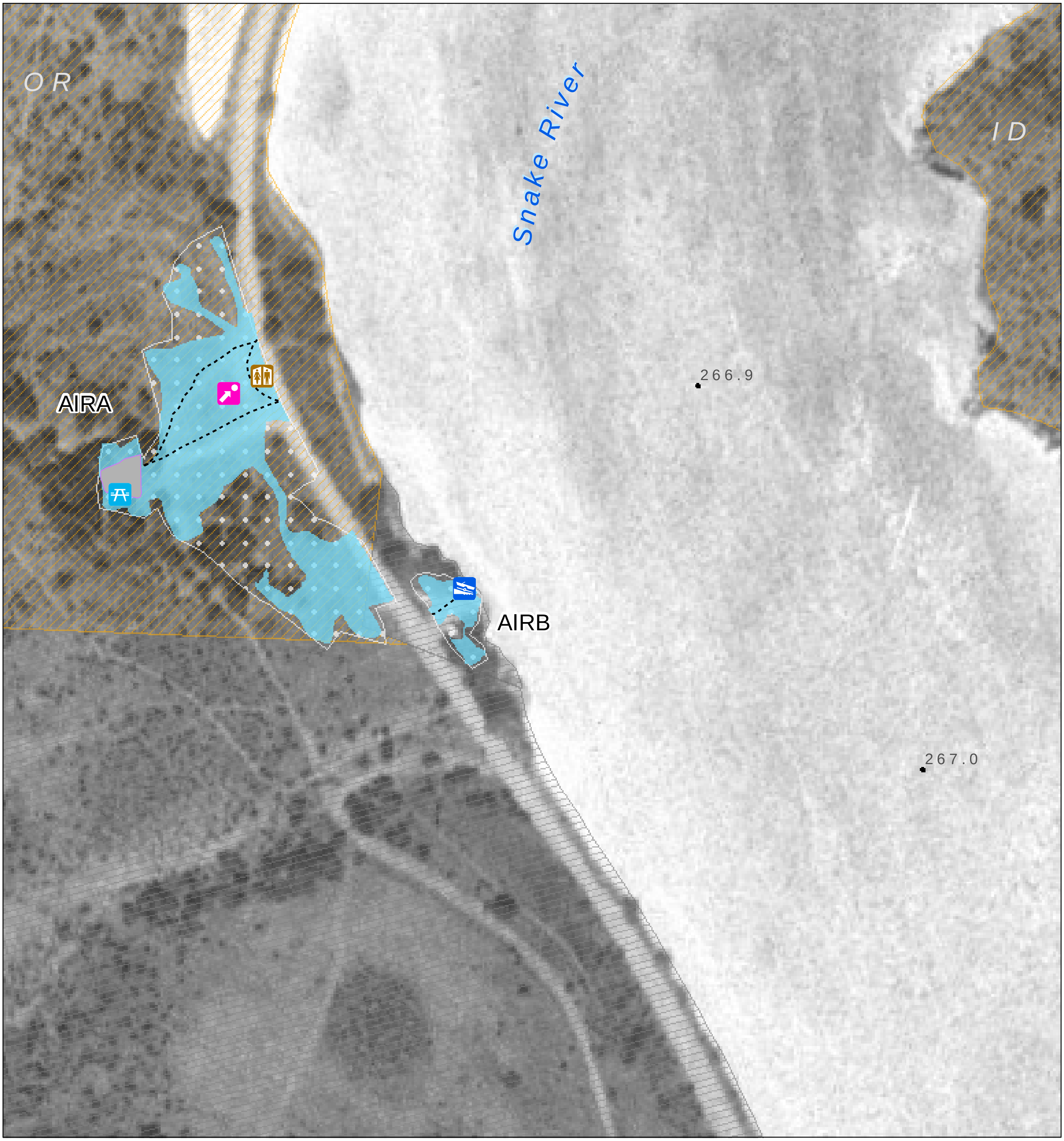
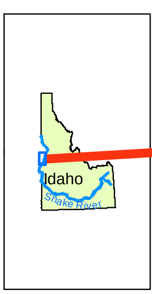
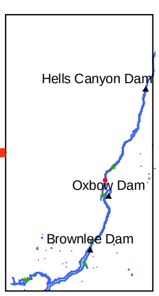


Figure E.5-81 Holbrook Creek, sections A and B—Mean daily count of camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000







Feature Legend

- Sign
- Picnic Table
- Port-A-Potty
- Impromptu Boat Ramp
- River Mile

Site Specific Roads

- Gravel

- Parking Area
- Used Area
- Dispersed Site Area
- BLM
- Idaho Power Company

HELLS CANYON PROJECT - F.E.R.C. No. 1971

Idaho Power Company - Boise, Idaho - 2003

Figure E.5-82

Airstrip Site, Sections A & B (AIRA, AIRB) Hells Canyon Reservoir

Scale 1: 2,000

20 10 0 20 40 60 Meters

IDAHO POWER
An IDACORP Company

N

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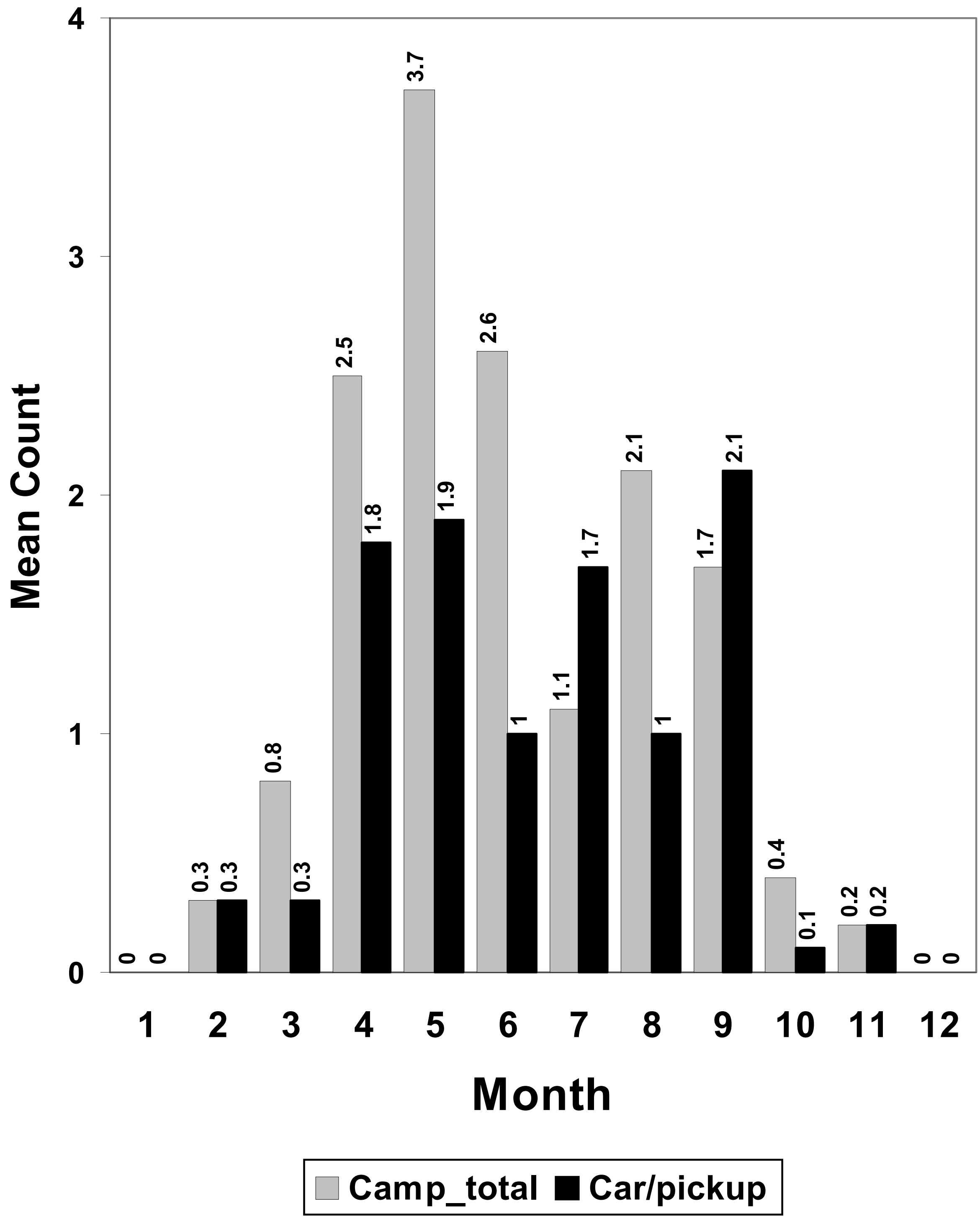


Figure E.5-83 Airstrip, sections A and B combined—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

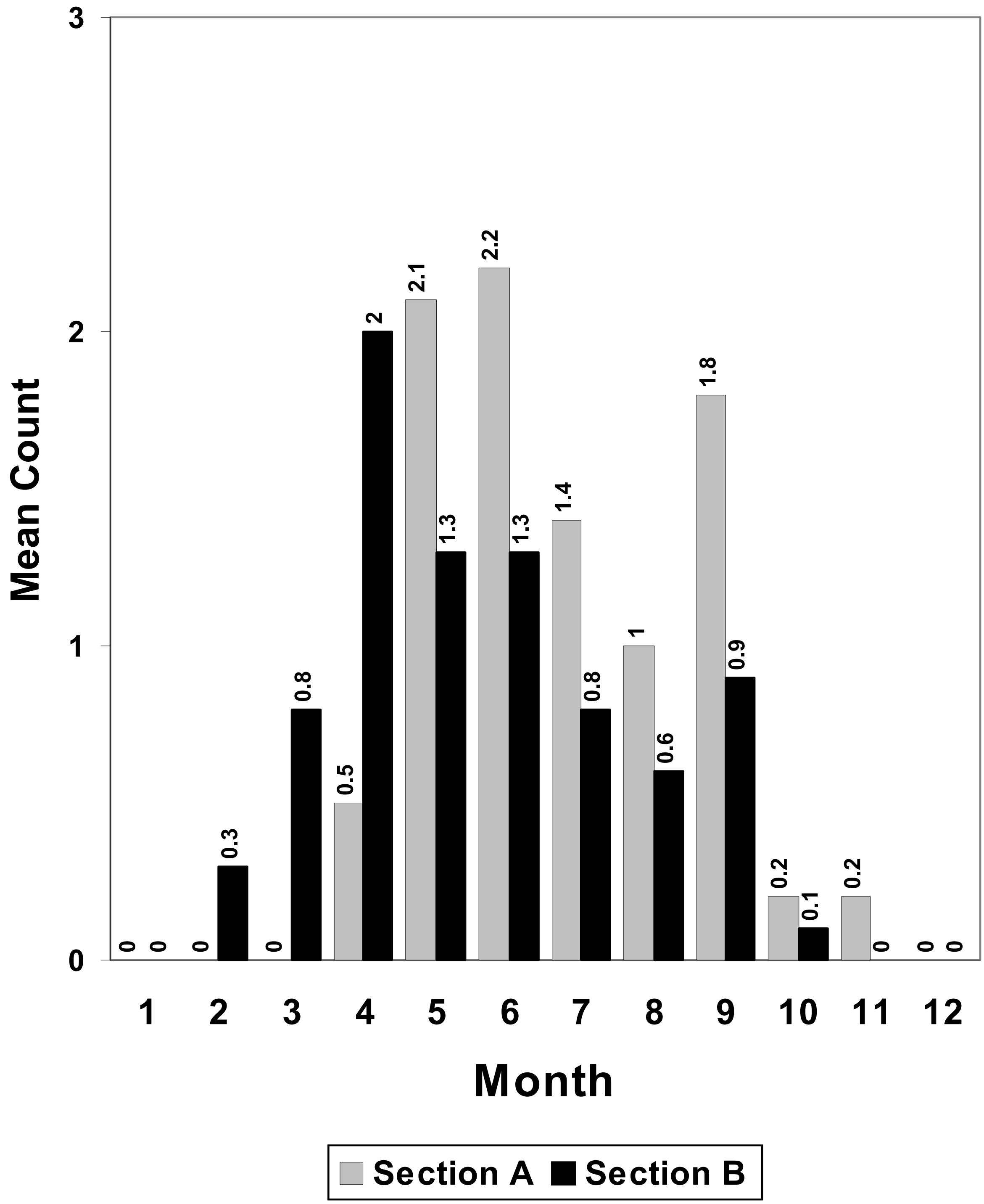
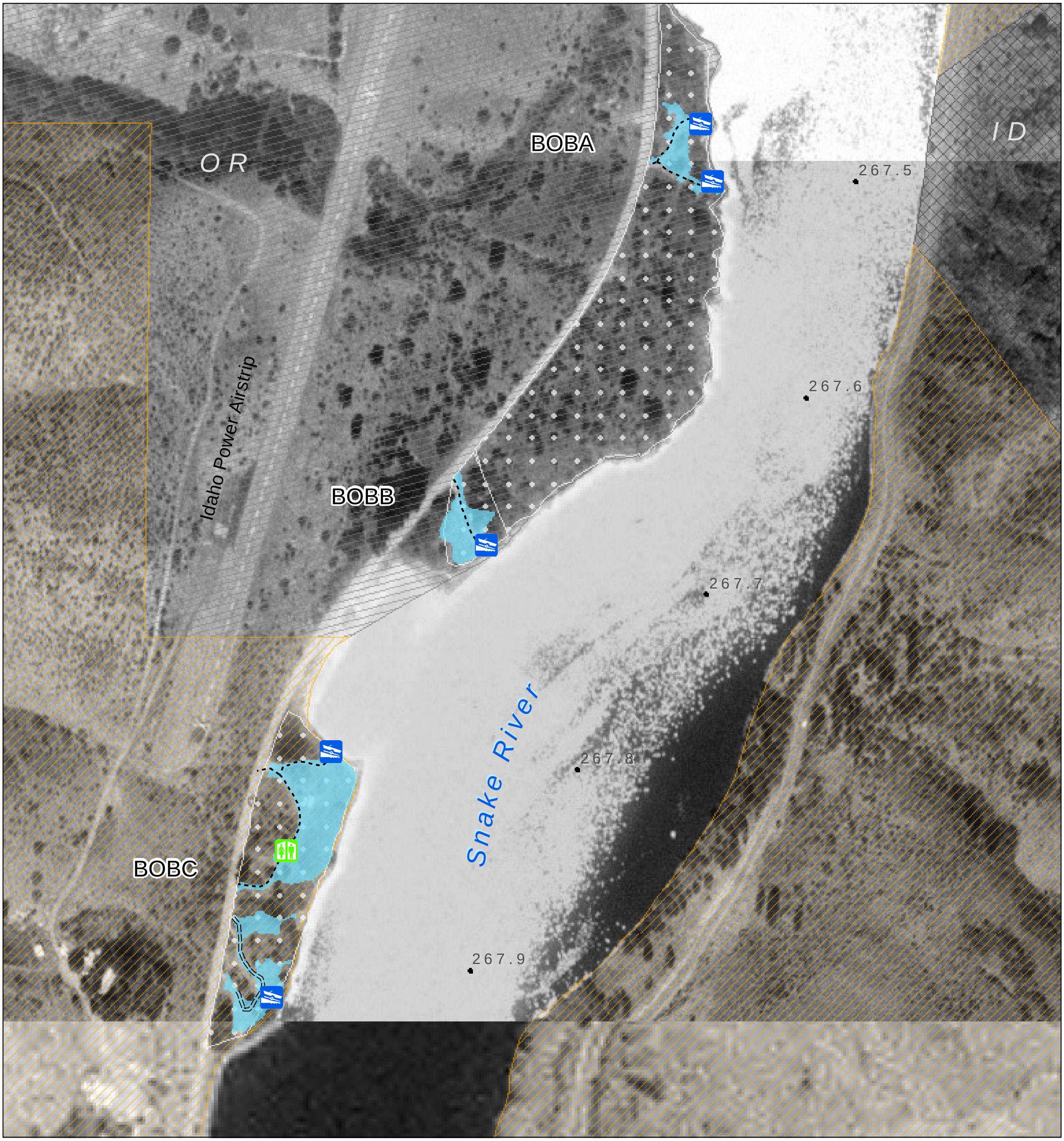
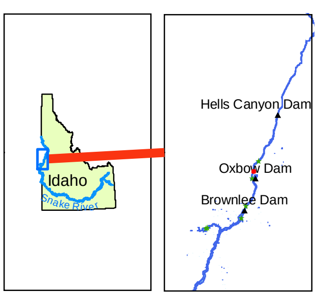


Figure E.5-84 Airstrip, sections A and B—Mean daily count of camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000





Feature Legend

- Vault/Pit Toilet
- Impromptu Boat Ramp
- River Mile

Site Specific Roads

- ------ Gravel
- ===== Unimproved

- Used Area
- Dispersed Site Area
- BLM
- Idaho Power Company
- Private

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971

Idaho Power Company - Boise, Idaho - 2003

Figure E.5-85

Bob Creek (BOBA, BOBB, BOBC)
Hells Canyon Reservoir

Scale 1: 4,000

40 20 0 40 80 120 Meters

IDAHO POWER
An IDACORP Company

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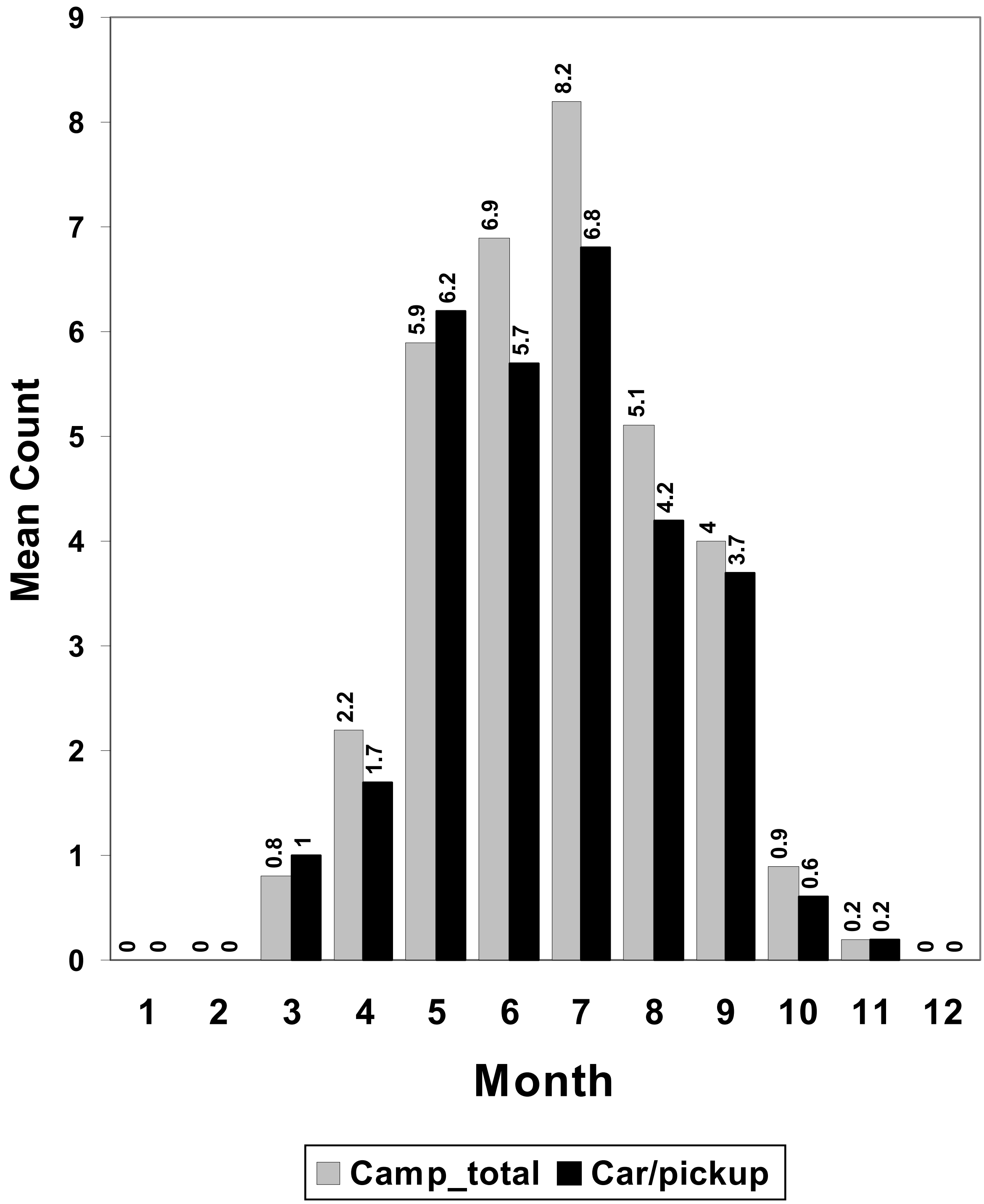


Figure E.5-86 Bob Creek, sections A, B, and C combined—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

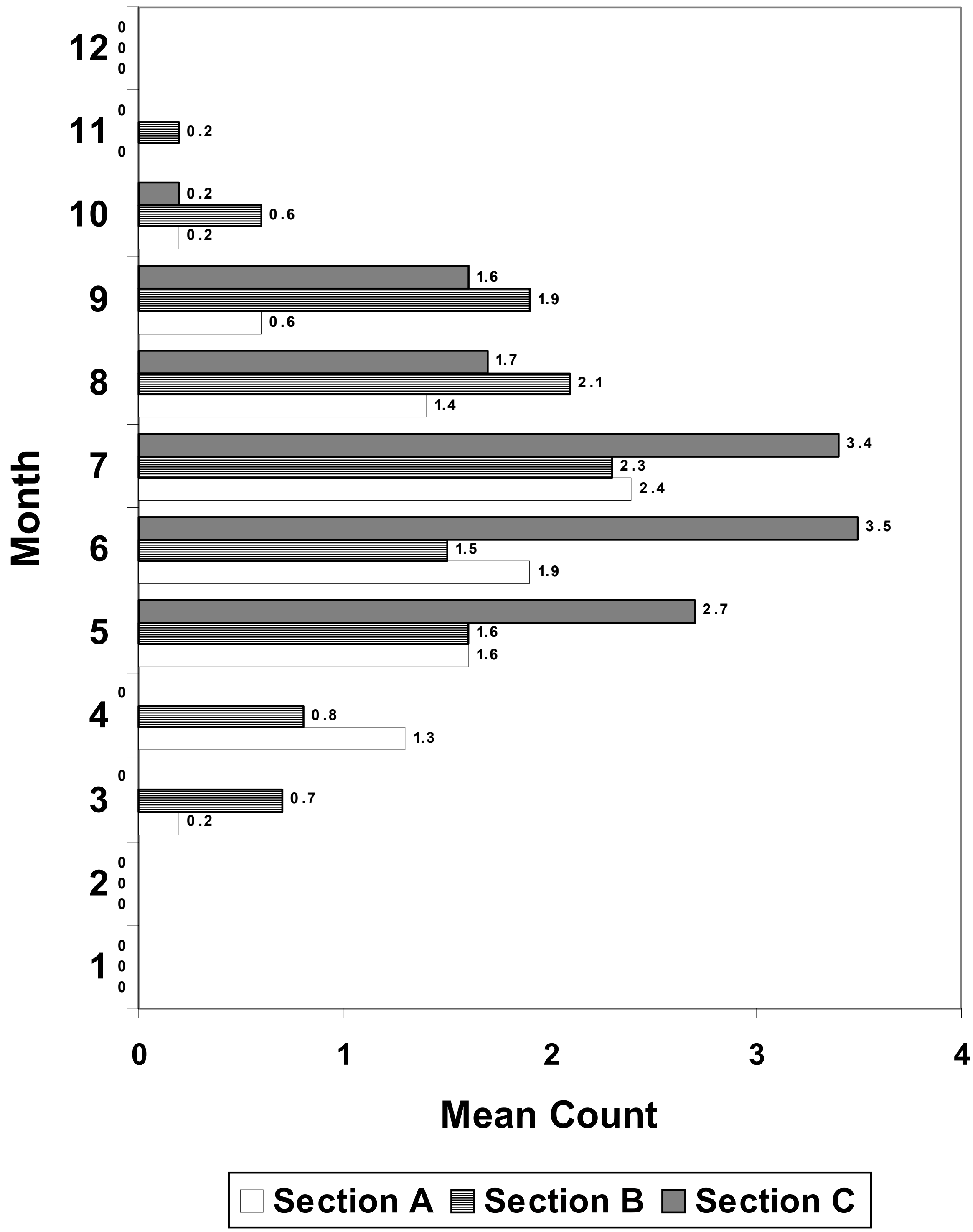
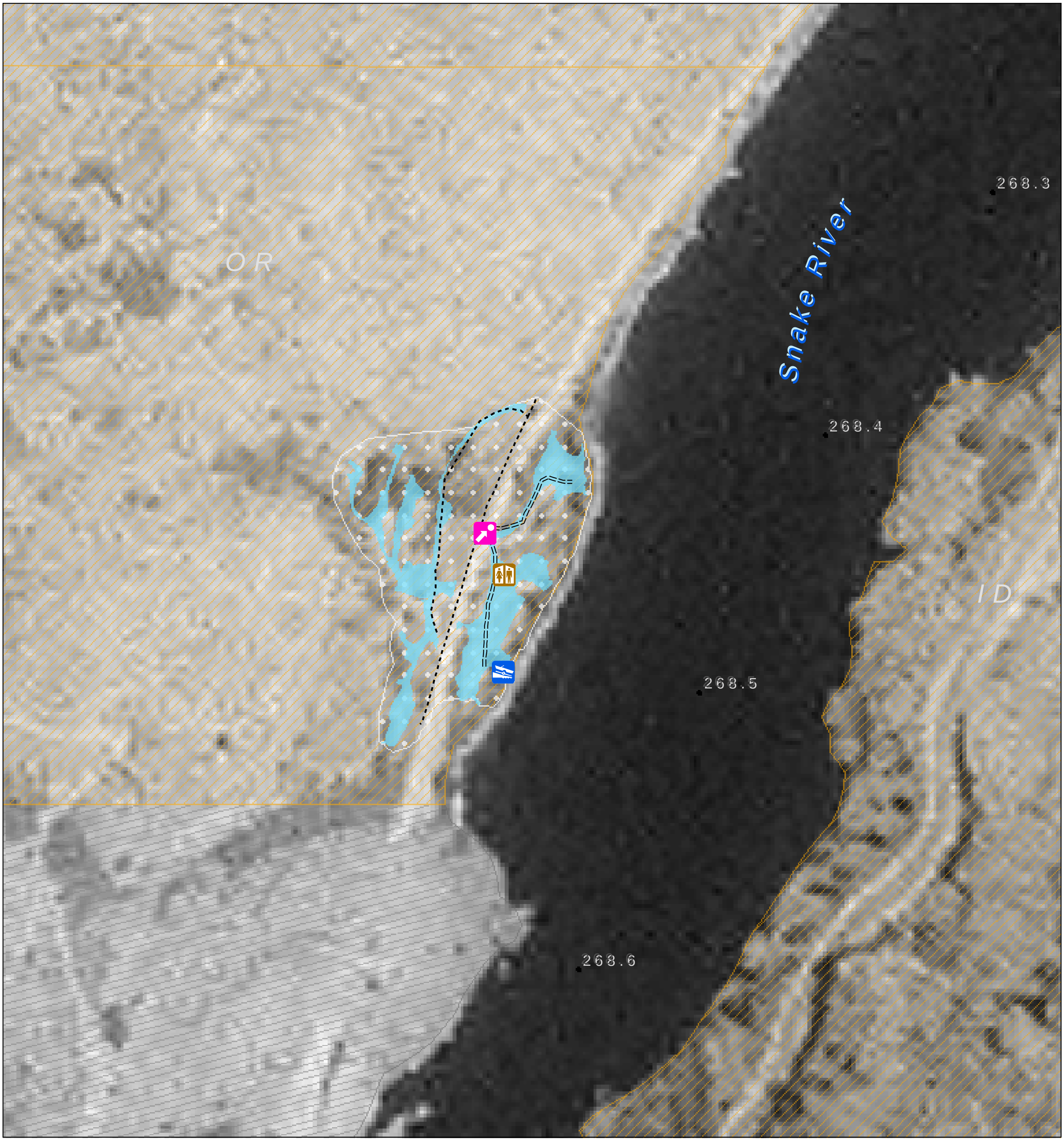
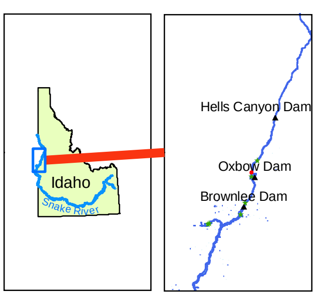


Figure E.5-87 Bob Creek, sections A, B, and C—Mean daily count of camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000





Feature Legend

Port-A-Potty

River Mile

Sign

Impromptu Boat Ramp

Site Specific Roads

- - - - - - Gravel
===== Unimproved

Used Area

Dispersed Site Area

BLM

Idaho Power Company

N

HELLS CANYON PROJECT - F.E.R.C. No. 1971

Idaho Power Company - Boise, Idaho - 2003

Figure E.5-88

Westfall (WEST)
Hells Canyon Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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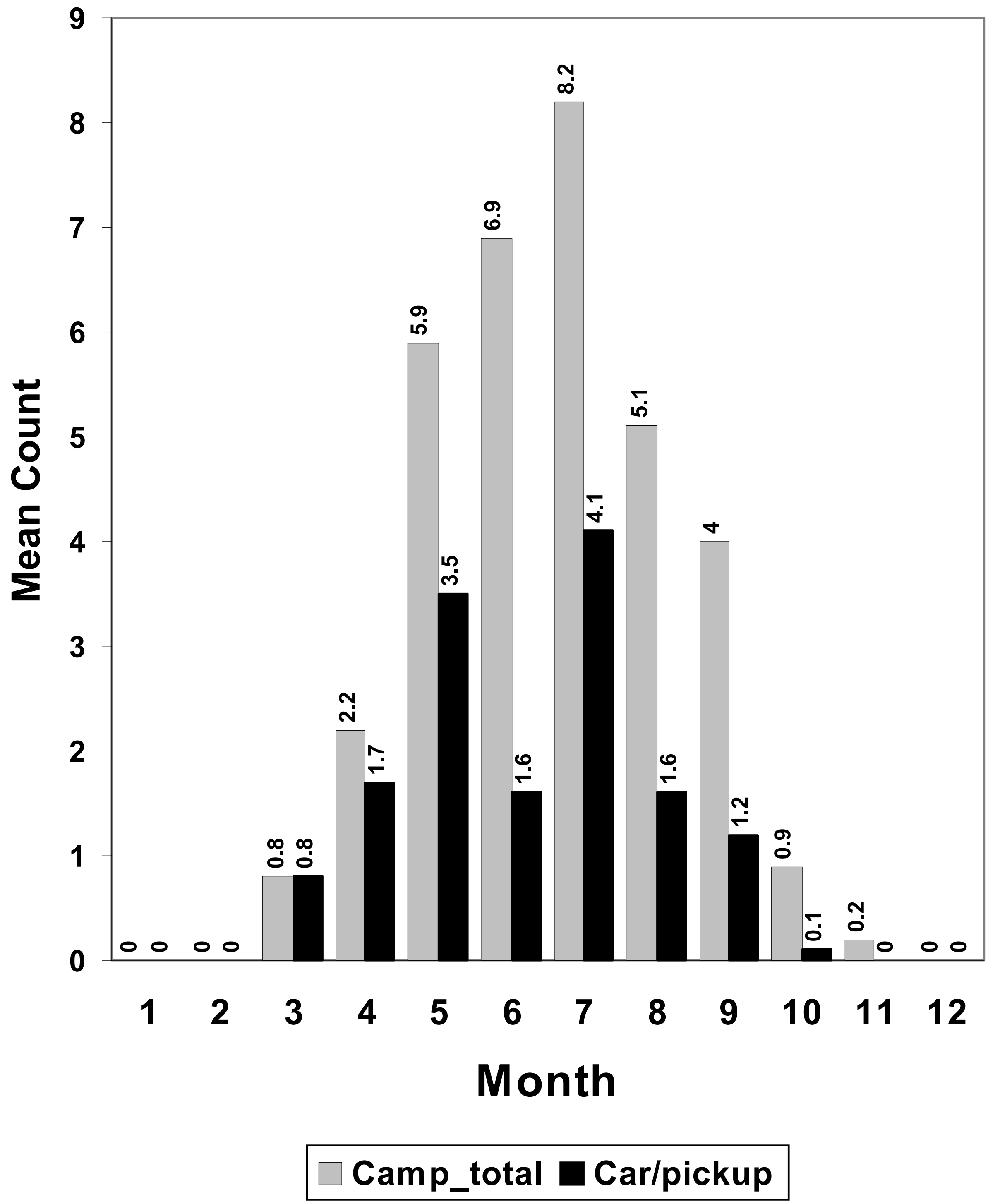

Figure E.5-89 Westfall—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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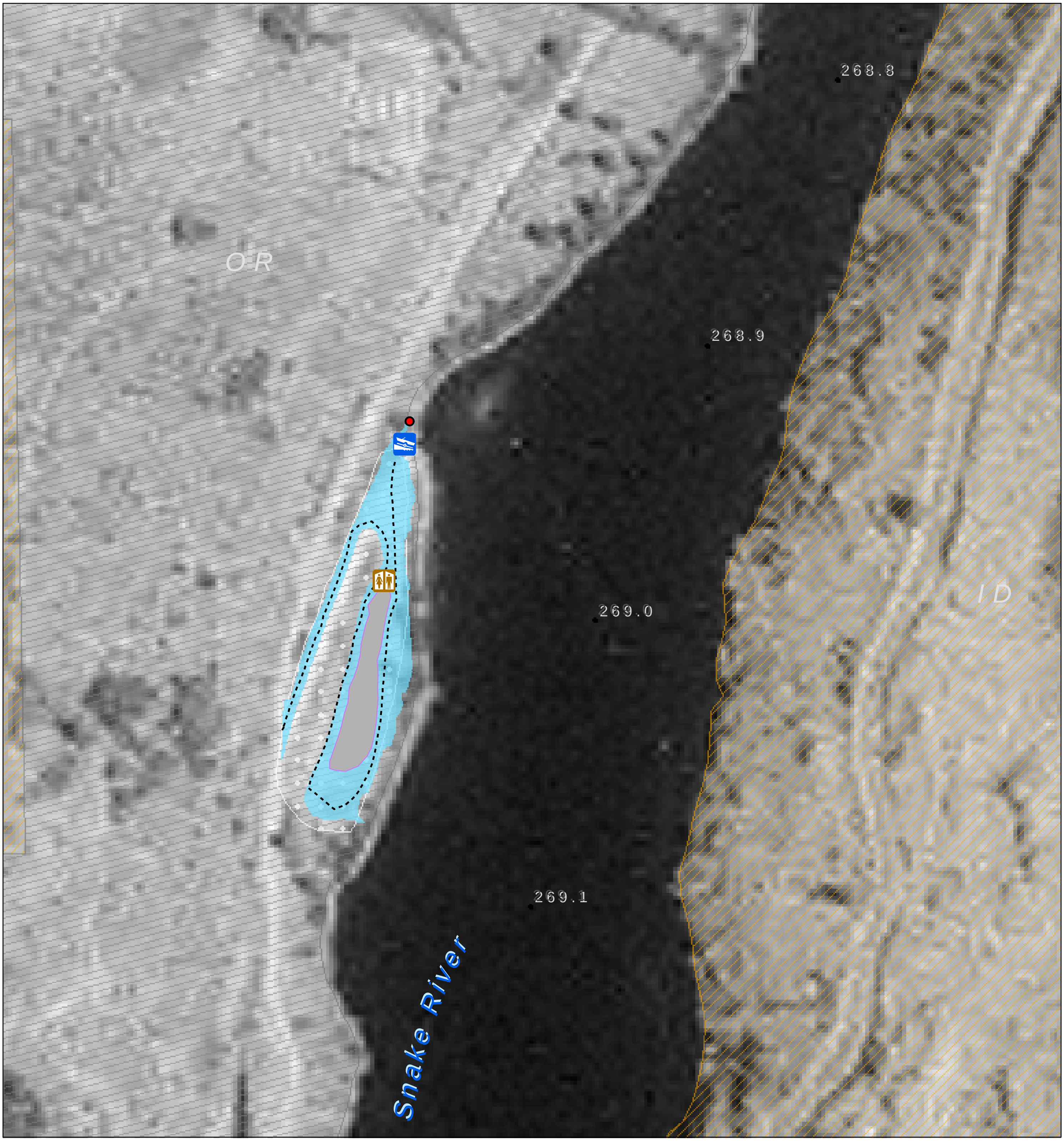

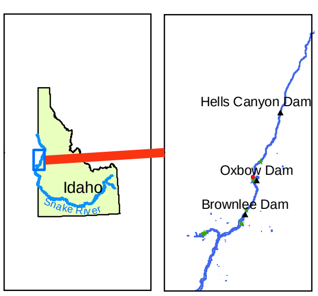

Feature Legend

- Port-A-Potty
- Boat Ramp
- Boat Dock
- River Mile

Site Specific Roads

- Gravel

- Used Area
- Parking Area
- Dispersed Site Area
- BLM
- Idaho Power Company

N

IDAHO POWER
An IDACORP Company

HELLS CANYON PROJECT - F.E.R.C. No. 1971

Idaho Power Company - Boise, Idaho - 2003

Figure E.5-90

Copperfield Boat Launch (CPBL)

Hells Canyon Reservoir

Scale 1: 3,000

0 15 30 60 90 120 Meters

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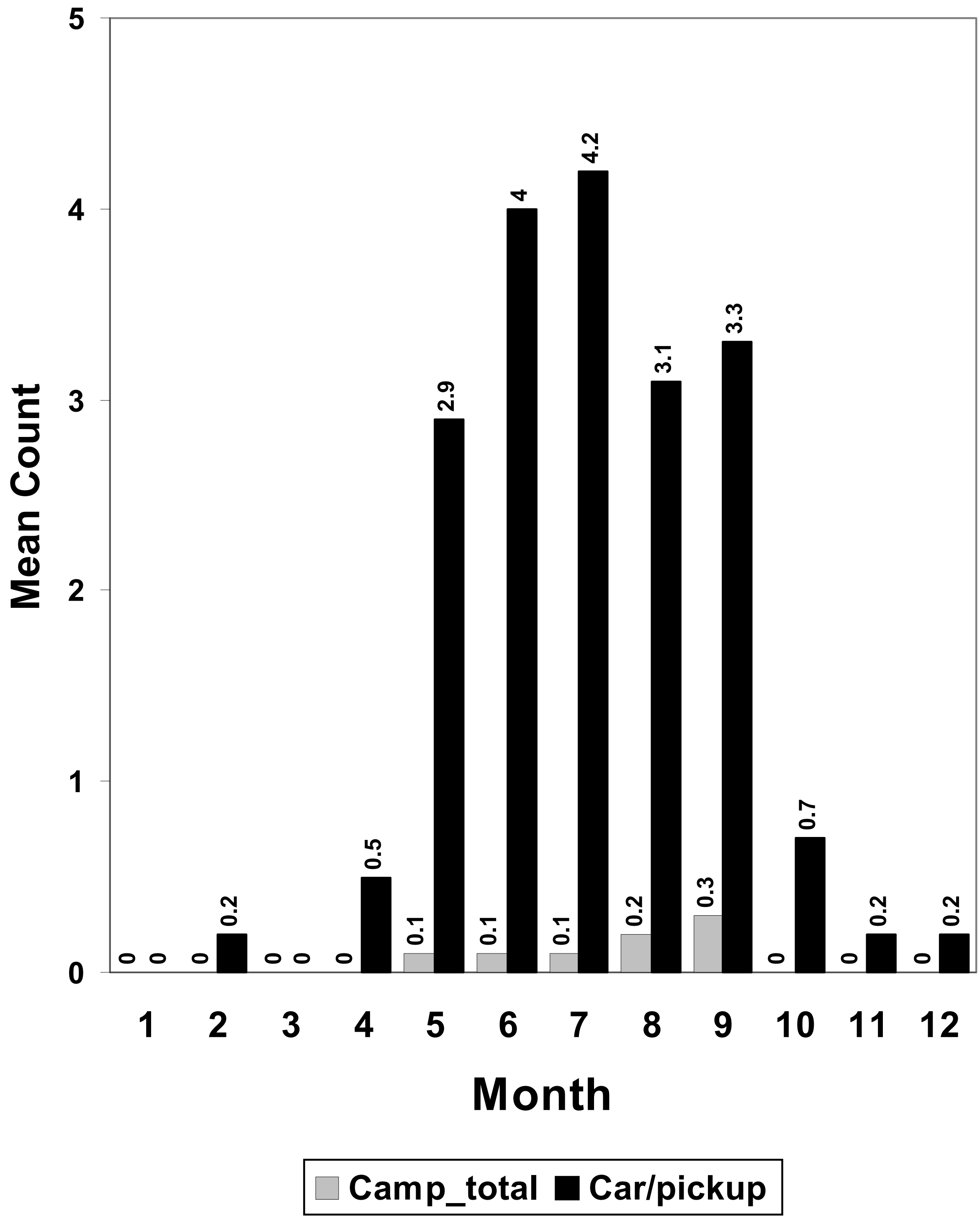

Figure E.5-91 Copperfield Boat Launch—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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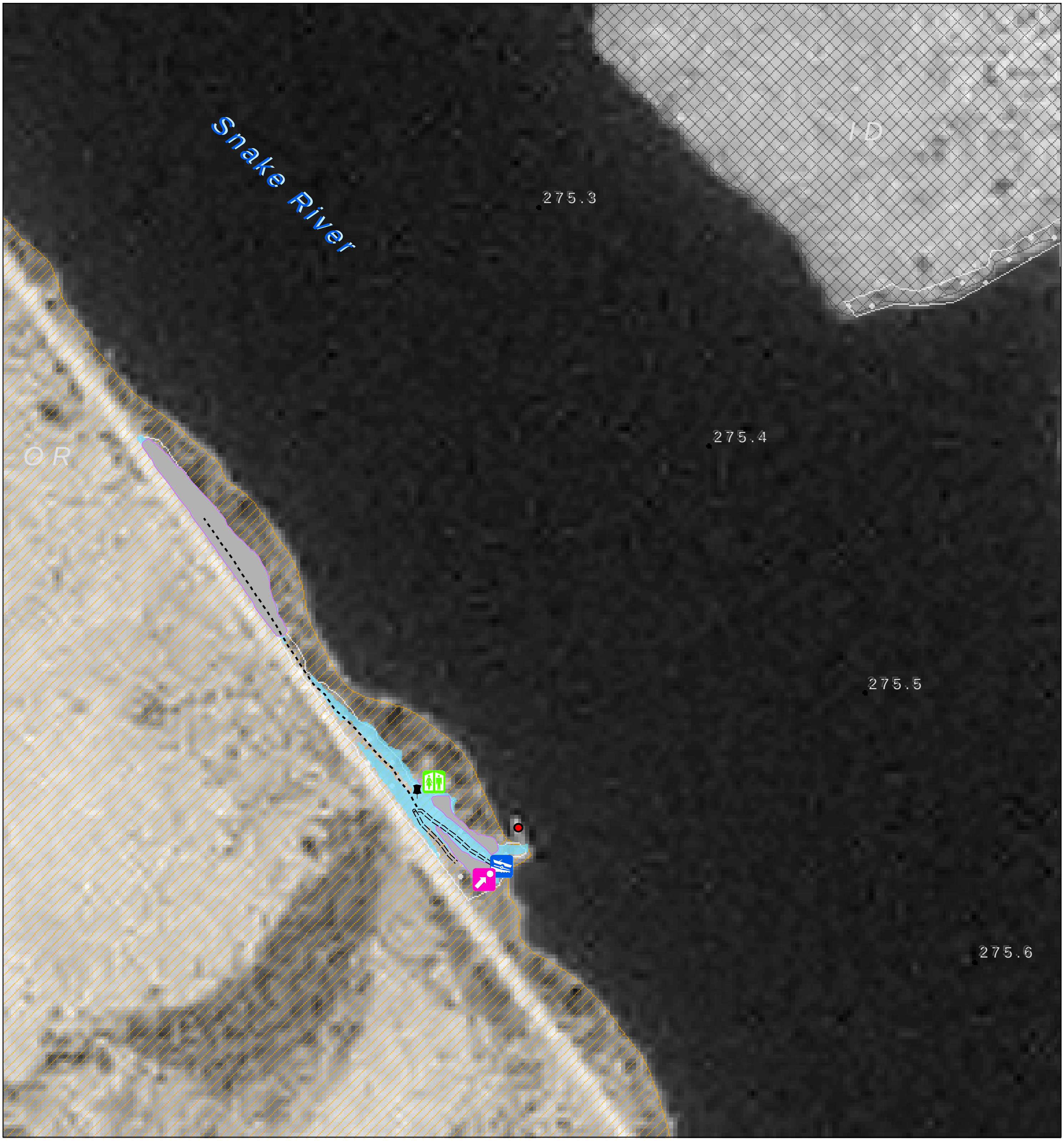

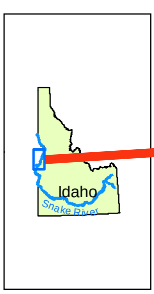

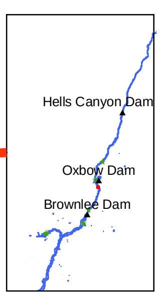

Feature Legend

- Trash Receptacles
- Vault/Pit Toilet
- Sign
- Boat Ramp
- Boat Dock
- River Mile

Site Specific Roads

- ------ Gravel
- ===== Unimproved

- Used Area
- Parking Area
- Dispersed Site Area
- BLM
- Private

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Idaho Power Company - Boise, Idaho - 2003

Figure E.5-92

Oxbow Boat Launch (OXBL)

Oxbow Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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N

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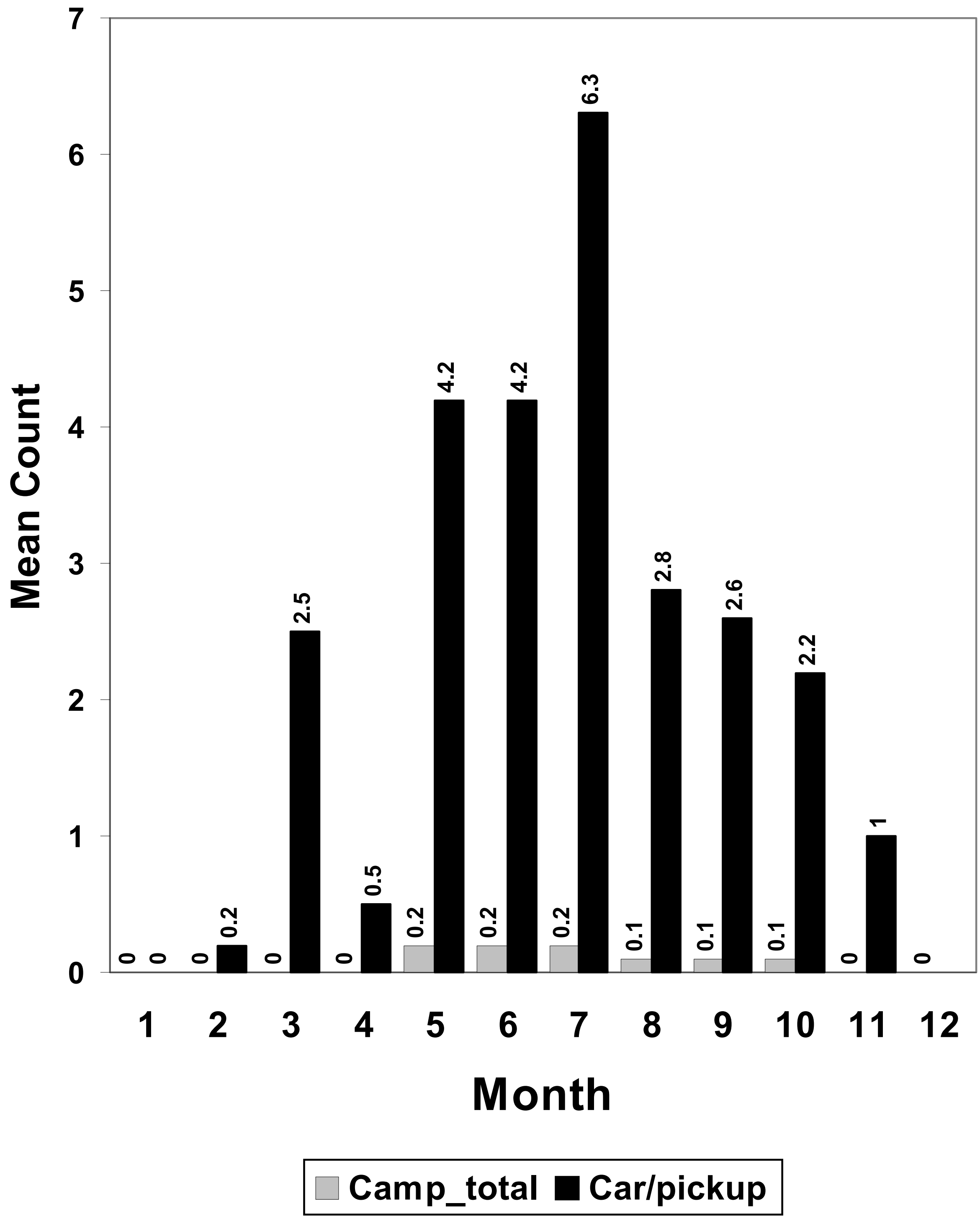

Figure E.5-93 Oxbow Boat Launch—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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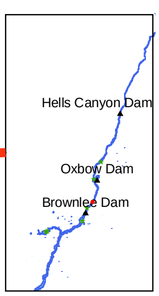

Figure Legend

- Trash Receptacles
- Vault/Pit Toilet
- Picnic Table
- Fire Grill
- Impromptu Boat Ramp

Site Specific Roads

- Gravel
- River Mile
- Fee Post

- Used Area
- Dispersed Site Area
- BLM
- Private

N

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Figure E.5-94

Carters Landing (CART)
Oxbow Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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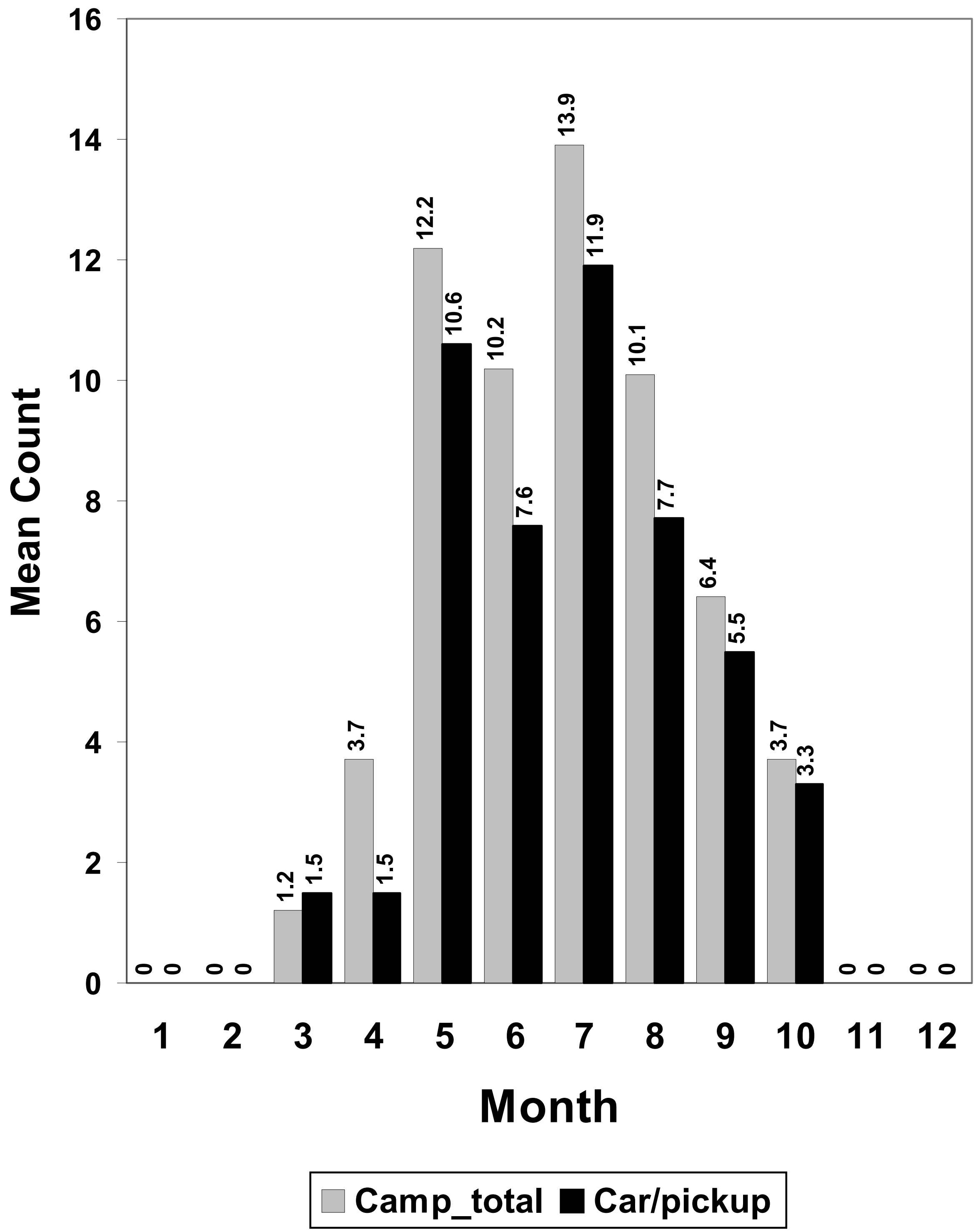

Figure E.5-95 Carters Landing—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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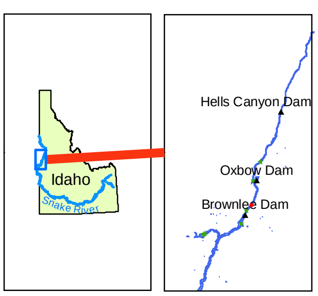

Feature Legend

- Trash Receptacles
- Port-A-Potty
- Impromptu Boat Ramp
- River Mile

Site Specific Roads

- Gravel

- Used Area
- Dispersed Site Area
- BLM
- Idaho Power Company

N

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Figure E.5-96

Old Carters Landing (OCAR)
Oxbow Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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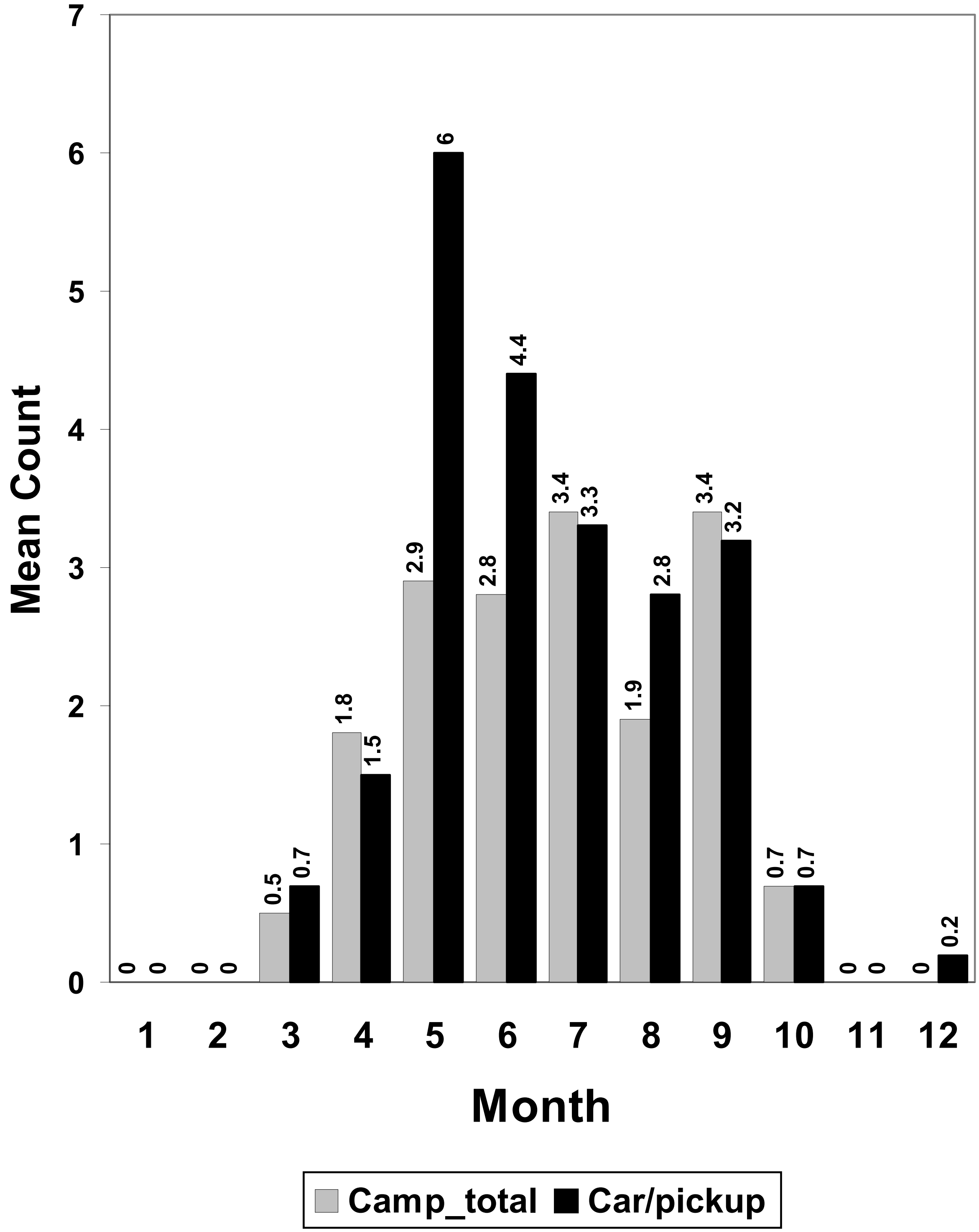

Figure E.5-97 Old Carters Landing—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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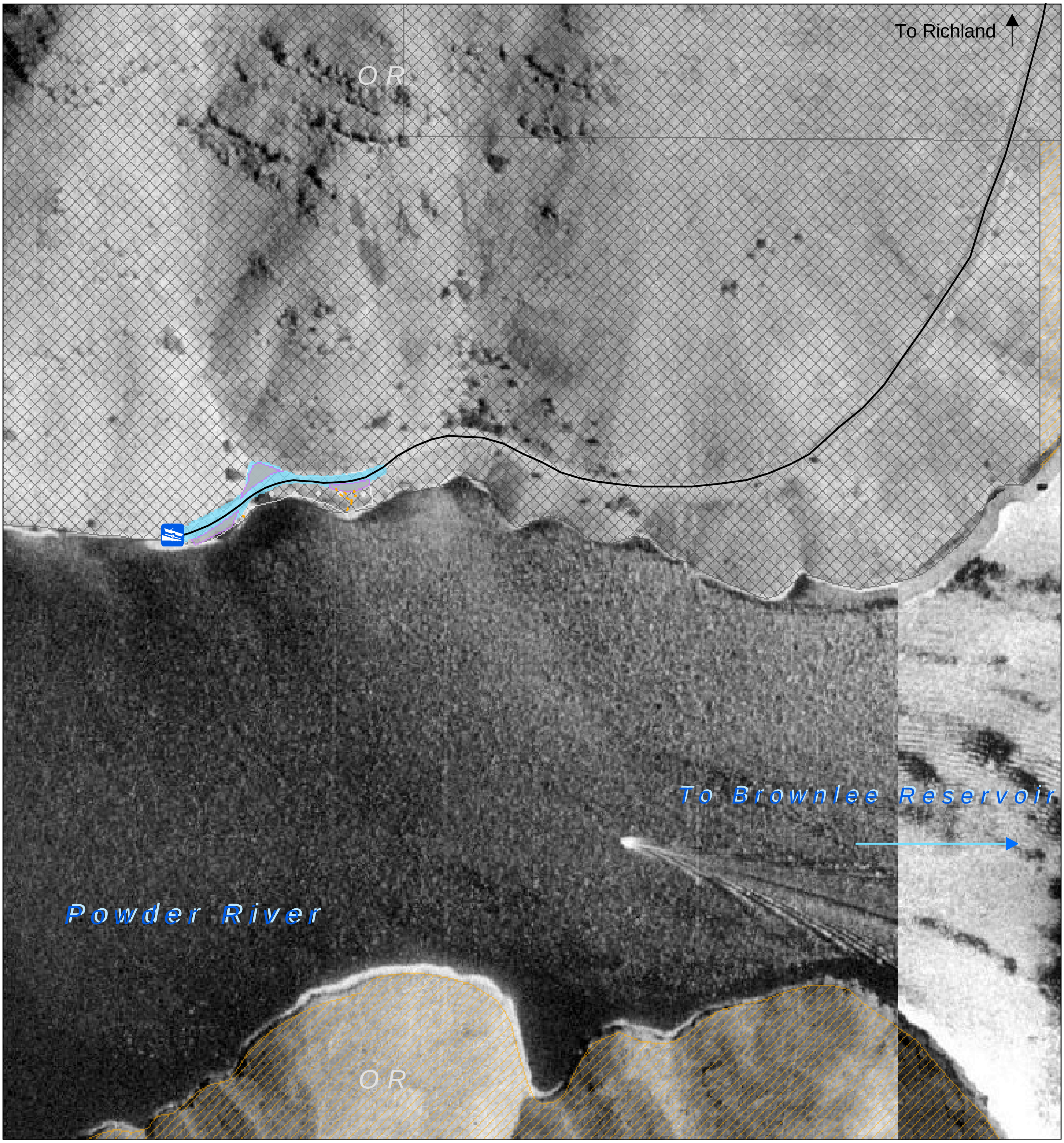

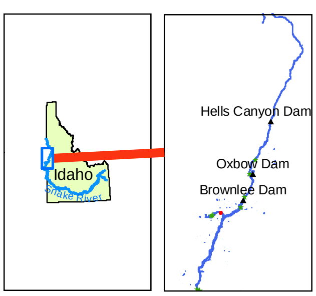

Feature Legend

Boat Ramp

Site Specific Roads

Paved

Trail

Used Area

Parking Area

Dispersed Site Area

BLM

Private

N

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Figure E.5-98

Sag Road (SAGR)

Powder River, Brownlee Reservoir

Scale 1: 3,500

30 15 0 30 60 90 Meters

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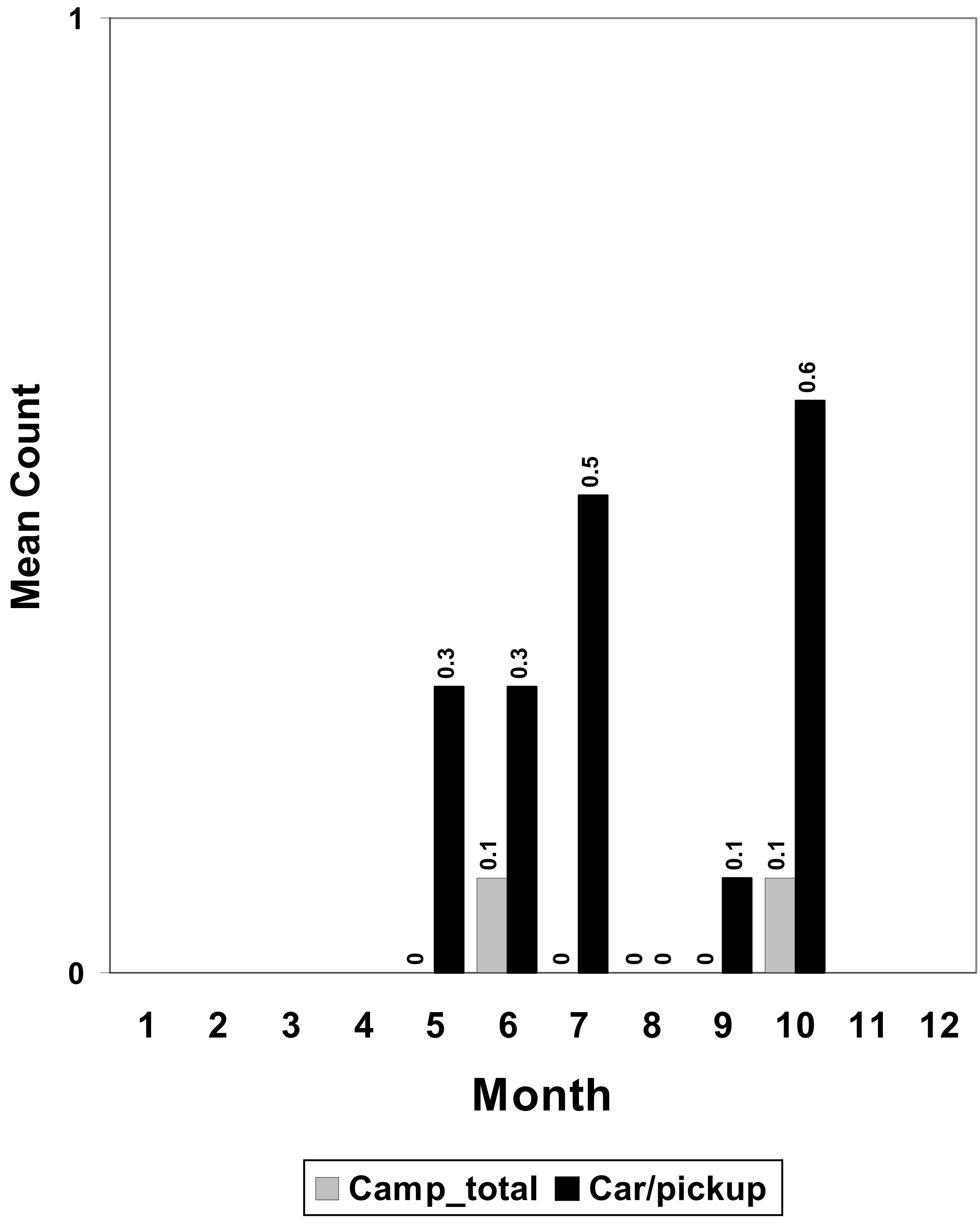

Figure E.5-99 Sag Road—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. Sag Road was not included in sampling as a distinct site during a year when winter sampling occurred

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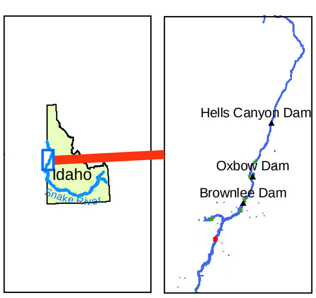

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Figure Legend

Boat Dock	**Site Specific Roads**		Used Area
River Mile	===== Unimproved		Dispersed Site Area
			BLM
			Private

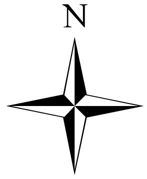

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Figure E.5-100

Private Dudes Cove (PDCV)
Brownlee Reservoir

Scale 1: 6,000

60 30 0 60 120 180 Meters

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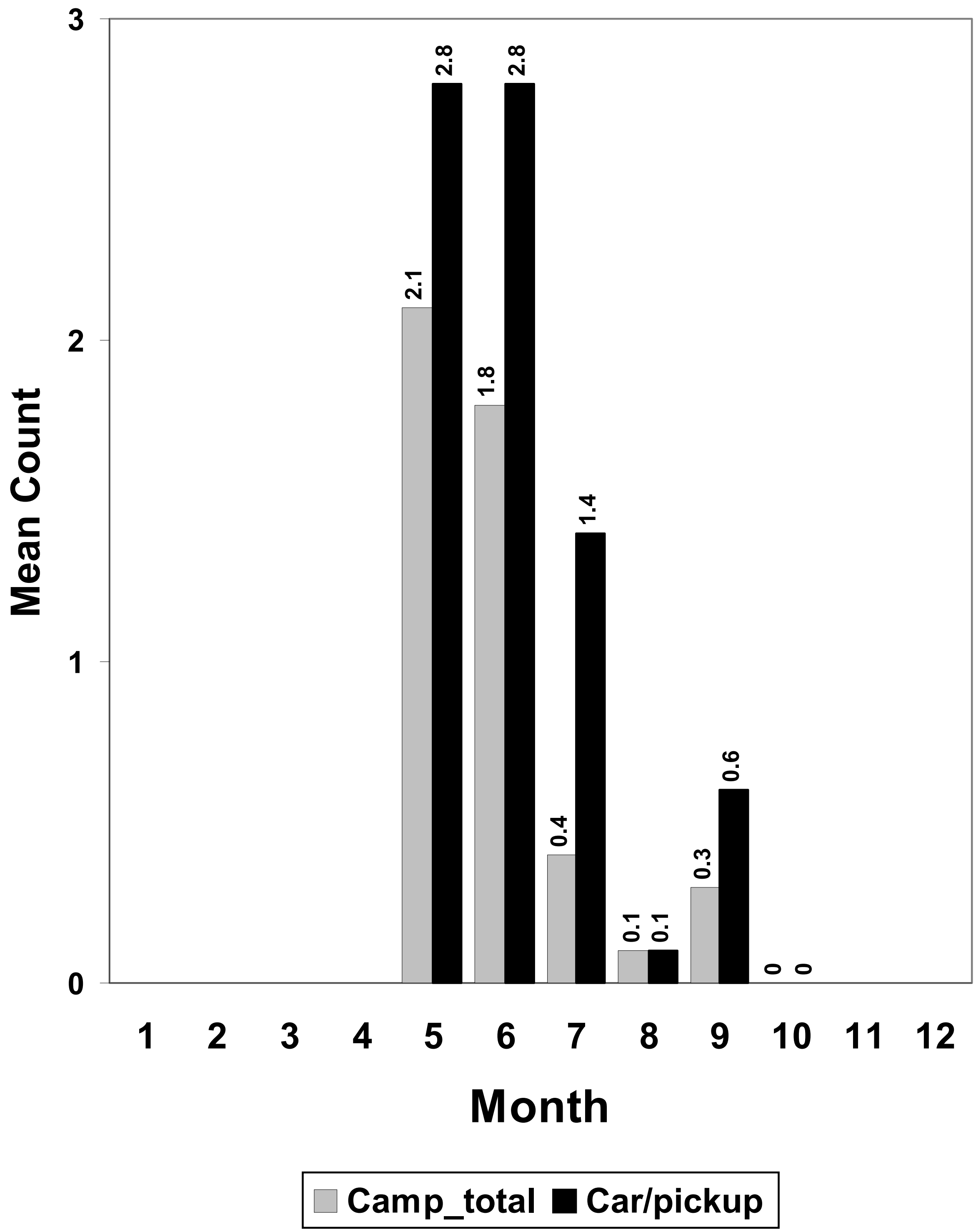

Figure E.5-101 Private Dudes Cove—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. This site was not included in sampling as a distinct site during a year when winter sampling occurred

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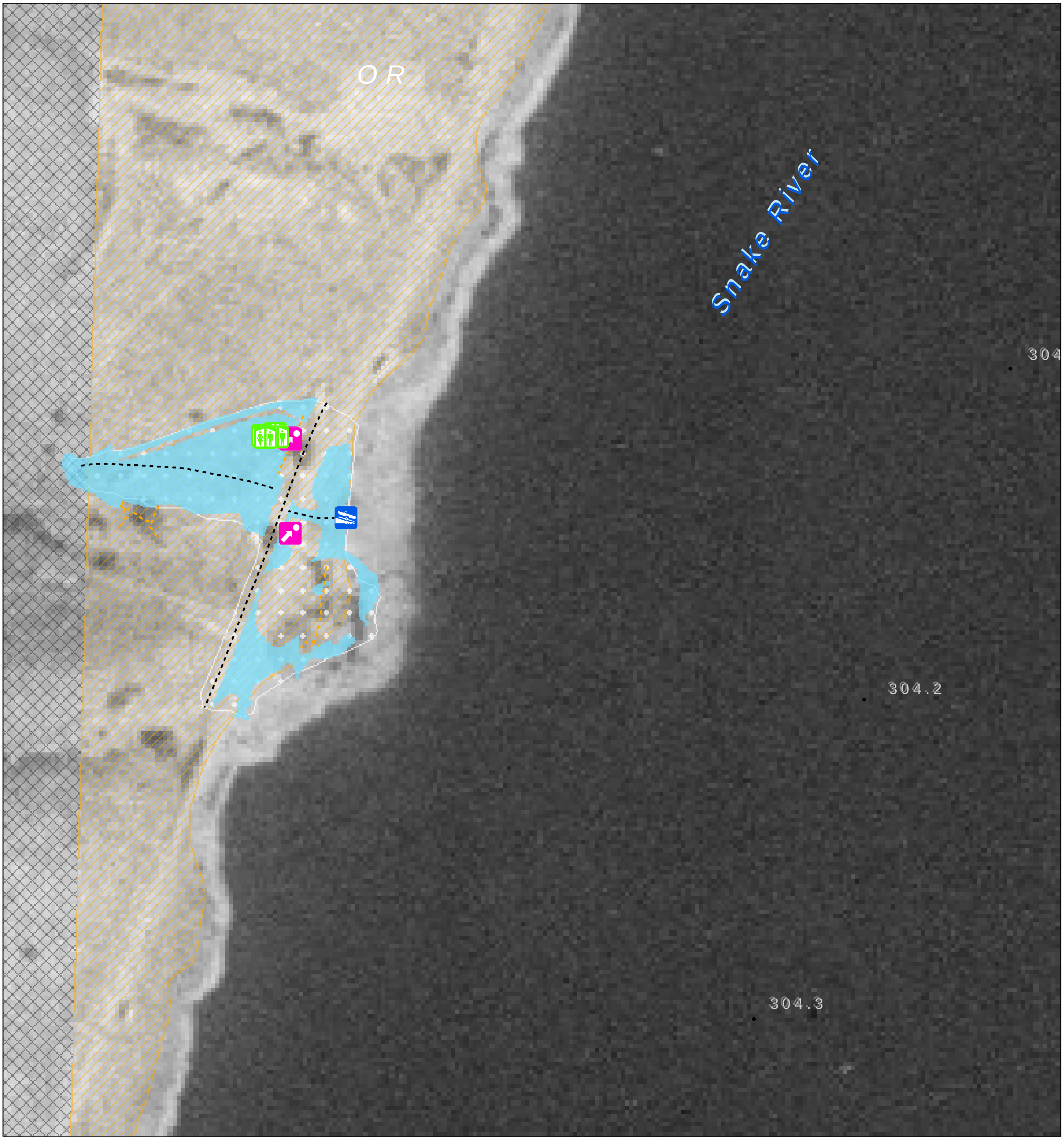

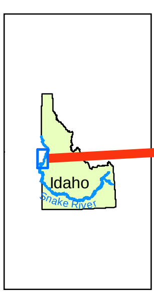

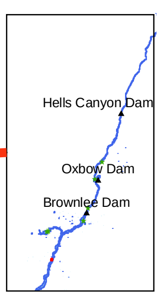

Feature Legend

Vault/Pit Toilet	**Site Specific Roads**	Used Area	
Impromptu Boat Ramp	Gravel	Dispersed Site Area	
Sign	Trail	BLM	
River Mile		Private	

N

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Figure E.5-102

Swedes Landing (SWLD)
Brownlee Reservoir

Scale 1: 2,500

20 10 0 20 40 60 Meters

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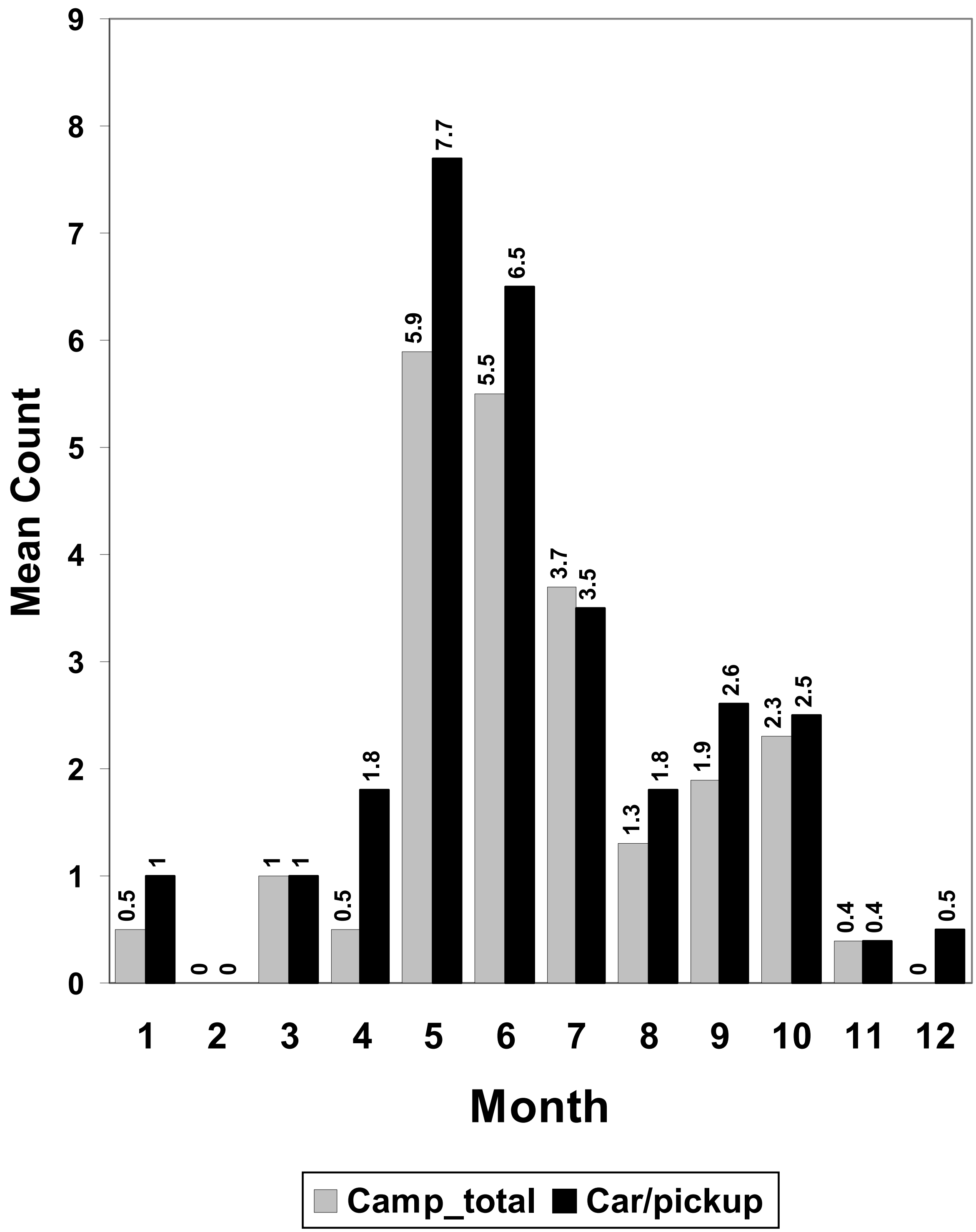

Figure E.5-103 Swedes Landing—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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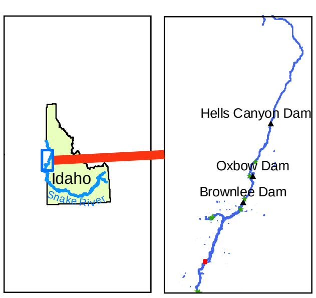

Figure Legend

- • River Mile
- **Site Specific Roads**
  - Trail
- Used Area
- Dispersed Site Area
- BLM
- Private

N

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Figure E.5-104

Connor Creek (CONN)
Brownlee Reservoir

Scale 1: 6,000

60 30 0 60 120 180 Meters

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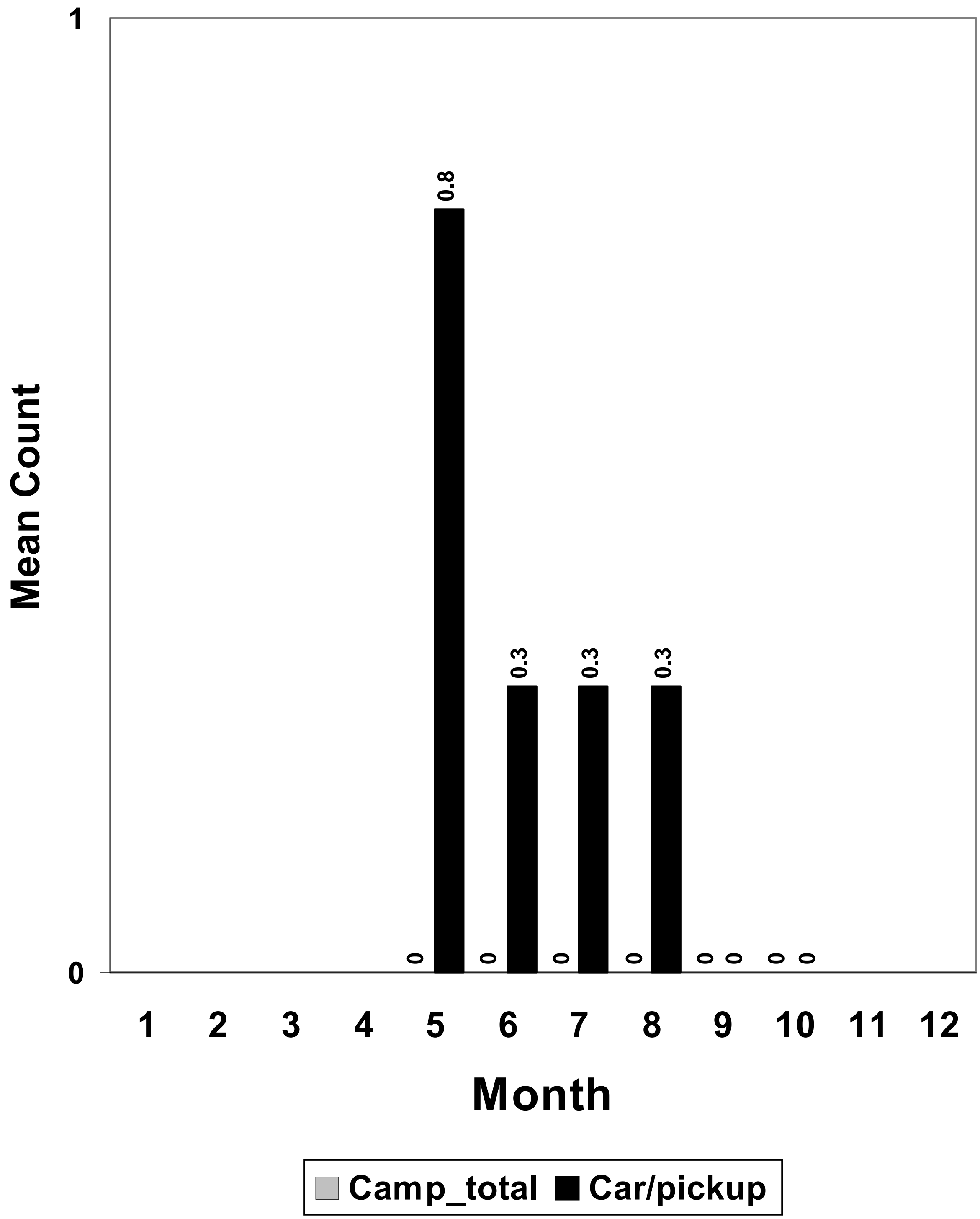

Figure E.5-105 Connor Creek—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. Connor Creek was not included in sampling as a distinct site during a year when winter sampling occurred

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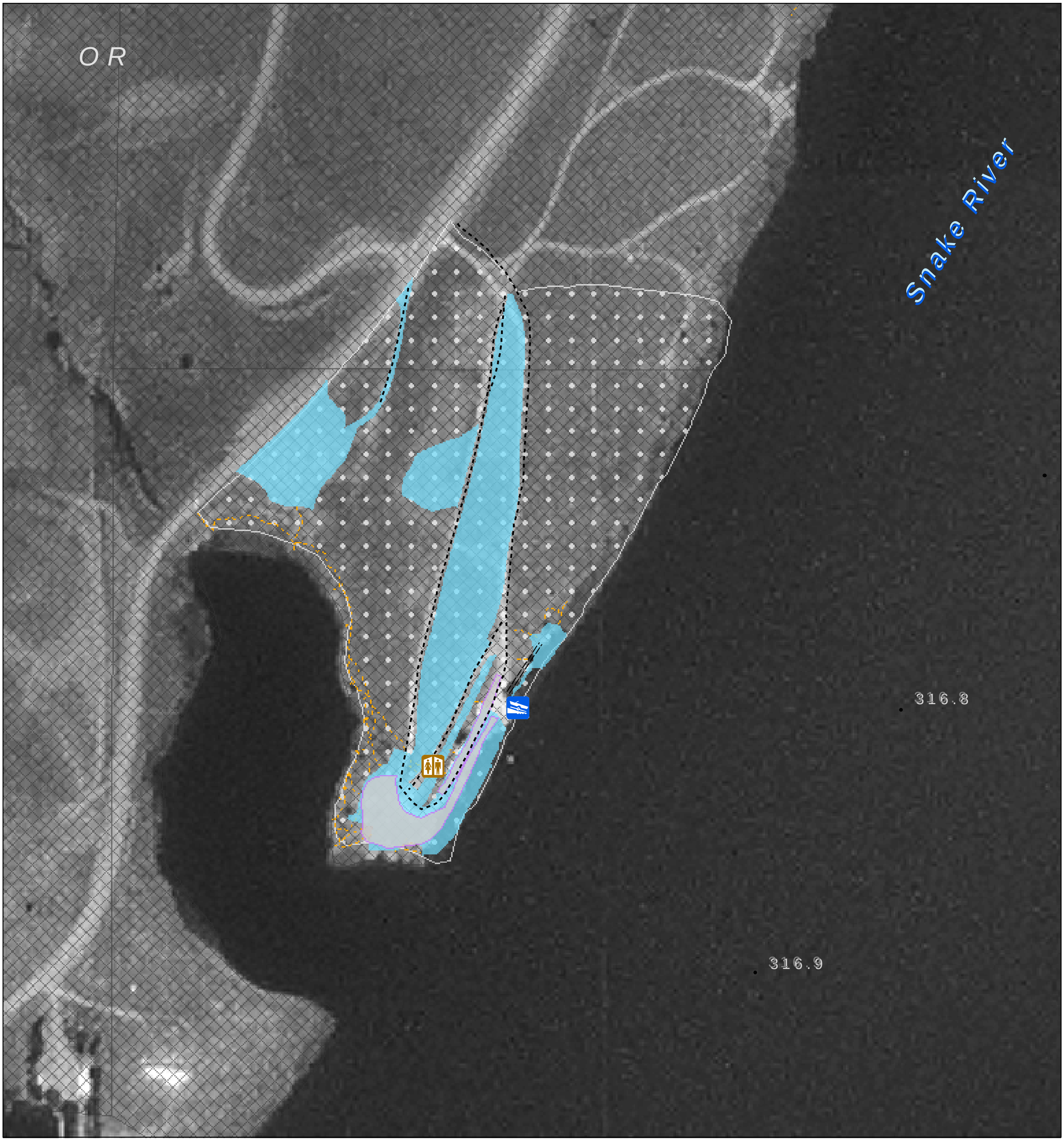

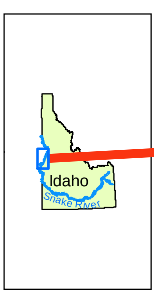

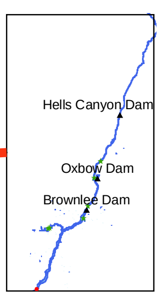

Feature Legend

Port-A-Potty

Impromptu Boat Ramp

River Mile

Site Specific Roads

Gravel

Unimproved

Trail

Used Area

Parking Area

Dispersed Site Area

Private

N

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Figure E.5-106

Hibbards Landing (HIBB)
Brownlee Reservoir

Scale 1: 3,000

30 15 0 30 60 90 Meters

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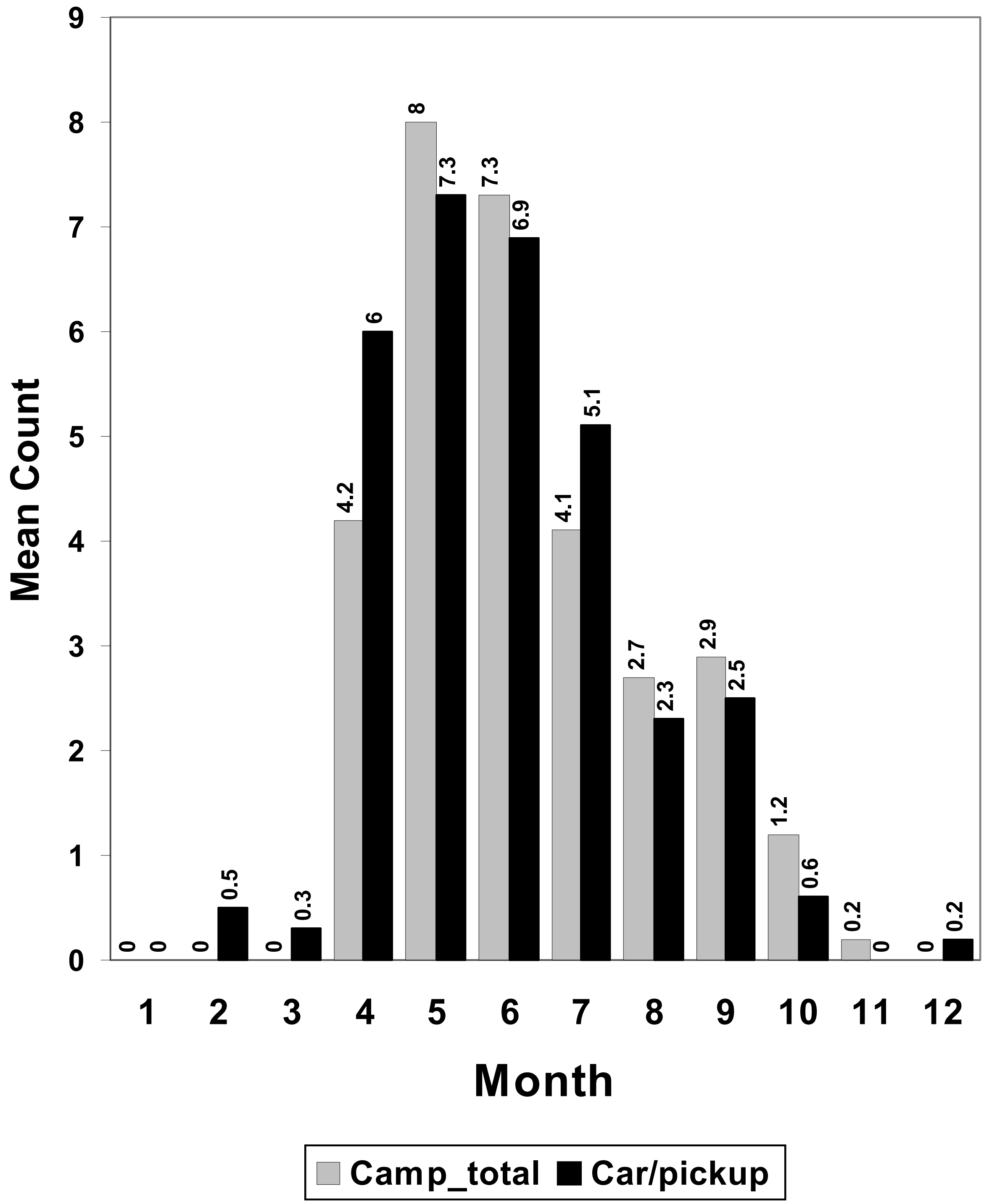

Figure E.5-107 Hibbards Landing—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

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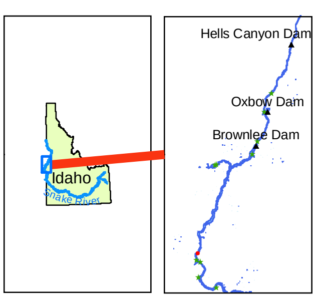

Feature Legend

• River Mile

Site Specific Roads

===== Unimproved

Used Area

Dispersed Site Area

BLM

N

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Figure E.5-108

Jennifers Alluvial Fan (JFAN)
Brownlee Reservoir

Scale 1: 2,500

25 12.5 0 25 50 75 Meters

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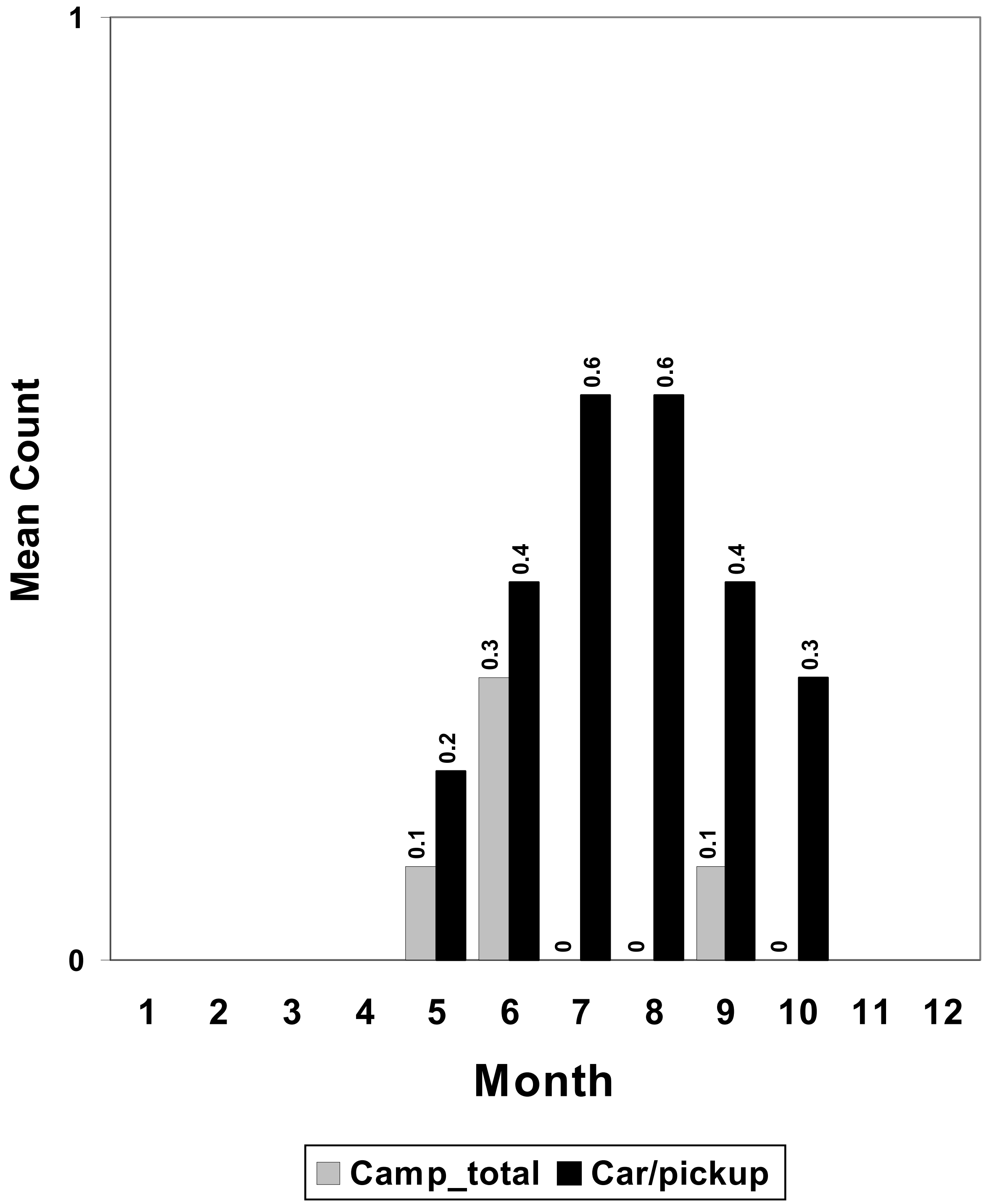

Figure E.5-109 Jennifers Alluvial Fan—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. This site was not included in sampling as a distinct site during a year when winter sampling occurred

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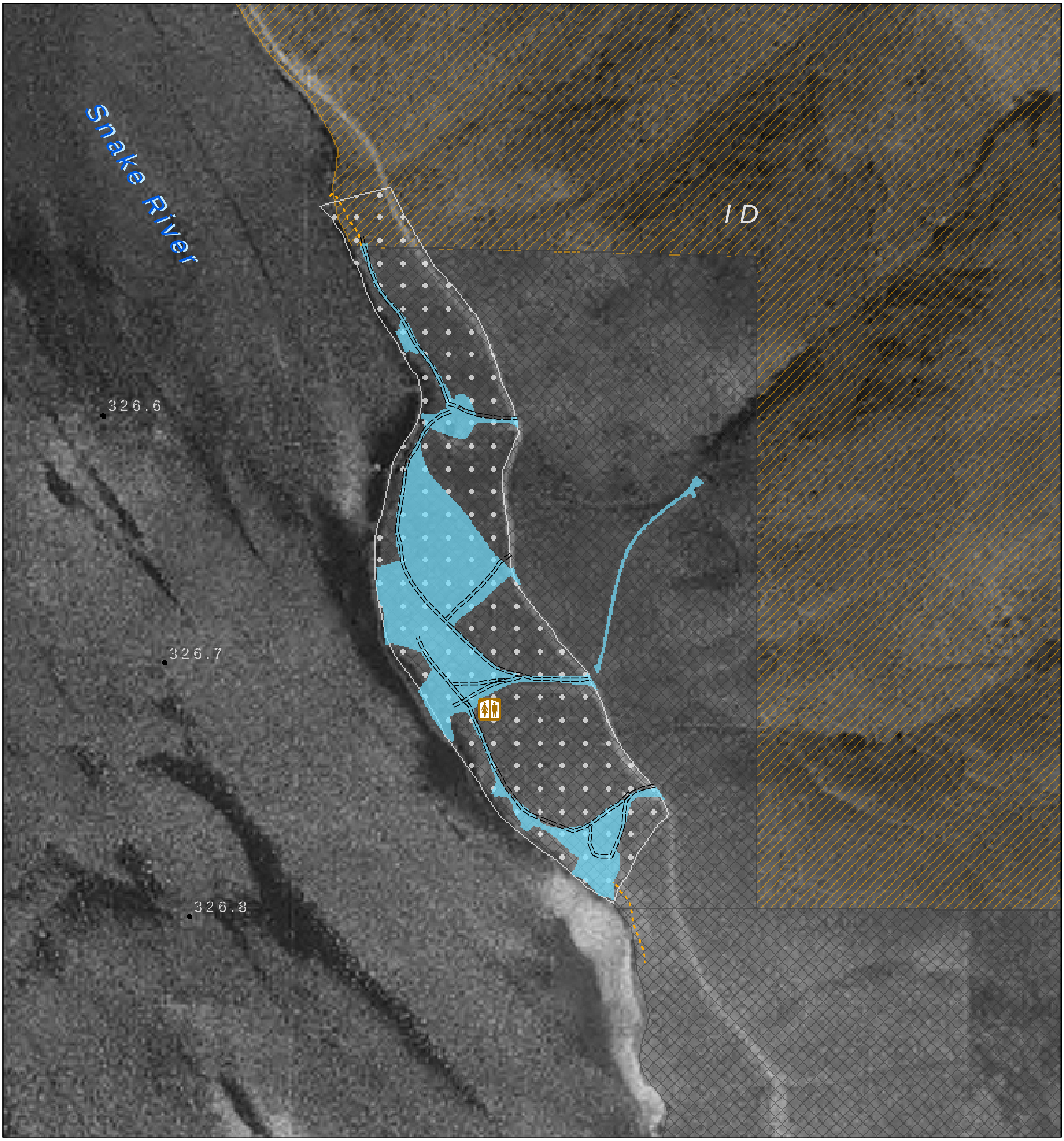

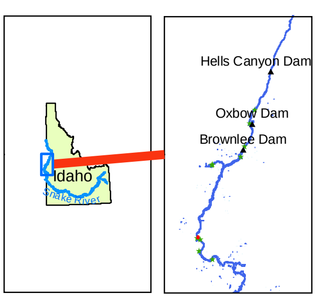

Feature Legend

Port-A-Potty
River Mile

Site Specific Roads
===== Unimproved
------ Trail

Used Area
Dispersed Site Area
BLM
Private

N

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Figure E.5-110

Kevins Alluvial Fan (KFAN)
Brownlee Reservoir

Scale 1: 3,500
30 15 0 30 60 90 Meters

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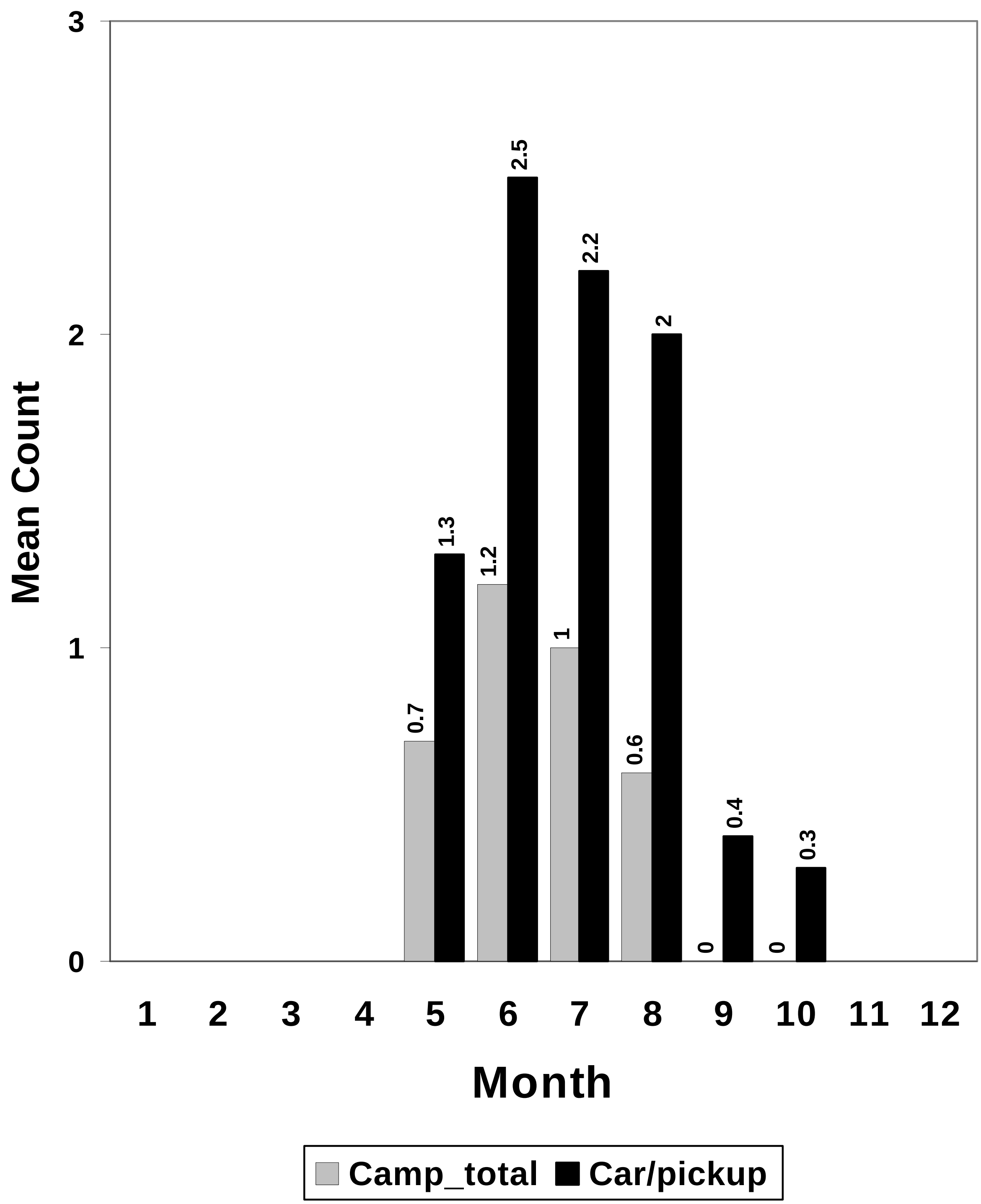

Figure E.5-111 Kevins Alluvial Fan—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. This site was not included in sampling as a distinct site during a year when winter sampling occurred

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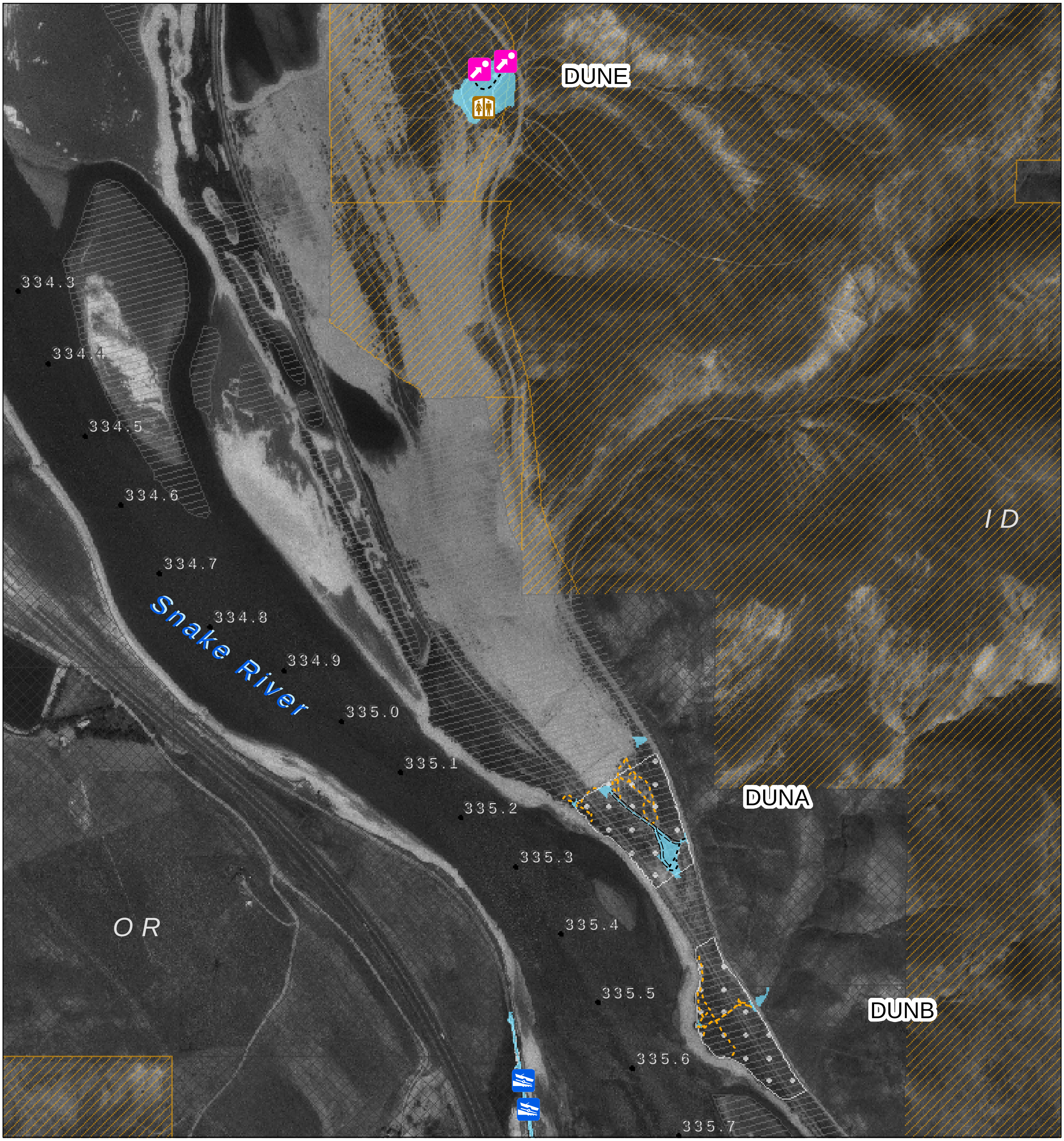

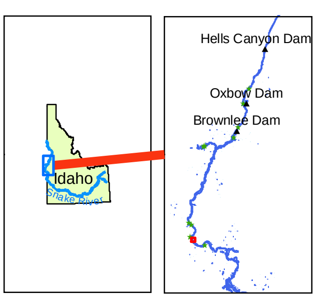

Feature Legend

- River Mile
- Impromptu Boat Ramp
- Sign
- Port-A-Potty

Site Specific Roads

- Gravel
- Unimproved
- Trail

- Used Area
- Dispersed Site Area
- BLM
- Idaho Power Company
- Private

N

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Figure E.5-112

Weiser Sand Dunes (DUNE, DUNA, DUNB) Brownlee Reservoir

Scale 1: 11,000

130 65 0 130 260 390 Meters

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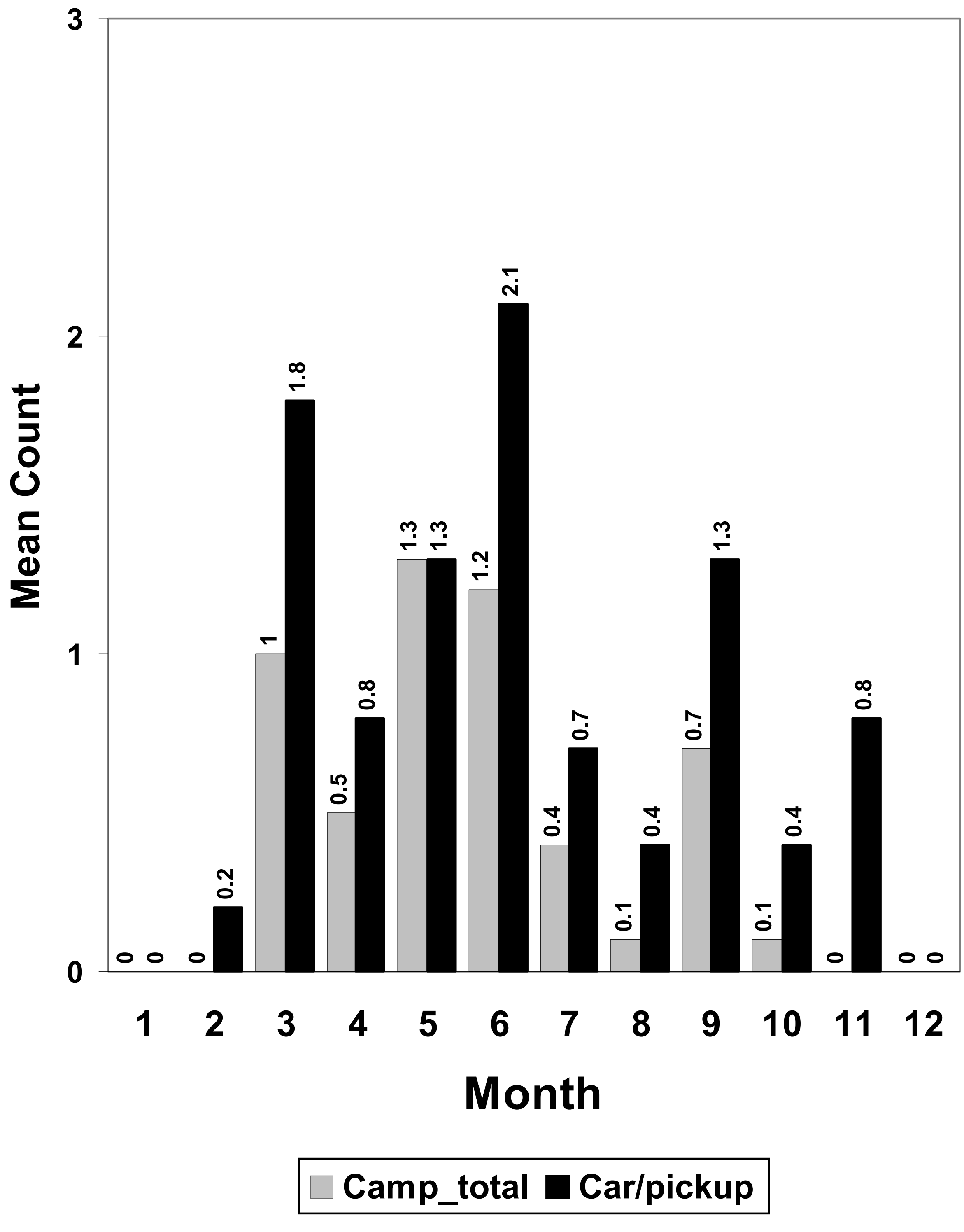

Figure E.5-113 Weiser Sand Dunes—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

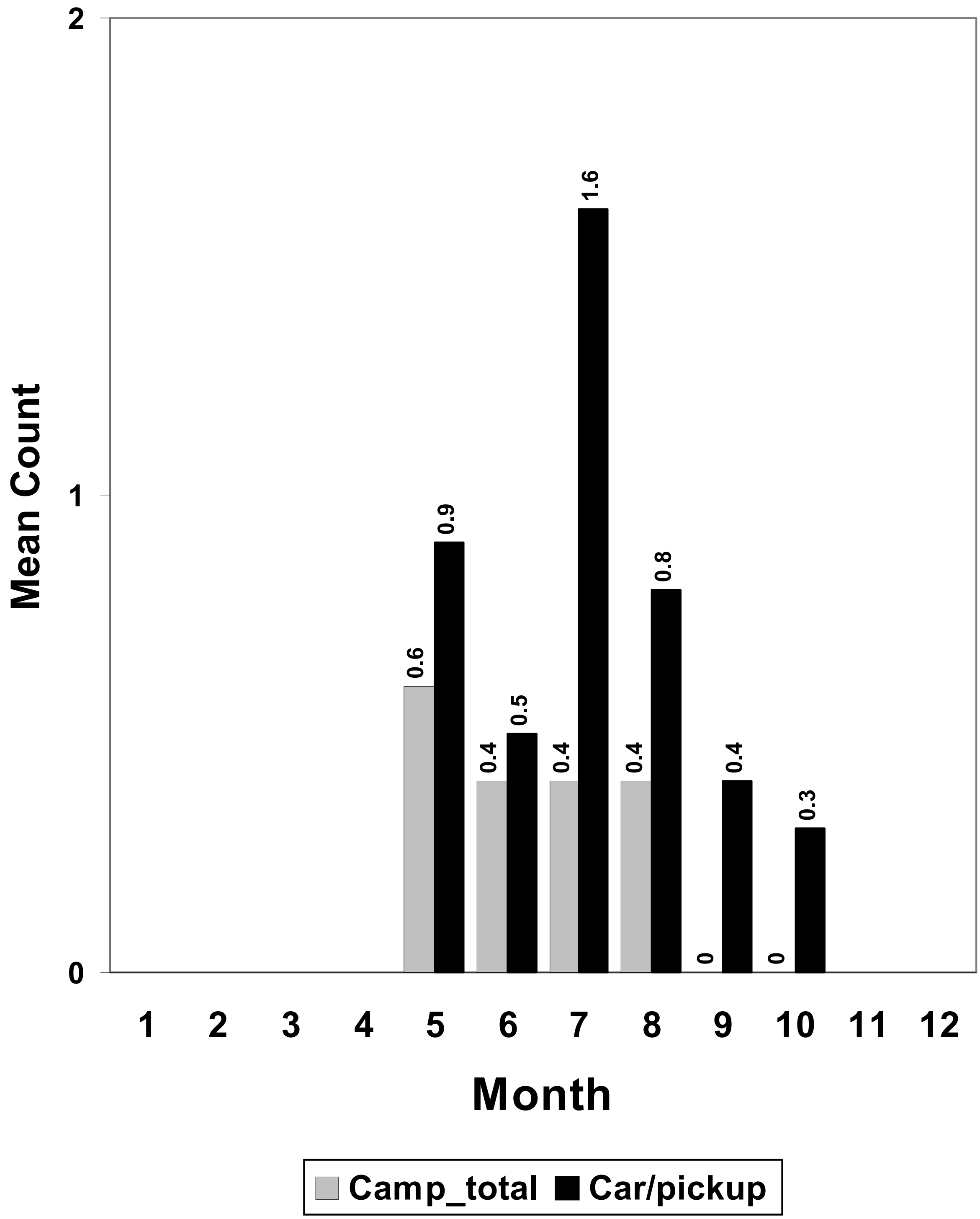

Figure E.5-114 Dune, sections A and B—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. These two sites (DUNA and DUNB) were not included in sampling as distinct sites during a year when winter sampling occurred

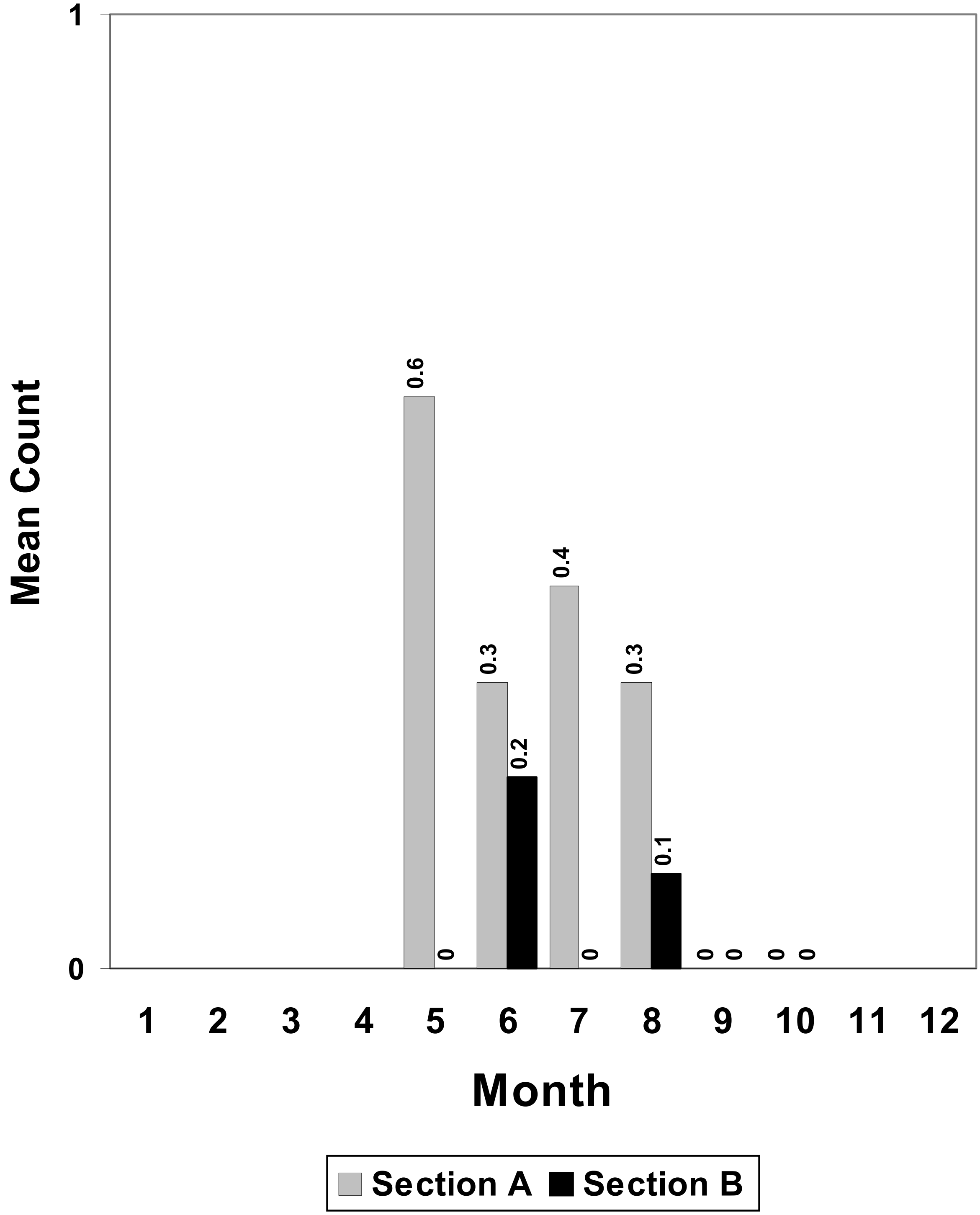

Figure E.5-115 Dune, sections A and B—Mean daily count of camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. These two sites (DUNA and DUNB) were not included in sampling as distinct sites during a year when winter sampling occurred

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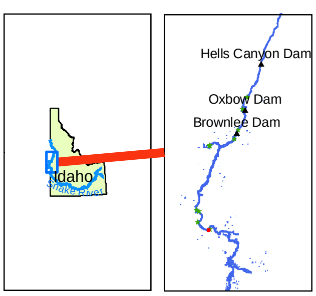

Figure Legend

• River Mile	**Site Specific Roads**		Used Area
	===== Unimproved		Dispersed Site Area
	------- Trail		BLM
			Private
			State

N

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Figure E.5-116

Cobb Rapids, (COBB)
Brownlee Reservoir

Scale 1: 4,500

50 25 0 50 100 150 Meters

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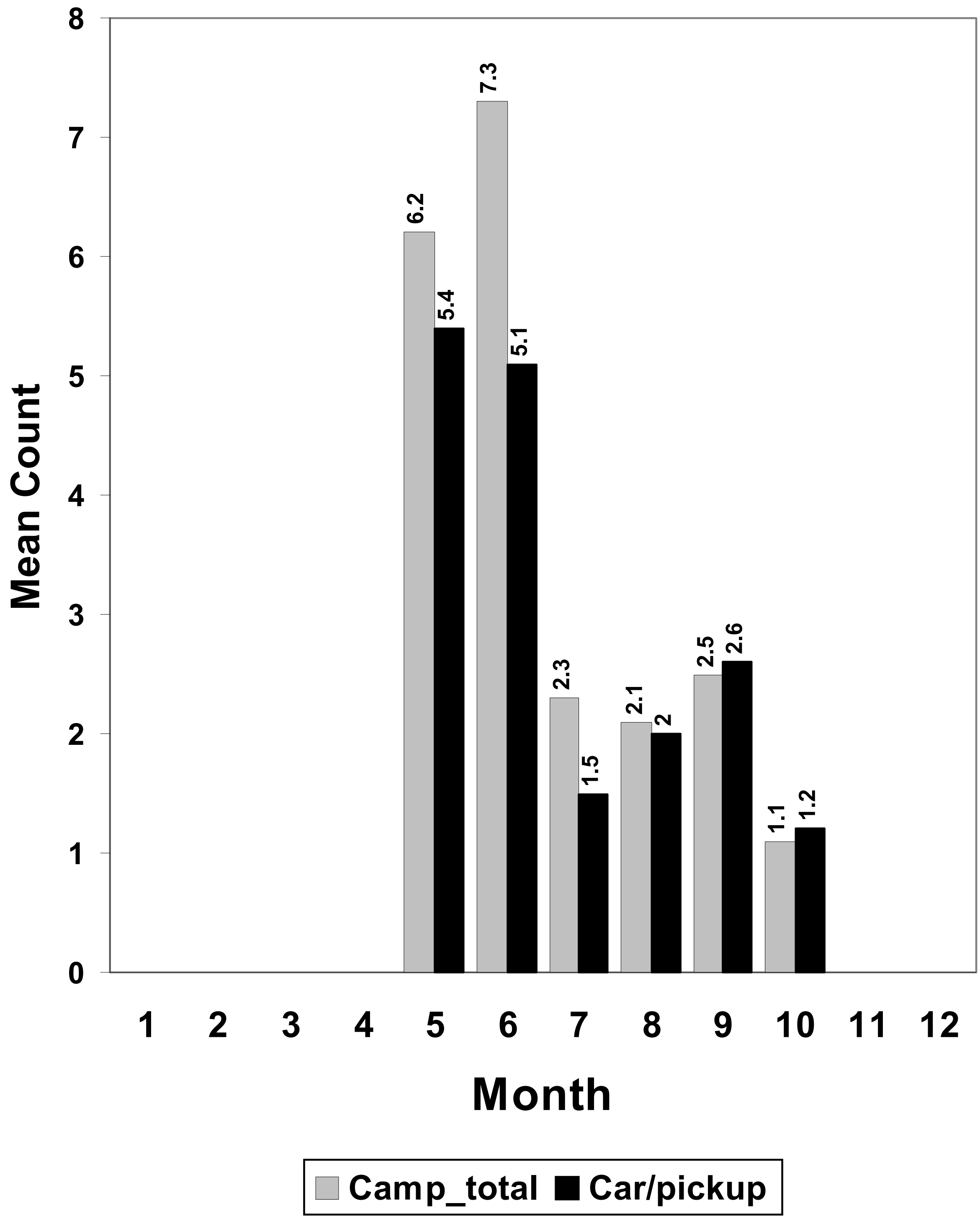

Figure E.5-117 Cobb Rapids—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000. This site was not included in sampling as a distinct site during a year when winter sampling occurred

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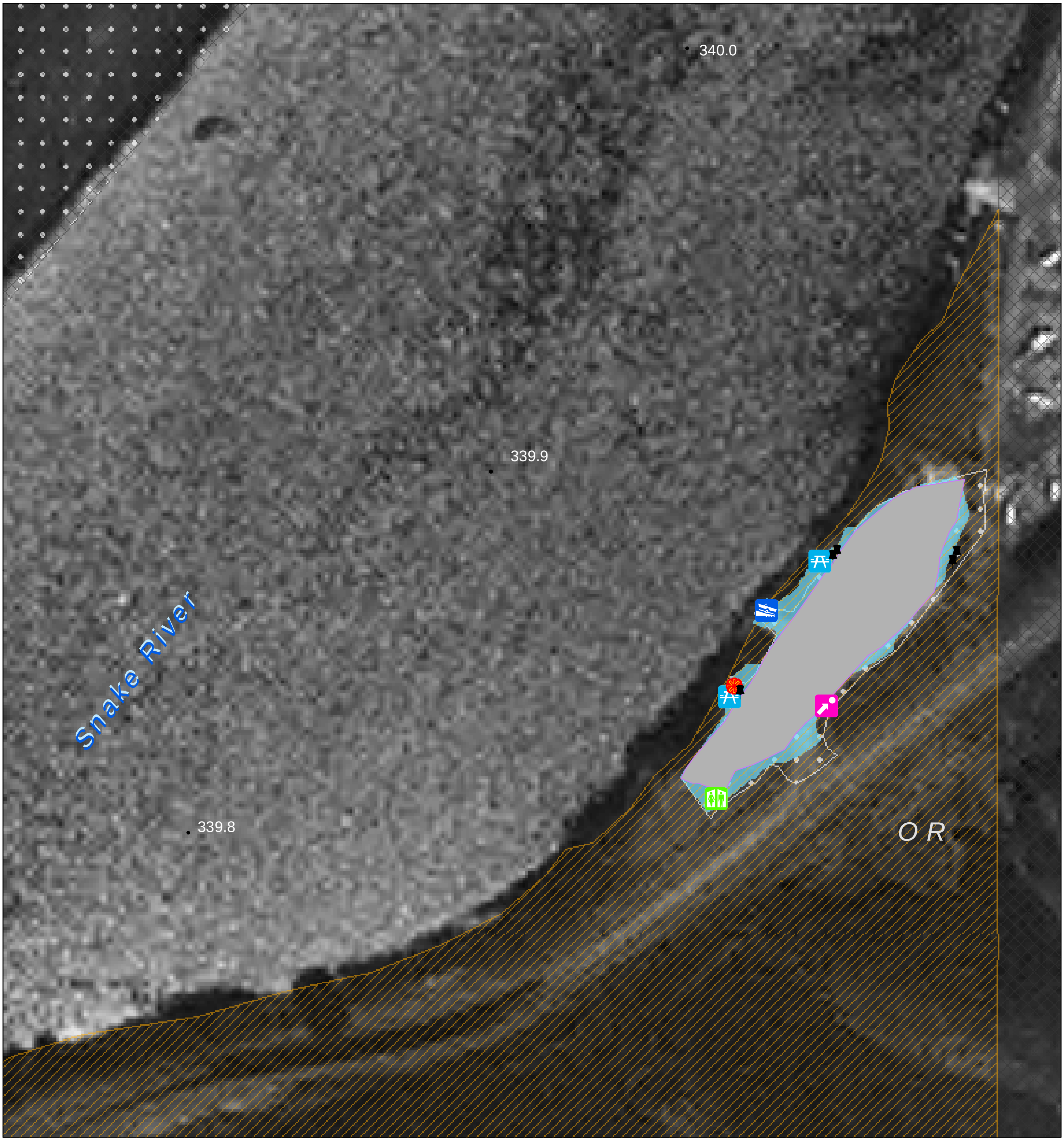

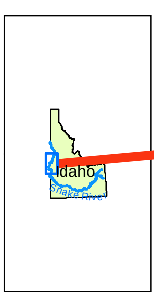

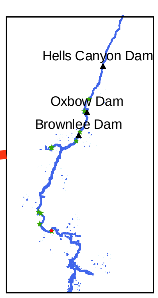

Feature Legend

Vault/Pit Toilet	Picnic Table	Used Area
Trash Receptacles	Boat Ramp	Parking Area
Fire Grill	River Mile	Dispersed Site Area
Sign		BLM
		Private

N

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Figure E.5-118

Oasis (OASC)

Brownlee Reservoir

Scale 1: 1,750

20 10 0 20 40 60 Meters

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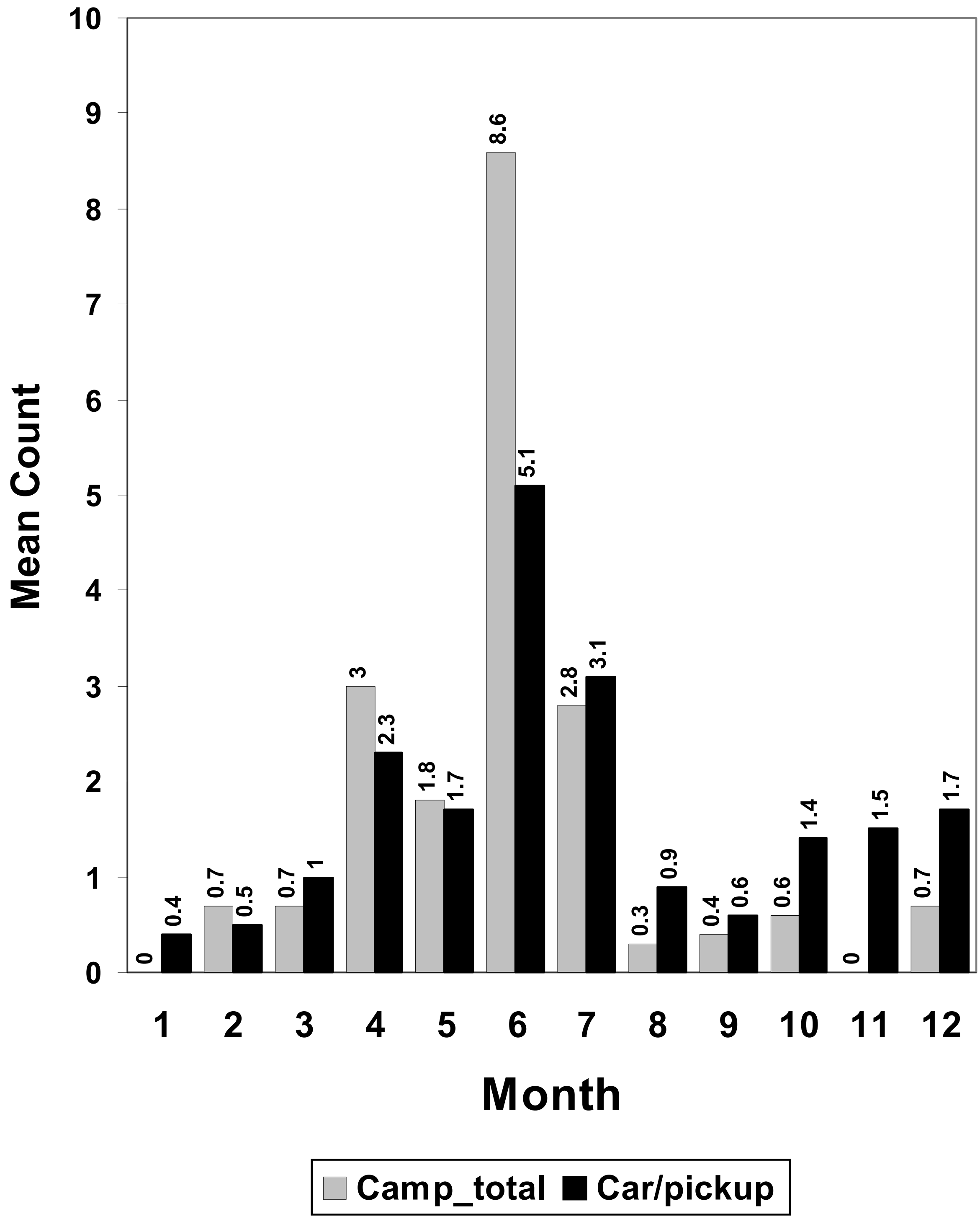

Figure E.5-119 BLM's Oasis (OASC)—Mean daily count of car-pickups and camp_total (all camping-related equipment combined) by month from surveys conducted by the Applicant during 1997, 1998, and 2000

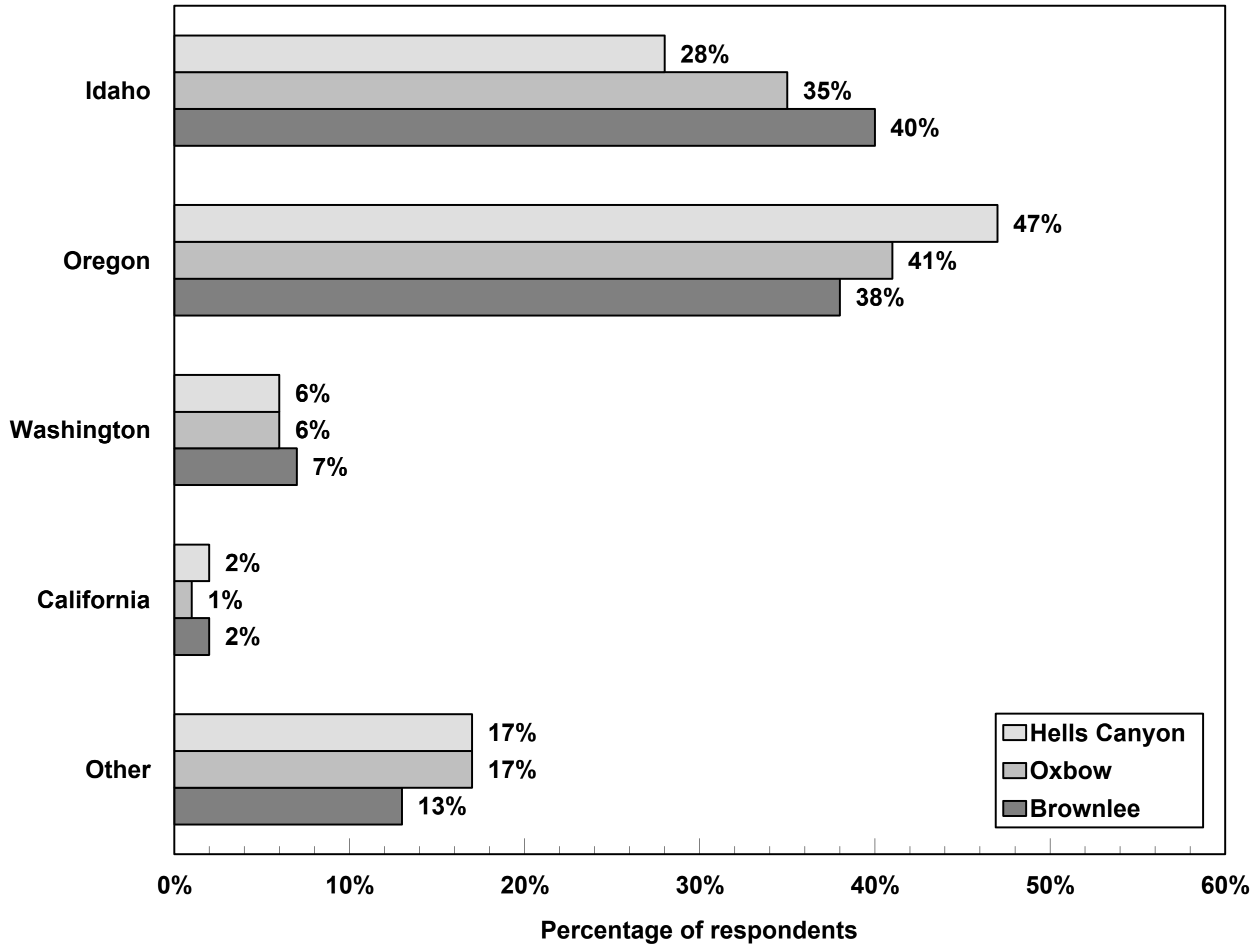

Figure E.5-120 Percentage of visitors residing in different states by reservoir (from 2000 mail survey)

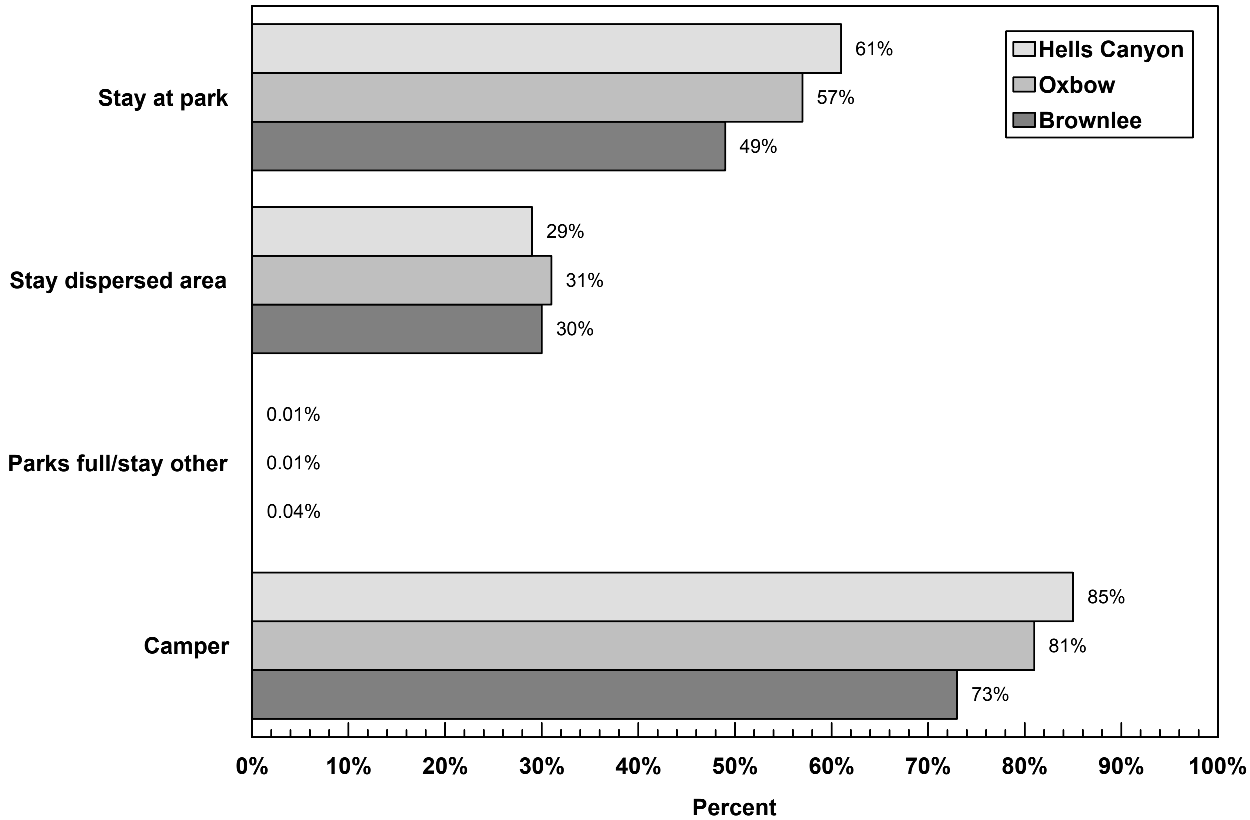

Figure E.5-121 Percentage of visitors that camped at parks, camped at dispersed areas, or camped at dispersed areas because parks were full, as well as the total percentage of campers for each reservoir in 2000

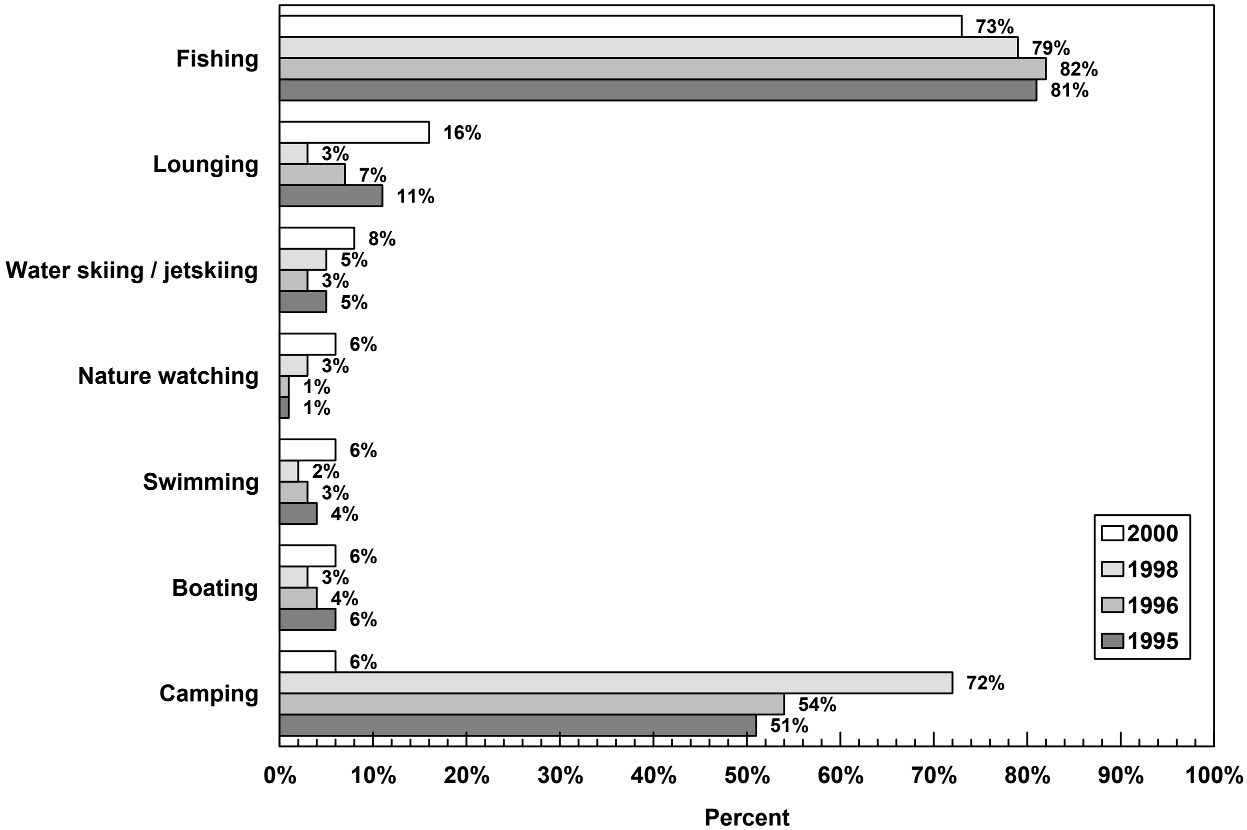

Figure E.5-122 Percentage of all reservoir visitors reporting various activities as one of their "top three" in 1995, 1996, 1998, and 2000

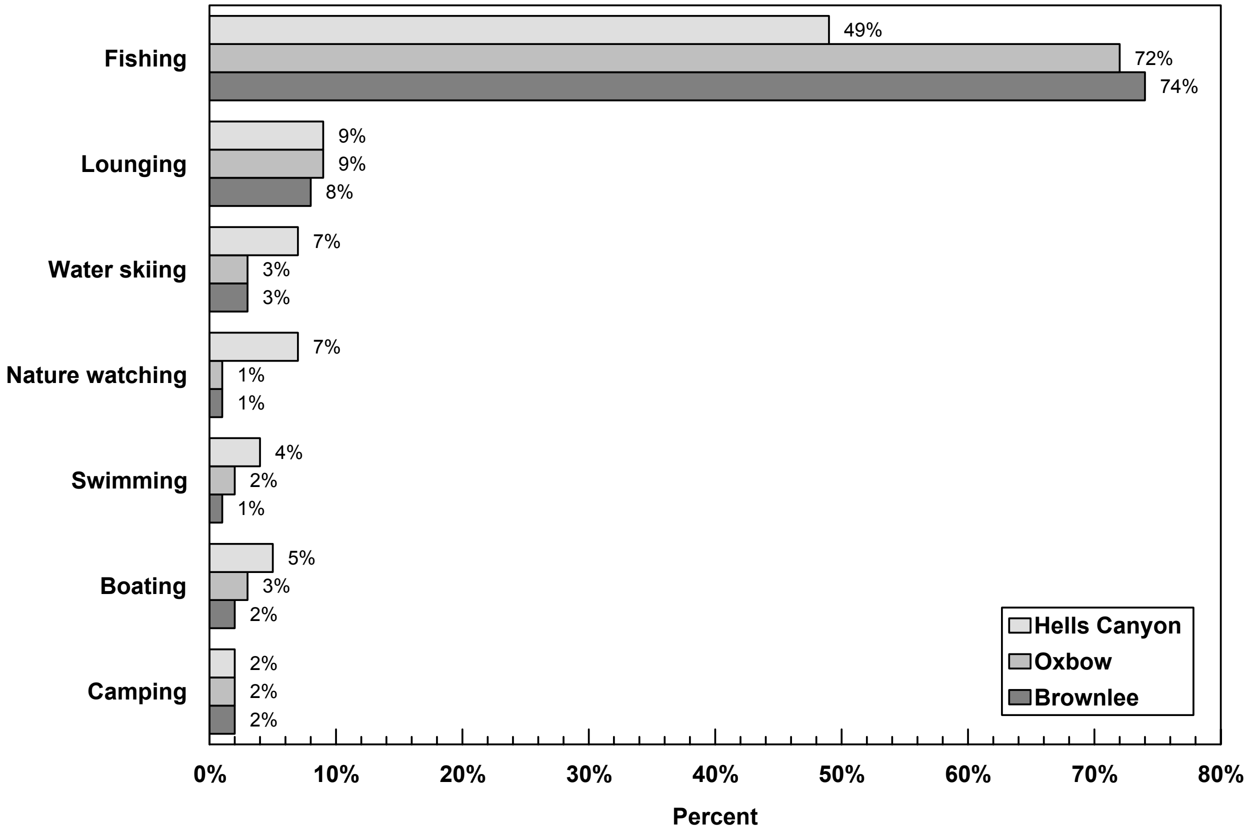

Figure E.5-123 Percentage of visitors (by reservoir) reporting various activities as their primary activity in 2000

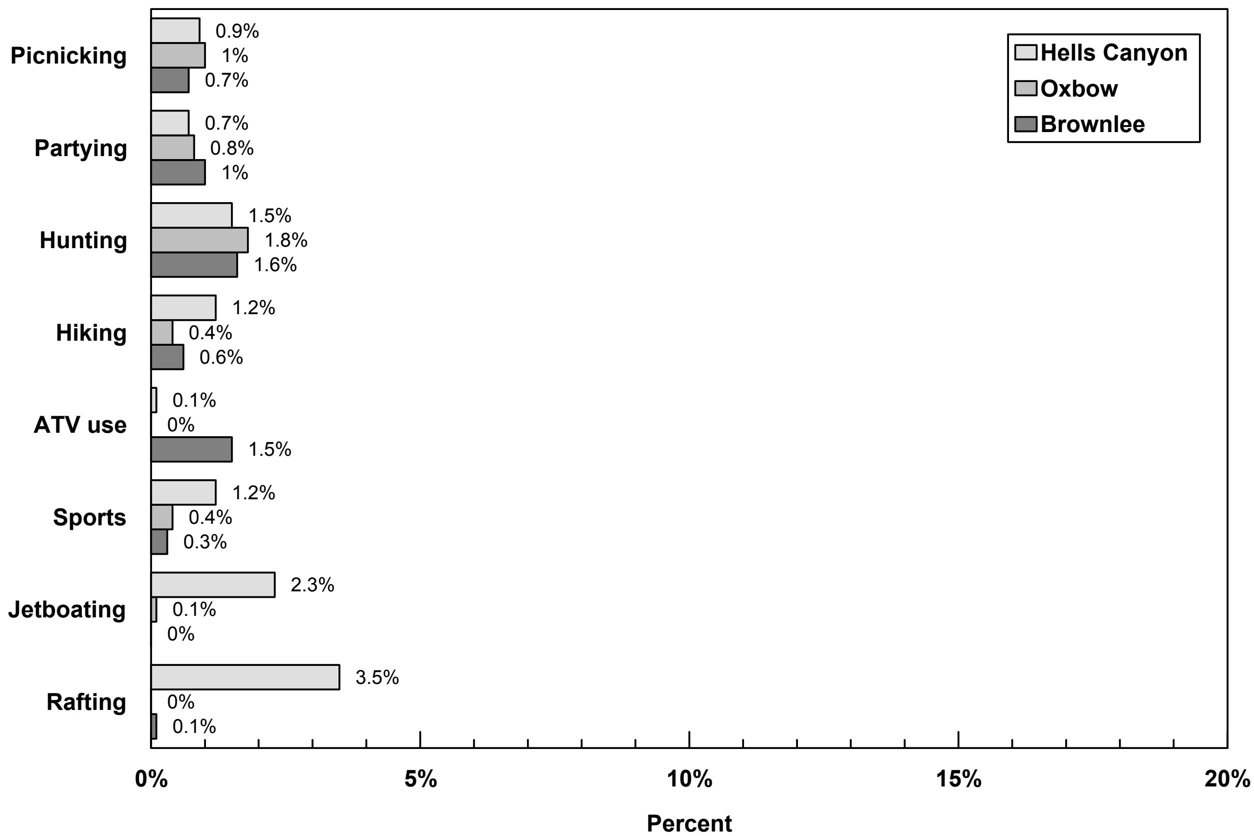

Figure E.5-124 Percentage of visitors (by reservoir) reporting other activities as their primary activity in 2000

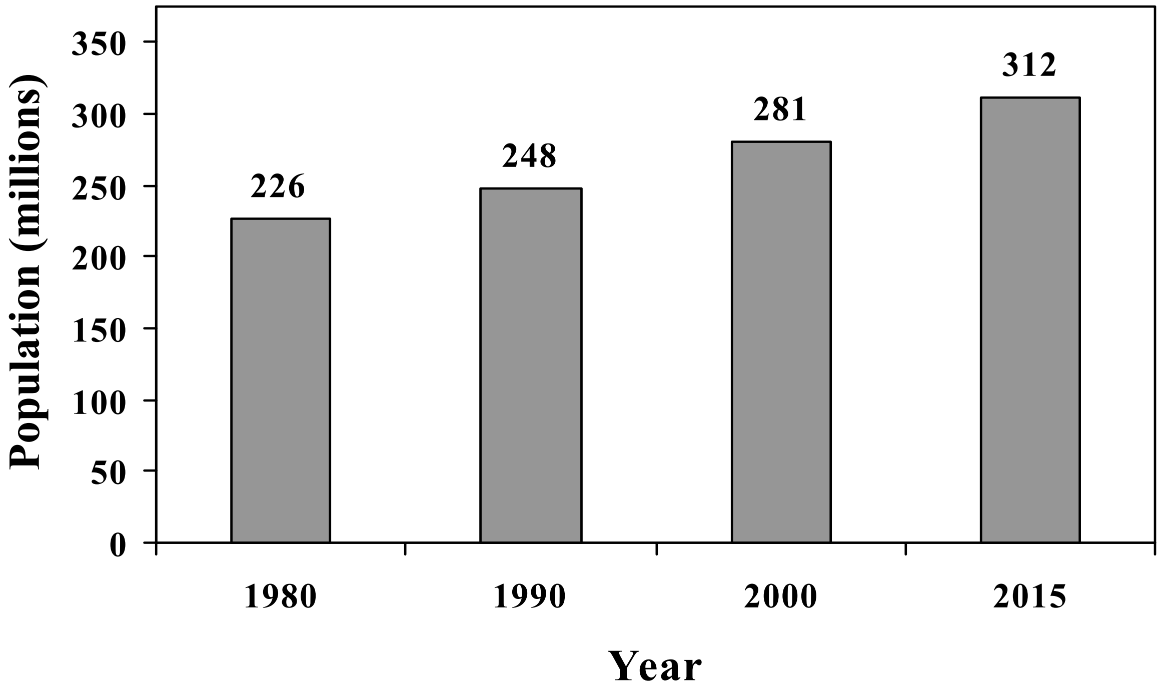

Figure E.5-125 Population in the United States in 1980, 1990, and 2000 and projected to 2015 (U.S. Census Bureau 2001)

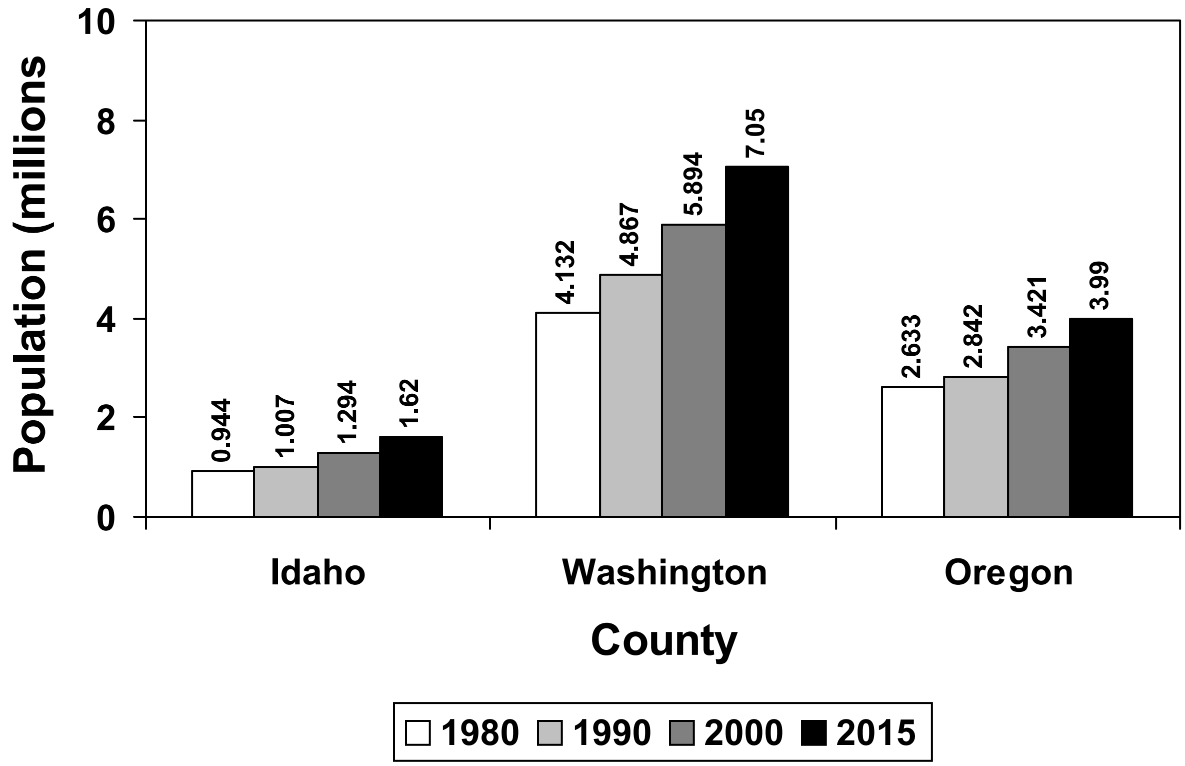

Figure E.5-126 Population in the Pacific Northwest, by state, in 1980, 1990, and 2000 and also projected to 2015 (U.S. Census Bureau 2001)

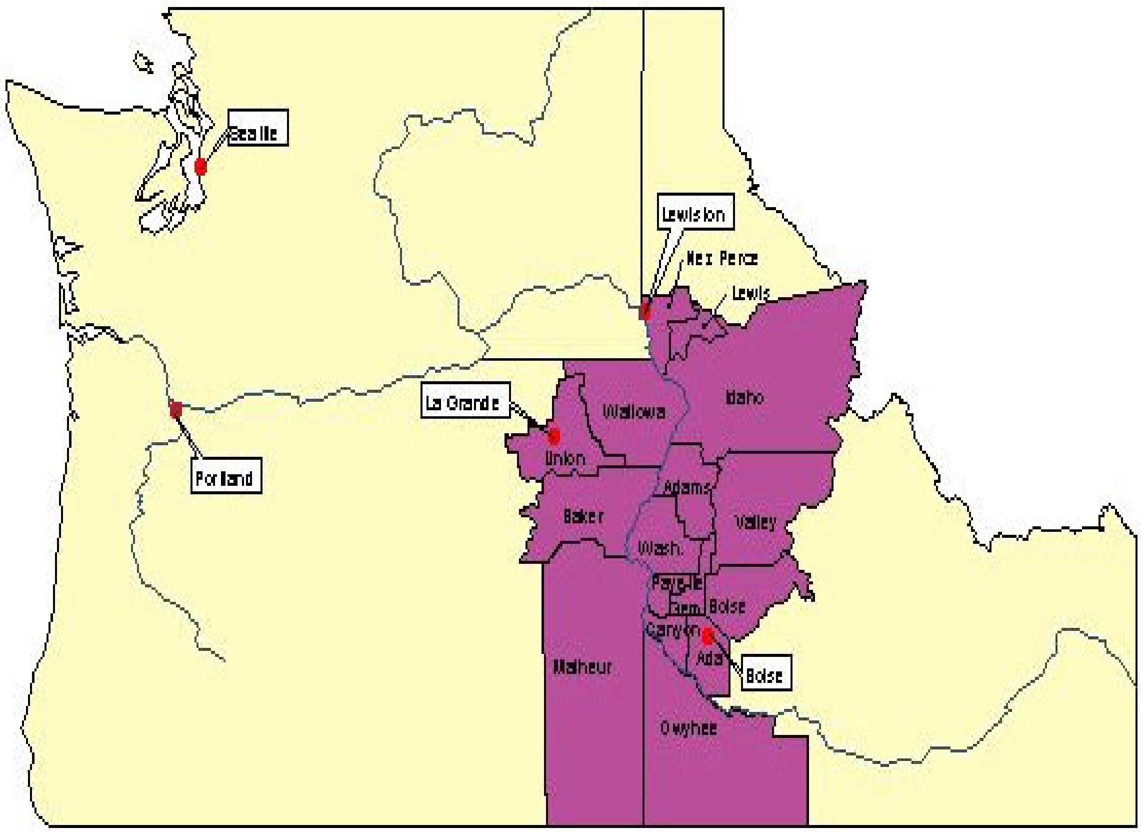

Figure E.5-127 Map of counties surrounding the HCC

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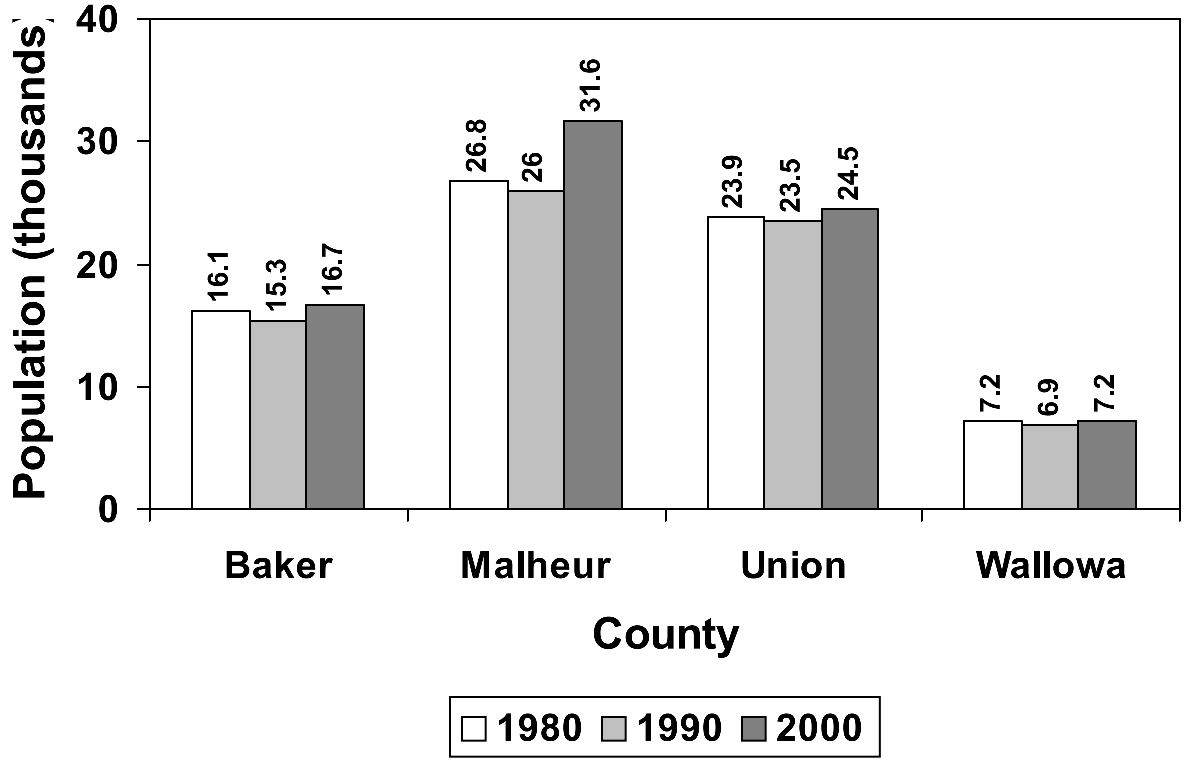

Figure E.5-128 Population in Oregon counties near the HCC between 1980 and 2000 (U.S. Census Bureau 2001)

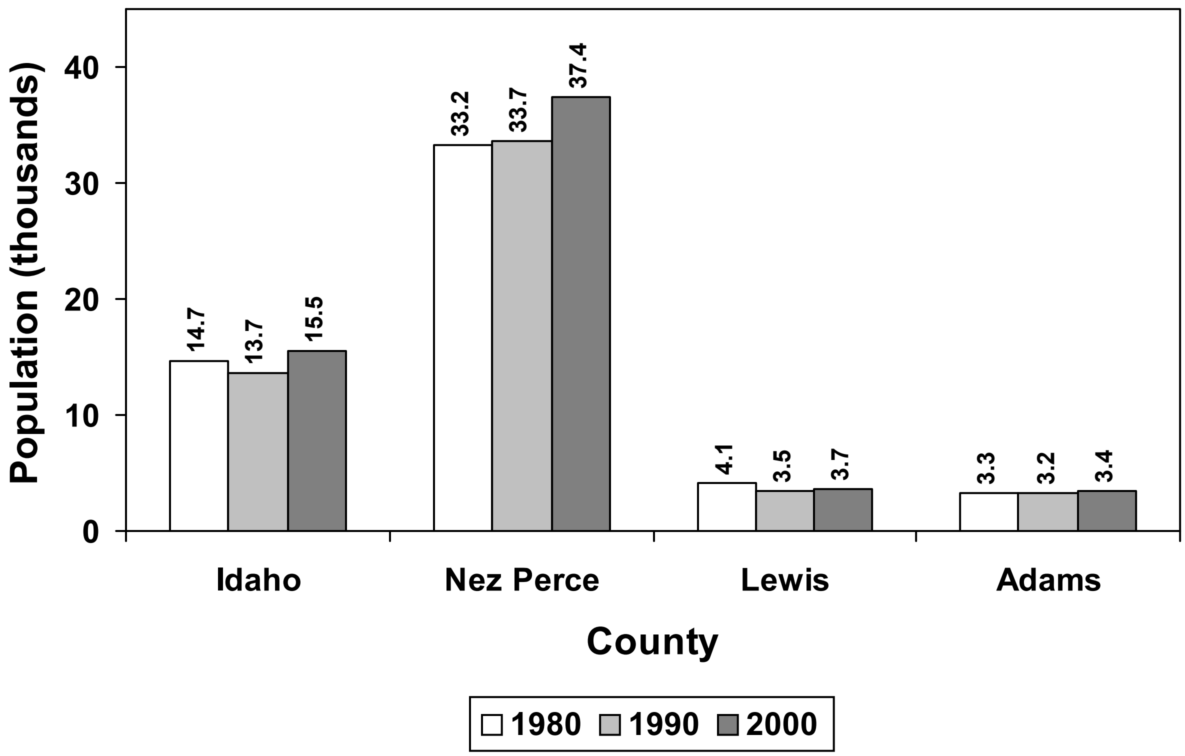

Figure E.5-129 Population in northern Idaho counties near the HCC between 1980 and 2000 (U.S. Census Bureau 2001)

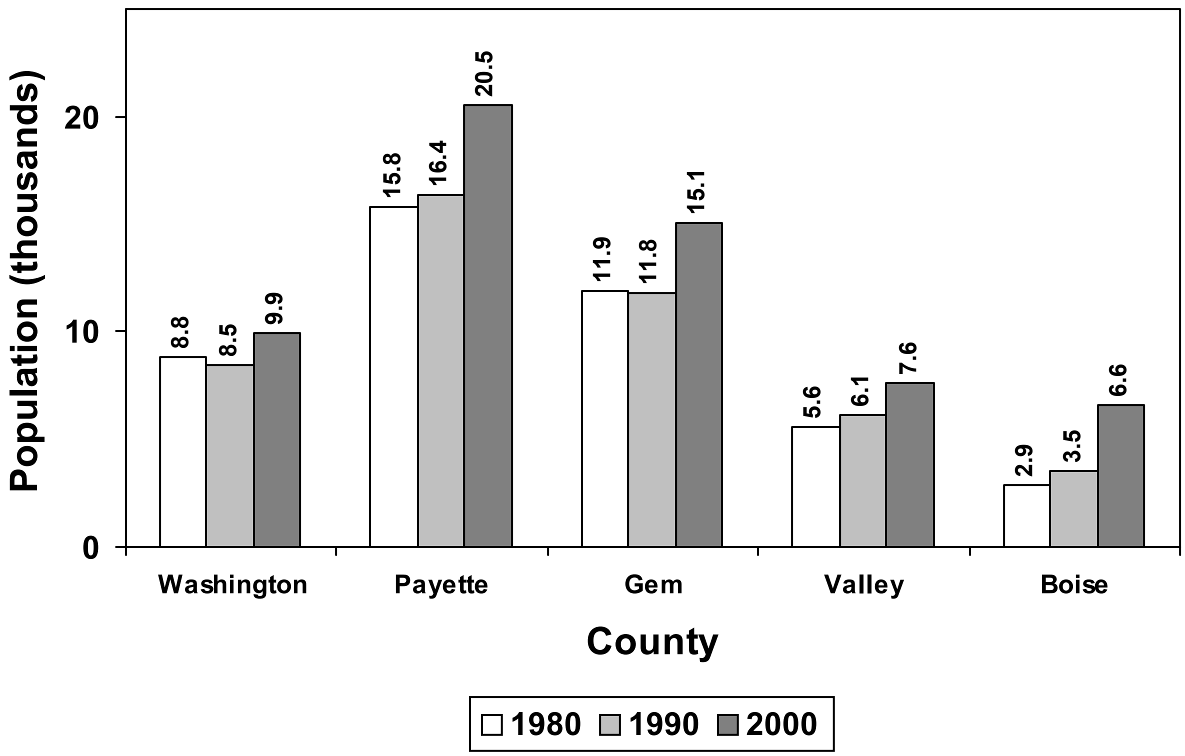

Figure E.5-130 Population in the low-population counties of southern Idaho near the HCC between 1980 and 2000 (U.S. Census Bureau 2001)

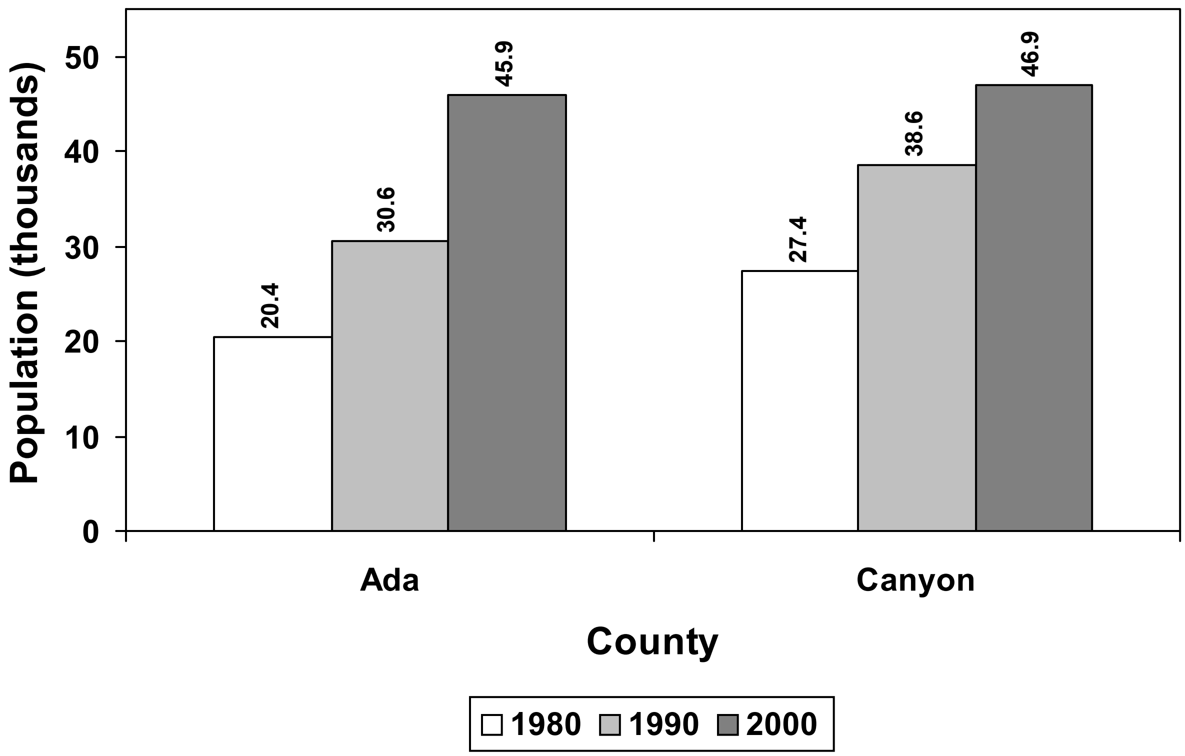

Figure E.5-131 Population in the high-population counties of southern Idaho near the HCC between 1980 and 2000 (U.S. Census Bureau 2001)

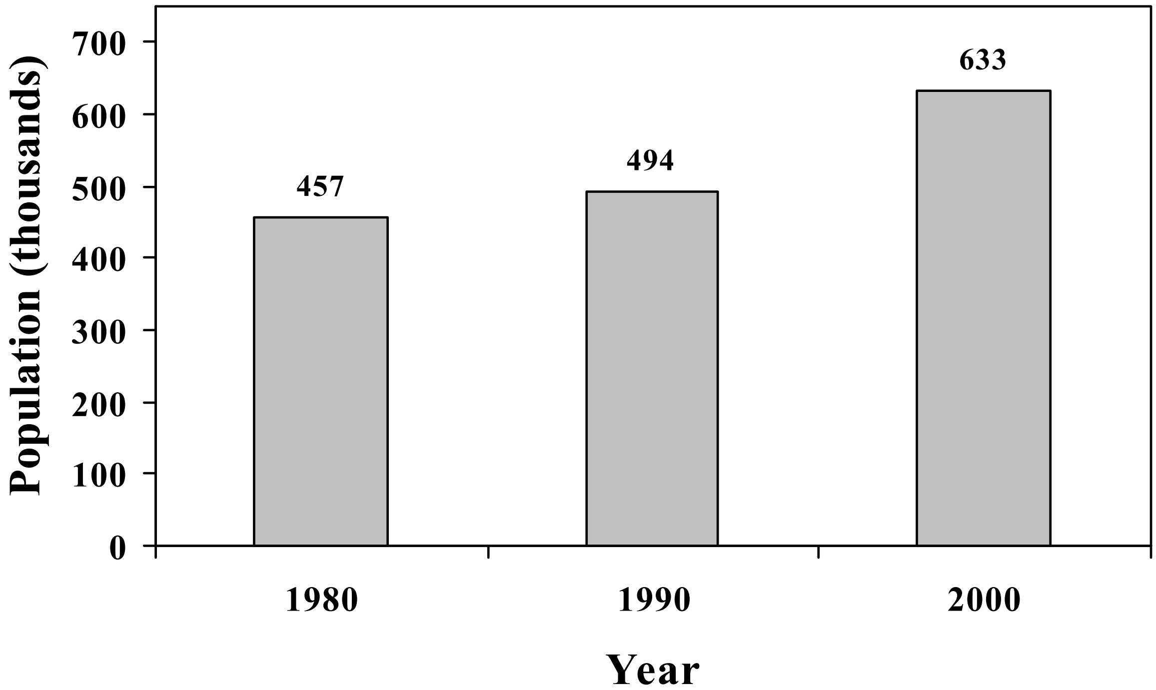

Figure E.5-132 Combined population in counties near the HCC between 1980 and 2000 (U.S. Census Bureau 2001)

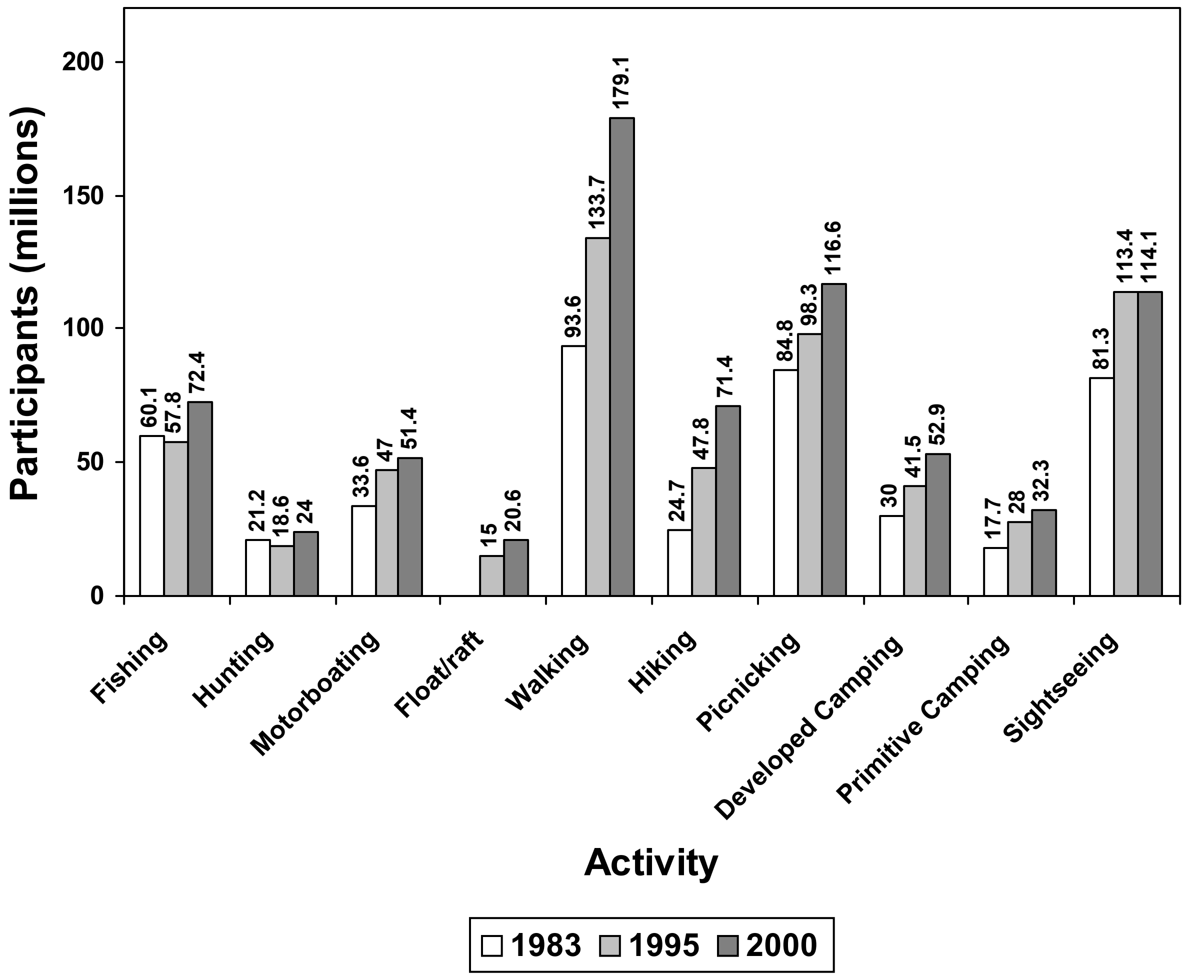

Figure E.5-133 Estimated number of participants in the United States in several categories of outdoor activities in 1983, 1995, and 2000 (Cordell et al. 1999)

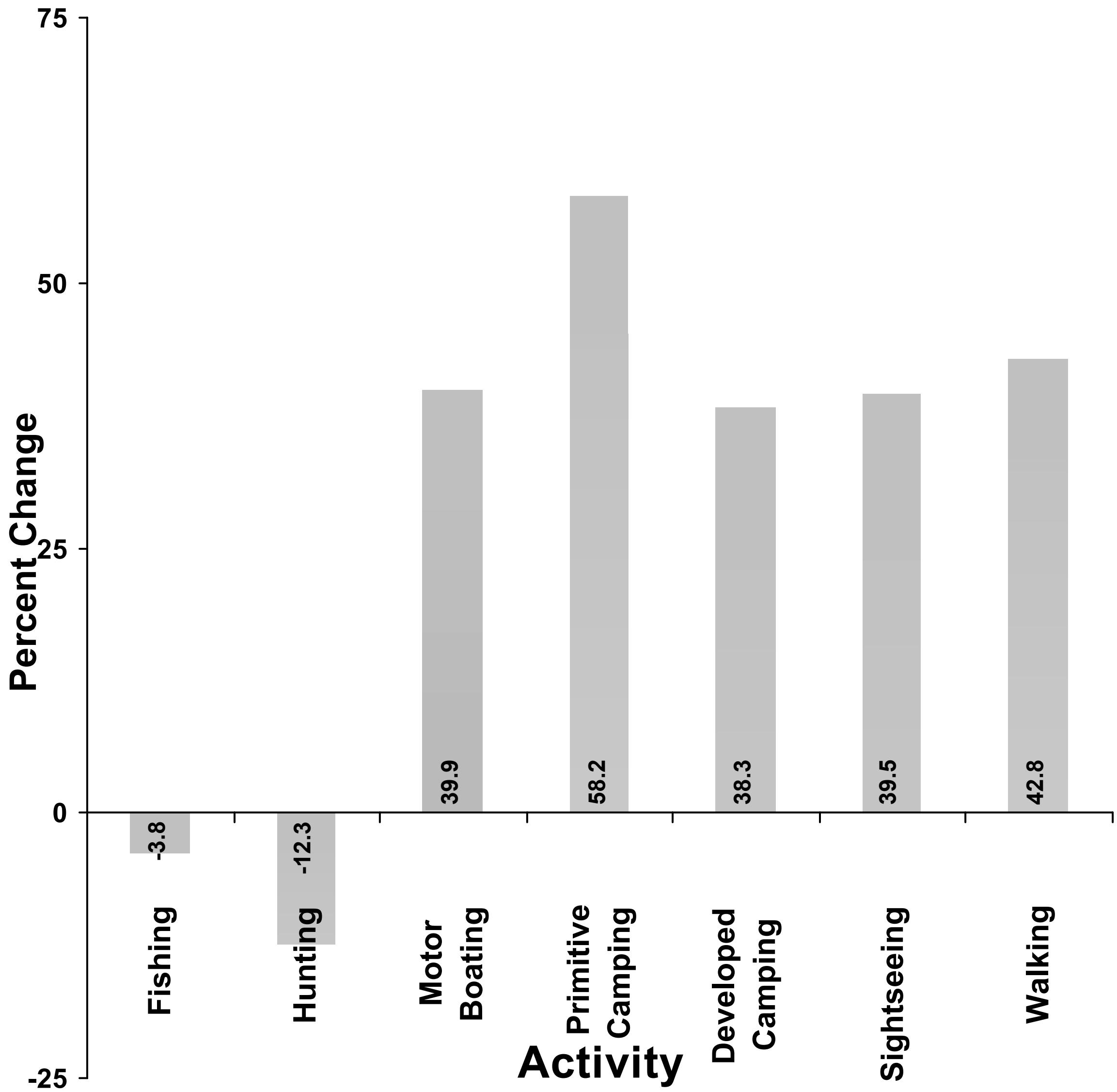

Figure E.5-134 Percentage of change in estimated number of participants in the United States in several categories of outdoor activities between 1983 and 1995 (Cordell et al. 1999)

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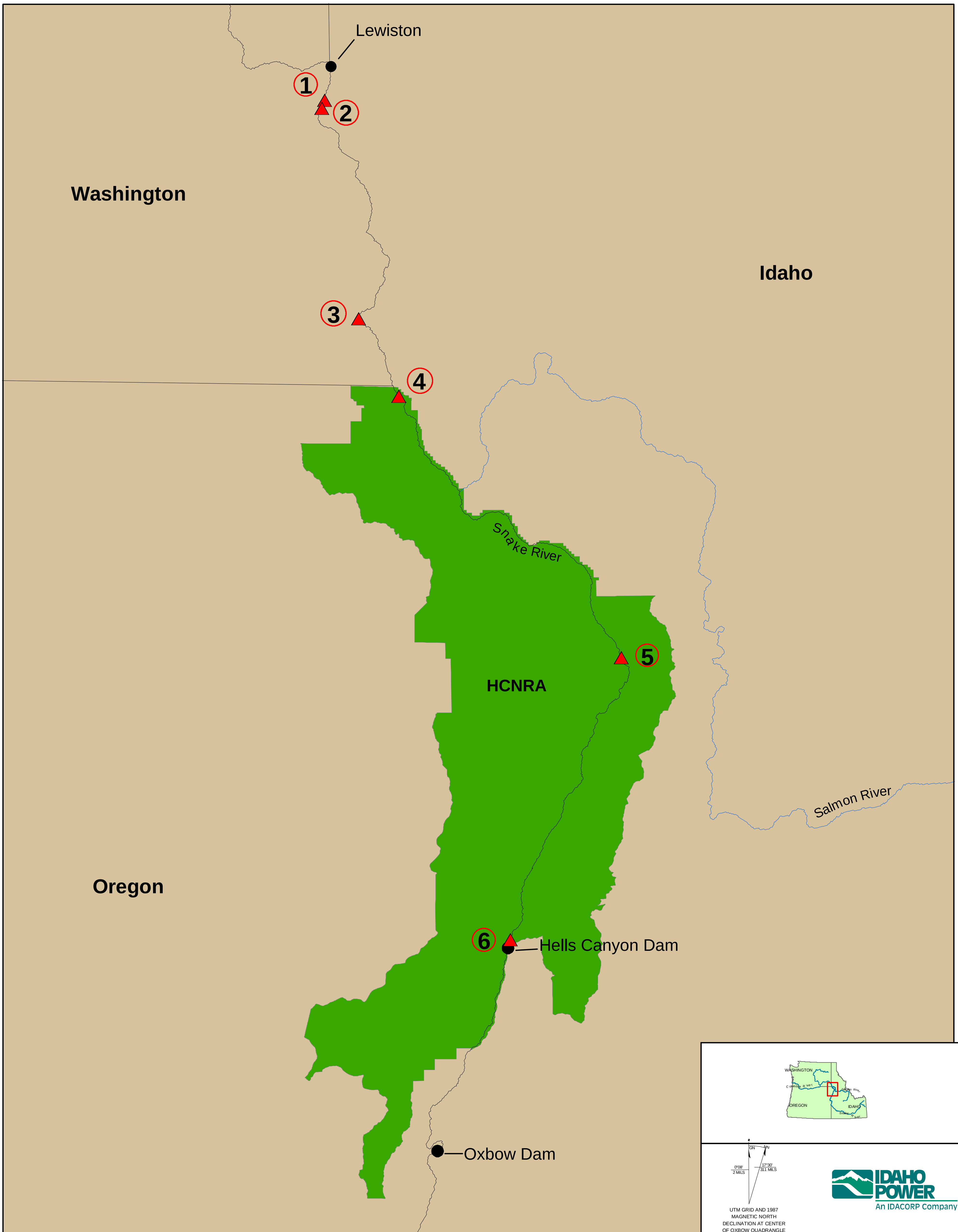

Flow Monitors

- 1 USFS Clarkston Office, Washington
- 2 Hells Gate Marina, Lewiston, Idaho
- 3 Heller Bar, Washington
- 4 Cache Creek USFS Administrative Site, Oregon
- 5 Pittsburg Landing, Idaho
- 6 Creek Recreation Site, Oregon

Hells Canyon Project - FERC No. 1971

Idaho Power Company- Boise, Idaho 2002

Figure E.5-135

Location of River Flow Information Monitors
Below Hells Canyon Dam

Scale1:544,047

0 2.5 5 10 15 20 Miles

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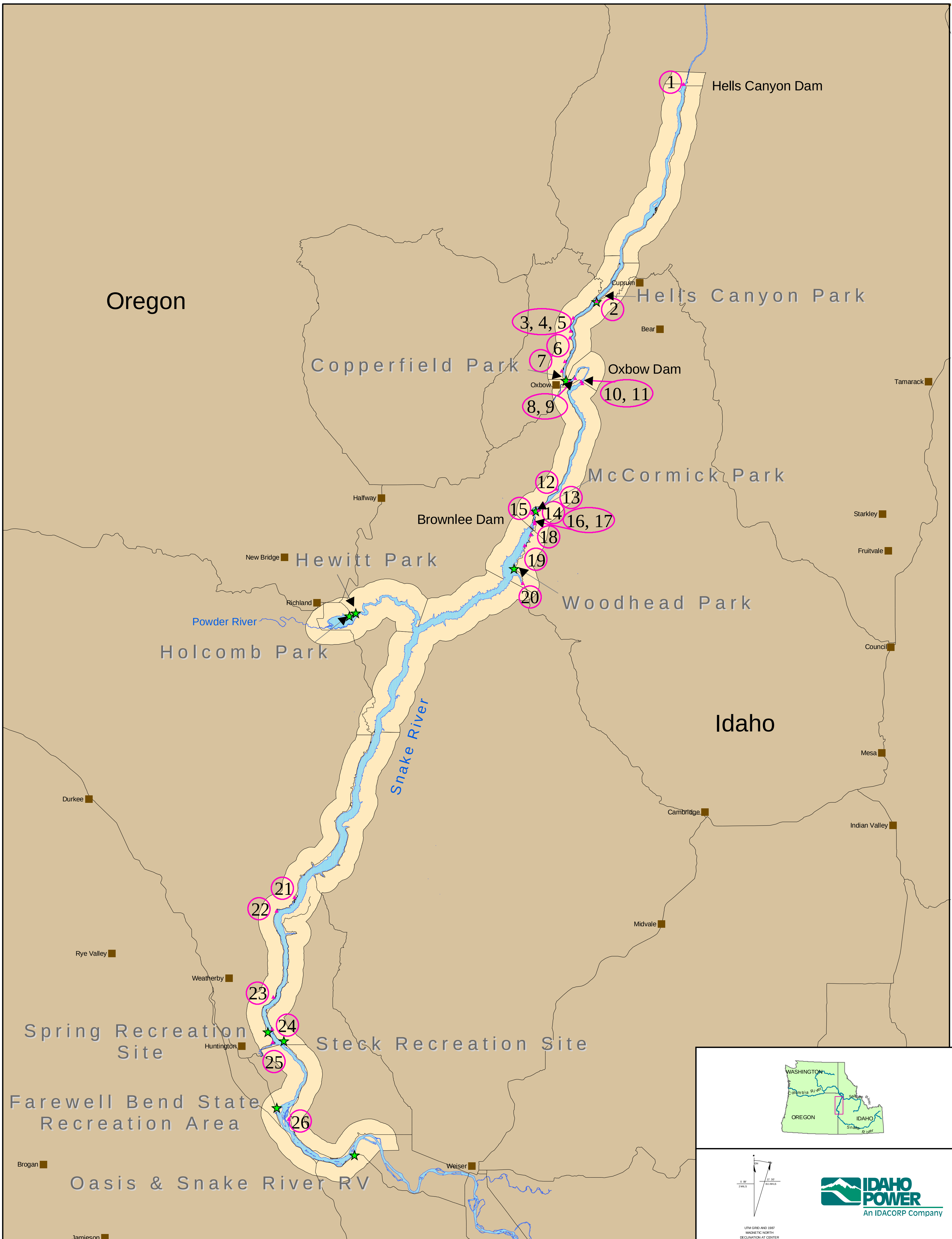

IPC Portable Toilet Locations in the HCC

\# ▲ Portable Toilets

1 RM 247.6 W Hells Canyon Power Plant (Employee use only)
2 RM 263.5 E Hells Canyon Park (4) (One handicapped)
3 RM 265.5 W Homestead Site
4 RM 266.6 W Holbrook Creek Section B
5 RM 266.8 W Airstrip Site Section A
6 RM 268.5 W West
7 RM 269 W Copperfield Boat Launch (Handicapped)
8 RM 269.8 W Oxbow Warehouse
9 RM 272.6 W Oxbow Tailrace
10 RM 270.1 W Oxbow Power Plant
11 RM 272.6 W Oxbow Dam West
12 RM 280.8 W Old Carters Landing
13 RM 282.3 W Bighorn Sheep Viewing Area
14 RM 283.7 E McCormick Park Overflow
15 RM 283.8 W Below Oxbow Bridge
16 RM 284.1 E Tree Site
17 RM 284.1 E Brownlee Switchyard (Employee use only)
18 RM 285 E Duke's Creek
19 RM 285.8 E Salmon Net Anchor Site
20 RM 288 E Brownlee Creek Arm
21 RM 316. 9 W Hibbard Creek
22 RM 318.2 W Morgan Creek
23 RM 324.1 W Railroad Tunnel Site Section A
24 RM 326.7 E Kevin's Alluvial Fan
25 RM 327.7 W Burnt River
26 RM 334 E Weiser Sand Dunes

Hells Canyon Project - FERC No. 1971
Idaho Power Company- Boise, Idaho-2003
Figure E.5-136
Locations of IPC Portable Toilets in the Hells Canyon Complex
Scale 1:383,326
0 2 4 8 12 Miles

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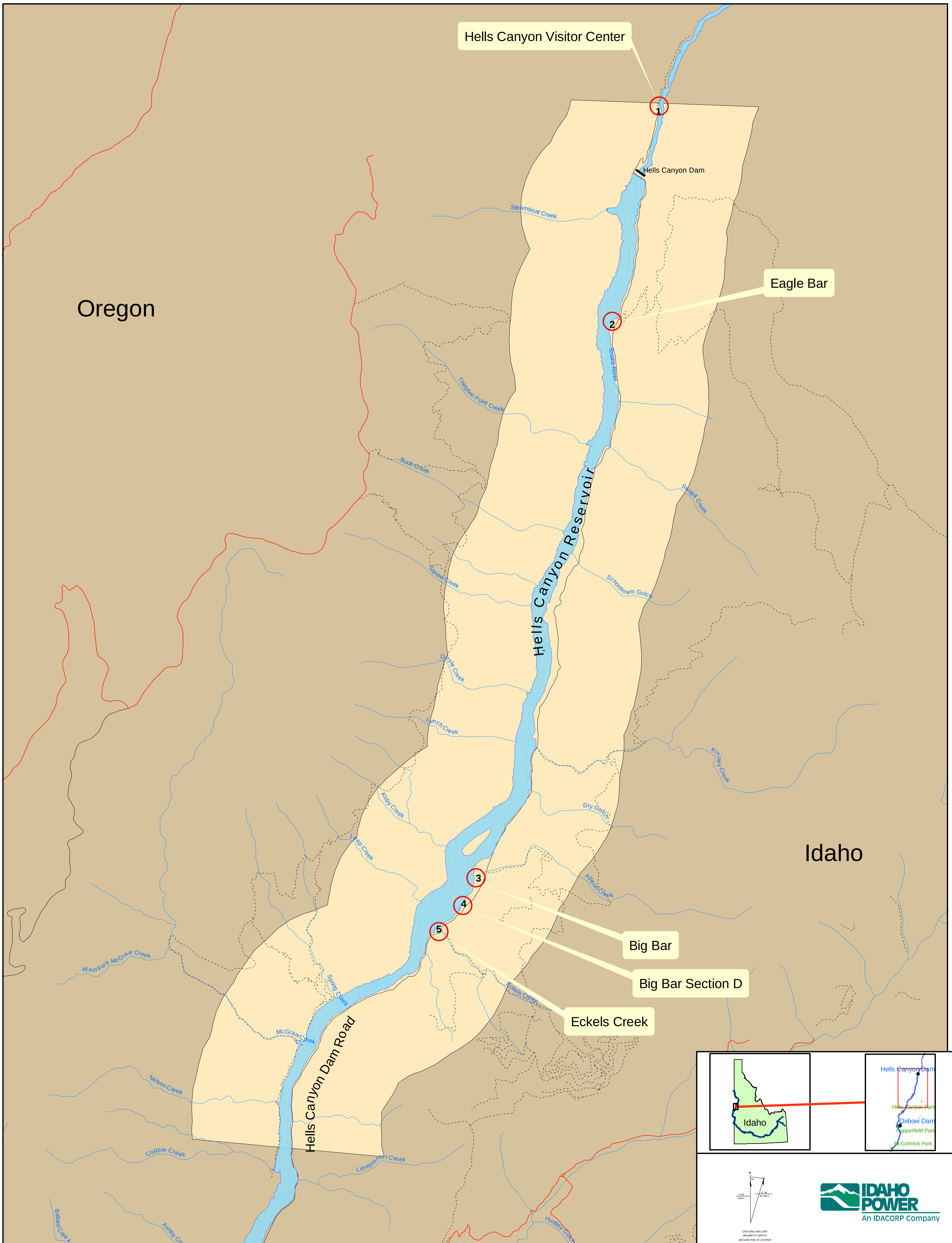

Zone 1 Legend

- Primary Road
- Light Duty Road
- Trail
- Snake River
- Zone 1

1. MOU between USFS and IPC
2. Enhance Eagle Bar Dispersed Recreation Site
3. Develop Site Plan for Big Bar Recreation Site
4. Enhance Boat Ramp and Associated Facilities at Big Bar Section D
5. Enhance Eckels Creek Dispersed Recreation Site

Hells Canyon Project - FERC No. 1971
Idaho Power Company- Boise, Idaho-2003
Figure E.5-137
Locations of Proposed Recreation PM&E Measures for Management Zone 1
Scale 1:67,631

1 0.5 0 1 Miles

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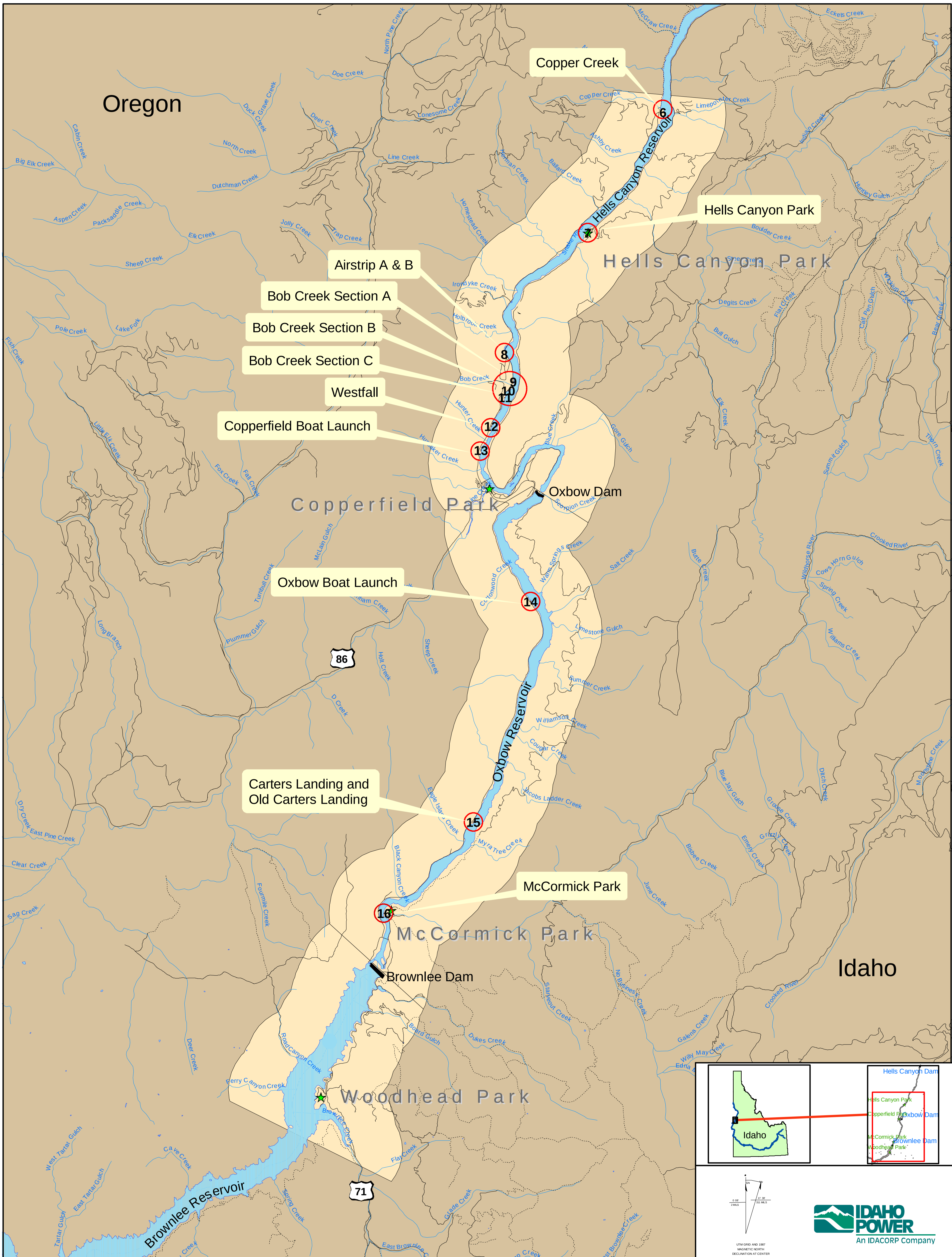

Zone 2 Legend

- Parks
- Primary Road
- Trail
- Snake River
- Zone 2

1. (6) Enhance Copper Creek Dispersed Recreation Site
2. (7) Reconstruct Hells Canyon Park
3. (8) Enhance Airstrip A&B Dispersed Recreation Site
4. (9) Enhance Bob Creek A Dispersed Recreation Site
5. (10) Enhance Bob Creek B Dispersed Recreation Site
6. (11) Enhance Bob Creek C Dispersed Recreation Site
7. (12) Enhance Westfall Dispersed Recreation Site
8. (13) Enhance Copperfield Boat Launch Area
9. (14) Enhance Oxbow Boat Launch
10. (15) Enhance Carters Landing and Old Carters Landing Recreation Site
11. (16) Reconstruct McCormick Park

Hells Canyon Project - FERC No. 1971
Idaho Power Company- Boise, Idaho 2003
Figure E.5-138
Locations of Proposed Recreation PM&E Measures for Management Zone 2
Scale 1:118,720
0 0.5 1 2 3 Miles

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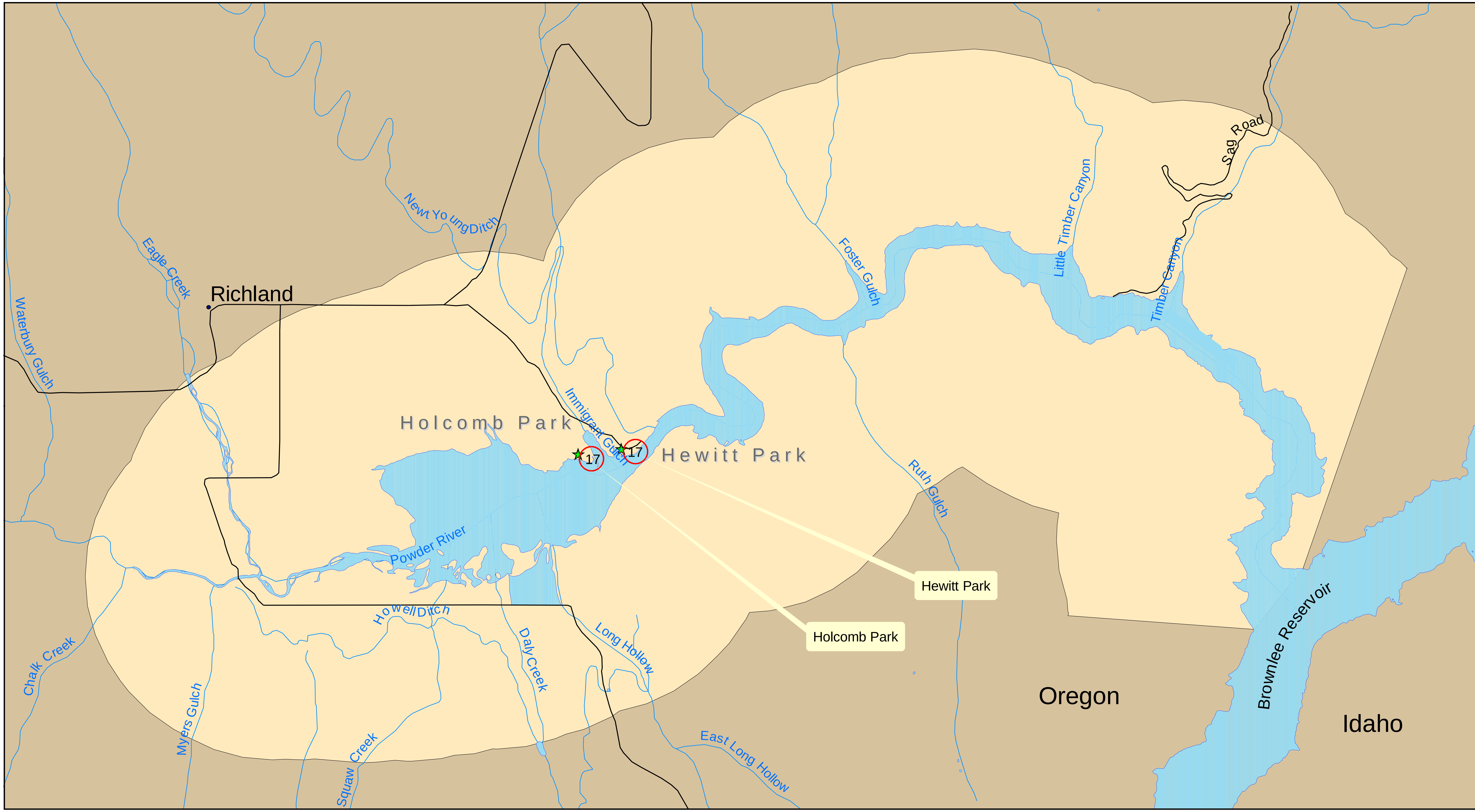

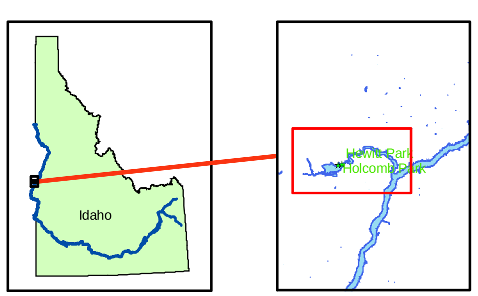

Zone 4 Legend

- Parks
- Primary Road
- Light Duty Road
- Snake River and Powder River Arm
- Zone 4
- 17 Enhance Hewitt and Holcomb Parks

IDAHO POWER
An IDACORP Company

UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
Idaho Power Company- Boise, Idaho 2003
Figure E.5-139
Locations of Proposed Recreation PM&E Measures for Management Zone 4
Scale 1:36,224

0 0.5 1 Miles

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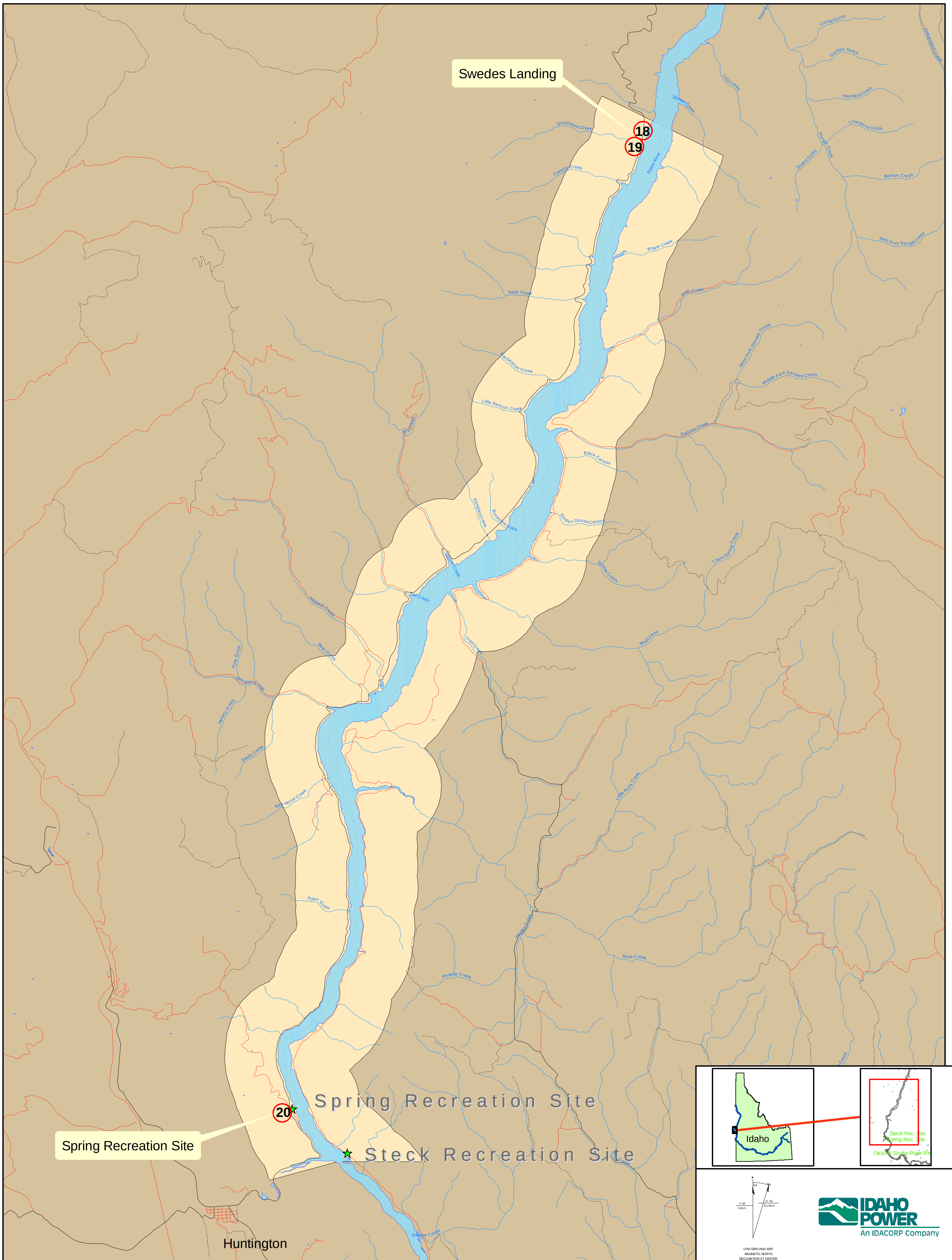

Hells Canyon Project - FERC No. 1971

Idaho Power Company- Boise, Idaho 2003

Figure E.5-140

Locations of Proposed Recreation PM&E Measures for Management Zone 5

Scale 1:113,656

Miles: 0, 0.5, 1, 2, 3

Zone 5 Legend

- Parks
- Primary Road
- Light Duty Road
- Trail
- Snake River
- Zone 5

18 Develop Low-Water Boat Launch at or near Swedes Landing

19 Enhance Swedes Landing

20 Enhance Spring Recreation Site

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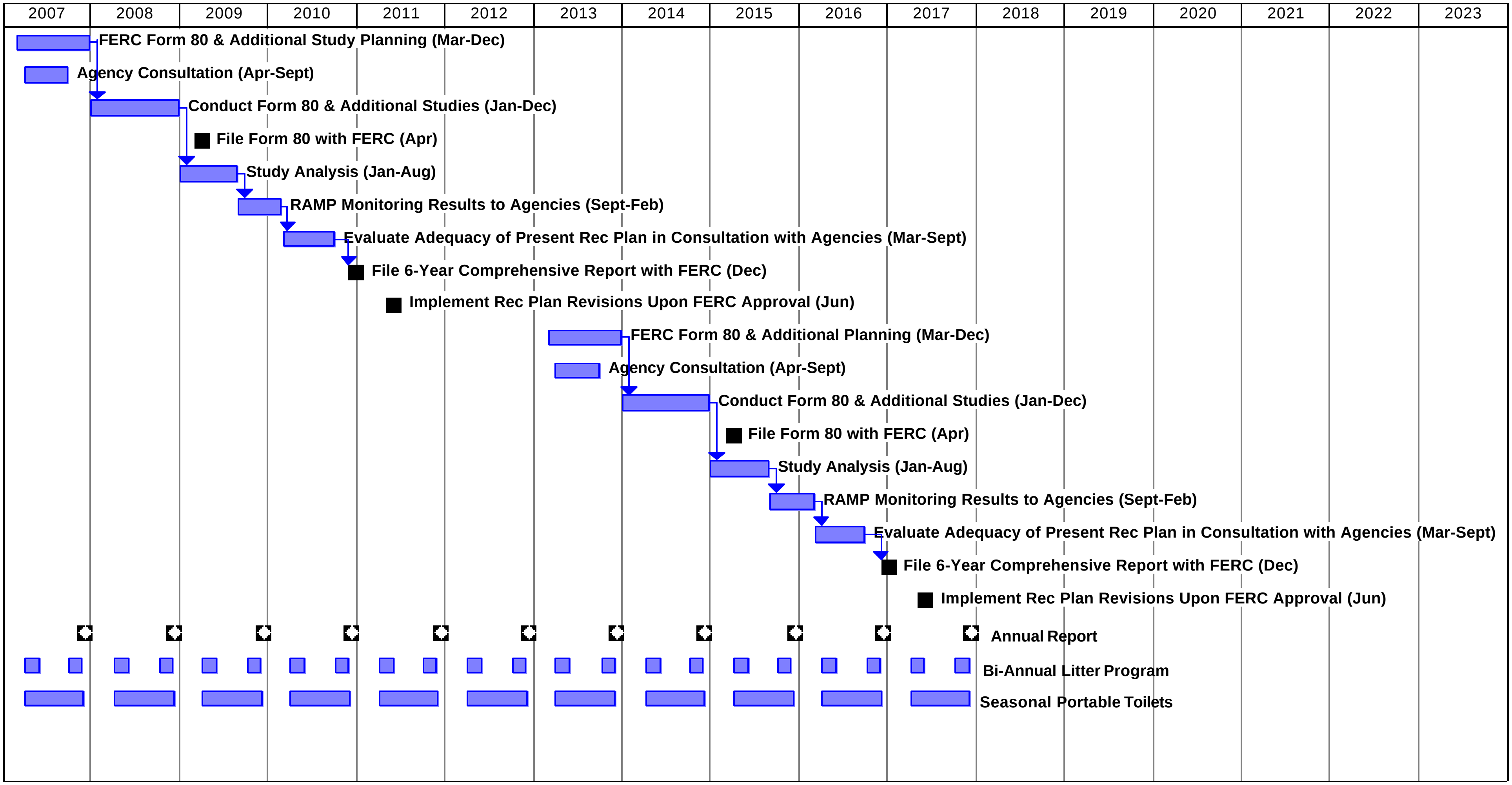

Figure E5-141

Example of monitoring, planning, and consultation activities over the course of two, 6-year cycles of RAMP.

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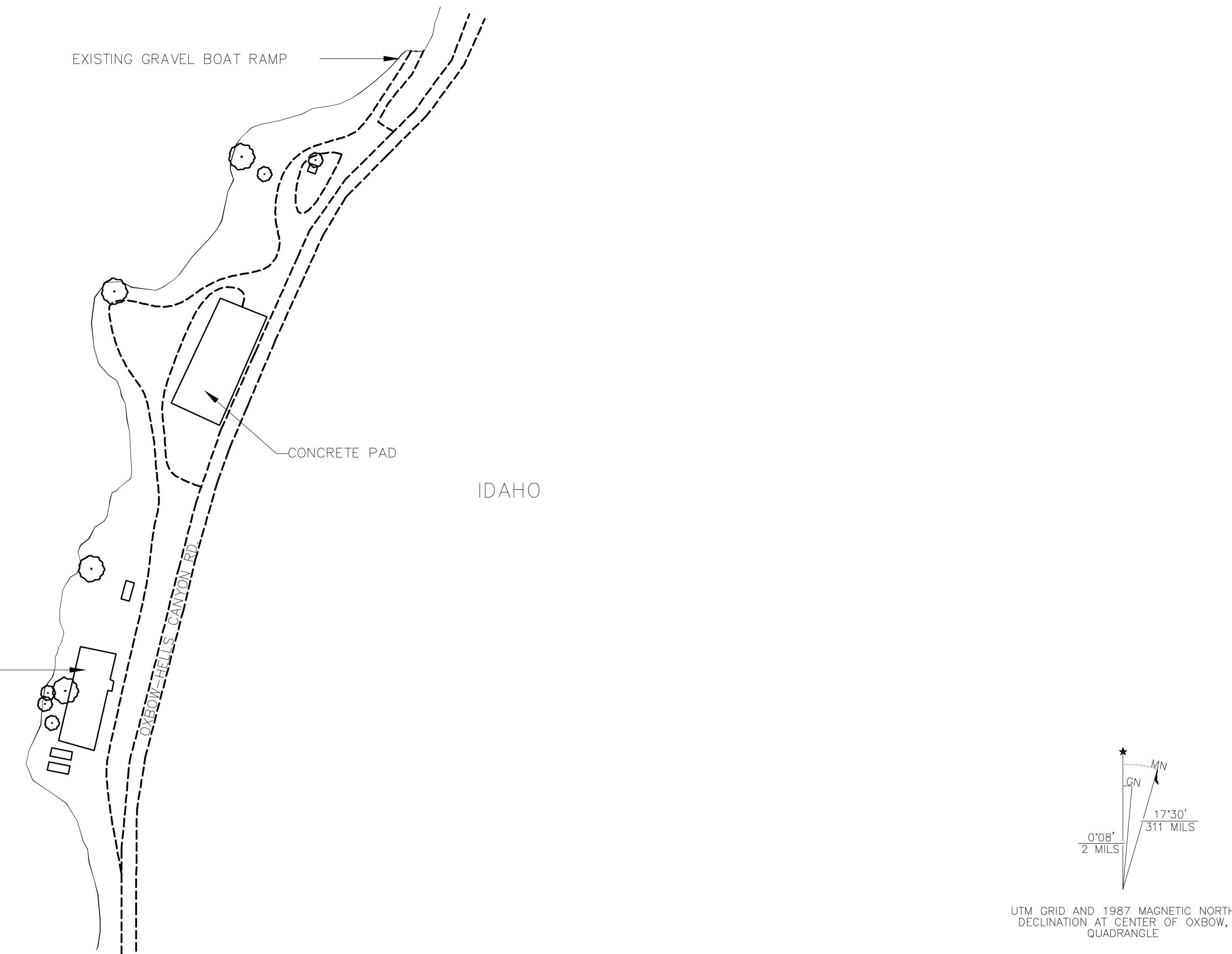


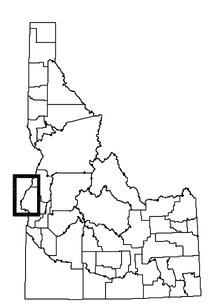
EXISTING
CONDITIONS

HELLS CANYON PROJECT – F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

EAGLE BAR
(USFS)
FIGURE E.5-142

0 15 30 60 90 120



Vicinity Map

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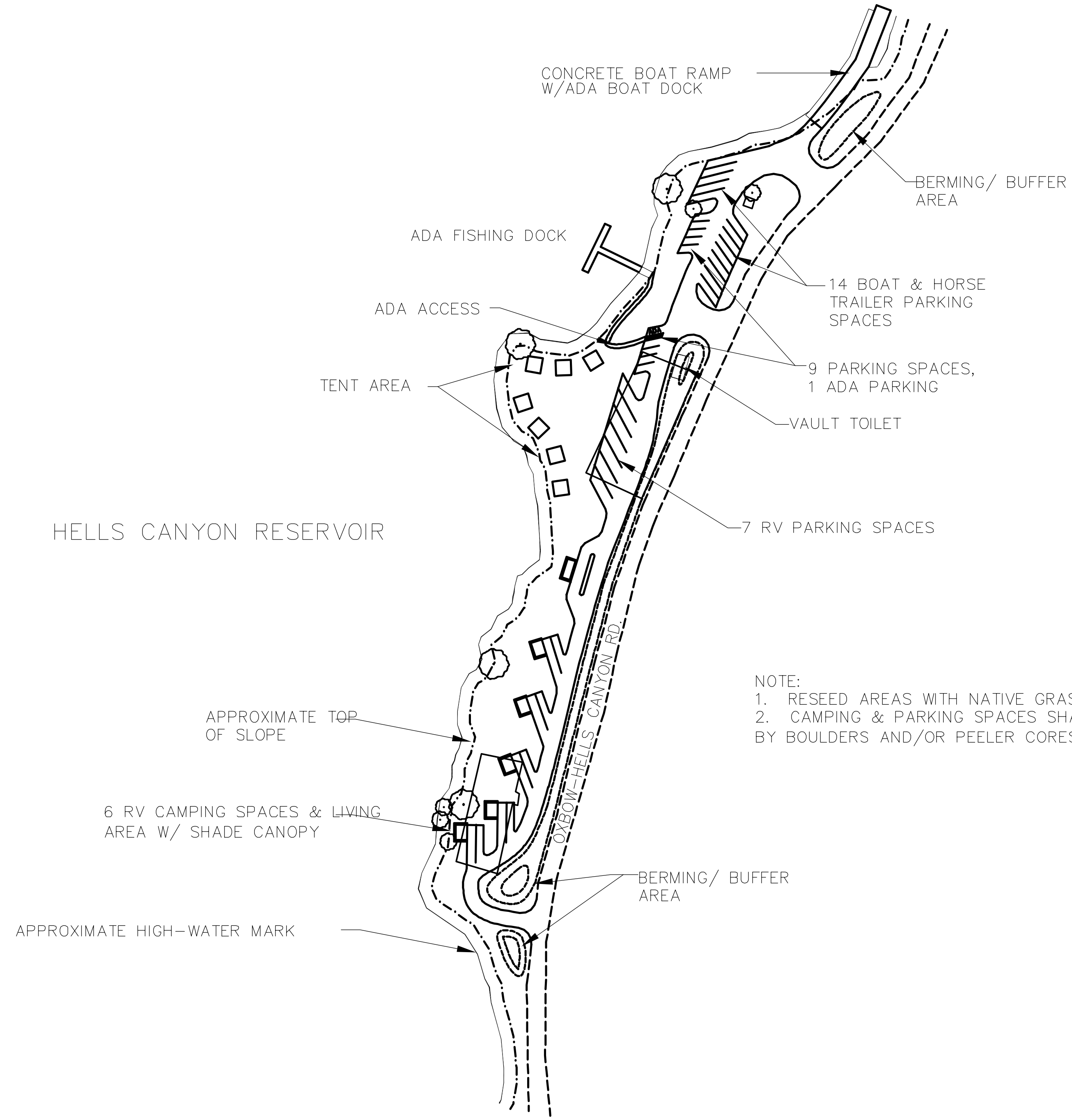
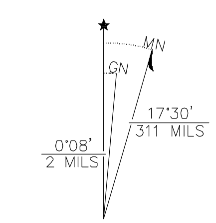
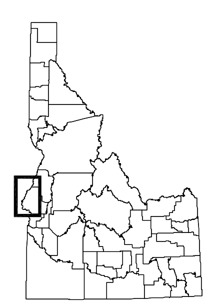


NOTE:
1. RESEED AREAS WITH NATIVE GRASSES.
2. CAMPING & PARKING SPACES SHALL BE DEFINED BY BOULDERS AND/OR PEELER CORES.



UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW, QUADRANGLE

PROPOSED CONCEPTS



Vicinity Map

HELLS CANYON PROJECT – F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

EAGLE BAR
(USFS)
FIGURE E.5-143

0 15 30 60 90 120

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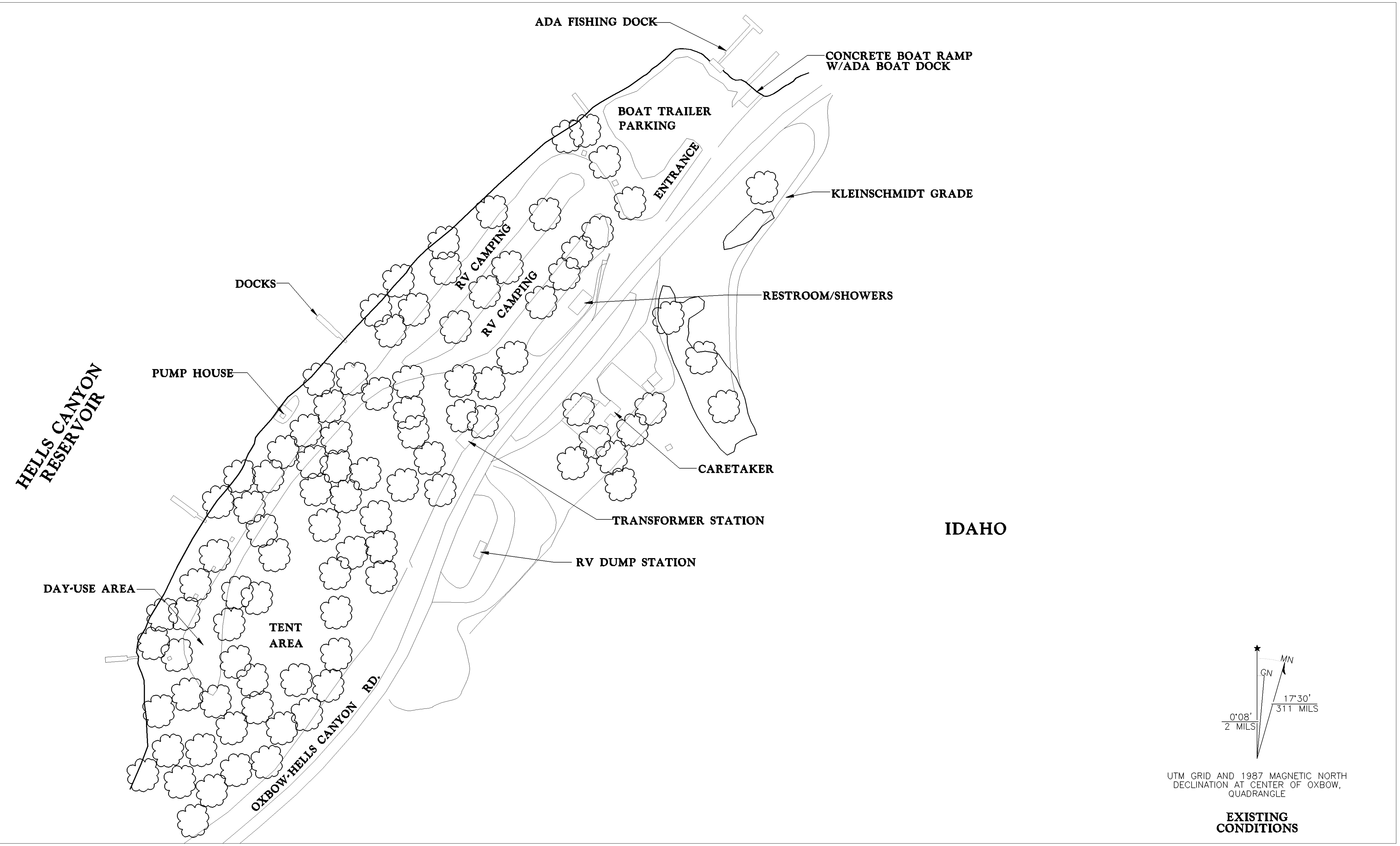
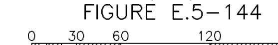
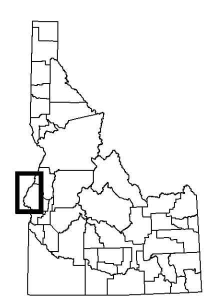


HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

HELLS CANYON PARK
(IPC)
FIGURE E.5-144





Vicinity Map

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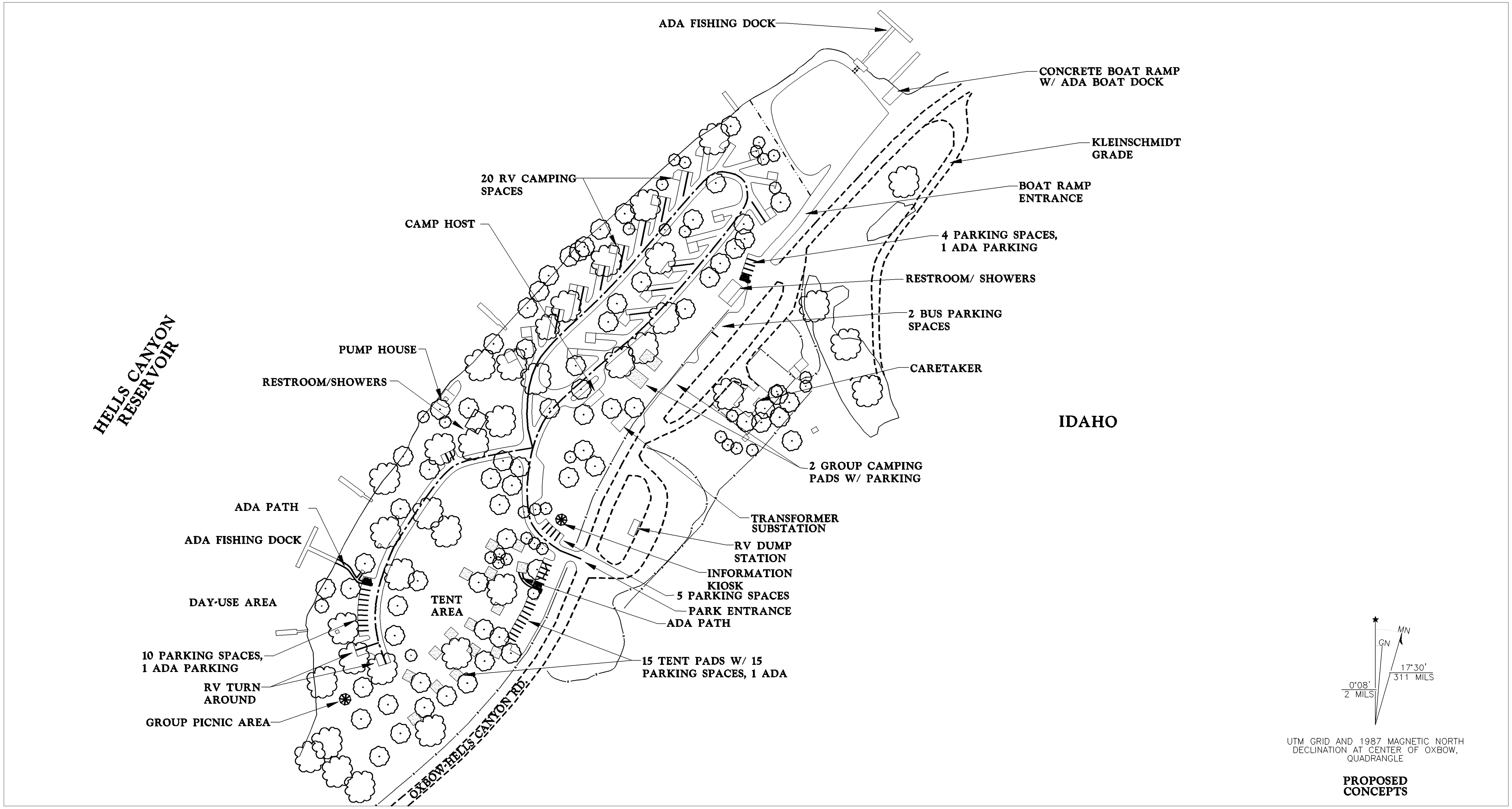


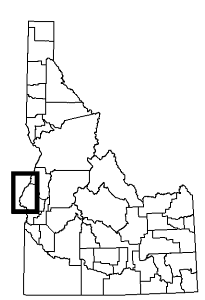
PROPOSED
CONCEPTS

HELLS CANYON PROJECT - F.E.R.C. NO. 1971
IDAHO POWER COMPANY – BOISE, IDAHO – 2002

HELLS CANYON PARK
(IPC)
FIGURE E.5-145

0 15 30 60 90 120

IDAHO POWER



Vicinity Map

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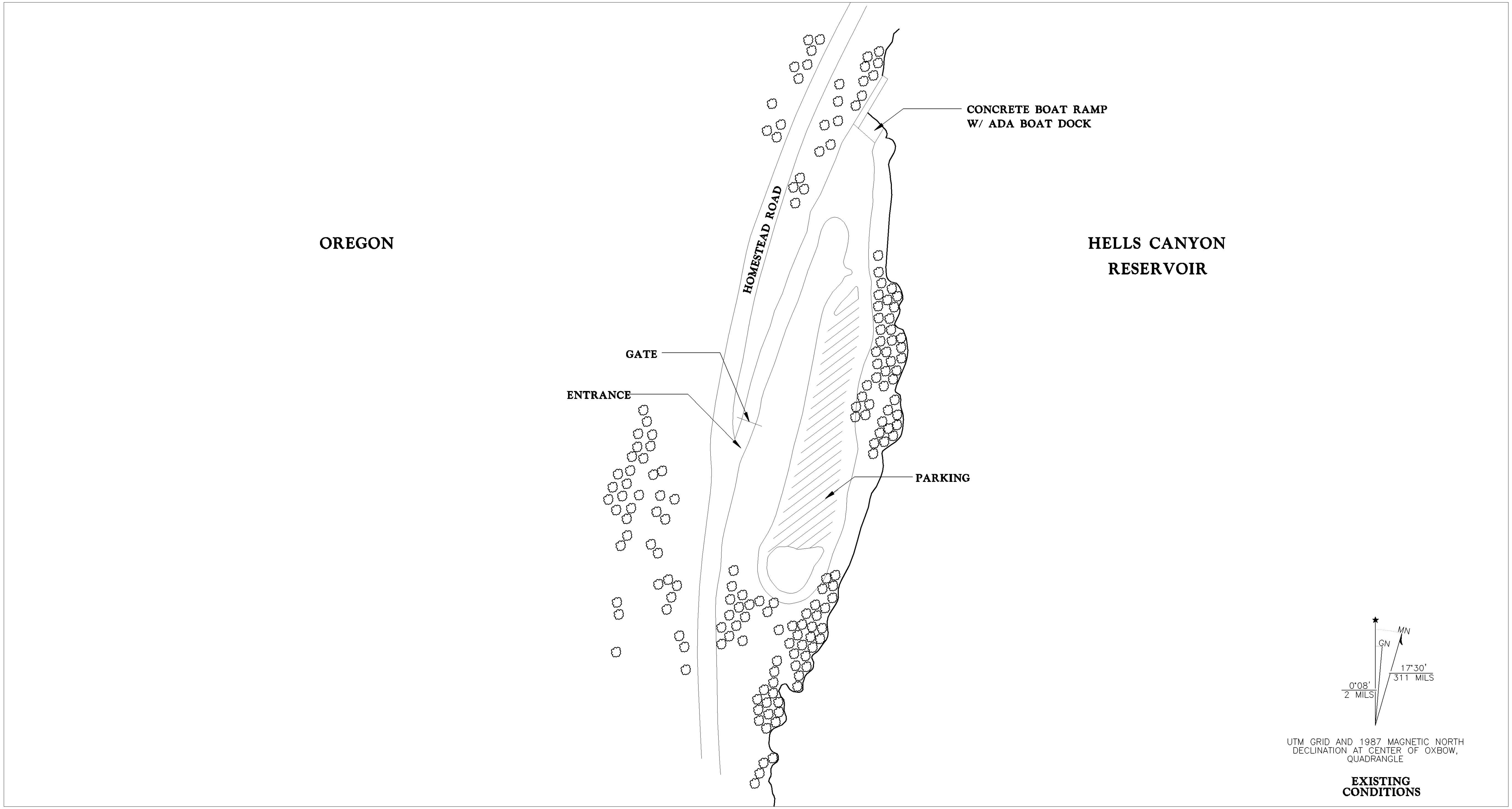
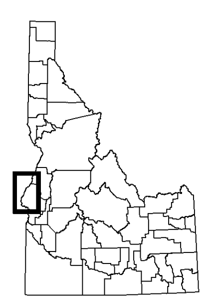


HELLS CANYON REC. PARK - F.E.R.C. No. 2778

IDAHO POWER COMPANY – BOISE, IDAHO – 1997

COPPERFIELD BOAT LAUNCH
(IPC)
FIGURE E.5–146

0 30 60 120 180



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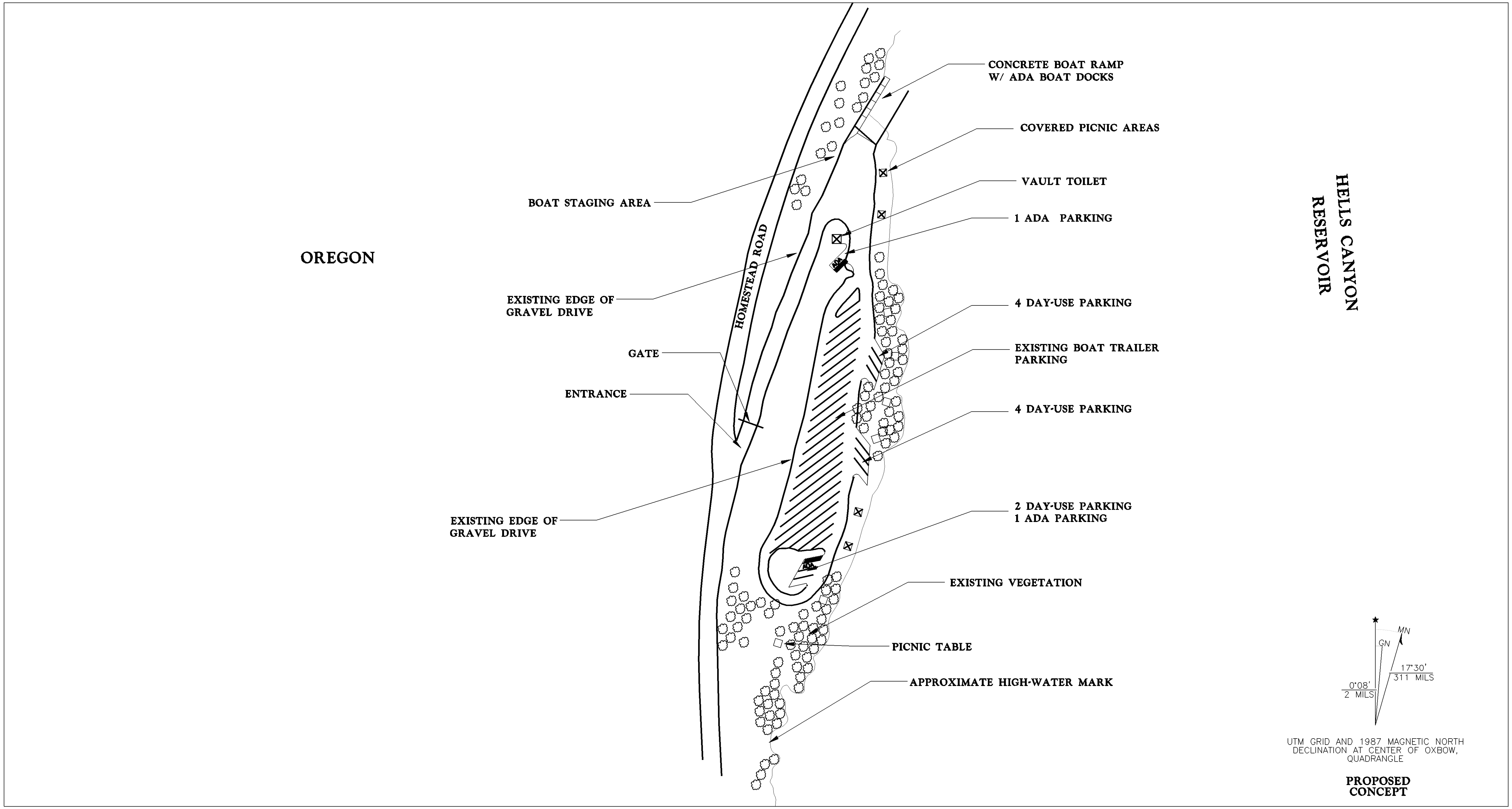
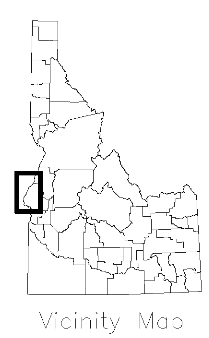


PROPOSED CONCEPT



HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

COPPERFIELD BOAT LAUNCH
(IPC)
FIGURE E.5-147

0 30 60 120 180

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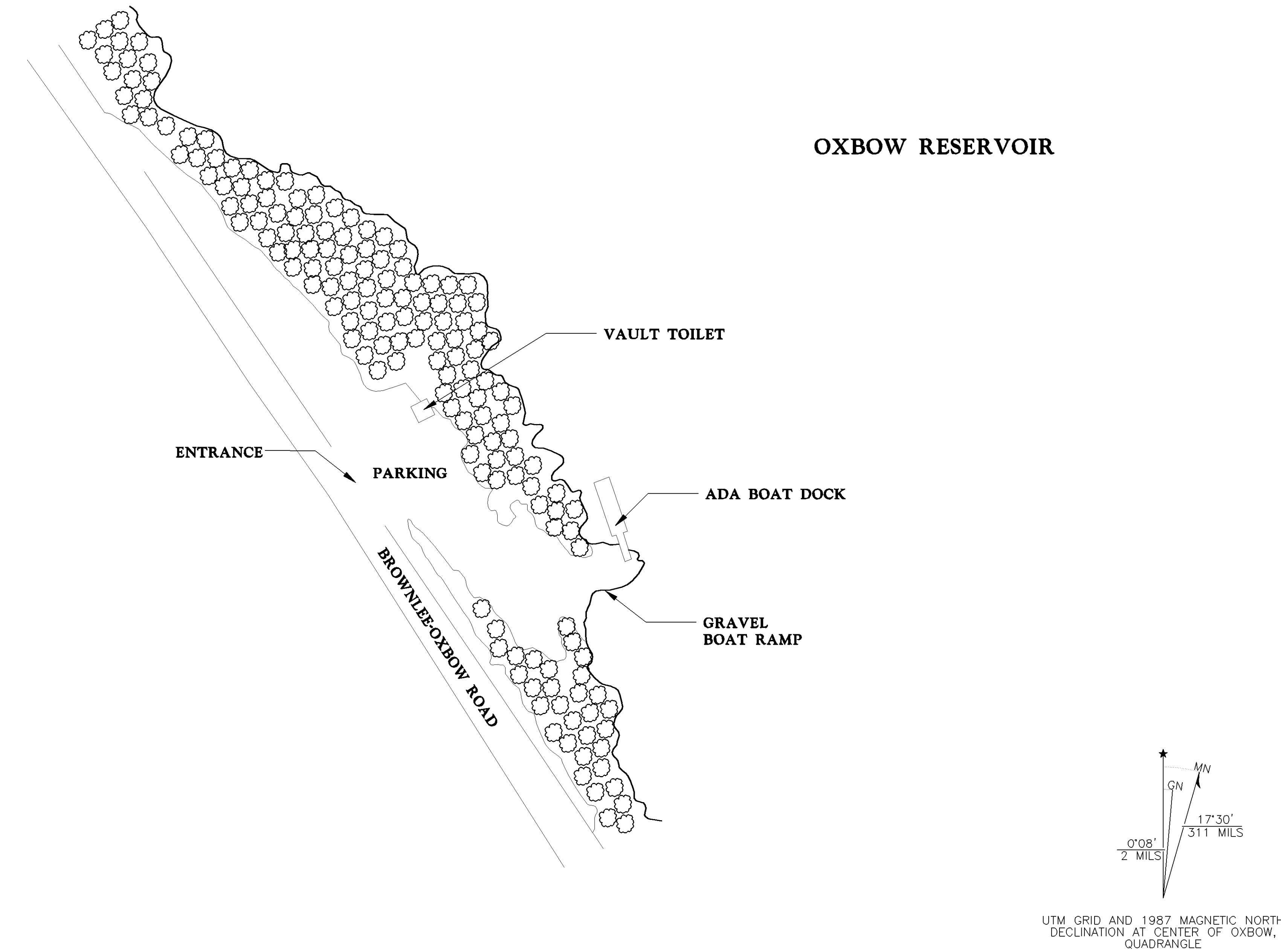
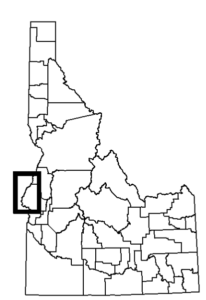


EXISTING CONDITIONS



Vicinity Map

HELLS CANYON REC. PARK - F.E.R.C. No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

OXBOW BOAT LAUNCH
(BLM/IPC)
FIGURE E.5-148

0 30 60 120 180

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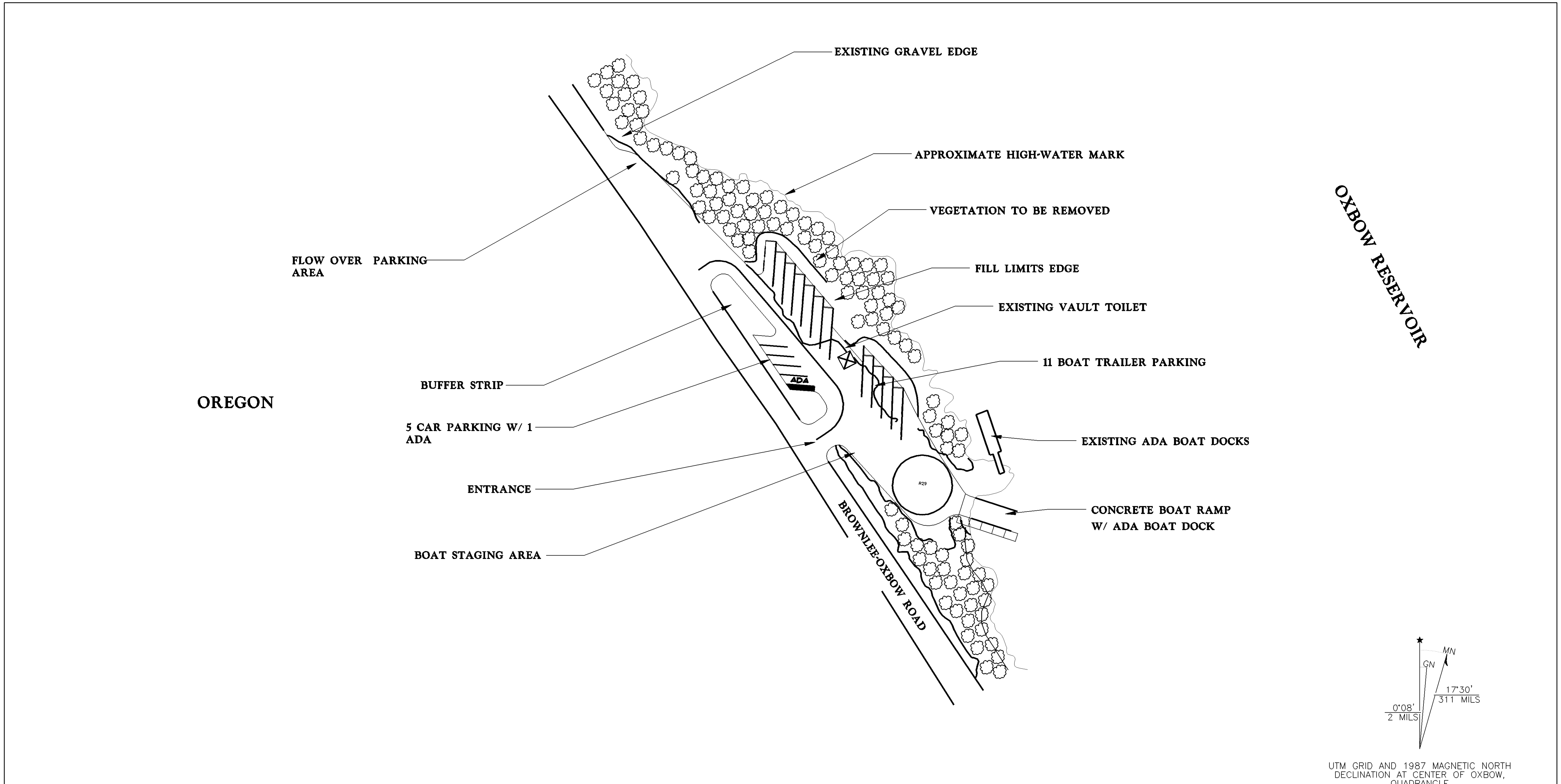


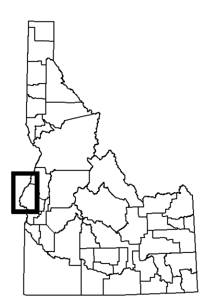
PROPOSED CONCEPT

HELLS CANYON REC. PARK - F.E.R.C. No. 1971

IDAHO POWER COMPANY - BOISE, IDAHO - 2002

OXBOW BOAT LAUNCH
(BLM/IPC)
FIGURE E.5-149

0 30 60 120 180



Vicinity Map

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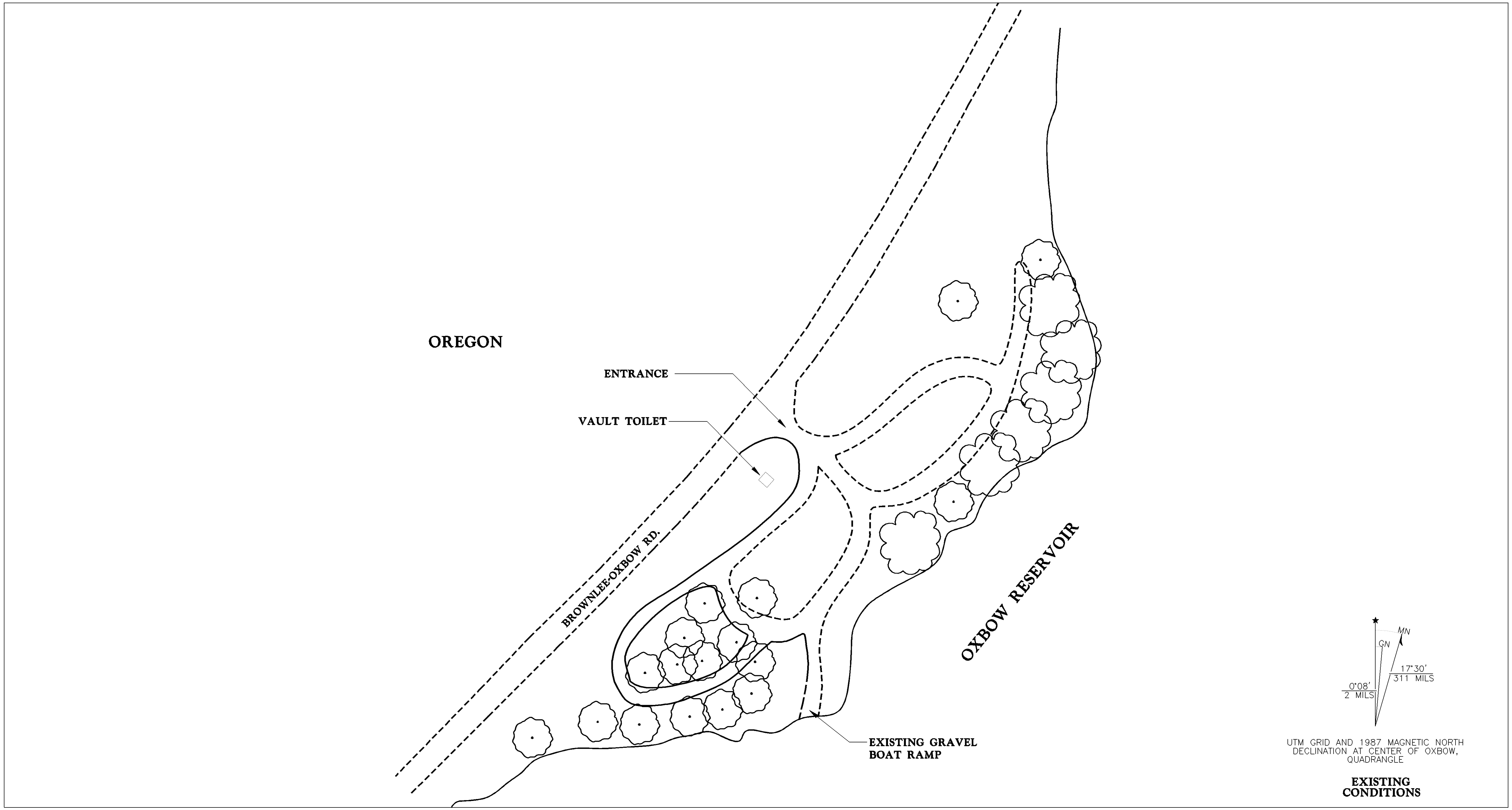


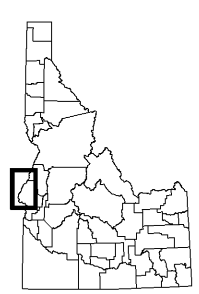
EXISTING
CONDITIONS

HELLS CANYON PROJECT - F.E.R.C. NO. 1971
IDAHO POWER COMPANY - BOISE, IDAHO - 2002

CARTERS LANDING
(BLM/IPC)
FIGURE E.5-150

0 15 30 60 90 120

IDAHO POWER


Vicinity Map

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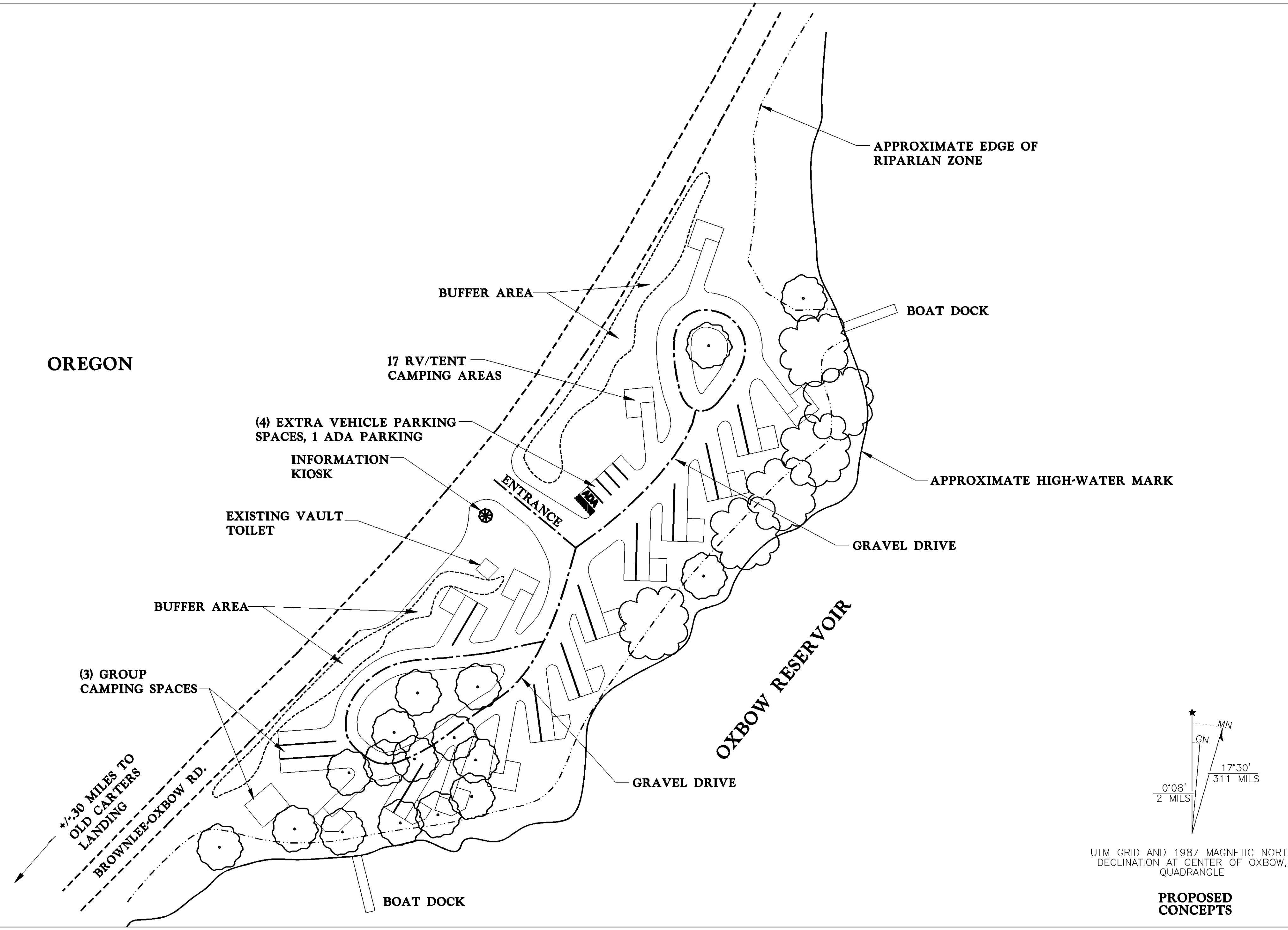

NOTE:
1. RESEED AREAS WITH NATIVE GRASSES.
2. CAMPING & PARKING SPACES SHALL BE DEFINED BY BOULDERS AND/OR PEELER CORES.

PROPOSED CONCEPTS

IDAHO POWER

Vicinity Map

HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

CARTERS LANDING
(BLM/IPC)
FIGURE E.5-151

0 15 30 60 90 120

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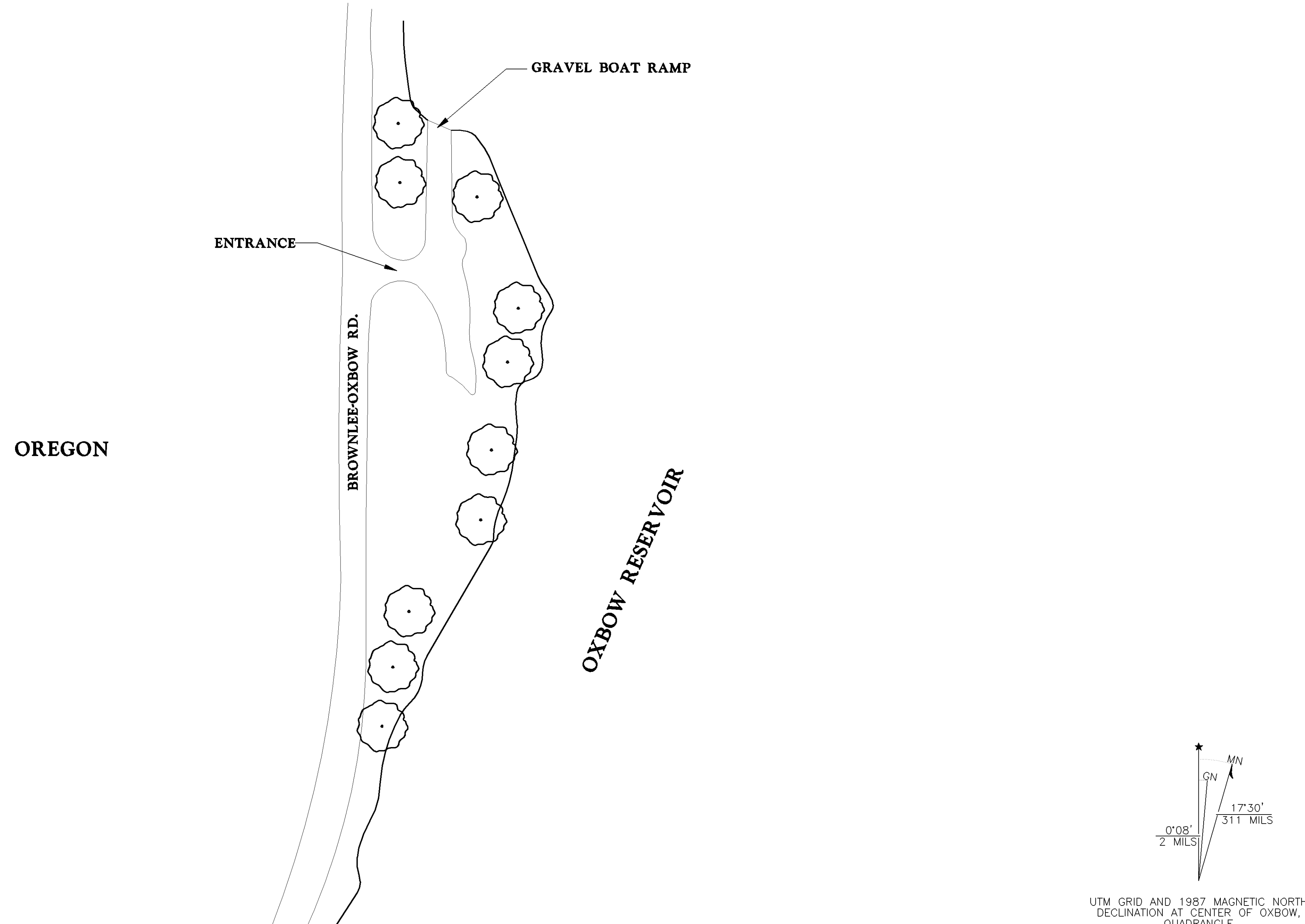


EXISTING CONDITIONS

HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

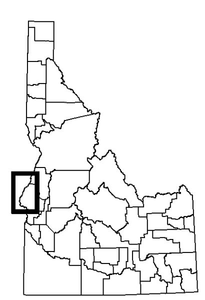
OLD CARTERS LANDING

(IPC)

FIGURE E.5–152

0 5 10 20 30 40 50 60

IDAHO POWER



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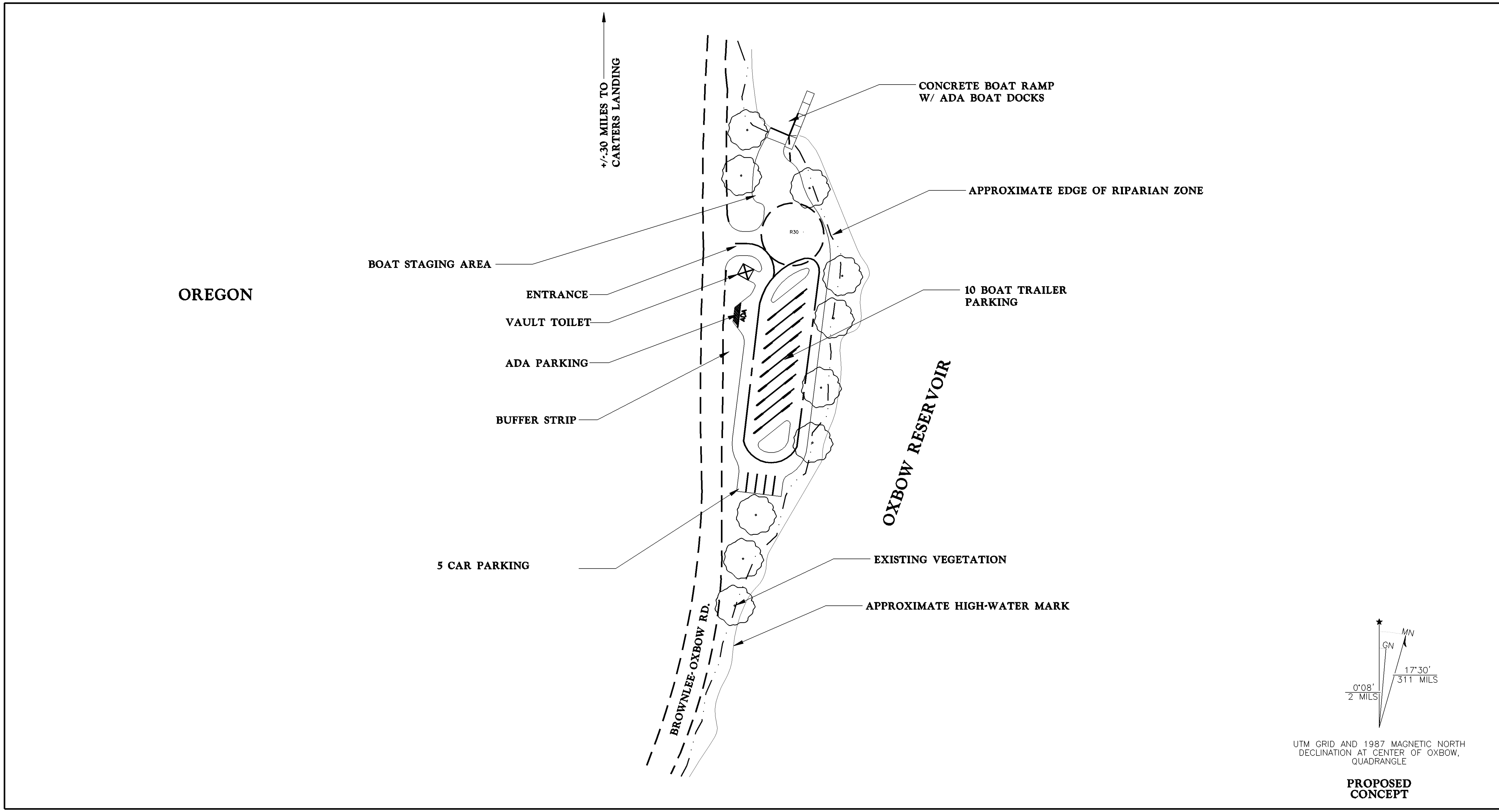

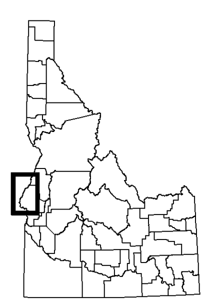

Vicinity Map

HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

OLD CARTERS LANDING
(IPC)
FIGURE E.5–153

0 5 10 20 30 40 50 60

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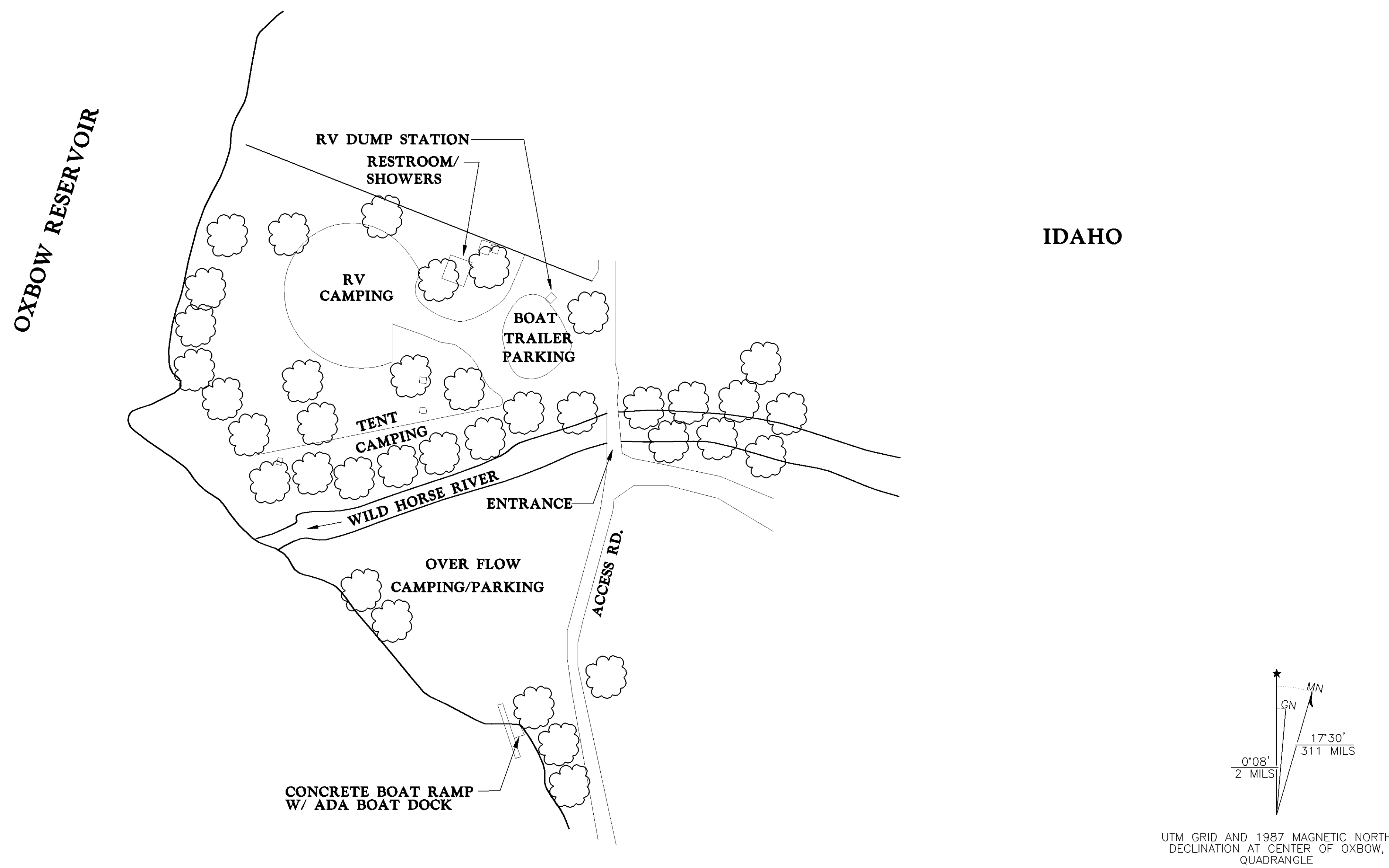
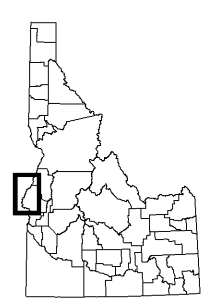


EXISTING
CONDITIONS



Vicinity Map

HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

McCORMICK PARK
(IPC)
FIGURE E.5-154

0 15 30 60 90 120

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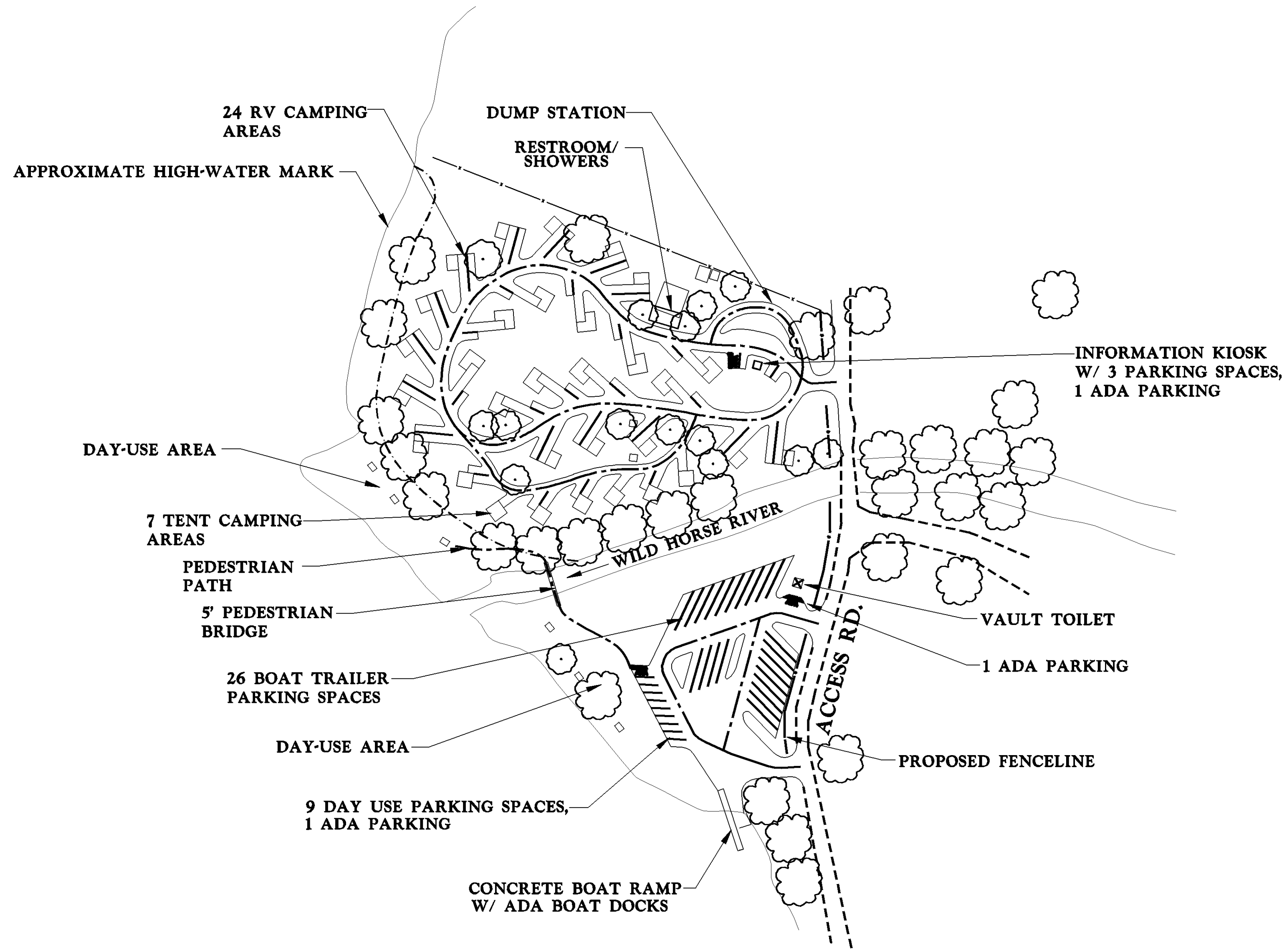
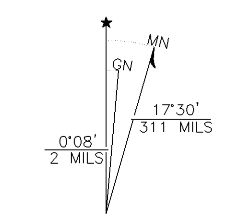




UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW, QUADRANGLE

PROPOSED CONCEPT

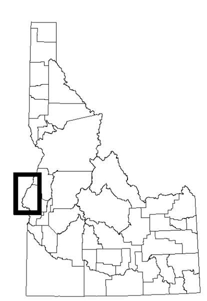
HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

McCORMICK PARK
(IPC)
FIGURE E.5–155

0 15 30 60 90 120

IDAHO POWER



Vicinity Map

file: F:\USER\ZAC\DAVIDM\FERC\EXBIT_E\MCMK_PROPOSED.DWG saved: 03/08/02 08:44 by: CLM3793

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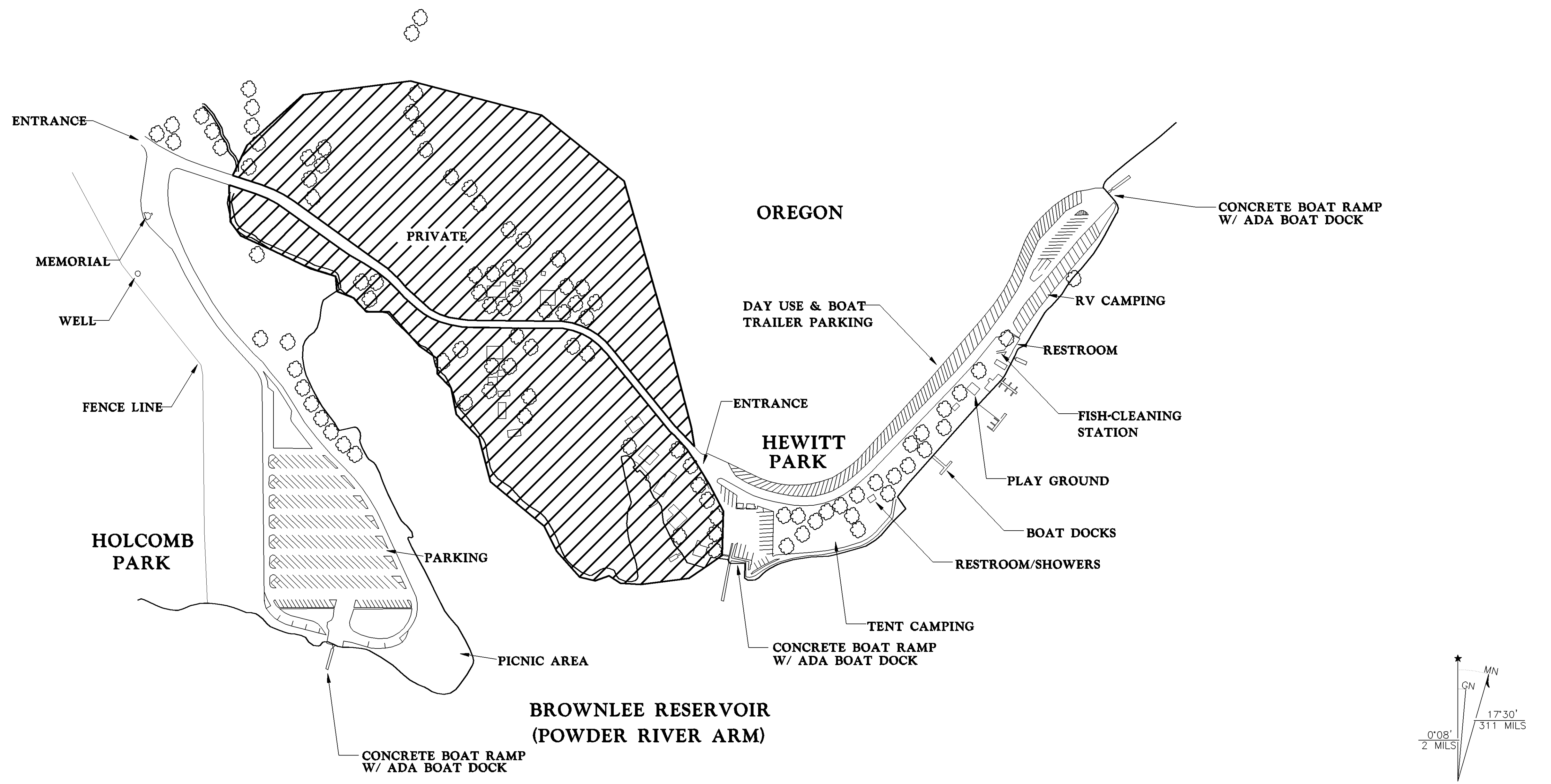
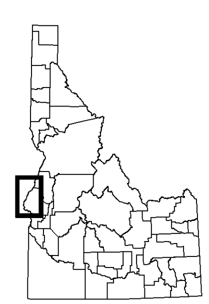


EXISTING CONDITIONS



HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

HOLCOMB AND HEWITT PARKS
(BAKER COUNTY)
FIGURE E.5-156

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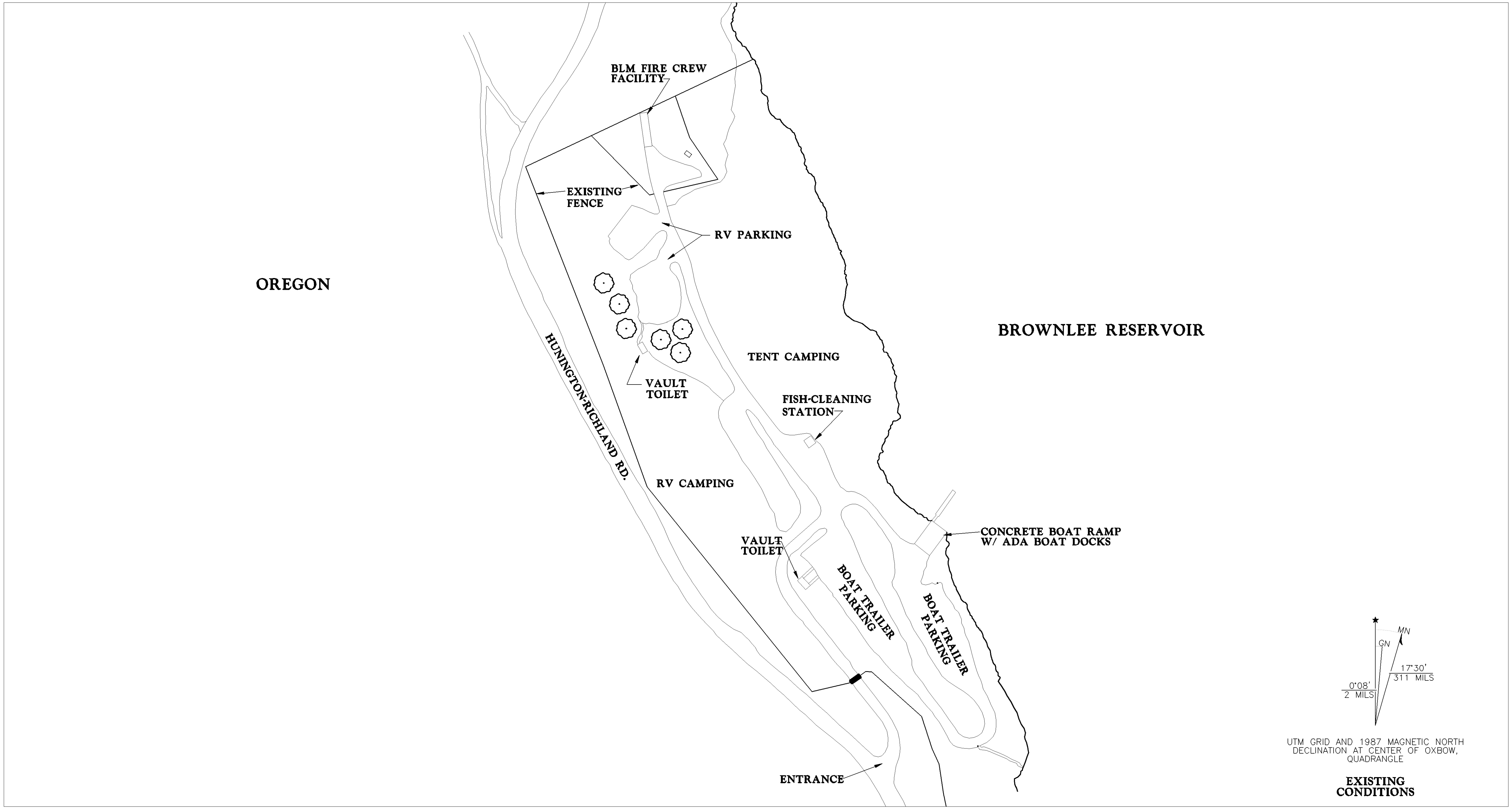
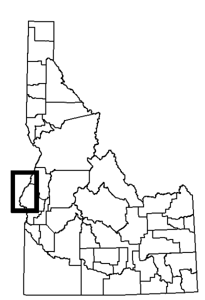


HELLS CANYON PROJECT - F.E.R.C. NO. 1971

IDAHO POWER COMPANY – BOISE, IDAHO – 2002

SPRING RECREATION SITE
(BLM)
FIGURE E.5–157

0 10 30 60 90



Vicinity Map

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The *Code of Federal Regulations* below—18 CFR § 4.51(f)(6)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(f)(6) *Report on land management and aesthetics*. The report must discuss management of land within the proposed project boundary, including wetlands and floodplains, and the protection of the recreational and scenic values of the project. The report must be prepared following consultation with local and state zoning and land management authorities and any Federal or state agency with managerial authority over any part of the project lands. Consultation must be documented by appending to the report a letter from each agency consulted indicating the nature, extent, and results of the consultation. The report must contain:
>
> (i) A description of existing development and use of project lands and all other land abutting the project impoundment.
>
> (ii) A description of the measures proposed by the applicant to ensure that any proposed project works, rights-of-way, access roads, and other topographic alterations blend, to the extent possible, with the surrounding environment.
>
> (iii) A description of wetlands or floodplains within, or adjacent to, the project boundary, any short-term or long-term impacts of the project on those wetlands or floodplains, and any mitigative measures in the construction or operation of the project that minimize any adverse impacts on the wetlands or floodplains.
>
> (iv) A statement, including an analysis of costs and other constraints, of the applicant's ability to provide a buffer zone around all or any part of the impoundment, for the purpose of ensuring public access to project lands and waters and protecting the recreational and aesthetic values of the impoundment and its shoreline.
>
> (v) A description of the applicant's policy, if any, with regard to permitting development of piers, docks, boat landings, bulkheads, and other shoreline facilities on project lands and waters.
>
> (vi) Maps or drawings that conform to the size, scale and legibility requirements of § 4.39, or photographs, sufficient to show the location and nature of the measures proposed under paragraph (f)(6)(ii) of this section (maps or drawings in this exhibit may be consolidated).

E.6. Report on Land Management and Aesthetics

E.6.1. Description of Existing Conditions

The project area for the Hells Canyon Complex (HCC)[1] extends from Cobb Rapids below the community of Weiser, Idaho, at river mile (RM) 343 to Hells Canyon Dam at RM 247.6 on the Snake River, a distance of just over 95 miles. The dam is also the southern boundary of the Hells Canyon National Recreation Area (HCNRA) on the Idaho side of the river. The HCNRA was established by Congress in 1975. Besides the project area, the study area for land use and aesthetic values includes a reach from the bridge near Weiser (RM 351.2) to the upstream end of the project boundary (referred to as the Weiser reach). Also included in the study area is the free-flowing reach of the river below Hells Canyon Dam downstream to RM 176.1, or the northern boundary of the HCNRA. The total river distance of the study area from south to north is about 170 miles. The study area extends east to west from the crest of the Seven Devils Mountains in Idaho to the crest of the Blue Mountains in Oregon. These mountains form a nearly 10,000-foot-deep canyon, the deepest in North America. Figure E.6-1 shows the extent of the project area within the study area described above. The project boundary is shown in

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project.

Figure E.6-2. The Applicant has adjusted the project boundary toward the reservoir on some federal lands to a contour line. This contour line serves as the project boundary on private lands and is consistent with the Federal Energy Regulatory Commission (FERC) guidelines for establishing project boundaries (see discussion in section E.6.1.1.).

Land in Hells Canyon is used for six primary purposes: cultivated agriculture, livestock grazing, hydroelectric power generation, recreation, wildlife habitat, and residential and rural residential use. In the past, industrial mining and timber harvest also occurred. Any mining remaining in the area is believed to be recreational rather than industrial. Although timber sales and harvest may still occur at higher elevations, no harvest is known to have taken place recently. Interstate 84 (I-84) passes near the upper end of the project area on the Oregon side. A small area of commercial use occurs adjacent to I-84 at Farewell Bend. The canyon's geography largely determines the distribution of these land uses and the aesthetic character of the area.

Hells Canyon, located in the high desert region, is arid to semiarid in climate. The study area's average annual precipitation is about 15 to 20 inches, with average annual evapotranspiration being about 52 inches. Most precipitation occurs in winter and spring. Seasonal temperatures within the canyon range from about 23 °F in January to about 95 °F in July. Winters are normally mild, while summers are hot on the canyon floor. At higher elevations in the study area, temperatures are somewhat cooler. The canyon floor's elevation ranges from 2,090 feet above mean sea level (msl) near Weiser to 910 feet msl near the north end of the study area. Within the study area, the canyon ranges in depth from about 2,000 feet at Weiser to nearly 10,000 feet near Hells Canyon Dam. The wide variation in elevation creates varying climatic zones and vegetation on the canyon walls.

The canyon and adjacent mountains are folded and faulted metamorphosed sediments and volcanic materials overlain by the Columbia River basalt. The canyon was formed in more recent geologic time as the river eroded the mountains. The topography is generally steep and broken, with many rock outcrops and talus slopes. Canyon walls rise vertically in the deepest areas. Side canyons have been deeply dissected by drainage, resulting in many tributaries entering the river throughout the study area.

The upper part of the study area (the Weiser reach) lies within the extensive Snake River Plain, which covers much of southern Idaho and a small part of northeastern Oregon. The plain transitions to rolling hills and then to rugged mountains within which the Snake River has formed Hells Canyon. The canyon reflects this topography. At the upstream end, the rolling hills provide easy access to the reservoir. Large, level areas allow human activity, such as agricultural development and a number of recreation areas. Downstream, the hills become steeper, and near the Powder River confluence, the hills are considered steep. To this point, the hills are generally treeless and covered with sagebrush (*Artemisia* species) and bunchgrasses. Human development occurs in a few pockets along the reservoir.

The Powder River arm of the reservoir differs significantly from the mainstem of the Snake River. Although steep hillsides guard the confluence, the arm opens into a broad valley farther upstream. The gently rolling lands adjacent to the reservoir and tributary streams have significant stands of riparian vegetation. Inland, the land is intensely cultivated and grazed, and the community of Richland, Oregon, lies near the head of the reservoir arm.

Downstream of Brownlee Dam, the land changes: the steep, grass-covered slopes continue but intermix with basalt outcroppings and bluffs, talus, and vegetative communities ranging from bunchgrasses to Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*). Because there are fewer level areas between the hillsides and the reservoir than there are upstream, human occupation is limited. In the small pockets of land that do occur, however, signs of human use are visible.

Downstream of Oxbow Dam, the canyon becomes awesome. The steep hills become primarily basalt walls. Some level areas exist on the Oregon (or west) side, areas that contain a few clusters of development, but few level areas occur on the Idaho (or east) side. Douglas-fir and ponderosa pine stands approach the narrow canyon bottom in many places. Below Hells Canyon Dam, this landscape continues to a point near Johnson Bar (RM 230), where cliffs again return to steep hillsides, producing a somewhat wider canyon. Below Johnson Bar, in several areas, the landscape reverts to high cliffs divided by the river, but generally the canyon is wider with relatively gently sloping shorelines.

Earliest known users of the area were Native American hunters and gatherers. After Congress passed the Homestead Act in 1862, the canyon saw substantial homesteading activity (Carrey et al. 1979). Further development, including establishment of the communities of Copperfield, Robinette, and Homestead in Oregon, was connected to mining, railroads, and early hydropower in the canyon. During this period, many more people lived in the canyon than do now. Communities ranged in size from a few people up to around 500. Mining was common in the canyon by the 1880s, and several historic mines can still be seen (IPC 1997). The Kleinschmidt Grade, a road entering the canyon near present-day Hells Canyon Park, was constructed in 1891 to carry ore from the mines down to steamboats that would ship it upriver to railheads near the upper end of the project area (Carrey et al. 1979). Agriculture flourished in the canyon during this time to provide food to the miners, and some orchards still remain. By the twentieth century, the age of electricity had arrived. Mining was the earliest market for electricity in the region, and the Snake River was the obvious source for hydroelectricity in southern Idaho and northeastern Oregon. In 1908, the Idaho-Oregon Light and Power Company developed a hydroelectric project on the Snake River at the Oxbow site in response to the need for power at various nearby mines. The company shortly thereafter encountered financial difficulties. During this period, many small companies formed, and competition for markets and resources was high. In 1916, to salvage investments that had been made in that early project, five companies were merged into Idaho Power Company.

Agricultural development became the next industry to generate electrical growth in the area as entrepreneurs searched for new markets in the sparsely populated and relatively isolated area. Those lands that could not be served by the newly formed gravity flow irrigation projects could often be served with water provided by relatively inexpensive electric pumps. Electric street-lighting in communities and then lighting in individual homes became a status symbol and then a necessity. Early in the twentieth century, the Applicant owned a number of smaller hydroelectric projects along the Snake River from Shoshone Falls to Swan Falls.

In the early 1940s, the company became part of a power pool of companies in the Northwest. By interlinking electric power plants and transmission systems, this pool provided flexibility to trade power as needed. Following World War II, the U.S. Army Corps of Engineers and U.S. Bureau of Reclamation developed plans to construct a 600-foot high dam at Hells Canyon Creek on the

Snake River. As with existing projects on the Columbia River, power would be produced and sold by the federal government. However, the Applicant held a federal power site-withdrawal that had been granted to its predecessor at the Oxbow site in the early 1900s and, in 1947, filed with the Federal Power Commission (FPC, the predecessor to FERC) to build the dam.

When the Applicant filed its final application with the FPC to permit the Oxbow Project's construction in 1949, it also notified the federal agency of its intent to construct four additional projects in this reach of the Snake River. The Truman administration had backed the federal project, but the change in administration in 1952 resulted in a year of FPC hearings on the company's application, culminating in August 1955 with permits issued for construction of the Oxbow Project, the Brownlee Project upstream at the Brown Lee Ferry, and a lower dam downstream at Hells Canyon Creek. Construction on the Brownlee Project began immediately and was completed in 1959. The Oxbow Project was completed in 1961; the Hells Canyon Project, in 1967 (see section C.1.).

In 1975 Congress adopted Public Law 94-199 to establish the HCNRA, which begins upstream of Hells Canyon Dam on the Oregon side near Copper Creek and extends nearly to the border between Oregon and Washington. This act also established the Hells Canyon Wilderness, which comprises a major portion of the HCNRA. The 67.5-mile reach of the Snake River within the HCNRA, from downstream of Hells Canyon Dam to the northern end of the HCNRA, was also designated as a wild and scenic river. The HCNRA Act, however, essentially "grandfathers" the Applicant's project (see section E.5.6.).

The area's topography and history also influence the land ownership in the canyon. Figure E.6-2 shows land ownership in the vicinity of the project area. Acreage by ownership is discussed in section E.6.1.1.

At the upstream end of the study area near Weiser, agriculture and private ownership are extensive. As the canyon steepens along Brownlee Reservoir, more lands come under federal ownership. These lands are managed by the Bureau of Land Management (BLM). Significant state ownership associated with the Cecil D. Andrus Wildlife Management Area occurs on the

Idaho side just upstream of Brownlee Dam. On the Powder River arm, BLM and private lands are interspersed until agriculture and corresponding private ownership predominate around the community of Richland, Oregon.

Along Oxbow Reservoir, BLM-managed land and private lands continue to be intermixed. The Applicant's land ownership in fee is focused on Brownlee and Oxbow reservoirs, with several larger parcels on the Powder River arm of Brownlee Reservoir.

On the Idaho side, the Payette National Forest reaches down to Hells Canyon Reservoir just downstream of Oxbow Village and continues downstream to Hells Canyon Dam, where the HCNRA begins. On the Oregon side of Hells Canyon Reservoir, private ownership predominates, with a few larger parcels of BLM-managed lands interspersed, down to Copper Creek, which forms the boundary of the HCNRA and Hells Canyon Wilderness. Most of the remainder of the study area lies within the HCNRA, which is managed by the Wallowa–Whitman National Forest.

The visual appearance of the study and project areas is reflected in the information provided above. Rolling, agrarian-type areas are seen in the Weiser and upper Brownlee Reservoir reaches. These areas transition to steep hillsides of bunchgrasses and sagebrush that gradually become more dramatic basalt cliffs at the lower end of the project and have larger stands of brush and evergreen trees. Areas of development are scattered through the project area, generally in a clustered manner because of local zoning and infrastructure. Small residential communities are located on the Oregon side of upper Brownlee Reservoir, around Richland on the Powder River arm, at the Applicant's Brownlee and Oxbow villages on the Oregon side of Brownlee and Oxbow reservoirs, and at Homestead near Hells Canyon Reservoir. A few scattered residences, the Applicant's hydroelectric facilities, and old mines occur throughout the area. A number of developed recreation areas and sanitary facilities at locations of impromptu recreation are other indications of human use.

However, visitors to the project area perceive the area to be extremely remote, with relatively natural character. In fact, protecting the visual resources was Congress's main objective for establishing the HCNRA. Therefore, substantial constraints apply to altering visual resources in the study area. Areas subject to such constraints include the HCNRA, along with areas designated as wilderness or as wild, scenic, or recreational river segments, mostly below Hells Canyon Dam. In addition, the Seven Devils Scenic Area, managed by the U.S. Forest Service (USFS) lies between Oxbow and Hells Canyon dams. The BLM and USFS have established visual resource management objectives for lands that they manage. These objectives require the effects of proposed development on visual resources to be evaluated. Figure E.6-3 shows the relationship of these political jurisdictions, most of which have some control over visual resources and land management in the study area.

E.6.1.1. Existing Land Development and Use Within or Adjacent to the Project Boundaries

Table E.6-1 provides a breakdown of land ownership, including federal, state, Applicant, and other private landowners, within the entire project area (including reservoirs). Ownership is reported by reservoir and is broken into flooded and nonflooded categories. The Applicant owns about 1,850 additional acres of land outside, but in the vicinity of, the project boundary. Also shown in Table E.6-1 is an acreage breakdown of lands in its ownership over which the Applicant has full or limited control. In many cases, when buying land for the project, the Applicant allowed the former owner to maintain certain use rights on the property purchased.

When the project boundary for the HCC was originally established, in addition to including all of the Applicant's lands used for project purposes, the project boundary on private land was established at a reservoir elevation (contour line). However, on federal lands, the project boundary generally followed boundary lines of (aliquot) parts of sections established by public land survey and thereby included more land than was needed for the project. Excess land included approximately 3,800 acres of federal land above the contour line (300 to 400 acres on both Oxbow and Hells Canyon reservoirs and the remainder on Brownlee Reservoir). According to FERC regulations, unless the land is needed for project purposes, the project boundary must be located no more than 200 feet (horizontal measurement) from the exterior margin of the reservoir. Therefore, in this license application, the Applicant proposes to use the same contour line on federal lands that is used on private land for the project boundary. The land that is currently within the project boundary but not within the proposed project boundary is not necessary for project purposes such as public recreation, shoreline control, or protection of environmental resources.

The proposed project boundary would have no effect on mitigation of project impacts on any lands in the vicinity of the project. It would also eliminate any constraints on land use or management of those federal lands excluded from the project that might occur as a result of those lands being within the project boundary.

Some difference occurs in the acreages of landownership provided in Exhibit A, Table E.6-1, the maps in Exhibit G, and some of the technical reports. The differences occur because the acreages were derived through different methods. Acreages in Exhibit A (including Table A-4 through Table A-6) and Exhibit G are based on the BLM's Master Title Plats and deeds. These documents indicate only federal and nonfederal landownership (no differentiation between flooded and nonflooded lands). Acreages in Table E.6-1 were determined by summing the noninundated acreages of all individual parcels within the project area, based on maps, and then subtracting that amount from the total acreage for the project area (based on existing records) to determine the acreage of flooded lands. Acreages in information extracted from some of the technical reports about terrestrial resources were determined from geographic information system (GIS) calculations. Also, the acreages provided in Table E.6-1 do not include the acreage of land located between the meander lines of the Snake River in the original public land survey.

The project area includes approximately 16,460 acres of land, including lands both above and below the normal high-water mark. In comparison, the larger study area includes approximately 848,000 acres. Again, the Applicant has adjusted the project boundary on some federal lands toward the reservoir to a contour line that serves as the project boundary on private lands. Of the total project acreage, about 5,270 acres (32%) are federally owned; 260 acres (about 2%) are state owned; and 10,930 acres (66%) are privately owned. Of the privately owned land in the project area, the Applicant owns about 9,740 acres (59% of the total acreage).

Of the total project acreage, about 6,340 acres (38%) are above the normal high-water mark. Federal lands comprise about 1,840 acres (29%) of the total unflooded acreage; and private lands, 4,290 (68%). The Applicant's lands comprise 3,450 acres of the private lands, or 54% of all the unflooded lands in the project area. In addition to the Applicant's ownership within the project boundary, another 1,850 acres are owned outside the project area but relatively close to the boundary.

Besides federal and state jurisdictions, land within the project boundary lies within the jurisdiction of four counties: two in Idaho and two in Oregon. Figure E.6-3 shows the county boundaries. In Washington County, Idaho, zoning is predominantly A-1 (agricultural). The three small exceptions to this zoning are the Mountain Man Lodge, a former commercial resort at the mouth of Dennett Creek that is zoned C-1 (local business); an area on Cottonwood Creek, also zoned C-1 but not developed as such; and the area around and including Steck Park, zoned O (open space). Adams County zoning is ATG (agriculture/timber/grazing). On the Oregon side, Baker County zoning is primarily EFU (exclusive farm use). Exceptions include several areas on Brownlee Reservoir and its Powder River arm, which are zoned as *recreation residential*. These relatively small areas are either developed with housing or platted for housing development. The Applicant's Brownlee Village, just below Brownlee Dam, is zoned *rural residential*, and its Oxbow Village and plant are zoned as *rural service area*. In the area of the Homestead community on Hells Canyon Reservoir, a number of smaller areas are zoned for mineral extraction. Zoning for mineral extraction also occurs adjacent to the Wallowa County line. Since all land within the project boundary in Wallowa County is included in the HCNRA, no zoning in that county is relevant to the project.

The following narrative describes existing land use by river reach. The three project reservoirs are each defined as a reach. Within those reaches, Brownlee Reservoir includes four subreaches (upstream, central, Powder River arm, and downstream), while Hells Canyon includes two subreaches (upper and lower). In addition, the portion of the study area upstream of the project area (the Weiser reach) and the portion downstream of the project area (the river reach) are discussed briefly because the project may also affect these areas. The reaches described are shown in Figure E.6-4.

Weiser Reach (bridge near Weiser to Cobb Rapids)—The area between the community of Weiser (with a 2000 population of 5,343) and the upstream project boundary (Figure E.6-5) differs significantly in character from the project area and the remainder of the study area. The rolling topography has facilitated development of cultivated agriculture and a significant rural population. A river channel with gentler gradient and a broader floodplain than those downstream also contributes to this development. The vast majority of cultivated agriculture in the study area lies in this reach. A substantial road network that includes links to several major highways has been developed to serve the area's rural community. Much of the available riparian habitat immediately along the shoreline of the mainstem Snake River occurs in this reach (see section E.6.1.3.) because of the relatively broad alluvial floodplain. The channel's low gradient has led to sediments being deposited in this reach (Technical Report E.3.3-1).

Brownlee Reservoir Reach—Land use surrounding Brownlee Reservoir (Figure E.6-6) includes mainly livestock grazing and recreation. These uses generally conform to county zoning, which calls primarily for exclusive agricultural use with relatively stringent limitations on land subdivision. Along with domestic grazing, much of those grass- and shrublands provide important wildlife habitat. Portions of lower Brownlee Reservoir, on both the Oregon and Idaho sides, serve as critical winter habitat for several species, including the mule deer and elk. Much of the area grazed by wildlife is also used for livestock grazing. In addition to private ranches, grazing allotments administered by the BLM occur on both sides of the reservoir. Because of the open range law in both states, unauthorized (open range) grazing also occurs on lands that are not intended for grazing.

Brownlee Reservoir reach includes four subreaches (upstream, central, Powder River arm, and downstream), each of which is described below.

- Upstream Subreach (Cobb Rapids to Burnt River/Spring Recreation site). Primarily, the southerly end of this reach is cultivated for agriculture, with accompanying rural residential use. The rolling topography at the upper end of this reach was selected as the location for I-84 to pass through the region, following the Oregon Trail route. Several commercial recreational vehicle (RV) parks and the Oasis dispersed recreation site, managed by the BLM, lie between the interstate highway and the river. Farewell Bend State Park, also located on the Oregon side of the river near I-84, provides recreation for travelers on this major corridor, as well as a destination for people from the region wishing to fish the reservoir. Several highway-oriented commercial businesses lie adjacent to I-84 near the park's entrance.

  Secondary roads owned and maintained by the counties closely parallel the reservoir shoreline on both sides of this subreach. Taking advantage of the accessibility to the regional population, federal and state agencies provide several other recreation areas along these roads.

The Spring Recreation Site managed by the BLM lies at the northern end of this reach on the Oregon side of the reservoir. On the Idaho side, the BLM and Idaho Department of Fish and Game (IDFG) cooperatively operate Steck Park, and the BLM manages the Weiser Dunes area for all-terrain vehicle use. Anglers have also created many dispersed, or impromptu, campsites between the roads and shoreline. These campsites occur on federal lands (BLM) and on private lands, including the Applicant's lands.

- Central Subreach (Burnt River/Spring Recreation Site to Swedes Landing). This subreach includes a significant private recreational residential (residences used seasonally or occasionally in association with recreation) community between the road and the shoreline for about 1 mile on the Oregon side; the Idaho side is virtually roadless. The portion of recreational residential use between Little Deacon and Douglas creeks conforms to Baker County zoning, while the remainder may be either grandfathered by the county or noncompliant. Due to the road access and the relatively level areas adjoining the reservoir throughout much of this subreach, dispersed recreation occurs heavily on the Oregon side between the road and the shoreline. At times, bass fishing and crappie fishing are excellent in the reservoir, and many anglers from within and outside the region camp along the reservoir during the season on lands under federal, private, and Applicant ownership.

On the Idaho side, and throughout the remainder of the Oregon side, wildlife habitat and livestock grazing are the primary uses. In this subreach, wildlife habitat on both sides of the reservoir is considered by biologists to be critical to winter grazing of mule deer and elk. A few large ranches, as well as BLM grazing allotments, are accessed from roads along gulches to the east of the canyon in Idaho. Boaters have established impromptu campsites along the shoreline in some locations, particularly on alluvial fans at the mouths of tributaries. At the alluvial fan formed by Dennett Creek lies a former commercial recreation use, Mountain Man Lodge. Established when Brownlee Reservoir remained relatively stable throughout the recreation season, the property includes a boat ramp, the lodge itself, a camping area, and marine services (the area for the latter two functions is leased from the Applicant). Since 1997, the lodge has not been operated commercially, apparently because of reservoir fluctuation (Gil Green, real estate specialist for the Applicant, personal communication, 2000). In addition to the commercial recreational use, the property includes cultivated agriculture and grazing. Aside from this former commercial recreational use, no developed recreation occurs in this subreach.

- Powder River Arm Subreach. This side channel to the reservoir presents a contrast in land use. From its confluence with the Snake River upstream to the western end of an oxbow on the south shoreline near Hewitt Park, the reach is virtually roadless, and land use is almost exclusively livestock grazing, providing wildlife habitat as well. At the west end of the small oxbow, a subdivision has been platted in compliance with current county zoning, and several recreational cabins and docks have been constructed. From this point upstream to the end of the arm (about 1 to 1.5 miles), the north side of the channel is generally developed. Hewitt and Holcomb parks, operated by Baker County, provide boat access to the reservoir for the local and regional community, as well as for visitors from outside the region. To the west lie scattered rural residences and their cultivated agriculture and grazing uses. The community of Richland, on Oregon Highway 86 (Oregon 86), lies a short distance to the northwest of the reservoir. On the south bank, livestock grazing on a private ranch dominates this side of the upper extent of the reservoir that forms a pool on the Powder River arm (referred to as the Powder River pool).

  This pool is the location of the second and only other major area of riparian vegetation in the project area (see section E.6.1.3.). Several of the larger parcels of land owned by the Applicant are located on the north and west sides of the Powder River pool. These parcels are currently leased and managed for livestock grazing or agriculture, together with wildlife habitat improvement (Technical Report E.6-2). The Powder River arm is also used as a wildlife corridor, providing passage to mule deer seeking access to winter range along the lower Powder River arm and the mainstem Snake River in Brownlee Reservoir (Technical Report E.3.2-32).

- Downstream Subreach (Swedes Landing to Brownlee Dam). This subreach on the mainstem Snake River is generally roadless. Only where Idaho Highway 71 (Idaho 71) drops down to the reservoir along its Brownlee Creek arm does improved road access exist. Because of the roadless condition, wildlife habitat and livestock grazing are the predominant uses.

Along the northeast side of the Brownlee Creek arm and the mainstem Snake River on the Idaho side, Idaho 71 provides access to the reservoir at the Applicant's Woodhead Park, the southernmost developed recreation area encountered on this road and included as part of the project, and to the Brownlee Dam operation and maintenance yard located just below the dam. Due to the access that the highway provides at lower elevations, dispersed recreation occurs at a number of places between the highway and the water.

Oxbow Reservoir Reach—While Brownlee Reservoir is extensive and quite remote in most areas, Oxbow Reservoir (Figure E.6-7) is much smaller and the hub of human activity in the project area. Just below Brownlee Dam, Idaho 71 crosses Oxbow Reservoir. On the Idaho side, near the bridge approach, a side road leads to the Applicant's second developed recreation area encountered from Idaho 71, McCormick Park. Adjoining the park on the north and east is the private OX Ranch, which includes much of the remaining land on the Idaho side of the reservoir and is used for livestock grazing. Upstream and northward along the Oregon side, on what is now the Applicant's Oxbow–Brownlee Road, a string of dispersed recreation sites lies between the road and the reservoir. Among these sites is the Applicant's Brownlee Village, comprising a handful of residential structures occupied by personnel, and a trailer park, originally used as a staging area for Brownlee Dam construction. Farther downstream, the dam intake and dam are located in an oxbow to the northeast of the road. Between the road and the reservoir lies the Oxbow Yard, including the shop, hatchery, equipment storage, and vehicle parking. Just to the north of the yard is Oxbow Village, the primary location of the HCC project operation and maintenance personnel and infrastructure services.[2] Oregon 86 intersects with the Oxbow–Brownlee Road and terminates at the village. Copperfield Park, the third major developed recreation area associated with the HCC, is part of this community. Much of the land under BLM management in this reach lies within the Sheep Mountain Area of Critical Environmental Concern (ACEC) and Wilderness Study Area (WSA). These areas are generally designated and managed to "...protect outstanding scenic qualities, and maintain or improve wildlife and crucial bald eagle winter habitat" (BLM 1989).

2. While Oxbow Village is technically at the upstream end of Hells Canyon Reservoir, it is so integral to other uses on Oxbow Reservoir that it is included in the description of the Oxbow Reservoir reach.

Hells Canyon Reservoir Reach—Continuing north from Oxbow Village are roads on either side of Hells Canyon Reservoir (Figure E.6-8). On the Idaho side, the Applicant's Hells Canyon Road is paved and open to the public to the USFS Hells Canyon Visitors Center, 0.25 mile downstream of Hells Canyon Dam. High above the reservoir in most places, the road offers only a few access points to the reservoir. On the Oregon side, the unpaved Homestead Road, owned by the County but with the majority of it maintained by the Applicant, follows along the reservoir shoreline for approximately 9 miles to Copper Creek, where it ends at the southern boundary of the HCNRA.

Hells Canyon Reservoir reach includes two subreaches (upper and lower), each of which is described below.

- Upper Reservoir Subreach. Just downstream of Oxbow Village, Homestead Road provides access to several private residences; a bed-and-breakfast establishment; and the Applicant's Oxbow boat ramp, a former substation, and the existing airstrip. Between this road and the shoreline are relatively large areas of flat land, a number of which have relatively large stands of riparian vegetation. While ownership varies throughout this shoreline strip (the Applicant, other private landowners, and the BLM), considerable dispersed recreation takes place nearly everywhere that hasn't been privately developed. Downstream, the community of Homestead, associated with mining as early as the 1880s, extends along the road. Cabins are privately owned and generally used for residential recreation. At the end of the road is a dispersed recreation site (Copper Creek) managed by the BLM. This site provides access to a trail into the McGraw Creek WSA, which adjoins the designated wilderness area, and the McGraw Creek ACEC. In the southern part of this subreach and extending northward to the McGraw Creek area, the Homestead ACEC and WSA have been designated and are managed on BLM lands "...to protect outstanding scenic qualities, and wildlife, bald eagle and sensitive plant habitat" (BLM 1989).

  On the Idaho side of the reservoir, Hells Canyon Road runs high above the reservoir and into the Payette National Forest just to the north of the bridge at Oxbow Village. Because of the steepness, land use here is limited to wildlife habitat and livestock grazing allotments. A project transmission line follows the road much of the way. Hells Canyon Park, the fourth of the Applicant's developed recreation areas associated with the project from south to north, lies about 9 miles north of the bridge at Oxbow Village.

- Lower Reservoir Subreach. Continuing downstream on the Idaho side, there are a few more level areas than in the upper reservoir reach. These level areas are used for dispersed recreation. Visitors first come to Big Bar and then to Eagle Bar. Big Bar is a relatively large, level site with a former orchard and high-quality riparian development. The site provides excellent wildlife habitat as well as an opportunity for dispersed recreation. Eagle Bar is a much smaller site with concrete pads, used in the past for staging Hells Canyon Dam construction. In the vicinity are a number of smaller dispersed recreation sites, several of which contain trailheads. This entire area, managed by the USFS, provides camping sites for boaters and other visitors traveling to the river launch, at the USFS Hells Canyon Creek Recreation Site and Hells Canyon Visitors Center just downstream of Hells Canyon Dam.

  The Hells Canyon Road crosses Hells Canyon Dam to the Oregon side. Uses along the Oregon side of the lower reservoir reach are those allowed under the HCNRA Act, which comprise primarily dispersed recreation and livestock grazing in this area. The HCNRA Act specifically provides for existing hydroelectric power projects, regulated under the Federal Power Act. Fishing and other dispersed recreation take place around the tailrace of the dam, at a small kiosk provided for visitors just below the dam and at several dispersed sites upstream of the USFS Hells Canyon Visitors Center. The road ends at this center, which is frequented by sightseers, hikers, and both float boaters and jet boaters.

River Reach—Since the project boundary extends just to Hells Canyon Dam, lands in this reach are outside the project area but within the study area described above. Most land within this reach (Figure E.6-9) lies within the HCNRA, and much of it is also in the Hells Canyon Wilderness (see Figure E.6-3). Under the National Wild and Scenic Rivers System, the river corridor is designated as wild from the Hells Canyon Dam downstream to 1 mile upstream of Pittsburg Landing and as scenic from that point downstream to the northern boundary of the HCNRA. Uses within the HCNRA and the wilderness are those permitted by the federal legislation that established those areas and by resource management plans adopted by the USFS for managing them.

Structural development is generally, but not totally, excluded from these areas. Limited structures, such as picnic tables, can be found. Along the river corridor, recreation use—such as jet boating, float boating, fishing, hunting, and camping—is the primary land and water use. Several campsites with limited facilities are provided (see Technical Report E.5-9 for a full description of recreational uses in this reach). A few cabins and active ranches remain under USFS permit and in privately owned enclaves. In addition, the USFS permits several lodges and ranches along the river that are operated as commercial establishments. The Kirkwood Historic Ranch (RM 221.5), on the National Register of Historic Places and managed by the USFS, is a popular spot for boaters to learn about homesteading in the canyon in the late 1800s and early 1900s. Several USFS administrative sites are also located within the HCNRA, including the Hells Canyon Visitors Center (RM 246.8), Pittsburg Landing (RM 215), and Cache Creek (RM 177).

The preceding description of land uses in and near the project boundary addresses the use of lands in a qualitative manner. The study of vegetation cover type conducted for this application also addressed land use cover type (Technical Report E.3.3-1). Although the study was limited to a smaller area (within 0.5 mile of the shoreline on either side of the river to Hells Canyon Dam and within 0.25 mile of the shoreline from Hells Canyon Dam downstream to the confluence with the Salmon River) than the broader study area defined in section E.6.1., this study area was considerably larger than the area within the project boundary. Though the vegetation study also used classifications not completely comparable to the description of land uses above, results of this study indicate proportions of cover types and land uses that provide a quantitative perspective. Table E.6-2 provides that information for the project area, and Table E.6-3 and Table E.6-4 for the cover-type study area.

E.6.1.2. Description of Wetlands and Floodplains

The following information on riparian resources is based on cover type mapping and riparian vegetation sampling, both along the river corridor and tributaries (Technical Report E.3.3-1). The study area for this study was somewhat smaller than the study area described in section E.6.1. This study area extended from the bridge (RM 351.2) near Weiser to the confluence of the Salmon River (RM 188.2). Above Hells Canyon Dam, land within 0.5 mile of each shoreline was included, while below the dam, land within 0.25 mile of each shoreline was included. The study area totaled roughly 48,373 hectares (119,530 acres) of land.[3] This description refers to riparian vegetation and includes both delineated wetlands and land in the transition between wetland and upland habitats.

Within this study area, riparian vegetation cover types—including *Shore & Bottomland Wetland*, *Emergent Herbaceous Wetland*, *Scrub-Shrub Wetland*, and *Forested Wetland*—composed less than 5% of total cover types. While upland vegetation types were much more abundant (nearly 66%), riparian cover types were found to be considerably more diverse in plant assemblages. Seventy-two plant assemblages were identified in the four riparian cover types, compared with 50 plant assemblages found in the eight upland cover types. *Shore & Bottomland Wetland* was found to be the most abundant riparian cover type, with 882 hectares (2,179 acres), or 1.82% of the total cover. However, the extent of this cover type constantly changes because of the filling and drawing down of the reservoirs. Most of this riparian cover type occurs in the upstream portions of Brownlee Reservoir, decreases in abundance to Brownlee Dam, and occurs in low to moderate amounts below Hells Canyon Dam.

Scrub-Shrub Wetland, covering 822 hectares (2,031 acres), or 1.7% of total cover, was the most abundant perennial riparian cover type. This cover type was followed in abundance by *Forested Wetland*, covering 390 hectares (964 acres), or 0.8% of all cover. These cover types primarily occur in the Weiser reach, upstream of Brownlee Reservoir, around the Powder River pool, and in the lower parts of the project area in Oxbow and Hells Canyon reservoirs and the lowest portion of Brownlee Reservoir. In the central reach (mid- to lower Brownlee Reservoir), much of the *Scrub-Shrub Wetland* and *Forested Wetland* habitats occur near the mouths of tributary drainages to the Snake River and in the bottoms of these tributaries. *Emergent Herbaceous Wetland* comprised 216 hectares (534 acres), or 0.45% of total cover. Although rare throughout most reaches of the study area, this habitat is notably abundant in the Weiser reach and in the upstream end of Brownlee Reservoir.

3. In this exhibit, acres are generally given. However, because the study on cover types used hectares as the standard unit of measure, that same unit is used in this section. Acreage is provided in parentheses.

In the study area, within a 20-meter band above the high-water mark, riparian habitat constitutes 62.3% of total habitat in the Weiser reach (15.9 acres per river mile); 8.4% along Brownlee Reservoir (2.0 acres per river mile); 21.2% along Oxbow Reservoir (3.6 acres per river mile); 21.1% along Hells Canyon Reservoir (3.7 acres per river mile); and 17.6% below Hells Canyon Dam (3.0 acres per river mile). The upstream Weiser reach supports relatively extensive riparian habitats. Tree- and shrub-dominated riparian cover types are generally dominated by introduced species such as box elder (*Acer negundo*), silver maple (*Acer saccharinum*), American elm (*Elmus americana*), green ash (*Fraxinus pennsylvanica)*, Russian olive (*Elaeagnus angustifolia*), white willow (*Salix alba*), false indigo (*Amorpha fruticosa*), and tamarisk (or salt cedar, *Tamarix* species). Dominant herbaceous species are primarily broad-leaved pepperweed (*Lepidium latifolium*), poison hemlock (*Conium maculatum*), purple loosestrife (*Lythrum salicaria*), marsh grass (*Heleochloa alopecuroides*), hemp dogbane (*Apocynum cannabinum*), and purslane (*Portulaca oleracea*), a number of which are listed noxious weed species.

In the Brownlee reach, tree- and shrub-dominated riparian cover types are often dominated by species such as water birch (*Betula occidentalis*), white alder (*Alnus rhombifolia*), syringa (*Philadelphus lewisii*), black cottonwood (*Populus trichocarpa*), netleaf hackberry (*Celtis reticulata*), and western poison ivy (*Toxicodendron rydbergii*, formerly *T. radicans*). An introduced species, false indigo, is also quite common in this reach. In the Power River arm of Brownlee Reservoir, woody native riparian species dominate plant assemblages. For example, the largest stand of black cottonwood in the study area occurs in this reach. Other dominant woody species here include coyote willow (*Salix exigua*), Wood’s rose (*Rosa woodsii*), and white willow. Weedy and noxious weed species occur in the riparian zone here, including purple loosestrife, broad-leaved pepperweed, marsh grass, and reed canarygrass (*Phalaris arundinacea*). Annual species colonizing mudflats include common cocklebur (*Xanthium strumarium*), purslane, pigweed (*Amaranthus* species), and barnyard grass (*Echinochloa crus-galli*).

Riparian areas in the Oxbow and Hells Canyon reaches are dominated by native species, such as water birch, syringa, white alder, western poison ivy, black cottonwood, netleaf hackberry, and black hawthorn (*Crataegus douglasii*). Downstream of Hells Canyon Dam, riparian cover types are primarily dominated by native perennial species. Dominant tree and shrub species include netleaf hackberry, water birch, white alder, syringa, coyote willow, and western poison ivy.

Common herbaceous riparian species include American licorice (*Glycyrrhiza lepidota*), long-leaved ground cherry (*Physalis longifolia*), western mugwort (*Artemisia ludoviciana*), Columbia River mugwort (*A. lindleyana*), chervil (*Anthriscus scandicina*), bedstraw (*Galium aparine*), and Canada goldenrod (*Solidago canadensis*).

Within the project vicinity, the two areas with the most significant cover of riparian vegetation include the Weiser reach above the project boundary, including the very upper part of Brownlee Reservoir, and the Powder River arm because of the relatively broad alluvial floodplains. Downstream of the project area, the steep canyon walls and prevalence of scouring floods restrict most *Forested Wetland* habitat to tributary drainages. Much of the *Scrub-Shrub Wetland* cover occurs along the high-water mark of the river channel.

In Hells Canyon, probably the most important environmental variable affecting upland and riparian habitats is the relative abundance of, or the intermittent character of, water in the habitat. For riparian vegetation, water abundance and intermittence character are influenced by slope, aspect, soil depth, groundwater percolation, changes in water surface elevation, and flood events. These factors combine in various ways to produce complex habitat diversity in the canyon.

Greater detail regarding the following information can be found in Technical Report E.3.2-45 and in section E.3.3. of this license application. The HCC reservoirs formed *fluctuation zones* when water levels were raised or lowered during historical operations. Although drafting of Brownlee Reservoir has varied within and among years, relatively large seasonal fluctuations were common (40 to 70 feet). The fluctuation zones of Oxbow and Hells Canyon reservoirs have been relatively small (3 to 5 feet). Large annual fluctuations on Brownlee Reservoir expose a barren zone and, where fine sediments are available, can be annually colonized by species such as common cocklebur, purslane, pigweed, and barnyard grass before being inundated when Brownlee Reservoir is refilled. In this fluctuation zone, these species are able to germinate, grow, and set seed during periods of drawdown, whereas most native and exotic perennial species cannot survive to propagate. In contrast, the smaller fluctuations of Oxbow and Hells Canyon reservoirs largely prevent the establishment of annual species in the fluctuation zones, and shoreline habitats predominantly consist of perennial herbaceous and woody species.

Reservoir operations often affect riparian habitats, particularly where large seasonal water-level fluctuations occur. Such fluctuation, while creating new full-pool reservoir shorelines (*shoreline zone*), can inhibit riparian vegetation from establishing. Large seasonal drafting of Brownlee Reservoir has historically limited the extent of riparian habitat in the shoreline zone of this reservoir. Most existing riparian habitat in the shoreline zone of Brownlee Reservoir occurs near the mouths of tributary streams or springs, where the shoreline soil moisture is not dependent on reservoir water surface elevation. In some locations, a narrow linear band of facultative perennial riparian species exists along the full-pool shoreline. During periods of drawdown, where fine sediments occur, expansive areas can be colonized by ruderal annual species, such as common cocklebur, purslane, pigweed, and barnyard grass. Otherwise, upland vegetation makes up most of the shoreline zone, extending to the reservoir full-pool shoreline.

In contrast to Brownlee Reservoir, trees, shrubs, and other perennial riparian species are relatively abundant along Oxbow and Hells Canyon reservoirs. Historical, relatively stable pool levels at both Oxbow and Hells Canyon reservoirs likely enhanced establishment of riparian habitats compared with what would exist if the reservoirs were not held relatively stable. Where suitable substrate and topography occur, a relatively wide band of perennial riparian habitat is promoted by the combination of small daily water fluctuations that irrigate riparian vegetation during the growing season and absence of large seasonal drafting.

Riparian zones are generally vulnerable to invasion by exotic species because riverine environments are dynamic and have recurrent disturbances, water is available year-round, and rivers provide a natural network for seed dispersal. Weed invasions can be pronounced where natural communities are further disturbed by river regulation. Prior to and since construction of the HCC, residential, industrial, recreational, and agricultural influences both upstream and within Hells Canyon likely introduced many weedy species to the Hells Canyon ecosystem. Most of the weedy species identified in Technical Report E.3.3-2 appear to have been present within the study corridor before the HCC was constructed (Technical Report E.3.2-44). With these weed introductions and the capacity of these species to proliferate, the current abundance of weeds in Hells Canyon is not surprising. Weedy exotic species would occur along the Snake River in Hells Canyon without the influence of HCC operations. Nonetheless, historical operation of the HCC reservoirs has likely contributed to the spread of noxious weeds.

While regulated water levels from hydroelectric operations can contribute to invasion of riparian habitats by exotic weeds, the large water-level fluctuations during historical operations on Brownlee Reservoir may have provided a barrier to impede downstream infestation by many perennial weedy species. Most riparian plant species, both native and exotic, are unable to establish and survive the successive drying and flooding in reservoir fluctuation zones that experience large, seasonal water-level changes (Nilsson and Keddy 1988). Table 12 in Technical Report E.3.3-1 identifies common and abundant exotic weedy riparian species found almost exclusively upstream and in the headwaters of Brownlee Reservoir that may have been impeded in their downstream spread. These species have appropriate life history traits for potentially increasing in abundance and distribution downstream under natural or regulated river-flow conditions. However, these species occur relatively infrequently, if at all, downstream of the headwaters of Brownlee Reservoir.

Specific evidence suggests that seasonal drafting of Brownlee Reservoir has impeded tamarisk (salt cedar) from invading riparian habitats downstream of Brownlee Reservoir. Listed as a noxious weed in other western states but not in Idaho or Oregon, salt cedar is quite prolific in the headwaters of Brownlee Reservoir and upstream along the Snake River, but it was found nowhere else along the Snake River in Hells Canyon, even though suitable habitat occurs all along this reach. Salt cedar also occurs downstream of Hells Canyon on the Snake and Columbia rivers. On the upper reaches of Brownlee Reservoir, young seedlings of salt cedar annually establish in the fluctuation zone, but they are subsequently killed by refilling of the reservoir. This species cannot survive more than three months of flooding. The young plants that establish in the reservoir shoreline zone are subsequently killed by long periods of reservoir drafting. Though not totally dependent on permanent groundwater, mature salt cedar usually occurs in areas where its roots can reach the water table (no more than 3 to 5 meters to groundwater), such as floodplains, along irrigation ditches, and on lakeshores. Given the invasive capacity of this species, if water levels were held relatively stable on Brownlee Reservoir, salt cedar could spread rapidly downstream to quickly dominate shoreline riparian habitats.

Several other weedy species occur along Oxbow and Hells Canyon reservoirs and have probably been introduced by other activities coincident with and prior to construction and operation of the HCC. In contrast to the headwaters of Brownlee Reservoir and the Weiser reach, the most abundant and common riparian plant assemblages along Oxbow and Hells Canyon reservoirs are dominated by native woody species such as water birch, white alder, syringa, western poison ivy, and black cottonwood. Relatively few riparian plant assemblages along Oxbow and Hells Canyon reservoirs are dominated by exotic vegetation. The Applicant's studies found 70% of the total weed populations investigated in the upstream Weiser reach were dominated by riparian weeds; 45% of the populations on Brownlee Reservoir; about 30% of the populations on Oxbow and Hells Canyon reservoirs; and about 10% of the populations downstream of Hells Canyon Dam.

Several factors generally influenced the occurrence of each noxious weed population: the types of disturbance (such as alluvial, flow zone, or water-level fluctuations; livestock grazing; mining; fire; road maintenance; recreation; industry; agriculture; or off-road vehicle use) and levels of disturbance present at each population. Generally, each disturbance factor correlated significantly with populations of one or more noxious weed species. In the reservoir reaches, the most frequent disturbance factors were flow zone, recreation, road maintenance, and livestock grazing. Two noxious weed species (broad-leaved pepperweed and reed canarygrass) and one special interest weed (false indigo) were found to be significantly and positively associated with water fluctuations. These species benefit from recurrent water-level fluctuations that create sites for weeds to establish and persist in riparian habitats. Other species, specifically yellow nut sedge (*Cyperus esculentus*), common horsetail (*Equisetum arvense*), leafy spurge (*Euphorbia esula*), purple loosestrife, and tamarisk were also positively associated with water-level fluctuations. Other factors that influence the spread of noxious weeds along the Snake River corridor through Hells Canyon include management actions of federal and state agencies and other private landowners.

Below Hells Canyon Dam, riparian cover types are primarily dominated by native perennial species. Dominant tree and shrub species include netleaf hackberry, water birch, white alder, syringa, coyote willow, and western poison ivy. Common herbaceous riparian species include American licorice, long-leaved ground cherry, western mugwort, Columbia River mugwort, chervil, bedstraw, and Canada goldenrod. Historical photographs taken during the early 1900s and recently retaken clearly show an increase in size and extent of riparian communities here, both above and below the river's high-water mark. Following damming and flow regulation, the band of perennial riparian vegetation became more dense and continuous along the reach. This expansion is likely related to both historical HCC operations and changes in land-use practices.

Most of the increase in riparian extent and cover occurred in native netleaf hackberry communities. In some instances today, the margin of the river is entirely bordered by riparian netleaf hackberry communities, while only scattered individuals were found there 60 to 80 years ago. The three major hydrologic reasons for the increase were 1) higher and more stable base flows during the summers than before HCC was constructed, 2) irrigation of portions of the riverbed by load-following flows (below 30,000-cubic feet per second [cfs] stage levels) in late spring and summer, and 3) stimulation of the growth and suckering of the root systems of netleaf hackberry growing near the high-water mark from the river's scouring action. In combination, these conditions enabled hackberry communities to occupy a broader zone than was previously unavailable.

Another reason for the observed increase in riparian habitat may be from changes in land use, including cessation of grazing, particularly of domestic sheep, and reduction in homesteading, ranching and mining. Reduction of these activities could have positively affected the survival and growth of netleaf hackberry. Coring of this species found that most of these stands were established during the past 60 to 80 years. Some plant communities below Hells Canyon Dam may have declined in abundance due to historical operations. HCC operations likely contributed to the decline of some obligate riparian plants, especially coyote willow, because of the trapping of fine sediments needed for building rooting substrate by the dams. The condition of weeds and noxious weeds below Hells Canyon Dam is discussed in more detail in section E.3.3.4.2.2.

E.6.1.3. Wetlands Within or Adjacent to the Project Boundaries

Within the project area, about 942 hectares (2,329 acres), or just over 14% of the total vegetation cover type, are riparian vegetation. *Shore & Bottomland Wetland* was again the predominant riparian cover type, comprising 655.46 hectares (1,619.64 acres), or 10.4% of the total project area cover. Much of this habitat, however, is eliminated when reservoirs are at full pool. *Scrub-Shrub Wetland* made up 127.98 hectares (316 acres), or about 5.39%. *Emergent Herbaceous Wetland* included about 122.07 hectares (301.63 acres), or 1.69%. *Forested Wetland* area was just over 37 hectares (91.5 acres), or 2.02% of the total project area cover. Table E.6-5 provides a breakdown of this information by project reservoir. Spatial distribution of this riparian vegetation within the project area is described in section E.6.1.2. for the study area and shown in Figure 3 in Technical Report E.3.3-1.

E.6.1.4. Floodplains Within or Adjacent to the Project Boundaries

Upstream of the project area between Weiser and Cobb Rapids (RM 343) at the head of Brownlee Reservoir, the floodplain is relatively broad because of the geomorphic conditions of the area. Within the project area for the HCC, the floodplain is entrenched within the relatively narrow and deep canyon of the Snake River. Downstream of the project area, the floodplain all the way to Lewiston, Idaho, is similar to that for the project area.

In the northwestern United States, the Pleistocene and early Holocene epochs had much wetter climates than the region has now. The resulting prehistoric hydrology and floods (such as the Bonneville Flood) formed the bed and channel shape of the Snake River above and below the area of the present-day complex. The climate over the last 1,000 years has been drier, and there have been no floods of the magnitude of those experienced previously. As a result, the channel has changed little since it was formed and is considered very stable under recent flows. While most of the study area on the Snake River is a gravel-bed river, it does not act as a classical alluvial river (with occasional flooding over broader areas) because the current river form was developed under significantly higher flow regimes than the current hydrologic conditions produce (Technical Report E.1-4).

Upstream of the project area, Weiser lies in a broader floodplain at the confluence of the Weiser and Snake rivers. The Weiser River has no control structures and often floods along its course. This situation also causes local flooding at the confluence. Only a few small communities (totaling somewhat fewer than 200 full-time residents), including those associated with the project, lie within or near the floodplain of the Snake River. In addition to these communities and the Applicant’s project facilities, some cultivated acreage, recreation development, and several working ranches are the only development within or near the floodplain. The numerous dams and hydroelectric projects upriver and on many of the major tributaries have kept floods on the

Snake River from being a significant problem for residents and owners, but flooding of undeveloped tributaries and the resulting backup of water in the mainstem have caused extensive damage, even in recent years.

In winter and spring 1997, heavy rainstorms on many of the tributaries flowing into all three of the project reservoirs resulted in "blow-outs" at the mouths of these side canyons. These blow-outs demonstrate the type of flood damage that can occur. Because of the steep topography and the narrow tributary channels meeting the broader river channel of the Snake River, large amounts of water move through the channels quickly, picking up all debris, and then blast out at the mouths of the tributaries, spewing the debris over the alluvial fans at the confluences. Because these alluvial fans provide much of the level land in the canyon, they have been significantly developed. Therefore, blow-outs can often cause considerable damage. The local backup of water in the Snake River following these events also contributes to flooding of adjacent lands.

A study conducted by the U.S. Geological Survey defines the 100-year flood on the Snake River at Hells Canyon Dam to be 111,000 cfs (adjusted by current data). For two of the larger tributaries within the project area, the 100-year flood has been defined as 4,680 cfs for Wildhorse River, which enters the Snake River at McCormick Park on Oxbow Reservoir, and 10,400 cfs for Pine Creek, which enters the river at Oxbow Village on Hells Canyon Reservoir (USGS 1996). Relatively recent flooding on both of these tributaries has substantially damaged nearby development. In fact, the peak flows for these two tributaries occurred in the 1996–1997 high-flow period when the Wildhorse River experienced flows of about 4,202 cfs and Pine Creek of 11,600 cfs. These flows in Pine Creek exceeded the 100-year flood for the creek. The spillways at all three hydroelectric plants are designed to pass a much greater flow than the 100-year flood for the Snake River. The spillway at Brownlee Dam has a capacity of 307,300 cfs at normal maximum reservoir elevation; the combined capacities of the two spillways at Oxbow Dam are 300,000 cfs, with the reservoir elevation surcharged to 5 feet above normal maximum reservoir level; and the capacity of the spillway at Hells Canyon Dam is also 300,000 cfs, with the reservoir elevation surcharged to 5 feet above normal maximum reservoir level.

The Federal Emergency Management Agency has prepared flood insurance rate mapping of the Snake River for Malheur County (adjacent on the Oregon side of the Weiser reach), Baker

County, Oregon, and Washington County, Idaho. A small area of Wallowa County, Oregon (at the very north end near the Oregon–Washington state border), has also been mapped. Downstream of the HCNRA and a considerable distance from the project area, some reaches in Idaho and Nez Perce counties, Idaho, are also mapped. Other areas may not be mapped because most of the lands adjacent to the Snake River are owned and managed by the federal government.

At Weiser, the floodplain shown on the flood insurance rate mapping is about 1.5 miles wide; at Cobb Rapids, about 1,500 feet wide; and at Brownlee Dam, just under 2,000 feet wide. The floodplain near the midpoint of Oxbow Reservoir is about 700 feet wide, while at Oxbow Village and the confluence of Pine Creek and the Snake River, the floodplain is somewhat more than 1,000 feet wide. The floodplain on Hells Canyon Reservoir downstream of Oxbow Village is narrower because of the narrowing of the canyon by the vertical cliff walls. However, since no flood insurance rate mapping of this area is available, no documented estimate is possible. The distance between canyon walls at Hells Canyon Dam is estimated to be about 900 feet.

E.6.1.5. Short- and Long-Term Impacts on Wetlands and Floodplains

E.6.1.5.1. Reservoirs

Details regarding the impacts identified below can be found in Technical Reports E.3.2-40 and E.3.3-3. With either the modeled proposed operations or full pool run-of-river scenarios, the reservoir fluctuation zones would continue to be at least seasonally inundated, thereby eliminating the fluctuation zones' ability to support perennial vegetation habitats. With either of these operational scenarios, the current lack of vegetation in the fluctuation zones would persist. According to model results, the proposed operations scenario would prevent 372 acres of land on Brownlee Reservoir, 7 acres on Oxbow Reservoir, and 9 acres on Hells Canyon Reservoir from supporting riparian habitats in the reservoir fluctuation zones. Therefore, proposed operations of the project would prevent 388 acres from supporting riparian habitat.

In the shoreline zones, analyses of the two operational scenarios (proposed operations and full pool run-of-river) found only modest differences in the ability to support riparian habitat on Oxbow and Hells Canyon Reservoirs, indicating no real advantage in either scenario. Their similar results are due to the lack of dramatic or significant differences in timing and magnitude of water-level variations between the scenarios. Under the full pool run-of-river scenario, the riparian corridor on Brownlee Reservoir would be expected to migrate upslope and be denser (more plant cover and plant density) than under the proposed operations scenario. A distinct difference was noted between the two scenarios regarding the dispersion and proliferation of noxious weed species, which would increase under full pool run-of-river operations.

Based on a combination of modeling analysis and life history consideration, 15 weedy species are predicted to be similarly affected by the two operational scenarios. One ruderal annual species, puncturevine (*Tribulus terrestris*), was predicted to increase in abundance under the proposed operations scenario, compared with the full pool run-of-river scenario. Four perennial species, including whitetop (*Cardaria draba*), leafy spurge, tamarisk, and possibly Russian olive, would be substantially reduced under the proposed operations scenario, compared with the full pool run-of-river scenario, because the drawdown of Brownlee Reservoir would continue to impede their downstream expansion. The occurrence of a dispersal barrier established by the drawdown pattern of Brownlee Reservoir would probably result in a substantial ecological benefit of the proposed operations scenario (over the full pool run-of-river scenario) by retarding the downstream spread of undesirable plant species, most notably tamarisk. Study investigators concluded, "Of all of the probable impacts addressed in the present report, the prevention of encroachment of salt cedar into the natural riparian zone along the Snake River downstream from the Hells Canyon Dam (under the proposed operations scenario) may be the most ecologically significant." On Oxbow and Hells Canyon reservoirs, both operational scenarios were found to contribute roughly equally to the spread of noxious weeds.

In summary, the proposed operations scenario would contribute to the spread of noxious weeds along the reservoir reaches in Hells Canyon, but to a much lesser extent than the full pool run-of-river scenario would. While the quantitative extent of the potential spread of noxious weeds along the reservoir cannot be predicted for either scenario, under the proposed operations scenario, the combination of drought stress and inundation stress on Brownlee Reservoir would eliminate the vast majority of many weedy species encroaching from upstream sources, controlling downstream infestation, especially in the 41.5-mile-long main pool.

E.6.1.5.2. Below Hells Canyon Dam

A qualitative analysis determined that the differences between the two operational scenarios considered below Hells Canyon Dam would be intermediate in magnitude (see Chapter 6 and Table 6.1 of Technical Report E.3.3-3, as well as Chapter 3 of the same report for numerical values represented by comparative terms such as "slight," "intermediate," and others). Species were classified into six categories. Overall, ruderal annuals would not substantially change under either of the two operational scenarios; a slight increase would occur in facultative riparian annuals and perennials under the proposed operations scenario (0.4% and 2.2%, respectively). A small increase in the obligate riparian annuals and perennials, particularly in the zone immediately above the mean annual water level, was predicted under the proposed operations scenario (2.2% and 9.0%, respectively). Additionally, an increase of 24.7% in hydrophytes, or water-loving plants, was predicted under the proposed operations scenario, although the magnitude of this increase was questionable. Currently, hydrophytes have a limited distribution at higher elevations because of localized water retention from fine sediment lenses. Investigators anticipated their distribution to remain sparse under the proposed operations scenario, with moderate increases in abundance and distribution under the full pool run-of-river scenario.

In the quantitative analysis of the existing shoreline zone (all lands within 11 meters vertically above the 20,595-cfs water surface elevation), 7.6% (262 of 3,435 acres) is estimated to be composed of riparian habitat. Under the proposed operations scenario, riparian habitat was projected to occupy slightly less area (7.4%, or 255 acres) than it currently occupies. Under the full pool run-of-river operations scenario, riparian habitat was projected to occupy even less of the shoreline zone (7.2%, or 246 acres) because no irrigation effect would occur. The Applicant concluded that slightly less riparian habitat than currently exists would occur along the shoreline under both of these operational scenarios, about 7 acres less under the proposed operations scenario and 16 acres less under the full pool run-of-river scenario. The proposed operations scenario would provide slightly more riparian habitat (about 9 acres) in the shoreline zone than the full pool run-of-river scenario.

Based on a combination of modeling analysis and life history consideration, 15 weedy species were predicted to be similarly affected by the two operational scenarios. One ruderal annual species, puncturevine, was predicted to increase in abundance under the proposed operations scenario, compared with the full pool run-of-river scenario. Four perennial species, including whitetop, leafy spurge, tamarisk, and possibly Russian olive, would be substantially reduced under the proposed operations scenario because the drawdown of Brownlee Reservoir would continue to impede their downstream expansion. The occurrence of a dispersal barrier imposed by the drawdown pattern of Brownlee Reservoir was also identified, providing a substantial ecological benefit of the proposed operations scenario by retarding the downstream spread of undesirable plant species, compared with their spread under the full pool run-of-river scenario.

Under the full pool run-of-river scenario, new sources of noxious weeds delivered to the canyon from above the HCC would 1) introduce species that were previously unknown to this reach (such as tamarisk); 2) significantly augment populations in the Oxbow and Hells Canyon reservoirs, which would increase their capacities to influence the downstream reach; and 3) add to existing populations of weedy species in the downstream reach. Combined, these influences would result in comparatively greater impacts to existing native perennial communities than impacts under the proposed operations scenario.

E.6.1.6. Existing Transmission Lines and Associated Service Roads

Several transmission lines are included in the existing project license. In addition, twelve transmission lines were included in the draft *New License Application: Hells Canyon Hydroelectric Project*. All but one of those lines have been excluded from this final license application because the Applicant has determined that they are not *primary* lines. The remaining transmission line is the Pine Creek–Hells Canyon 69-kV line (Line 945). Line 945 begins at the Pine Creek Substation near Oxbow Village and runs to Hells Canyon Dam along the Oxbow–Hells Canyon Road (also referred to as the Hells Canyon Road). The length of the right-of-way (ROW) is 22.3 miles, and the width is 50 feet. Twenty-one percent of the line is on BLM property; 72%, on USFS land in the Payette National Forest; and 7%, on private land. The primary land uses of the land through which Line 945 passes are transportation and recreation.

From a functional perspective, the presence of Line 945 has little, if any, effect on other land uses in the area but does affect visual quality. The lines are mildly reflective, and poles or towers visible in the foreground interrupt the landscape. However, a survey of canyon users found that people are relatively tolerant of transmission lines and accept them as a necessary part of the landscape. This finding is discussed further in section E.6.1.7.

Several mitigation measures for the visual impacts of this line were developed by the Aesthetic Subgroup.[4] This mitigation includes the following standards, the objective of which is to reduce the visual impacts of structures, conductors, and ROW through time:

1. When conductors are replaced or upgraded, nonspecular conductors will be used.

2. If a structure or series of structures need to be replaced during a planned rebuild, structure type and in-line location will be reviewed with the BLM and/or USFS to incorporate aesthetic concerns, when compatible with existing engineering needs and designs.

E.6.1.7. Existing Aesthetic Values

Section E.6.1.1. described the general aesthetic character of the study and project area through information about land forms, vegetation, and land uses in each reach and subreach. To summarize, the area upstream of the project area has rolling hills covered primarily with grasses and cultivated crops. The hills are somewhat removed from the river, and the river is relatively broad with large islands. Generally, the view is rural, though some highway commercial uses are located near I-84. On Brownlee Reservoir, higher sage- and grass-covered hills converge on the reservoir, creating an ever-narrower canyon downstream. Much of this reach is devoid of human signs; however, a few areas have residential development and docks along the reservoir fringes where sufficient level land exists. The reservoir is very broad. When the reservoir is lowered for flood control in wetter years, a large, light-colored ring (up to 101 vertical feet) is visible the length of the reservoir. This ring is referred to as the “drawdown zone.” The Powder River arm has a similar remote character near the confluence with the Snake River, but farther upstream, sage and grassland hillsides give way to residential development and docks along the river and then to more level areas with developed parks and a rural agricultural community. Large areas of riparian vegetation line the shoreline.

4. The Aesthetic Subgroup is a subgroup of the Recreation and Aesthetics Resources Work Group, a technical group formed as part of the collaborative process for relicensing the HCC.

On Oxbow Reservoir, the steep hillsides become rock cliffs and talus slopes. Greater vegetation growth, including shrubs and trees, occurs along the narrowing canyon bottom. The reservoir is also narrower here. Since reservoir fluctuation is minor (less than 5 feet over the period of a day), the drawdown zone is small. Considerable development is seen in this reach on the Oregon side, including many of the Applicant's major facilities.

The Hells Canyon Reservoir reach is dramatic, consisting primarily of vertical cliffs of rock and talus slopes. The canyon is generally narrow, with greater shrub and tree coverage. While some residential community development related to historic mining occurs on the Oregon side, the Idaho side has little development, except for Hells Canyon Park. At Hells Canyon Dam, the visual character is outstanding: the canyon is at its narrowest, the rock walls are sheer, the reservoir is still and reflects the scenery on the upstream side, and the river rushes away below on the downstream side. The river reach below the dam continues through a narrow, vertical basalt canyon for approximately 17 miles before broadening somewhat as the rock cliffs give way again to steep grass-covered hills.

In preparing this license application, the Applicant evaluated BLM and USFS objectives for visual resources. Technical Report E.6-3 was prepared to assess project effects on aesthetic resources in the canyon and along the project transmission-line ROWs. The BLM's Visual Resource Management System (VRM) was applied in the areas of predominately BLM land; the USFS's new Scenery Management System (SMS), in areas of predominately USFS land. With the exception of Line 945, the Applicant has removed all transmission lines from the final application.

Both of these visual management systems establish visual quality objectives for their management areas. These objectives are the yardsticks against which ongoing project facilities and operations are evaluated to determine compliance. For those facilities and operational effects that do not comply, the study identified possible mitigation that would lessen the impact or might bring the facility or effect into compliance. Within the VRM study area, 59 viewpoints were identified, 47 of which had views of project facilities or operational effects. Visual contrasts were rated so that the appearance of the project facilities and effects could be compared with the established visual objectives. Thirty-five of the 47 viewpoints were found to exceed the acceptable level of contrast allowed to maintain the visual quality objective. (At the request of the BLM, the study also reevaluated the conditions on which its visual quality objectives are based and recommended some changes. If the BLM were to adopt the recommended changes, 10 of the 35 viewpoints exceeding acceptable contrast would become compliant.)

The nature of visual contrasts identified in the VRM study area included visibility of transmission-line structures (see section E.6.1.6.), as well as the appearance of power-generation facilities and substations, reservoir drawdown, vegetation alterations, and hardscape elements (that is, recreation facilities). Facilities visible from these key observation points (viewpoints) include the Brownlee and Oxbow dams, powerhouses, substations, access roads, appurtenant facilities, and all three reservoirs. These facilities typically dominate views and create strong to moderate degrees of contrast in form, line, color, and/or texture.

Reservoir drawdown on Brownlee Reservoir is a result of the seasonal water-level fluctuations in the reservoir and appears in the landscape as a distinct white- to buff-colored band along the perimeter of the reservoir. The effect can be dramatic since the spring drawdown for flood control can lower the reservoir level as much as 101 feet in spring, although the reservoir has been fully drawn down only three times in the past 30 years. A more normal drawdown is 20 to 70 feet. In fall, drawdown for the fall chinook program lowers the reservoir generally between 10 and 70 feet, depending on various conditions. Very little drawdown effect is visible on Oxbow Reservoir (normally 3 to 5 feet during the day) since it functions as a re-regulating reservoir, with only minor fluctuations occurring over the course of a day. Consequently, the drawdown effect on these reservoirs typically results in weak contrast in form, line, and texture and moderate contrast in color.

Deviations from native vegetation create visual contrast on both Brownlee and Oxbow reservoirs. Two types of deviations were noted. Where receding water levels create opportunities for annual weed species to colonize on bare soil of the drawdown zone, they may contrast weakly in form, line color, and texture when viewed from key observation points. The other type of deviation occurs where exotic plants are incorporated into the landscape at facilities and parks. The intensive use of exotic plants and their unnatural placement in the landscape results in strong to moderate contrasts in form and line, moderate contrast in color, but weak contrast in texture.

Hardscape elements include items such as site furnishings, parking areas, boat ramps, roads, picnic shelters, and toilet facilities. These features are most apparent at developed recreation sites and at some dispersed recreation sites, often in combination with exotic vegetation. Woodhead Park and Hells Canyon Park are most notable for the visual contrast of hardscape because of the nature of hardscape materials and designs used there compared to the surrounding landscapes. Hardscape elements generally create strong contrasts in form, line, and color but moderate contrasts in texture.

In the SMS (USFS) study area, 93 viewpoints were identified as potentially subject to evaluation. Because 44 of these were eventually identified as having views of or being affected by project facilities or operational effects, they required evaluation. Views were compared with the visual quality objectives previously established by the USFS, or with those developed during the study. Results showed that 41 of the 44 special places (viewpoints) did not meet the desired landscape character, one part of the visual quality objective. In addition, at 33 of the 44 viewpoints, the desired scenic integrity, the second part of the visual quality objective, was not achieved. However, in some of the locations, the Applicant's facilities or operations did not lead to the viewpoints' failure to achieve the objective. For example, some viewpoints had a less than optimal ecological stage because of long-term human use, while others failed to achieve the objective because of the presence or condition of visible structures that were not associated with the HCC.

The nature of contrasts identified in the SMS study area included transmission structures (see section E.6.1.6.), power-generation facilities, reservoir drawdown effects, river water-level fluctuations, alterations to vegetation, hardscape elements and structures, and the loss of sandy beaches. Most of these contrasts were similar to those described for the VRM study area. Power-generation facilities in this study area included Hells Canyon Dam and associated equipment. The study found that, in addition to creating strong to moderate deviations in form, line, color, and texture from the landscape, the design of the entry sequence provided at the dam to the USFS Hells Canyon Visitors Center just downstream was inadequate to the importance of the place—that is, the entrance to a national recreation area, wilderness, and wild and scenic river. The reservoir drawdown effect on Hells Canyon Reservoir is significantly less noticeable than on Brownlee Reservoir. Hells Canyon, as a re-regulating reservoir, normally fluctuates only 2 to

3 feet daily, the maximum being 5 feet (under typical conditions). Since the drawdown zone regularly receives water, vegetation does grow in it, thereby decreasing or eliminating any contrast in color or texture. Alterations to vegetation are similar to those found in the VRM study area. In addition, however, in the HCNRA below Hells Canyon Dam, vegetation at many sites (about 6 acres total) is trampled because of heavy recreational use. This trampling is not a direct effect of the complex, but is due to the existence of the HCNRA. The possible loss of sandy beaches was raised as an issue because previous studies documented the erosion of beaches below the dam. However, based on current studies, the HCC's contribution to this condition is limited (see section E.6.1.5. and Technical Reports E.1-1 and E.1-2).

Various surveys of canyon users were conducted to determine the places they consider aesthetically important and the extent to which the HCC affects their visual enjoyment of the canyon. Participants assigned scores of 1 (dislike very much) to 7 (like very much) to 33 photographs of the canyon shown in the survey. As expected, results revealed that relatively undisturbed, dramatic images of the canyon landscape rated highest (6.0 and above), although half of these included some type of project effect, and that images with mid-range scores (5.9 to 5.1) included noticeable human alterations such as road cuts, distant transmission lines, and limited development. Most of these photographs included project effects. Images with the lowest scores (4.9 to 4.1) included substantial human alterations such as transmission lines, roads, dams, and significant development in the foreground or middleground view. All of these photographs included project effects. The consultant who conducted the survey concluded that, while the Applicant's facilities do have an interruptive effect on views, constituents are generally tolerant of the visual impacts of project effects and accept them as a necessary part of the landscape. They were also found to be more tolerant of visual effects upstream of Copperfield Park (that is, along Oxbow and Brownlee reservoirs) than downstream (Hells Canyon Reservoir and the wild and scenic areas of the Snake River).

Measures that could lessen or eliminate the visual effects on these sites were also considered. However, at this point, the consultant, Applicant, and Aesthetic Subgroup also recognized that visual quality is only one factor among many that should be balanced in the environment. For example, in the hot, dry canyon, many visitors welcome some areas of exotic green grass and shade trees. While light or reflective colors often do contrast with the surrounding landscape, in the heat of the canyon, heat reflectance in buildings is important. And, although unnatural colors of hardscape and buildings detract from the natural landscape, they help recreationists locate these facilities and therefore reduce the potential for sign clutter.

E.6.2. Applicant's Existing and Proposed Measures or Facilities

E.6.2.1. Measures or Facilities Recommended by the Agencies

To consolidate measures, the Applicant has included measures or facilities recommended by the agencies in section E.6.4.6. The measures are listed by agency. Measures that the Applicant has accepted appear first; they are followed by measures that the Applicant has rejected, as well as reasons for their rejection.

E.6.2.2. Existing Measures or Facilities to Be Continued or Maintained

No measures for impacts to wetlands and floodplains, aside from the Applicant's *Emergency Action Plan*, or for impacts to aesthetic resources currently exist. However, the Applicant administers the *General Land Management Policies* (GLMP), a plan that ensures compliance with the land-use article of the current project license and compatibility among land uses in the project area and vicinity. Administration of this plan would continue until a new license was issued, at which time the proposed *Hells Canyon Resource Management Plan* (HCRMP) (see section E.6.4.) would be administered in place of the GLMP or until the Applicant voluntarily chose to begin administering the HCRMP instead of the GLMP, whichever occurred first.

E.6.2.3. Mitigation for Construction Impacts to Wetlands and Floodplains

The Applicant proposes no mitigation for construction in wetlands and floodplains since no such construction is proposed.

E.6.2.4. Mitigation for Operations of the Hells Canyon Complex on Wetlands and Floodplains

The Applicant proposes to acquire riparian habitat to mitigate for impacts of ongoing project operations to wetland areas. The Terrestrial Resources Work Group, a technical group formed as part of the collaborative process for relicensing the HCC, strongly favored land acquisition as its top priority for mitigating project impacts to riparian habitat. In addition, the Applicant would manage its existing property in the Powder River arm for protection and enhancement of riparian vegetation. The Powder River pool area is one of only two areas within the project boundary where there could be substantial mitigation for losses of riparian habitat caused by HCC operations. The Applicant currently owns approximately 190 acres in the vicinity of the pool that would be incorporated as part of the land acquisition measure. Managing for protection and enhancement of this area would require additional funding.

While large fluctuations on Brownlee Reservoir may help reduce the spread of several noxious and weedy perennial species downstream of the Weiser reach, ongoing operations can contribute to the spread of a few noxious annual weeds along the reservoirs and downriver. Since state laws require landowners to control noxious weeds on their lands, the Applicant will control noxious weeds and proposes to monitor and reseed sites through cooperative projects with federal and state land managers.

Although, at most, the complex scarcely affects the floodplain, the Applicant complies with the FERC requirement of an emergency action plan, anticipating possible flooding actions and planning for their management.

E.6.3. Description of Wetlands and Floodplains

Information about wetlands and floodplains is included in section E.6.1.3. and section E.6.1.4., respectively.

E.6.4. Buffer Zone for Protecting Recreational and Aesthetic Values

To establish or maintain compatibility between and among the various land and water uses in the vicinity of its hydroelectric projects and to promote excellent land stewardship, the Applicant has prepared comprehensive resource management plans. The HCRMP was developed as part of the collaborative process conducted during relicensing and addresses resource management, including land use, in an integrated manner. The plan is included as Technical Report E.6-1. It contains goals and objectives, land- and water-use designations, and land-use and other resource management policies. The HCRMP creates virtual buffers between what might otherwise be conflicting uses, such as project facilities and recreation or wildlife habitat. While the HCRMP addresses the entire planning area, the Applicant will implement these policies only on its own lands. The Applicant will not implement these policies on any lands owned or controlled by others, except as a cooperative effort. The following sections describe policy direction included in the plan and that is intended to protect multiple uses in the project area.

E.6.4.1. Public Access

The Applicant's road along the Oregon side of Oxbow Reservoir and its Hells Canyon Road along the Idaho side of Hells Canyon Reservoir provide the primary public access to these areas. In addition, the Hells Canyon Road provides the only land access to the USFS Hells Canyon Visitors Center in the HCNRA. These roads will continue to allow public access for recreational and other purposes. The Homestead Road, along the Oregon side of Hells Canyon Reservoir to approximately Copper Creek, is a county road, but it is maintained by the Applicant to about Ballard Creek.

In addition, access to the reservoirs and recreation facilities is provided over the Applicant's lands. Areas immediately adjacent to project facilities where either public safety could be an issue or access would compromise security of the facilities are generally closed to the public. Private residential areas on company lands are not intended for public use or access. Those areas not open to the public for safety or security reasons are signed and/or fenced to prohibit trespass. All other Applicant lands have been and continue to be accessible to the public.

During the collaborative process for this license application, various technical resource work groups concluded that public access and recreation must be managed to protect natural and cultural resources in the area. The remoteness of the canyon protects the wildlife, their habitat, and other resources, and it constrains human access. While the current level of recreational use in the canyon may not be highly detrimental to these resources, substantially higher levels would create greater conflicts. Scientists interpret actions to improve human access, either by improving the number or quality of access points, as potential threats to resource protection. Therefore, in areas where the Applicant found that natural and cultural resources are highly sensitive and preservation is justified (*resource protection* areas; see section E.6.4.2.), the HCRMP sets a policy that major road improvements (intended to improve traffic flow) should not be supported. In all areas, however, the plan proposes to maintain existing public access on the Applicant's roads and lands, except where public access may threaten public safety and/or the security of HCC facilities.

E.6.4.2. Recreation

The Recreation and Aesthetics Resources Work Group, another work group developed as part of the collaborative process for relicensing the HCC, created a plan for future recreation in the canyon. This plan ties directly to land use. The group studied existing access, geomorphic and natural resources, and recreation conditions in the project vicinity and identified six zones having relatively homogeneous characteristics. Vision statements projecting desired conditions for the future were prepared for each zone, along with guidelines for recreational activities and facilities in the zone (see section E.5.4.2.). Group members then developed a conceptual recreation hierarchy that included elements defined as major nodes (areas with a relatively high level of recreation development and a number of facilities), minor nodes (areas with a lower level of recreation development and fewer facilities than major recreation nodes), points (locations of single recreation facilities, functions, or features), and lines (linear recreation features, mainly trails). Based on the vision statements and guidelines, this hierarchy was applied to existing and future recreation sites to create a plan for recreation facilities. Although most of the sites identified already exist, the plan also defines any improvements that might be made at each of the facilities. The plan not only provides a basis for the Applicant's proposed protection, mitigation, and enhancement (PM&E) measures, but also provides information for governmental agencies responsible for managing recreation facilities in the vicinity of the HCC. The plan also provides the basis for the recreation component of the HCRMP, which then integrates that recreation component with other environmental and human elements in the project vicinity.

The amount of recreation occurring in both the vicinity of and within the HCC is considerable (Technical Reports E.5-2 and E.5-3). In the studies and scientific discussions conducted in support of the license application, participants learned that, like most human actions, recreation in Hells Canyon poses both opportunities and constraints. The opportunities offered include the enjoyment of a wide range of activities under a variety of conditions in a unique setting. The constraints posed on the environment are related to human activity and its resulting physical manifestations. Therefore, recreation management in the HCRMP is partially directed at seeking compatibility of uses. The management directive determined for the overall HCRMP is to “provide for continued human use and opportunities while protecting natural and cultural resources” (that is, balancing resource priorities).

Before compatibility policies could be developed, the effects of HCC land use on recreation had to be considered. In turn, the effects of recreation on project facilities and operation and on other land uses also had to be considered. First, dams, powerhouses, spillways, administrative buildings and yards, roads, transmission lines and substations, and the supporting communities displace possible recreation use of those lands. Activities associated with project operation and maintenance of facilities, transmission lines, roads, and parks can disturb recreation occurring in the same area.

However, HCC land use also benefits recreation. Four developed parks are provided by the Applicant within the project area, all of which provide for overnight camping, day use, and reservoir access (see section E.5.1.2.5. for more information about these parks). The Applicant’s roads provide the only access to locations along the Oregon side of Oxbow Reservoir and the Idaho side of Hells Canyon Reservoir, as well as to the USFS Hells Canyon Visitors Center just downstream of Hells Canyon Dam. Sanitary facilities, including portable and vault toilets and garbage containers, are located at a number of dispersed recreation sites. The project and its support communities, as well as agreements between the Applicant and the counties supporting emergency services, make emergency assistance readily available to recreationists.

On the other hand, recreation can also conflict with project facilities and communities. Vandalism, as well as accidental damage, occurs to facilities and parks. Recreationists often fail to use sanitary facilities. The transient population can disturb community residents. Perhaps a greater concern in Hells Canyon is the interface between recreation and cultural and natural resources. The canyon provides winter habitat for a number of big game species. A number of sensitive species, as well as species listed as threatened or endangered under the Endangered Species Act (ESA), are found in the canyon. Furthermore, many cultural resource sites have been identified throughout the study area, any of which can be damaged by human activity. In some cases, significant potential conflicts between recreation and natural and cultural resources were identified during a human use study (Technical Report E.3.2-46). Therefore, the HCRMP establishes land- and water-use designations in appropriate areas to balance the various land uses, as well as management policies to further protect the resources. The use designations define the primary uses, while the accompanying policies describe additional allowable uses and how they are to be managed to remain compatible with the primary use.

Two designations provide for recreation to be the primary land use in applicable areas: *developed recreation*, which allows for developed facilities, and *dispersed recreation*, which addresses impromptu activities for which development is limited to sanitary facilities and definition of the site to protect other resource values. The areas designated for these uses generally have road and reservoir access, relatively level ground, and a high level of existing recreational use. Level land suitable for many activities is limited in the canyon. Essentially only a thin rim of land adjoining the shoreline of the reservoirs is sufficiently level for developed facilities or impromptu camping. Most of the larger level areas have already been developed with recreational facilities. So the smaller level areas are used heavily for dispersed recreation. An additional consideration in designating recreation areas was the level of sensitivity of wildlife resources in the area. If studies showed that recreation use has been generally low and resource values higher, the area was designated as *resource protection* for the primary use, rather than as *dispersed recreation*.

In both of the recreational-use designations, provisions for allowing utility facilities related to the HCC are specified and tightly controlled. Only facilities directly serving the recreational facility—or transmission, distribution, or other infrastructure lines that comply with listed criteria—are allowed in these designated areas.

Developed and dispersed recreation uses are also allowed in other land-use designations with which they may be compatible. Developed recreation is allowed in the *community* and *resource conservation* designations, the lowest level of resource protection included in the plan. Dispersed recreation, because of its transitory nature, is allowed in all other designations. However, in the designation of *special management area* (sometimes referred to as *SMA*, the highest level of resource management), dispersed recreation is discouraged unless a specific site plan is developed that allows such recreation. In addition, in the *resource protection* designation, policies call for evaluation of all dispersed recreation sites (identified areas where less transitory activities such as camping regularly occur) to determine whether they should remain or be rehabilitated as wildlife habitat. A policy also calls for dispersed recreation sites in all other designations to be evaluated to determine the need to define access and camping areas so that recreational activities are contained and vegetation and other resources are protected.

A third designation also relates to recreation: *recreation reserve*. While the philosophy of the HCRMP is to avoid significantly expanding recreational use and development, most participants of the Recreation and Aesthetics Resources Work Group recognize that, with population growth in the region, provision must be made for some increase in recreational use. A monitoring program for recreation would be established to determine needs as they develop. In anticipation of the need to expand recreation facilities, the *recreation reserve* designation is to be applied to lands recognized as suitable for future recreational development. Then these areas can be preserved for that future use. A single parcel has been given this designation at this time: an existing trailer park on the Oregon side of Oxbow Reservoir that includes remnants of an orchard. Short-term land uses other than recreation are allowed on this parcel until the land is needed for developed recreation.

In addition to the land- and water-use designations for recreation that were described above, the following recreation policies that apply in all areas, referred to as Common Policies, have also been established. These policies are excerpted from Technical Report E.6-1. (Note that in the Common Policies, the use of the words *will* and *should* are significant, indicating which policies are intended to implement legal requirements [will] and which are intended to achieve policy goals that are important but discretionary [should]).

1. Public recreation is allowed on IPC [Idaho Power Company] lands unless those lands have signs or fences to exclude the public. However, gatherings for which an attendance fee is charged and gatherings of more than 15 people require written authorization from IPC.

2. Existing developed recreation facilities should be improved and redeveloped.

3. Recreational development and use should be clustered, rather than dispersed, to help maintain extensive, undisturbed areas in which to sustain natural and cultural resources. (*The continuance of dispersed recreation in existing sites is recognized; however, significant expansion of dispersed recreation sites in the area is not desirable.*)

4. Opportunities for viewing and enjoying the natural resources of the canyon should be provided. The interpretive and education program should provide information to visitors to enable them to appreciate the natural resources while also minimizing potential conflicts.

5. Dispersed recreation sites will generally be maintained because they provide a particular type of recreation experience. However, individual sites may be evaluated and modified or closed to protect natural or cultural resources.

6. No dumping of refuse will occur in the Planning Area[5], except in designated waste receptacles. Visitors generating trash in the area are responsible for packing out that waste.

7. Sanitary facilities will be provided in conformance with the IPC, USFS, and BLM recreation plans.

8. Wherever camping is allowed, its duration will be limited to 14 consecutive days. At the end of that time, all personal property must be removed from the site. The recreationist(s) will then relocate at least 14 miles away from that site.

5. The Planning Area is the geographic area considered in the development of the HCRMP and for which the plan's policies are appropriate. This area is the same as the study area described in section E.6.1. of this exhibit.

9. Motorized watercraft will be limited to a no-wake speed limit (approximately 5 to 7 miles per hour) within 100 feet of the shoreline of all reservoirs to minimize safety hazards to other activities in accordance with both Idaho and Oregon State Law.

10. No mechanical work on motor vehicles or other machinery, except for emergency actions, should be conducted on or near reservoir waters.

11. All new recreation development will be constructed in compliance with the aesthetic design and landscape standards. Existing development will be brought into compliance with these guidelines during normal maintenance and reconstruction.

12. Recreation development should be designed to minimize disturbance to natural and cultural resources from human activities. Screening, berming, fencing, and other buffers should be used to achieve this.

13. Habitat enhancement should be undertaken along with recreation development when and where the IPC Interdisciplinary Team[6] determines that such enhancement could benefit natural resources.

14. Areas within and near the project boundary that are appropriate for developed recreation should be reserved for future recreation development and should be designated *recreation reserve.*

15. Private docks may be allowed on IPC's lands in accordance with the land-use designations established in this plan [the HCRMP] and with the *Policy and Guidelines for Private Boat Docks* (IPC 1994). That policy requires that an applicant wanting to obtain a special-use permit from IPC apply for one. The applicant must "…own or lease land adjacent to a reservoir or adjacent to Company-owned freeboard land," and such land "…must have at least 75 linear feet of freeboard frontage." Private docks will not be permitted within areas designated for *resource management* in this plan.

6. The Applicant's Environmental Affairs manager will organize an internal interdisciplinary team to make decisions and provide input on all land/water use and management determinations related to the HCRMP. The team will include, at a minimum, representatives of aquatic, recreation, botanical, wildlife, cultural, aesthetic, water management, and land use areas of study.

16. Community docks serving two or more residential dwellings will be preferred over multiple private docks, although community docks are subject to the same provisions as private boat docks.

17. Structures attached to boat docks, including shelters, shanties, or dwellings, will not be allowed.

18. IPC should work with county governments to resolve potential sanitation problems from existing covered docks.

19. IPC should work with private property owners to protect their lands through improved communication, considerate facility design, use of buffer areas, provision of sanitation facilities, monitoring of recreational activity, and other management activities on IPC lands.

E.6.4.3. Aesthetic Values

To address the various effects of the HCC on aesthetic resources in the canyon, several possible PM&E measures were identified in the aesthetic resources study (see Technical Report E.6-3), though many of these measures were not practical for a variety of reasons. The Aesthetic Subgroup identified measures that would have the greatest aesthetic benefit for the cost in locations that are most visible to visitors. The final measures fall into the following seven categories:

1. Design standards and guidelines for physical structures

2. Design standards and guidelines for landscaping

3. General aesthetic clean-up plan and implementation

4. Replacement of guardrails

5. Mitigation of contrast from project facilities

6. Enhancement of others' facilities

7. Information and education

Although some measures fall into more than one of these categories, they are grouped in the most appropriate category. Ultimately, the goal is to blend facilities and operations with the surrounding landscape. Technical Report E.6-3 details the justification for implementing these measures.

E.6.4.3.1. Design Standards and Guidelines for Physical Structures

The Applicant proposes to develop standards (mandatory) and guidelines (advisory) for designing new structures and modifying existing structures. Objectives for these standards and guidelines are as follows:

1. Provide a consistent architectural style for facilities throughout the canyon.

2. Carry out the recreational visions for different zones of the HCC.

3. Blend the appearance of structures with the natural environment.

4. Facilitate direction and guidance for visitors without creating excessive visual contrast.

5. Minimize maintenance needed to address vandalism and natural aging.

6. Establish an appearance of permanence in all structures and facilities.

Standards and guidelines would address the visual factors of form, line, color, and texture, in addition to facility placement. The Aesthetic Subgroup has defined a "homestead" style of architecture as the concept for the architectural standards and guidelines. This style is generally defined as a rectangular or square building or structure with a moderately pitched roof. Some exceptions to this style may be included. Rough-sawn lumber and native rock, or materials that resemble them, are the materials to be used in construction. Other materials used in historic structures in the canyon may be considered. Construction is to vary by region. More lumber- and less rock-like materials would be used at the upstream reaches, while more rock- and less lumber-like materials would be used in the downstream reaches to reflect the rocky canyon cliffs. The following types of facilities would be addressed by the standards and guidelines:

1. Portal facilities. Several locations in the project area have been identified as portals to Hells Canyon. The standards would define what services or facilities are appropriate in a portal facility and would provide general design guidelines for them.

2. Camping and recreation areas. Levels of development would be defined, and standards and guidelines appropriate to each level would be included.

3. Viewpoints. Facilities appropriate for interpretation and sightseeing at viewpoints will be described.

4. Information kiosks.

5. Restrooms (portable, vault, or plumbed to septic system).

6. Barriers (guardrails, access limitation, or pedestrian safety).

7. Public and private boat docks.

8. Pathways and trails.

9. Site furnishings (picnic tables, benches, trash containers, fencing, walls, and fire rings).

10. Water and septic systems (visible portions).

11. Fish-cleaning stations.

12. Definition of campsites and minor access roads.

13. Signs, including directional, entry portal, identification, information, and interpretive. Public safety signs should be consistent with the current *Manual on Uniform Traffic Control Devices* (FHWA 2001).

14. Other (telephone booths and vending machines).

The standards and guidelines would be developed through a consultation process, including the Applicant's Interdisciplinary Team and agencies involved in the Aesthetic Subgroup. All new and modified Applicant structures (at the time of construction or modification) must comply, as must all new and existing leases, permits, and other agreements that may involve construction or modification of a structure.

Cultural resources, specifically historic resources, should benefit from this measure since efforts taken under this proposed measure would increase viewers' awareness of the historical background of the canyon.

E.6.4.3.2. Design Standards and Guidelines for Landscaping

The Applicant proposes to establish standards and guidelines for the design of vegetation and hardscape elements and structures in developed areas to achieve the following objectives:

1. Support the objectives of the design standards and guidelines for physical structures.

2. Provide appropriate landscaping for the type and level of activity in areas.

3. Control noxious weeds and undesirable vegetation.

4. Blend developed areas into the natural landscape.

5. Restore and sustain the occurrence of desirable vegetation in Hells Canyon.

Below is a list of landscaping measures that would be addressed in the standards and guidelines and would meet the objectives that were listed above:

1. Summarizing existing conditions affecting landscaping in the canyon area including vegetation, topography, soils, climate, water source, and levels of use.

2. Identifying appropriate vegetation types and hardscape materials for specific site types, including portal facilities, camping and other recreation areas, viewpoints, and other sites.

3. Identifying sensitive plant species that occur in the Planning Area and ways to protect them.

4. Controlling weeds, including appropriate methods of weed control by site type, for both noxious and nuisance weeds.

5. Using aesthetic screening, including identification of appropriate situations for screening, plant materials, and other materials.

6. Listing appropriate plants to use, including native plants and acceptable ornamental and exotic plants.

These standards and guidelines would be developed through a consultation process including the Applicant's Interdisciplinary Team and agencies involved in the Aesthetic Subgroup. All new and modified landscaping by the Applicant (at the time of development or modification) must comply, as must all new and existing leases, permits, and other agreements between the Applicant and other parties for projects that may involve development or modification of landscaping.

Benefits of this measure would also affect recreation and botanical resources since the plant list would exclude nuisance types of plants that could injure recreationists or interfere with their activities. Standards and guidelines would also emphasize the use of native botanical species over exotic species, particularly those species that dominate native types. A list of sensitive species in the Planning Area, along with drawings or photographs, would help in efforts to protect and further the occurrence of these plants.

E.6.4.3.3. General Aesthetic Clean-Up Plan and Implementation

The following measures regarding general clean-up would be included:

1. Relocating the burn pit adjacent to Hells Canyon Park away from the road to a visually acceptable location.

2. At the Oxbow plant, dam, and spillway, sandblasting graffiti off a rock in Oxbow Reservoir and cleaning up general litter left by anglers, the area around the fish hatchery, and gravel/ concrete spoils piles scattered through the vegetation in the vicinity of the dam.

3. In the Brownlee Yard area, cleaning up the yard to be orderly and reduce visual contrasts; constructing a shelter for materials; screening the view of the yard from the road, to the extent possible.

4. Along Oxbow and Hells Canyon roads, cleaning up spoils piles along the road and removing or replacing damaged signs.

5. Controlling noxious and nuisance weeds at all facilities and continuing to work with the BLM to manage weeds at the Weiser Dunes.

These measures would benefit recreational activities since recreationists have complained that litter and waste left by others has decreased the quality of their recreational experiences. Botanical resources in the vicinity of project facilities would also benefit from the control of nuisance and noxious weeds. These control efforts would impede the spread of weeds that decrease the abundance of desirable plant species within and near the project area.

E.6.4.3.4. Replacement of Guardrails and Jersey Barriers

Metal guardrails and Jersey barriers would be replaced throughout the project area with barriers made of corten steel or other visually acceptable material. However, Jersey barriers would not be replaced where they function as barriers to slides and falling rocks along roads and developed areas.

E.6.4.3.5. Mitigation of Contrast from Project Facilities

The line, form, color, and/or texture of a number of structures and their surroundings at the Applicant's facilities differ notably from the surrounding landscape. The following measures would lessen the contrast:

1. Developing and implementing a plan to modify the "cage" over Idaho 71 near the Brownlee Yard to minimize the visual contrast while continuing to protect the powerhouse from rocks.

2. Modifying the color and reflectance of facilities at Woodhead Park during the normal maintenance process so that they comply with design guidelines and standards and modifying the landscaping during the normal maintenance process (during the first 5 years after a license is issued) to improve the transition from park to natural landscaping.

3. Defining and emphasizing the entrance to McCormick Park, paving the access road, screening the flood berm and spoils pile, replacing the jersey barriers in the parking lot with wheel stops, and modifying signs to comply with design standards.

4. Developing and implementing an overall improvement plan for the Oxbow Power Plant area, including painting the shop building, to lessen the visual contrast.

5. Enhancing and identifying the entrance to Oxbow Village, including refurbishing the visitors' area, removing or modifying the chainlink fence on the north side of the road and landscaping this area, landscaping around the facilities on the north side of the road, improving signage, painting buildings and structures during normal maintenance so they contrast less with the surrounding landscape, and landscaping or filling the "island" in the road on the Idaho side of the bridge.

6. Making improvements at Bob Creek and the landing strip, including contouring and revegetating bare earth at the end of the airstrip, and minimizing contrasts of the old substation, including the color of the building and chainlink fence. Alternatively, the substation building could be removed.

7. Redesigning Hells Canyon Park to comply with design standards and guidelines (see section E.5.4.4.3.3.); enhancing the entrance to the park, including removing or modifying the chainlink fence, screening and landscaping the RV dump station and caretaker's house, and visually tying the park entrance with the landscaping.

8. Developing and implementing an improvement plan for Hells Canyon Dam, including enhancing the road entrance to the dam and HCNRA, painting contrasting or reflective fixtures (such as railings and light standards), relocating or interpreting stop logs, revegetating the shoreline below the dam, and providing interpretation of the complex.

9. Developing and implementing a conceptual plan for enhancing the Brownlee Bridge area (just below Brownlee dam), particularly the dispersed recreation area at the Oregon end of the bridge, and visually tying the various elements together.

Improvements to Hells Canyon and McCormick parks and to Oxbow Village, along with the enhancement of the Brownlee Bridge area, would also benefit recreation since they would improve the quality of the recreational experience. The berm and spoils pile at McCormick Park would be screened as mitigation for botanical resources, but this screening would also enhance the aesthetic values by improving the line and form of these features.

E.6.4.3.6. Enhancement of Others' Facilities

The Applicant would cooperate with the BLM and USFS to develop and assist them with implementing the proposed design standards and guidelines at the following recreation facilities that they operate in the project area. These cooperative efforts are described fully in section E.5.4.4. Because all structures and landscaping to be modified or replaced at these facilities would be done in accordance with the standards and guidelines for physical structures and landscaping (see section E.6.4.3.1. and section E.6.4.3.2.), these actions would also mitigate for aesthetic impacts described in Technical Report E.6-3.

1. Spring Recreation Site on Brownlee Reservoir (BLM)

2. Copper Creek Trailhead on Hells Canyon Reservoir (BLM)

3. Big Bar on Hells Canyon Reservoir (USFS)

4. Eagle Bar on Hells Canyon Reservoir (USFS)—This measure would include eliminating the visual contrast resulting from concrete pads at this site and from impromptu camping. The concrete pads would either be removed or covered with native gravel, and the site would be screened from the road with vegetation.

E.6.4.3.7. Information and Education

The Applicant proposes to provide signs and/or facilities that interpret some elements of the HCC that cannot be effectively modified to reduce their visual contrast. The overall plan for the project (see section E.5.4.4.1.3.) would determine those sites for interpretation. The following sites should be considered in that evaluation:

1. Farewell Bend State Park (Oregon)—Partnering with the Oregon Department of Parks and Recreation to provide interpretive signage regarding reservoir drawdown and improving the appearance of the dock affected by the drawdown

2. Salmon Net Anchor below Brownlee Dam

The Aesthetic Subgroup determined that one additional measure—developing an overlook on Kleinschmidt Grade to provide an uninterrupted view of the canyon—was unwarranted but that it would be considered in the future if recreation monitoring indicates that sightseeing has increased substantially since the current studies were completed.

E.6.4.4. Natural and Cultural Resources

Establishing compatibility among recreation and other land-use practices in the vicinity of the HCC (see section E.6.4.2.) introduced the Applicant's approach for balancing the various land uses and resources in the canyon. Based on the studies conducted for this license application, the Applicant has identified several measures intended to protect and improve wildlife habitat and cultural resources. The policies of the HCRMP are consistent with these measures.

In developing the HCRMP, the Applicant recognized that there are areas within the project where resource protection should be the dominant objective and where natural and cultural resources should be buffered from areas of human activities. In such instances, the HCRMP helps define policies that would minimize the potential for human interference.

The *resource management* designations identify areas where resource management is the dominant objective. Three levels of resource protection are defined: *special management area*, *resource protection*, and *resource conservation*. The *special management area* (or *SMA*) designation provides the potential for the highest level of resource protection, but also the greatest flexibility for considering specific, highly sensitive resources and specific site conditions. The *SMA* designation would be applied to such resources as eagle nest and roost sites, rare plant sites, and large areas of or particularly valuable riparian vegetation in strategic locations. Until a specific resource plan is developed for an *SMA*, human activities would be curtailed.

The *resource protection* designation is intended to provide a high level of protection to more extensive, but still highly sensitive, resources. Winter range and important habitat for sensitive species are examples of *resource protection* areas. Secondary uses allowed in this designation are limited. Dispersed recreation sites in these areas are to be evaluated to determine whether they should be rehabilitated as wildlife habitat, defined to guide recreation and protect resources, or maintained in their current condition. Sites that conflict with the intent of the plan are to be rehabilitated as wildlife habitat. In addition to limiting motor vehicle travel to roads, motorized trails, and access drives, policies for *resource protection* call for no new roads to be constructed or major road improvements to be supported. Existing vegetation is not to be removed within a *resource protection* area, except as part of an approved action.

The *resource conservation* designation provides a lower level of protection for less sensitive resources. Although resource protection remains the primary objective in these areas, more intensive human activities—including developed recreation, community features, utility facilities, and gravel extraction—may be permitted if a proposal is found to be compatible with other uses and resources nearby.

In addition to the land- and water-use designations and policies described above, the HCRMP includes the following Common Policies for natural and cultural resources in all designations (excerpted from Technical Report E.6-1).

E.6.4.4.1. Aquatic Resources

1. Sufficient water levels will be provided during the spawning and incubation period to protect fall chinook redds.

2. Reservoir fluctuations will be limited (in accordance with the warmwater fish plan) to protect spawning of bass and crappie.

3. Excavation, dredging, and filling in perennial streambeds should be timed to protect fish, wildlife, and other resources.

4. Best Management Practices (BMPs) for resource protection should be defined and followed for any development, improvement, and maintenance activities.

5. Any chemical herbicides used near a waterway will consist only of products approved by the U.S. Environmental Protection Agency for aquatic application. These products will be used in compliance with labeling instructions and will be applied by a state-certified applicator.

6. No significant human action should occur within 75 feet of a perennial tributary stream, except for activities that are important for resource protection or essential for utility operations, or for public access where streamside location is necessary.

7. All new and replaced culverts for drainage purposes will comply with Oregon and Idaho fish passage requirements.

E.6.4.4.2. Botanical Resources

1. Native plant species that enhance the shoreline are encouraged to be planted in the shoreline buffer zone to provide stabilization, wildlife, and aesthetic benefits. Appropriate plant species

will be selected from the aesthetic landscape standards and in consultation with IPC's botanical ecologist.

2. Areas of significant riparian vegetation that are accessible by motor vehicles from roads should be protected from vehicle access.

3. No significant human actions should be undertaken within areas of significant riparian vegetation, except for land management, necessary operations and maintenance, and resource enhancement or protection activities. These allowed activities should minimize destruction of vegetation.

4. Except for sensitive botanical species, botanical resources will be made available to Native American tribes for medicinal and other traditional purposes.

5. Wherever grazing or agriculture may be permitted, an acceptable grazing and/or agriculture management plan will be provided by the applicant, describing the proposed use and proposed monitoring of conditions. Any proposed changes in the use will require the permittee to update the plan and obtain IPC's approval. Grazing leases will be coordinated with appropriate state and federal agencies when they adjoin state or federal lands.

6. An approved plan to control noxious and nuisance weeds during and after construction should be included in all project plans. A botanical ecologist will conduct a predisturbance survey of the site to determine the presence or absence of such weeds. If present, prior to construction, weeds will be controlled within the area to be disturbed, as well as in undisturbed lands within 50 feet of that area. Where noxious weeds are found and controlled, efforts will be monitored for three growing seasons and actions taken to eliminate them from the site.

7. Any chemical herbicides used in or near riparian areas will consist only of products approved by the U.S. Environmental Protection Agency for aquatic application. These products will be used in compliance with labeling instructions and will be applied by a state-certified applicator.

8. All equipment used for off-road operations and maintenance purposes should be cleaned prior to each use and following each use to avoid spreading noxious and nuisance weeds.

9. Native plant species are preferred vegetation within the Planning Area. Noninvasive exotic species may also be used. Native or exotic species that may be a danger or nuisance at a specific site (poison ivy or plants having thorns or low branches in a *developed recreation* area) or that may outcompete or displace native species should not be used. Aesthetic landscape standards will provide lists of acceptable plant species and guidance for selecting appropriate species.

10. Following any significant human action, revegetation should be undertaken as soon as weather conditions permit (fall: September–October; spring: March–April), in accordance with aesthetic landscape standards, and proper maintenance should be conducted, or the disturbance should be treated through other BMPs to control erosion. (*This policy is not applicable to areas where the disturbance is essential to the function of the improvement and therefore intended to be permanent, such as a road and its shoulders*.)

11. IPC personnel should control both noxious and nuisance weeds on all IPC properties. This policy will be implemented in accordance with state law where applicable.

12. IPC will undertake cooperative agreements with other land owners in the project area to control noxious weeds on their lands.

13. A plan should be prepared to guide weed control in Hells Canyon. The plan should establish the following: roles in the control of weeds, appropriate times for applying controls, and priorities for types and locations of weeds to be controlled.

E.6.4.4.3. Wildlife Resources

1. Grazing of domestic sheep and goats will not be allowed within the Planning Area because of the potential for spreading lethal disease to bighorn sheep.

2. Protecting and enhancing habitat for nongame wildlife should be considered important resource needs. Habitat for nongame and game wildlife should be given equal consideration.

3. IPC will coordinate and cooperate with the Idaho Department of Fish and Game (IDFG) and the Oregon Department of Fish and Wildlife (ODFW) on problem wildlife issues.

4. A plan for fencing of lands to eliminate open-range livestock grazing from sensitive resource areas should be developed and implemented.

E.6.4.4.4. Cultural Resources

1. Full compliance with section 106 of the National Historic Preservation Act, as amended in 1992, is required for significant human actions and for alterations proposed for buildings and structures that are potentially eligible for the National Register of Historic Places.

2. Recognized cultural resource sites will be protected from human activities through implementation of site-specific protection plans and the *Cultural Resources Management Plan*.

3. Artifacts of any kind found within the Planning Area will not be removed or disturbed, except in the case of projects authorized by the State Historic Preservation Offices.

4. The location of any potential cultural or historic artifact that is discovered will be reported to the appropriate State Historic Preservation office (of either Oregon or Idaho) for evaluation.

5. Except for sensitive botanical species, botanical resources will be made available to Native American tribes for medicinal and other traditional purposes.

6. IPC will work with the Native American groups, including the tribal councils of the Burns Paiute, Nez Perce, Shoshone-Bannock, Shoshone-Paiute, Warm Springs, and Umatilla tribes to provide Native American access to IPC lands within the Planning Area consistent with existing Native American rights and appropriate state and federal laws. Areas where access would raise operations or safety concerns would be exceptions to this policy.

E.6.4.4.5. Access

1. Except where public safety and project security could be affected, IPC will continue to allow public use of its project roads.

2. Improvement of roads into and within the canyon would facilitate access of more and larger vehicles and more people and would therefore increase potential conflicts with wildlife and other natural and cultural resources. Because lands suitable for recreation are limited and because of the importance of the canyon habitat for many wildlife populations, improvements in and new access to and within the canyon should be minimized.

3. Except when necessary for maintenance of lands and utilities, motor vehicle use should be limited to roads, access drives, and areas specifically designated for motorized vehicles by a federal, state, or local agency.

4. Commercial use of IPC roads is prohibited without written permission through the use authorization process.

5. IPC participation in developing new access drives for private or public use should be considered on a case-by-case basis.

6. Vehicle use below the full-pool level of the reservoirs can damage soil, cultural resources, and water quality and, except for the launch and retrieval of watercraft, should be discouraged.

7. A road maintenance plan will be prepared by IPC to identify routine maintenance activities and to describe the methods and practices to be used.

E.6.4.4.6. Public Use, Information, and Safety

1. Campfires should be confined to grills, firepits, and camp stoves. Uncontained campfires are prohibited. Other outdoor burning on IPC's land is not allowed without written permission from IPC.

2. IPC will work cooperatively with federal, state, and local law enforcement agencies and tribes to enforce the policies of this plan. Also, IPC will work with these groups and those of other jurisdictions to clarify responsibilities for enforcing public use and safety measures.

3. The manager of HCC operations will be the contact person for coordination with law enforcement agencies in the Planning Area.

4. IPC will continue to sponsor meetings and to coordinate with law enforcement agencies with jurisdiction in the Planning Area on a regular basis.

5. IPC will implement and enforce its public safety and emergency action programs to be consistent with the policies of this plan whenever possible.

6. Destroying, injuring, defacing or removing vegetation, rocks, soil, artifacts, or other property is prohibited. IPC will work with appropriate authorities to enforce this provision on IPC-owned land. (This policy does not pertain to land management or operation and maintenance activities, nor to the use of botanical species by Native American tribes for medicinal or other traditional purposes.)

7. Public information within the Planning Area should be improved. A plan to provide information, interpretation, and education, including signage, should be prepared.

8. IPC will work to increase public awareness, appreciation, and protection of natural resource values through an educational program, and IPC will coordinate with appropriate agencies and entities.

9. Use of lands and waters in a manner that produces noise at a level detrimental to public use and enjoyment is unacceptable. Visitors disturbing others may be asked to leave the property.

10. IPC should continue to coordinate with public agencies regarding the occurrence of controlled and uncontrolled fires.

E.6.4.5. Cost Analysis and Other Constraints

Information about costs and schedules for implementing the measures proposed to blend project features with the landscape and to buffer land uses is given in Table E.6-6. Costs estimated for implementing the HCRMP are only partial since additional operation and maintenance funding that is currently spent on administering land use in the area would be continued separately of the relicensing effort. Costs for mitigating impacts to wetlands are included in section E.3.3.3.2.

E.6.4.6. Measures or Facilities Recommended by the Agencies

The following measures recommended by the agencies were taken from comment letters received on the draft *New License Application: Hells Canyon Hydroelectric Project* and from feedback received at the joint agency meeting held on March 5 and 6, 2003. Often the comment letters did not clearly indicate specific recommended measures. However, the Applicant made a good-faith effort to extract as many recommended measures as possible. In this section, the Applicant includes agency-recommended measures where those measures were clearly stated and contained specific elements. Statements regarding the Applicant's proposed measures, general observations, or vague references to measures are not included as recommended measures, because to do so would require unfounded assumptions or speculation as to what the agencies intended. In addition, Applicant-proposed measures that the agencies supported without qualification are not included in this section. In all cases, the Applicant has responded to agency comments on the draft license application. Full responses to these comments are in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix.

Measures in this section are categorized as either accepted or rejected by the Applicant and then listed by agency. Following each recommendation, the Applicant provides a response explaining why the measure was either accepted or rejected. In some cases the responses in this section are abbreviated from the responses provided in section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix. Once again, refer to the Consultation Appendix for full responses.

E.6.4.6.1. Accepted or Conditionally Accepted Measures or Facilities

U.S. Forest Service comment letter, dated January 8, 2003

USFS3-111

> The concrete pads need to be removed from the site. Covering them with native gravel is not a sufficient solution.

Response

The Applicant states in section E.6.4.3.6. that "The concrete pads would either be removed or covered with native gravel, and the site would be screened from the road with vegetation." The intent is that, in developing the specific plan for this site with consulting agencies (certainly the USFS in this case since Eagle Bar is part of the Payette National Forest), a decision would be made as to whether the concrete would be removed or covered with gravel. A number of comments regarding the desirability of these pads for parking RVs were received from recreationists during recreation surveys. The Applicant and consulting agencies may want to consider this in deciding how to treat these pads. However, since this is USFS-managed land, if the USFS desires to remove the concrete, the Applicant would agree.

Shoshone-Bannock Tribes comment letter, dated January 10, 2003

SBT1-209

> …informational signs or sites relating the importance of fishing resources to native peoples…should be included and made a goal of the applicant.

Response

The Shoshone-Bannock Tribes' recommendation, echoed by the Nez Perce in the Joint Agency Meeting held March 5 and 6, that the Applicant provide informational signs or sites relating the importance of fishing resources to native peoples is consistent with the Applicant's PM&E proposal in section E.5.4.4.1.3. to develop and implement an information and education plan.

Because of the importance of this subject to the tribes, the Applicant agrees to include such a provision as a specific component of this plan.

SBT1-210

> (informational signs or sites) that reflect ethnographic importance to the tribes

Response

The Shoshone-Bannock Tribes' recommendation that the Applicant provide informational signs or sites reflecting ethnographic importance of environmental features to native peoples is consistent with the Applicant's PM&E proposal in section E.5.4.4.1.3. to develop and implement an information and education plan. Because of the importance of this subject to the tribes, the Applicant agrees to include such a provision as a specific component of this plan.

E.6.4.6.2. Rejected Measures or Facilities and Explanations for Rejection

U.S. Forest Service comment letter, dated January 8, 2003

USFS3-105

> This species (*Tamarix*) should be eradicated from the HCC. This non-native species is not yet widespread and should be dealt with before it becomes a problem.

Response

The Applicant rejects the USFS recommendation that the Applicant "eradicate" *Tamarix* from the HCC for two primary reasons. First, the Applicant has committed in several sections of this license application to control both noxious and nuisance weeds (see section E.3.3.3.2.1.2., E.6.2.4., E.6.4.3.2., and E.6.4.4.2. [item 13]) on its lands and intends to cooperate with agencies in helping to control such weeds on lands owned by others. However, the apparent suggestion that the Applicant have the sole responsibility to eradicate *Tamarix* throughout the HCC is unreasonable. While the Applicant agrees that this species should be a focus of weed-control efforts, complete elimination of such a weed from the headwaters of Brownlee Reservoir and the Weiser reach is probably unattainable. Second, the expectation of the USFS that the Applicant should have sole responsibility for eliminating this weed from all lands in the HCC, regardless of ownership, is unreasonable. Historical and current land-use practices on all lands in the area have contributed and continue to contribute to the weed problem, and a cooperative effort to control weeds will therefore be required. The USFS forest resource management plans include goals recognizing USFS's responsibility for this effort: "Manage non-native plant species to reduce negative impacts to native plants, wildlife, and other resources. Use all reasonable means to eradicate, control, or otherwise reduce negative impacts of non-native, undesirable species." The Applicant notes that the USFS does not require weed eradication on national forest lands.

USFS3-109

> Jersey barriers that function as barriers to slides and falling rocks should be stained with a concrete stain that would help the barriers blend in with the natural occurring rock in the area. The placement of jersey barriers should be done in accordance with Manual of Uniform Traffic Control Devices (MUTCD) standards.

Response

The Applicant rejects staining the barriers to blend with the natural rock. These barriers must be visible to motorists where the barriers are placed near the edge of the roadway or they would pose a safety hazard. This potential safety hazard is also identified by the Idaho Department of Parks and Recreation in its comment IDPR1-14 on the draft license application. Furthermore, the effort to stain the number of barriers that are used throughout the HCC is not warranted by the slight decrease in contrast (light gray to dark gray) that would be achieved by this measure. The Applicant already conforms to the MUTCD standards in locating Jersey barriers.

USFS3-185

Two additional study requests have been developed in other sections of this document. They are Study Request #6, Integrated Resource Operations described on page 76 of the Project Hydrology section, and Study Request #1, Feasibility Study for Stabilization and Enhancement of Fluvial and Alluvial Features, on page 218 of the Recreation section.

[Note: These include comments USFS1-251 through USFS1-263 and USFS3-96 through USFS3-100, all of which are included in section VII of the Consultation Appendix. At the Joint Agency Meeting, USFS representatives confirmed that this study request is recommended by the agency as a PM&E measure.]

Response

The Applicant rejects Study Request #6, Integrated Resource Operations, described on page 76 of the Project Hydrology section, and Study Request #1, Feasibility Study for Stabilization and Enhancement of Fluvial and Alluvial Features, described on page 218 of the Recreation section. The reason for rejecting Study Request #6 is that the hydrologic information to be obtained in this study is already included in the various resource technical reports and is therefore available to the reader. Study Request #1 is rejected because the USFS conclusions justifying this study request are not supportable as they are not based on credible, documented information.. This recommendation infers that the Applicant is responsible for the majority of erosion impacts to sand and sediment features (such as beaches, upland benches, and the river channel). Over the period of time in which the Applicant has been discussing the issue of erosion with the USFS (approximately seven years), the agency has not identified specific sites where such impacts from the project are occurring. Neither has it provided information indicating such trends at HCNRA campgrounds. Applicant studies show that, while the project does have some effect on sediment and erosion, only a small proportion of sands trapped by the HCC are of a size that would contribute to building and maintaining beaches. The Applicant's studies also indicate that the large majority of erosion is caused by high flows (over 30,000 cfs) outside the control of the Applicant. Erosion at campsites is generally due to heavy human use. Repeated human activity in the same areas throughout the recreation season causes destruction of vegetation and ensuing erosion of level, attractive camping areas close to the river and of boat-mooring locations up to the camping areas. Certain camping sites are more visible and attractive to boaters on the river than are other sites. Areas of taller vegetation offering shade, beaches, and large level areas for cooking and camping are unquestionably most attractive to boaters. The USFS has an obligation and opportunity to manage such use by rotating closures of camping areas. For these reasons, the Applicant has rejected Study Request #1.

Oregon Department of Fish and Wildlife comment letter, dated January 10, 2003
ODFW3-94

> All riparian vegetation should be protected from vehicle access and other adverse human impacts. Unavoidable impacts should be mitigated with measures consistent with ODFW's Fish and Wildlife Habitat Mitigation Policy.

Response

ODFW's recommendation is generally consistent with the intent of a number of PM&E measures proposed by the Applicant and proposed policies of the HCRMP. In section E.3.3.3.2.1. of the Application, measures to acquire land and control weeds, providing protection to riparian vegetation, are proposed. Numerous policies of the HCRMP also address protection of riparian vegetation, including policies 6.3.2.3. (allowing of development no closer than 50 feet to significant riparian areas), 6.3.4.1. (planting of native species in shoreline buffer zones), 6.3.4.2. (protection of riparian vegetation from motorized vehicles), 6.3.4.3. (prohibition of most significant human actions within areas of significant riparian vegetation), 6.3.8.6. (prohibition of damaging or destroying vegetation), and 6.3.9.5. (evaluation, modification, or closure of dispersed recreation sites to protect natural resources). However, ODFW's recommendation that the Applicant protect all riparian resources from human actions would be virtually impossible, and ODFW's recommendation that the Applicant mitigate for any unavoidable impacts would be impractical and unreasonable. The Applicant therefore rejects this recommendation.

E.6.5. Applicant's Policies for Permitting Development

The Common Policies of the HCRMP that apply to all land- and water-use designations include a section about new development and other human actions. These policies are excerpted from Technical Report E.6-1.

E.6.5.1. New Development and Other Human Actions

1. Development of areas in Hells Canyon that are currently undeveloped should be minimized because of the canyon's importance to natural and cultural resources and to the recreation experience in a relatively natural environment. Development should generally be clustered within an appropriately designated area, rather than dispersed. (*The continuance of dispersed recreation in existing sites is recognized; however, significant expansion of dispersed recreation sites in the area is not desirable.*)

2. A 75-foot-wide reservoir shoreline buffer zone—measured horizontally from the ordinary high-water mark of the reservoir upslope, or between the ordinary high water mark and the road, whichever is less—should generally be maintained as open space. The IPC Interdisciplinary Team will evaluate all development proposals on a case-by-case basis and modify the extent of the buffer as appropriate. New development, with the exception of boat ramps and docks, developed recreation areas, structures that are important for resource protection or essential for hydroelectric operations, or structures that provide public access where streamside location is necessary, should not be permitted within the shoreline buffer area. Other significant human actions proposed within this area should be reviewed for their effect on resources, and mitigation should be required whenever significant human actions are authorized. (*This policy does not prohibit dispersed recreation or other authorized activities that do not involve buildings or structures. On federally managed lands within drainages containing ESA-listed species [bull trout], INFISH policy requires new development to maintain a 300-foot buffer.*)

3. Development should be no closer than 50 feet to a significant riparian area, rare plant site, or spring, unless site conditions provide natural protection with a lesser setback.

4. All new development and other significant human actions will be sited, designed, and conducted with input from the IPC Interdisciplinary Team.

5. Prior to undertaking any significant human action, a predisturbance survey will be conducted to identify sensitive and other resources in the vicinity of the site and to plan for and carry out appropriate protection during and after the action. Information collected from these surveys will be retained in a resource database.

6. All new development and landscaping will be conducted to comply with the aesthetic design and landscape standards. Existing development and landscaping will be brought into compliance with these standards as normal maintenance and reconstruction occur.

7. As soon as weather conditions permit (fall: September–October, or spring: March–April), all ground disturbed by new development or by human action related to project operation and maintenance should be revegetated in accordance with aesthetic landscape standards and proper maintenance should be undertaken, or the land should be treated through other BMPs to control erosion. (*This policy is not applicable to areas where the disturbance is essential to the function of the improvement and therefore intended to be permanent, such as a road and its shoulders*.)

8. Extensive areas of pavement (hardscape) are undesirable in the canyon in terms of floodplain protection and runoff. Whenever pavement is proposed, alternatives to pavement should be considered and weighed against other considerations.

9. Earthwork should be minimized in the Planning Area. Where earthwork is necessary, project plans will address where excavated material is to be placed or whether the material should be replaced as backfill, be recontoured and revegetated, or be removed from the property. Such material should not be deposited onto surrounding lands or waters, unless specified in approved project plans.

10. Erosion control structures along water bodies should be permitted only where essential to protect existing development or cultural resources and where technically feasible.

11. Except for private residences associated with operation and maintenance of the HCC, IPC will not permit private residences on its lands. Where private residences already exist and have accidentally encroached on company lands prior to August 1, 2000, appropriate leases and/or permits may be issued.

12. Except for landscaping associated with operation and maintenance of the HCC, IPC will not permit private landscaping on its lands. Where private landscaping already exists and has accidentally encroached on IPC lands prior to August 1, 2000, appropriate permits and/or easements may be issued.

13. All utility facilities should be maintained in good visual condition and will be brought into compliance with adopted aesthetic design standards at appropriate times during maintenance. New facilities will be designed to comply with the aesthetic design and landscape standards.

14. Except for transmission and distribution lines, their appurtenances, and facilities directly serving a use in compliance with this plan, buffer zones of at least 75 feet should be maintained between future utility facilities and any *developed recreation* area.

15. No building should be placed within the designated right-of-way of a transmission or distribution line. Any structure to be placed within such right-of-way must comply with this plan and be approved by IPC.

16. IPC will maintain access to all of its transmission and distribution line structures in the manner authorized by the owner. All operation and maintenance work on the lines will be conducted according to operation and management plans for transmission lines and will be consistent with the National Electric Safety Code standard and any right-of-way conveyance requirements.

17. No new utility line support structures should be located closer than 50 feet from the average high-water elevation of the reservoir.

18. All FERC-licensed electric line supports will be constructed or evaluated and modified as necessary for raptor safety as described in *Suggested Practices for Raptor Protection on*

Power Lines: The State of the Art in 1996 (APLIC 1996), subsequent revisions to this document, and operation and management plans for transmission lines.

19. Industrial uses unrelated to hydroelectric generation and transmission are generally inappropriate in the Planning Area. A proposed industrial use may be considered in a *community*, *utility facilities*, or *resource conservation* land-use designation through IPC's authorization process if the location of such use could be beneficial to the general public welfare and would not cause significant negative impacts to community activities or to natural, cultural, or recreation resources. (Such uses would also have to comply with the appropriate county zoning.)

20. Except for gravel extraction, mining will not be permitted on IPC lands. Areas in which gravel extraction may be permitted will be extremely limited, and criteria must be met for both excavation and restoration.

21. Gravel extraction should be allowed only to provide for local use.

22. Commercial retail concessions are allowed in *developed recreation*, *community*, *recreation reserve*, and *resource conservation* land-use designations within the Planning Area through IPC's authorization process. The focus of these uses is expected to be recreation and recreation support.

23. Any new development providing direct or indirect facilities, goods, or services in support of recreation should be consistent with the Recreation Vision Statement (Appendix 2[7]).

24. Off-premise signs will be allowed only under the following conditions: 1) they will comply with IPC architectural standards; 2) they will be located only in central locations established and maintained by IPC for the purpose of local advertisement (e.g., kiosks and directional signposts); 3) they will have been processed and approved through the administrative process described in Section 7 of this plan.

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7. Because these policies are excerpted from the HCRMP (Technical Report E.6-1), the references in this and the next item can be located in that document as well. They are not included in this license application.

E.6.5.2. *Applicant's Policies for Permitting Piers, Boat Docks, and Other Facilities on Project Lands and Waters*

In 1993, the Applicant adopted its current policy regarding the permitting of piers, docks, and other shoreline facilities associated with project lands and waters. In summary, permits for private boat docks and similar structures are issued only to people who own or lease land adjacent to a project reservoir or adjacent to company-owned freeboard land. The dock must be accessed from the reservoir bank adjacent to a permittee's land by means of a gangplank, ramp, or walkway, though this access may be on the company-owned portion of freeboard land. In addition, the relevant private land must have at least 75 feet of freeboard frontage. Permits may be issued to property associations, provided that the dock is intended to serve single-family dwellings and designed to accommodate no more than four watercraft at a time. The docks must also be attached to the reservoir bank. A number of specifications for such structures must also be met, including proof of compliance with all state, local, and federal regulations.

The Applicant's Land Management Services division manages a program by which this policy and other management policies are administered. An application must be submitted, reviewed, and evaluated before a permit is issued; the permit must be signed by the permittee.

Under the proposed HCRMP (described in section E.6.2.4. and included as Technical Report E.6-1), this policy would be continued, except that such docks would be allowed only in areas with land- and water-use designations of *community*, *developed recreation*, and *dispersed recreation*. In other designations, these structures would not be allowed.

E.6.5.3. *Consultation*

The Consultation Appendix accompanying this license application, as well as Appendix 1 of the HCRMP (Technical Report E.6-1), contains documentation of the agency consultation that occurred during the preparation of this exhibit. The agencies consulted about the aesthetic elements during the relicensing process are listed in Attachment F in section I of the Consultation Appendix. Those consulted during the preparation of land management aspects are listed in Appendix 1 of the HCRMP. Section VI, Collaborative Process Documentation, of the Consultation Appendix contain summaries of the Recreation and Aesthetics Resources Work

Group and Aesthetic Subgroup meetings, as well as summaries of Resource Management Planning Group meetings. These summaries provide detailed information about the nature and extent of consultation on this section of the exhibit and the relevant technical reports. Finally, section VII, Comments/IPC Responses to Draft License Application, of the Consultation Appendix contains letters from most of the agencies consulted that include comments on the draft *New License Application: Hells Canyon Hydroelectric Project*, this exhibit, and the relevant technical reports. These letters also generally discuss the nature and extent of each agency's involvement in consultation and the results of that consultation.

E.6.5.4. Consistency with Other Plans

The Federal Energy Regulatory Commission's (FERC) list, dated April 30, 2002, of comprehensive plans with which the Applicant's proposal is to be evaluated for consistency includes 12 documents relevant to the license application in Idaho and 29 relevant in Oregon (FERC 2002) (Table E.6-7). Five of these documents are relevant to both states.

The Applicant used its collaborative process to obtain input on resource direction that would be consistent with agency plans. Representatives from a number of Idaho, Oregon, and federal agencies participated regularly and provided input. Their involvement helped the Applicant in evaluating consistency with the plans. Each of the plans is discussed in this section. In addition, the Applicant found that some of the documents in the FERC list had been updated or replaced by other documents. In this situation, the updated plan is addressed and noted.

E.6.5.4.1. Plans Relevant to Both States

Five plans on the FERC list are relevant for both states (Table E.6-7). Each of these plans is addressed in this section. Because three of these documents were different revisions of the same plan (*Columbia River Basin Fish and Wildlife Program*), those documents are discussed together.

Columbia River Basin Fish and Wildlife Program (Northwest Power Planning Council [NPPC] 1984, 1987, 1994)—The 1984 document was replaced by the 1987 edition under the same name. No longer available, it was amended by the September 1988 document entitled *Protected Areas Amendments and Response to Comments* (NPPC 1988). These amendments pertained to sections of the program document regarding protected areas and clarified that the protected areas designation applies only to new hydroelectric projects and not to existing projects or their relicensing. Since the HCC dams already exist and are undergoing relicensing, these documents are not applicable.

The 1994 revision of the *Columbia River Basin Fish and Wildlife Program* supplements the 1987 document, but it too is no longer available. This response is, therefore, based on the fiscal year *1998 Annual Implementation Work Plan* (NPPC 1997), which implements the original document. The plan pertains to the upper Snake River subbasin, or the Snake River above Hells Canyon Dam, and calls for five actions:

1. Investigate conditions of native salmonids.

2. Quantify changes in resident fish and wildlife habitat resulting from flow augmentation for anadromous fish.

3. Rebuild recoverable populations of native salmonid species in the Fort Hall Bottoms.

4. Implement several specific measures in the Owyhee River subbasin and Malheur River.

5. Recover and protect native trout species through habitat improvement and protection.

Through preparation of this license application, the Applicant has contributed substantial new information on native salmonids, including bull trout, redband and rainbow trout, steelhead, spring chinook salmon, and fall chinook salmon (see section E.3.1.1.). This information will contribute toward considerations of how flow augmentation for anadromous fish affects salmonid populations as the relationships of flow and habitat are studied further. The PM&E measures included in section E.3.1.1. are directed at improving water quality, developing a native salmonid plan, protecting and enhancing riparian vegetation, improving fish passage, and continuing to study and monitor. These measures would contribute to recovery and protection of native trout species and are consistent with this *1998 Annual Implementation Work Plan*.

Northwest Conservation and Electric Power Plan (NPPC 1986)—The 1986 edition was replaced with the *Draft Fourth Northwest Conservation and Electric Power Plan*, adopted on March 13, 1996 (NPPC 1996). In response to the restructuring of the electric industry, the NPPC prepared this 1996 document as a first step toward "…making recommendations for changes in the institutional structure of the region's electric utility industry." Such changes were designed to protect natural resources and equalize costs and benefits of the competitive marketplace, while allowing the region to maintain the advantages of its power system. Rather than identifying recommended actions or policy decisions, the 1996 document provides background on the industry and its restructuring and analysis of major issues expected to be addressed as deregulation occurs. Aside from encouraging awareness of the issues and considering them in future planning, actions that the Applicant already takes, the plan requires no compliance actions.

Protected Areas Amendments and Response to Comments (NPPC 1988)—The 1987 document entitled the *Columbia River Basin Fish and Wildlife Program* was amended by the September 1988 *Protected Areas Amendments and Response to Comments*. These amendments pertained to sections of the program document regarding protected areas and clarified that the protected areas designation applied only to new hydroelectric projects and not to existing projects or their relicensing. Since the dams in the HCC already exist and are undergoing relicensing, this document is not relevant to the project.

E.6.5.4.2. Plans Relevant to Idaho

Seven plans on the FERC list are relevant to Idaho only (Table E.6-7). Each of these plans is addressed in this section.

Payette National Forest Land and Resource Management Plan, 1988 (USFS)—Overall goals of the plan relevant to Hells Canyon relicensing include the following:

1. Identify and manage significant cultural resources and areas of Native American religious importance.

2. Provide a variety of diversity of habitat throughout the forest to support viable populations of all native vertebrate species.

3. Provide necessary habitat and population protection for rare plant species.

4. Manage drainages containing habitat for anadromous fish to improve on overall existing habitat capability of the forest. [This goal applies to the Snake River downstream of Hells Canyon Dam.]

5. Maintain existing overall habitat potential for resident trout occurring outside of drainages containing habitat for anadromous salmon and trout. [This goal applies to the Snake River upstream of Hells Canyon Dam.]

6. Manage soil and water resources at levels designed to meet the management objectives for forest watersheds [to meet other resource objectives].

7. Protect air quality while achieving other resource management objectives.

8. Manage riparian areas to maintain or improve riparian-dependent resources.

9. Respond to notices of FERC Exemption, License, and Preliminary Permit Application for hydroelectric proposals.

10. Manage existing and proposed Research Natural Areas to protect their unique qualities.

11. Develop and manage wastewater collection systems, treatment works, and disposal facilities to avoid creating health hazards or nuisance conditions; restore and maintain the chemical, physical, and biological quality of water resources; and prevent future pollution or degradation of surface or groundwaters.

12. Provide appropriate access on roads, trails, and access roads that is compatible with management direction and protection objectives; consider public safety; and minimize conflicts with other users.

Relicensing of the HCC is of primary relevance to four of the management areas identified in the plan with specific management direction: Area 1—Seven Devils, Area 3—Hornet, Area 5—Cuddy Mountain, and Area 6—Brownlee. Consistency of the Applicant's proposals for PM&Es and project operation will be evaluated by the specific direction for these areas, as well as with the general goals.

Some of the measures provided or proposed by the Applicant that are consistent with this Payette National Forest plan include the following:

- Conducting comprehensive cultural resource studies to identify archaeological and historical resource sites and areas (see section E.4.2.5.)
- Implementing aspects of the cultural resource management plan (section E.4.2.5.)
- Acquiring and managing habitat, including winter range, riparian areas, and upland areas (section E.3.2.3.2.)
- Providing resource conservation, protection, and management through the HCRMP (Technical Report E.6-1)
- Identifying rare plants through studies (section E.3.3.3.2.)
- Conducting surveys of rare plants and cultural resources before carrying out significant human actions (Technical Report E.6-1)
- Developing and/or implementing resource-specific management plans and projects for highly sensitive resources (sections E.3.1.3.1.1., E.3.1.3.2.1., E.3.1.3.2.3., E.3.2.3.2.1.4., E.3.2.3.2.2.1., E.3.3.3.2.1.3., and E.4.2.5.)
- Improving water quality (section E.2.4.2.)
- Continuing the fall chinook plan (section E.3.1.3.1.1.)

- Implementing protective designations and policies for sensitive resources (Technical Report E.6-1)

- Improving riparian habitat above Hells Canyon Dam (section E.3.3.3.2.)

- Using best management practices (BMPs) for operation and maintenance activities (section E.3.3.3.2.)

- Identifying and monitoring highly sensitive resources through studies and implementing policies to protect them (sections E.3.1.3.1.1., E.3.1.3.2.3., E.3.2.3.2.1.4., E.3.2.3.2.2.1., E.3.3.3.2.2.1., and E.4.2.5.)

- Providing a wastewater treatment system at Woodhead Park (section E.5.4.3.2.1.)

- Establishing road maintenance and improvement policies to appropriately control access in the area (section E.5.4.4.1.6.)

- Continuing monitoring and adaptive management programs for natural and cultural resources as well as for recreation resources (sections E.3.1.3.1., E.3.2.3.1., E.3.3.3.1., and E.5.4.3.)

Idaho Fisheries Management Plan, 1986–1990 (IDFG 1986)—Because this plan provides agency direction for a five-year period, it has been updated for 1991–1995, 1996–2000, and most recently for 2001–2006 (IDFG 1991, 1996, 2001). The statewide management policies of this plan generally provide for 1) protecting/enhancing fish and wildlife populations for ecosystem, esoteric, and recreational purposes; 2) maintaining and restoring wild native populations in suitable waters; and 3) providing recreational opportunities, including public education and both consumptive and nonconsumptive activities concerning fish and wildlife, while protecting private property rights. Program direction of the plan provides more detailed objectives for the resource: 1) increase emphasis on habitat protection; 2) continue emphasis on protecting and enhancing wild trout; 3) continue emphasis on hatchery trout programs in streams, lakes, and reservoirs; and 4) continue emphasis on protecting and enhancing salmon and steelhead.

The second part of the plan provides specific management direction for, and lists objectives and programs specific to, each drainage. Two drainages are involved in the project area: the Snake River from C.J. Strike Reservoir downstream to Hells Canyon Dam and the Snake River and minor tributaries from Hells Canyon Dam to the Idaho/Washington border. For the former drainage, bull trout and redband trout are to be given management priority to protect wild stocks from overharvest and habitat degradation. Objectives for the resource here are to provide a diversity of fishing experiences for smallmouth bass within river and mainstem impoundments, enhance largemouth bass fisheries in reservoirs by increasing their habitats, increase abundance of sturgeon, and protect native bull trout and redband trout populations in the Snake River tributaries. For the Hells Canyon Dam to the Idaho/Washington border drainage, the objectives are to improve juvenile fish migration survival to Lower Granite Dam, enhance game fish production below Hells Canyon Dam, and manage mountain lakes within productivity and user-preference constraints of individual lakes.

All the measures proposed in section E.2.4. of this license application to protect, mitigate, or enhance water quality, as well as measures in sections E.3.1.3., E.3.2.3., and E.3.3.3. for fish, wildlife, and botanical resources, are consistent with this plan's policies. Specific examples include following measures:

- Implementing a warmwater fish plan (see section E.3.1.3.1.3.)
- Developing and implementing a native salmonid plan, which would include modifying the Hells Canyon Dam fish trap, redesigning the Oxbow Fish Trap, and implementing other measures (section E.3.1.3.2.1.)
- Conducting pathogen surveys in Pine and Indian creeks (section E.3.1.3.2.1.1.)
- Considering and possibly modifying culverts on Hells Canyon and Brownlee reservoirs (section E.3.1.3.2.1.3.)
- Enhancing habitat and protecting riparian areas (section E.3.1.3.2.1.3.)

- Screening irrigation diversions (section E.3.1.3.2.1.3.)
- Monitoring brook trout and possibly implementing a brook trout removal program in Indian Creek (section E.3.1.3.2.1.7.)
- Continuing the fall chinook plan (section E.3.1.3.1.1.)
- Developing and implementing the white sturgeon protection and enhancement plan (section E.3.1.3.2.3.)
- Continuing and improving the Pahsimeroi, Oxbow, Niagara Springs, and Rapid River hatchery programs (section E.3.1.3.2.2.)
- Providing for public recreation on the Applicant's lands

These measures are consistent with the IDFG plan's objectives for providing both consumptive and nonconsumptive recreational opportunities. The policies and implementation of the HCRMP would also contribute to the plan's objectives by attempting to balance recreation and resource protection and enhancement.

Pacific Northwest Rivers Study. Final Report: Idaho (IDFG and Bonneville Power Administration [BPA] 1986)—The stated purpose of this study was to identify environmental and institutional considerations that could affect hydroelectric development in the Northwest. River segments were evaluated for their environmental significance based on resident fish, wildlife, natural features, cultural features, and recreational resources. At specific locations, each of these resources was rated as outstanding, substantial, moderate, limited, or unclassified. A matrix showing the number of locations by rating for each resource was then provided for the river segment at various locations. The Snake River (Hells Canyon Dam to Weiser River and Salmon River to Hells Canyon Dam) segments are relevant to this license application. This license application is consistent with this report because of the extensive studies of the conditions of the same resources that were conducted and the updated information about the resource conditions that became available through these studies. Resource monitoring proposed by the Applicant would continue to provide additional information on the resources.

Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (Idaho Department of Environmental Quality [IDEQ] 1985)—This document was updated in 2001. It establishes water quality standards applicable to the project reservoirs and downstream flows. The Applicant has participated in developing and will implement appropriate measures developed for the draft total maximum daily load (TMDL) (IDEQ and ODEQ 2001) for this river basin that will improve water quality conditions. In past years, the Applicant has eliminated point sources of pollution that required National Pollutant Discharge Elimination System (NPDES) permits. In addition, the PM&E measures included in section E.2. would improve dissolved oxygen and total dissolved gas conditions. These actions are consistent with the IDEQ plan.

Idaho Outdoor Recreation Plan (Idaho Department of Parks and Recreation [IDPR] 1983) and *Idaho Statewide Comprehensive Outdoor Recreation and Tourism Planning Assessment and Policy Plan* (IDPR 1997)—The 1983 document was replaced by the 1997 plan, which was updated in 1998 under the title *State Comprehensive Outdoor Recreation and Tourism Plan*. It assesses recreation needs throughout the state and discusses how they should be met. The plan's goals are as follows:

- Develop a new strategic planning process
- Improve maintenance and provide recreation and tourism infrastructure and services
- Create benefits and value
- Establish a recreation and tourism information and education network
- Diversify and manage funding
- Promote a unified communication and marketing program

- Monitor outputs and collect and manage data
- Recognize the importance of transportation planning and project development
- Integrate historic and cultural preservation
- Promote environmental balance
- Enhance trail corridor, greenbelt, and greenway opportunities
- Promote partnerships
- Promote and maintain high-quality fish and wildlife recreation opportunities
- Maintain diversity of water-based recreation opportunities
- Protect and enhance landscapes, scenery, and visual resources

The plan's recommendations focus on ways to enhance partnering as well as ways to encourage partners to improve and coordinate their strategic and operational planning efforts with others. Its goals and strategies provide guidelines for coordinating and integrating implementation efforts at the state, regional, and local levels via plans by government agencies, businesses, and nongovernmental organizations. It also provides for the continued development and maintenance of a database containing updated, shared information that would be used in recreation and tourism planning, management, marketing, and monitoring.

Recreation data gathered to prepare this license application, the PM&E measures for recreation proposed specifically in section E.5.3., and the aesthetic measures in section E.6.4.3. are all consistent with the IDPR plan's direction. Throughout the license application, proposals are included—those regarding protection and enhancement of natural, cultural, and aesthetic resources; the continued monitoring of and adaptive management for recreation; the partnerships created by recreation improvement measures proposed on public lands; and the HCRMP policies intended to balance recreation and resource conditions—that all contribute to achieving this plan's goals.

State Water Plan (Idaho Water Resource Board [IWRB] 1986)—The 1986 plan was revised in 1992 (IWRB 1992). It establishes objectives and policies that apply generally throughout the state. Objectives and policies are directed at water use, conservation, protection, management, and river basins. Many of these objectives and policies are not directly relevant to the HCC and will therefore not be affected by the project. Those objectives and policies that are relevant and may be affected by the project are summarized and addressed below:

- Include certain nonconsumptive water uses (including fish and wildlife habitat and hydropower) as beneficial uses
- Protect against "unreasonable contamination or deterioration in quality" to maintain designated beneficial uses
- Consider the need for adequate water treatment, not simply dilution
- Consider public interests in decision making to maintain sustainable populations of species threatened by human actions and cooperate in efforts to conserve and restore listed species
- Appropriate waters for instream flow when determined to be in the public interest
- Protect "the ecological viability of riparian habitat and wetlands"
- Protect floodplains and rely on management to reduce or prevent flood damage
- Consider public interest, existing water rights, related settlement agreements, and future water and energy needs of the state in hydropower licensing
- Maintain minimum average daily flow of 5,000 cfs in the Snake River at Johnson Bar a minimum of 95% of the time

- Recognize hydropower as a beneficial use of water, as long as minimum flows are maintained
- Provide sufficient water for commercial and recreational navigation by the minimum flows established in this plan

Beyond those policies with which the Applicant's proposals are obviously consistent, the Applicant has and will continue to maintain a minimum flow in the Oxbow Bypass (see section E.2.4.1.) and continue the fall chinook plan (see section E.3.1.3.1.1.). In addition, the Applicant has proposed to maintain reservoir stability during spawning of warmwater species to help ensure their spawning success (see section E.3.1.3.1.3.). The Applicant has participated in the TMDL process (see section E.2.2.1.) and will implement measures to improve water quality. In addition, PM&E measures include actions to improve dissolved oxygen conditions (see section E.2.4.2.). Through the collaborative process and development of the HCRMP, the Applicant has encouraged public involvement and considered the public interest in developing actions proposed to mitigate for impacts of the HCC and to protect sensitive, threatened, or endangered species. PM&E measures for botanical and wildlife resources in section E.3.3.3. and land designations and policies included in the HCRMP would mitigate for negative effects to riparian resources or protect and enhance these resources. Floodplains would be protected through the policies of the HCRMP to minimize development and paving in the canyon. In addition, the collaborative process has provided a forum for state agency personnel to follow the development of and provide input regarding this license application. Finally, the Applicant's proposal would maintain the 5,000-cfs minimum flow at Johnson Bar, as called for in this IWRB plan.

E.6.5.4.3. Plans Relevant to Oregon

Twenty-four plans on the FERC list are relevant to Oregon only (Table E.6-7). Each of these plans is addressed in this section.

Baker Resource Management Plan Record of Decision (BLM 1989)—Five management areas defined in this plan fall within the HCC and adjoining areas: Lookout Mountain, Homestead, Oregon Trail, Sheep Mountain, and Baker County Miscellaneous. Following is a summary of the management objectives for these areas:

- Reestablish, improve, and/or maintain riparian habitat
- Enhance or maintain habitat quality for featured wildlife species
- Maintain/improve bald eagle habitat
- Maintain forage for big game
- Establish/maintain suitable habitat for reintroduction of native wildlife species, including bighorn sheep
- Maintain scenic quality
- Enhance recreational opportunities, including hunting, sightseeing, and hiking and provide for primitive recreation
- Protect/preserve information potential and public values of cultural resources
- Maintain/enhance the Oregon Trail
- Provide historical interpretation
- Consolidate ownership patterns to improve resource management of private and public land
- Maintain availability of public lands for utility and transportation corridors
- Maintain wilderness values of wilderness study areas
- Maintain lands for mineral extraction and exploration

Many of the policies and actions proposed in the Applicant's license application contribute toward the achievement of this plan's goals. PM&E measures included in section E.3.3.3.2. regarding the acquisition and management of riparian lands, as well as the land-use classifications and riparian protection policies in the HCRMP, support riparian resources. In addition, measures to acquire winter range, riparian areas, and upland areas (see section E.3.2.3.2.1.1.), along with the land-use classifications and policies of the HCRMP, would enhance and maintain habitat quality for featured wildlife, forage for big game, and habitat for reintroduction of native species. Designation of *SMA*s for eagle nests and roosts (see section E.6.4.4.) and associated resource plans described in the HCRMP and in section E.3.2.4.3.2. would help maintain and improve eagle habitat. In addition, the HCRMP would prohibit domestic sheep grazing on company lands so that reintroduced bighorn populations would be protected. Scenic quality would be maintained and enhanced by the PM&E measures proposed in section E.6.4.3. The construction and reconstruction of new recreational facilities (see section E.5.4.4.), protection of dispersed recreation areas by the HCRMP, improvement of visual quality (see section E.6.4.3.), and implementation of measures and policies proposed to protect and enhance wildlife (see section E.3.2.3.2.) would increase recreational opportunities, including hunting, hiking, and sightseeing.

The historic properties management plan (Technical Report E.4-15) and other cultural resource PM&E measures (see section E.4.2.5.) and the proposed information and education plan (see section E.5.4.4.1.3.) would contribute to protecting and preserving the information and public value of cultural resources and to providing historic interpretation. The Applicant's recreation plan for Zone 6 (see Appendix 2 to the HCRMP) emphasizes the Oregon Trail theme for this area. In addition, there are several opportunities for the BLM to partner with the Applicant (a private landowner) to improve resource management: the collaborative effort for relicensing the HCC, in which the BLM has participated fully; consultation on a number of the recreation PM&E measures in section E.5.4. for planning and improving recreation areas; and implementation of the HCRMP. The identification of transmission-line corridors and provision of criteria for their future location in the HCRMP enable the BLM to plan for and provide utility corridors. Also, the HCRMP establishes designations and policies for mineral extraction that would be implemented on Applicant lands.

Oregon Comprehensive Waterway Management Plan (Hydro Task Force, Strategic Water Management Group 1988)—This plan was prepared to coordinate the state's various departments and its policies and regulations on waterway management and to "…provide better understanding…as to how the various elements of the state plan relate to each other and comprise a comprehensive plan….” Besides defining the various agencies’ roles, defining coordination among the agencies’ policies and regulations, and explaining the provision for input from others, the plan describes a process for evaluating applications for hydroelectric projects. It also provides bibliographies of information to be considered in addressing a new project. The process described for evaluating hydroelectric applications has been modified in recent years by the Oregon Legislature to become the Hydroelectric Application Review Team (HART). The Applicant participates in the HART process and is therefore consistent with the intent of this plan.

Comprehensive Plan for Production and Management of Oregon’s Anadromous Salmon and Trout: Part I. General Considerations (Oregon Department of Fish and Wildlife [ODFW] 1982)—This plan provides a framework for managing individual anadromous species. ODFW’s mission is to “maintain populations and distributions of anadromous salmon and trout to provide the greatest possible recreation, commercial, and nonconsumptive benefits to present and future generations of Oregon citizens.” The goals are to 1) achieve and maintain optimum populations of naturally and artificially produced anadromous salmon and trout, 2) maximize the utilization of harvestable surpluses of anadromous salmon and trout in concert with other management goals, and 3) achieve and maintain an orderly and equitable harvest. Four management concepts are presented: the importance of wild fish; the differentiation and maintenance of individual stocks (stock concept); the ratio between stock, or parents, and their recruits, or offspring (stock recruitment concept); and the importance of quality and quantity of habitat to maintaining and enhancing populations (the habitat concept).

The Applicant’s various studies on anadromous and trout populations investigated many aspects of these four management concepts. For example, a number of studies were directed at water quality conditions in the reservoirs in relation to standards for fisheries and the general condition of habitat, both upstream and downstream of the project area (habitat concept). The HCRMP and the Applicant’s responsibilities in implementing measures of the draft TMDL (IDEQ and ODEQ 2001) address land-use practices intended to improve habitat in the future. The proposed PM&E measures for anadromous fish, native trout, and other fish species include habitat enhancements, such as providing fish passage, that would expand available habitat for these populations (see section E.3.1.3.). Improvement of tributary streams, including improved flows, screening of diversions, and improved riparian habitat, would improve habitat for bull trout and redband trout. The Applicant's reintroduction plan proposes further study so that key uncertainties regarding adequacy of habitat for reintroduction above the HCC can be better addressed. Downstream of Hells Canyon Dam, the fall chinook plan would maintain habitat (see section E.3.1.3.1.1.).

To achieve optimum numbers of artificially produced anadromous fish and trout, the Applicant proposes to continue operating its Pahsimeroi, Oxbow, Niagara Springs, and Rapid River fish hatcheries and improve the facilities at each of them (see section E.3.1.3.2.2.).

Oregon Bighorn Sheep Management Plan (ODFW 1986)—This document has been updated by the *Oregon's Bighorn Sheep Management Plan 1992–1997* (ODFW 1992a). The plan identifies goals and issues regarding the stocking of bighorn sheep, coordination with land management agencies, threats to the well-being of sheep, monitoring of herds, funding problems of the program, and hunting demand and supply. The following goals and issues are relevant to the HCC:

- Parasites and diseases, especially those transmitted from domestic sheep, can devastate bighorn sheep.
- Some herds may be approaching carrying capacity.
- Current survey procedures may be inadequate in terms of frequency, timing, and intensity.

The Applicant's proposal to acquire and manage winter range and upland areas—along with the HCRMP's land-use classifications and policies, specifically the policy prohibiting domestic sheep grazing on the Applicant's lands—are consistent with this Oregon bighorn sheep plan.

Warmwater Game Fish Management Plan (ODFW 1987a)—This plan's goals are to provide optimum recreational benefits to the people of Oregon by managing warmwater game fish and their habitats. Of the five subgoals, habitat maintenance necessary to meet the production needs of wild fish is relevant to the Applicant's license application. The four objectives that would lead to realization of that goal are 1) provide diversity of angling opportunity; 2) expand distribution by stocking warmwater species where habitat is suitable and expansion is consistent with fish management programs; 3) increase angling opportunities and use of warmwater species where desirable; and 4) maintain, restore, and enhance populations of warmwater game fishes in individual waters.

The HCC provides substantial angling opportunity by enabling public access to the warmwater fishery through its lands and roads along the reservoirs. The current proposal would increase angling opportunities in Oregon by constructing an additional boat ramp at Swedes Landing to provide access at lower reservoir elevations when other boat ramps in Oregon are unusable. The Applicant proposes water quality improvements through implementing the draft TMDL (IDEQ and ODEQ 2001) and land management practices that should in turn improve fishery habitat. Finally, the Applicant would continue stabilizing Brownlee Reservoir during bass and crappie spawning periods to help protect spawning habitat (see section E.3.1.3.1.3.). Ongoing monitoring of warmwater species would be continued to determine the effects that these and other actions have on these species.

The Statewide Trout Management Plan (ODFW 1987b)—Goals, policies, and objectives for the management of trout throughout Oregon are presented and alternative management options identified. Although the intent for the management options is to assign the appropriate option to the appropriate waters, no such assignments are made in this plan. The management goals include the following:

- Maintain all species of wildlife at optimum levels and prevent the serious depletion of any indigenous species.
- Develop and manage the lands and waters of the state to enhance production and public enjoyment of wildlife.
- Permit orderly and equitable use of available wildlife.
- Develop and maintain public access to lands, waters, and wildlife.

- Regulate wildlife populations and public enjoyment of wildlife in a manner compatible with primary uses of lands and waters and that provides optimum public recreational benefits.

Generally, protection and enhancement of wild stocks are given first and highest consideration. Hatchery stocks may be released where necessary to provide optimum benefits. Aquatic and riparian habitat must also be actively protected, rehabilitated, and enhanced. In addition, management plans must be written for major waters.

These goals and policies are similar to those of the 1982 *Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout* (discussed earlier in this section) by the ODFW. The Applicant's proposals, which are notably consistent with these goals and policies, are also similar to those listed for the anadromous salmon and trout plan. The Applicant's proposed HCRMP and responsibilities in implementing the draft TMDL (IDEQ and ODEQ 2001) address land-use practices intended to improve trout habitat. Proposed PM&E measures for native trout include enhancements, such as providing fish passage, that would expand the amount of available habitat for these populations (see section E.3.1.3.2.1.). Proposed improvements to tributary streams—including improved flows, screened diversions, and improved riparian habitat (see section E.3.1.3.2.1.4.)—would also benefit habitat for bull trout and redband trout. The Applicant's reintroduction plan proposes further study so that key uncertainties regarding adequacy of habitat for reintroduction of trout and other species above the HCC can be addressed. The Applicant's proposals for wildlife protection and enhancement included in the HCRMP and in PM&E measures for wildlife (see section E.3.2.3.2.) would be consistent with the general wildlife goals of this plan.

Oregon Elk Management Plan (ODFW 1992b)—The ODFW's goal is to protect, maintain, restore, and enhance elk habitat throughout Oregon. Habitat management is to emphasize improving the effectiveness of elk habitat by maintaining adequate cover and forage, encouraging effective road management programs, and seeking and providing adequate funding for habitat improvement projects. The ODFW will acquire critical elk habitat when all other options have been exhausted. Furthermore, the ODFW plans to establish and maintain population management objectives for each management unit and identify and resolve conflicts between management interests for elk habitat and public and private landowners' interests. Other directives deal with population structure, hunter management, and nonconsumptive recreation.

The Applicant's proposal to purchase and manage winter range and upland areas (see section E.3.2.3.2.1.1.), along with the land-use classifications and policies in the HCRMP to protect and enhance wildlife, is consistent with this plan. Moreover, the Applicant requires that best management practices be used for maintaining roads and prohibits major road improvements in designated resource management areas, practices that contribute to implementation of this plan.

Oregon Black Bear Management Plan, 1993–1998 (ODFW 1993a)—This plan defines strategies for addressing a number of pressing black bear management issues. Among these issues are 1) the lack of reliable data on population numbers and characteristics; 2) control methods for damage-causing bears, a problem exacerbated by the legal taking of such bears on private land, an activity that further limits the ODFW's knowledge and opportunity to resolve problems; 3) conflicting hunting practices; and 4) the encouragement of public viewing of bears. Issues 1, 2, and 4 are relevant to the HCC.

Several of the Applicant's studies about larger mammals and about botanical resources may be useful in determining population characteristics for black bears. The Applicant also includes a policy in the HCRMP regarding coordination with wildlife agencies on the taking of damage-causing wildlife on its lands. This policy enhances the ODFW's knowledge and ability to resolve black bear problems. Recreational access provided by the Applicant's lands and roads facilitate public viewing of bears.

Oregon Wildlife Diversity Plan (ODFW 1993b)—This plan, which was updated in January 1999, focuses on nongame species. Elements of the plan address recovery of threatened and endangered (T&E) species, prevention of T&E species listings, maintenance of wildlife diversity, information and public outreach, and funding activities to achieve these plan elements. Most of these elements are self-explanatory. The element of maintaining wildlife diversity is directed at maintaining healthy and diverse habitats and ecosystems through effectively collecting and using data and through monitoring habitat and wildlife conditions.

The Applicant has already conducted a number of studies identifying current conditions for listed T&E and other sensitive species (such as Technical Reports E.3.2-37, E.3.2-38, and E.3.3-2). The information from these studies will be made available to the ODFW. Within the HCRMP, an *SMA* designation has been established to be applied wherever highly sensitive wildlife species (such as bald eagles, bats, southern Idaho ground squirrels, and others) have been identified. That designation calls for the development of a resource- and site-specific management plan, which would specify actions needed to adequately protect the relevant species. In the absence of such a plan, most human activity is prohibited in a *SMA*. The management plan also includes other management policies that protect T&E wildlife species. For example, surveys would be required to locate sensitive resources before any major construction or similar activity can be undertaken. A GIS atlas of critical and sensitive resources is another implementation measure included in the HCRMP. In addition, a number of the Applicant's proposed PM&E measures are targeted at sensitive (including T&E) species. Several other measures would also contribute toward the implementation of the *Oregon Wildlife Diversity Plan*: acquisition of winter range, riparian areas, and upland areas and management of those areas; closure of bat caves; a public education program to raise awareness of sensitive resource needs; and ongoing monitoring of sensitive species and collection of data.

Oregon Cougar Management Plan, 1993–1998 (ODFW 1993c)—Issues surrounding cougar management include lack of knowledge on population characteristics, methods required for hunting, control of damage by the animals, maintenance of habitat, and potential for encounters between humans and cougars. Another concern is that population control from hunting is geographically and temporally unbalanced. The following issues are relevant to the HCC:

- Cougar population characteristics are not well known.
- Additional population information on cougars is needed.
- Legal taking of damage-causing animals on private lands further limits the ODFW's knowledge and opportunity to resolve problems.

- Maintenance of cougar habitat (that is, habitat supporting deer and elk) is necessary for continuing healthy cougar populations.

- Potential encounters with humans is a problem because of lack of public knowledge about the animals.

Several of the Applicant's studies about larger mammals and about botanical resources may be useful in determining population characteristics for cougars. The Applicant also includes a policy in the HCRMP regarding coordination with ODFW on the taking of damage-causing wildlife on its lands. This policy enhances the ODFW's knowledge and ability to resolve cougar problems. Proposed PM&E measures to acquire and manage winter range and upland areas (see section E.3.2.3.2.1.1.), as well as the land-use classifications and policies of the HCRMP for protecting valuable resource areas, are directed at improving deer and elk populations. The Applicant's proposed public education program could incorporate information about cougars and other wildlife to minimize the potential for and fear of encounters with these animals.

Oregon Wildlife and Commercial Fishing Codes (ODFW 1993d)—This document sets forth the current state legislation relating to fish and wildlife. The major subjects covered include the following:

- Final legislative actions

- Wildlife code

- Commercial fishing code

- Miscellaneous related statutes

By virtue of containing state statutes regarding fish and wildlife, this document includes a number of requirements which may be applicable to the relicensing of the HCC and the implementation of the PM&E measures. The Applicant intends to comply with those applicable provisions of the Oregon statutes that are not otherwise inconsistent with or preempted by the Federal Power Act and other applicable federal laws. Therefore, the proposals in this application are consistent with the document.

Biennial Report on the Status of Wild Fish in Oregon (ODFW 1995a)—This document is a status report on various species of wild fish in Oregon as of 1995. No goals, objectives, or other desired conditions are contained in this report, so consistency cannot be evaluated in terms of contribution toward desired conditions. However, the numerous studies on wild fish conducted by the Applicant and included in Technical Reports E.3.1-2 through E.3.1-7 do contribute a great deal of information toward the subject and are, therefore, consistent with the purpose of this document.

Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part III. Steelhead Plan (ODFW 1995b)—The goals of the steelhead plan are to 1) sustain healthy and abundant wild populations of steelhead; 2) provide recreational, economic, cultural, and aesthetic benefits from fishing and nonfishing uses of steelhead; and 3) involve the public in steelhead management and coordinate ODFW actions with the tribes and other agencies. The objectives that are most relevant to the Applicant's project include the following:

- Protect and restore spawning and rearing habitat.
- Provide safe migration corridors.
- Protect wild populations of steelhead from detrimental interactions with hatchery fish.
- Monitor the status of wild steelhead so that long-term trends in populations can be determined.
- Provide recreational angling opportunities reflecting the desires of the public while minimizing impacts on wild fish.
- Increase nonangling uses of steelhead that provide recreation.

- Coordinate ODFW steelhead management activities with other habitat and fisheries managers.

The Applicant's studies have provided information about the status of wild steelhead, updating information that ODFW has assembled in the past. The Applicant is committed to implementing the draft TMDL (IDEQ and ODEQ 2001) (section E.2.2.1.) and the proposed native salmonid plan and reintroduction plan (section E.3.1.3.2.1.). These PM&E measures would be consistent with this Oregon plan for steelhead because they improve habitat and passage. The Applicant's continued operation of the Oxbow and Niagara Springs fish hatcheries for steelhead would provide opportunities for harvest while protecting wild fish. In addition, the Oxbow Fish Hatchery and other services provided by the Applicant promote opportunities for nonconsumptive public recreation that involves steelhead. Tours of the hatchery and viewing of the steelhead are services provided at the hatchery. The Applicant also makes presentations about fish conservation to schools and other groups. In addition, the Applicant's proposed information and education plan (see section E.5.4.4.1.3.) could promote other types of public recreational activities.

Species at Risk: Sensitive, Threatened, and Endangered Vertebrates of Oregon (ODFW's Wildlife Diversity Program 1996)—This publication is related to elements of the *Oregon Wildlife Diversity Plan* (discussed earlier in this section) for avoiding the listing of species and for collecting reliable and current information on sensitive and T&E species. With the knowledge gained, land managers can make better decisions regarding the species and their habitats.

The discussion (earlier in this section) of the Applicant's consistency with the *Oregon Wildlife Diversity Plan* also explains how the license application is consistent with this plan.

The Oregon Plan for Salmon and Watersheds: Supplement 1 Steelhead (ODFW 1997)—"The intent of this supplement is to describe progress to date and to list activities that are either underway or needed to restore the vitality of steelhead and other trout populations in Oregon's river basins." The supplement is a dynamic document, parts of which have been revised since the original supplement was published. The plan approaches restoration of the health of these fish on a watershed basis. Measures proposed to improve steelhead health and populations by state and federal agencies include water quality, physical habitat, water quantity, fish management, hydroelectric projects and large storage dam factors; measures by cities, counties, and other partners include primarily activities directed at physical habitat factors. Watershed councils, soil and water conservation districts, compliance with environmental laws, enforcement, outreach and education, independent multidisciplinary science teams, monitoring, and funding are other elements of proposed plan implementation.

Specific measures proposed by the Applicant that are consistent with this plan include implementation of the draft TMDL measures, Brownlee Reservoir aeration and turbine venting and spillway flow deflectors at Hells Canyon Dam, along with existing water quality improvement measures (section E.2.4.); the native salmonid plan, including a number of individual measures (section E.3.1.3.2.1.); improvements to the Oxbow, Niagara Springs, and Pahsimeroi mitigation hatcheries, including monitoring and evaluation of these hatcheries (section E.3.1.3.2.2.); acquisition, enhancement, and maintenance of riparian areas (section E.3.1.3.2.1.3.., section E.3.2.3.2.1.1., and section section E.3.3.3.2.1.1.); resource management policies and implementation to protect and improve riparian habitat (section E.6.4.4.); and a public information and education plan that would make people aware of the sensitivity of natural resources and the need to protect them in their activities in Hells Canyon (section E.5.4.4.1.3.).

Statewide Comprehensive Outdoor Recreation Plan (Oregon State Parks and Recreation Division 1983)—This plan was updated in 1994, and the state is currently developing a new plan that is scheduled to be completed in December 2002. The 1994 plan provides statewide planning strategies, a wetlands priority plan, and the addition of two recreational settings definitions for state recreation. Statewide strategies relevant to this relicensing include 1) providing equitable opportunities for recreation (notably related to economic resources) and promoting partnerships with public and private landowners; 2) resolving user conflicts among users, with adjacent properties, and with the environment; 3) improving awareness and appreciation for natural, cultural, and outdoor resources through interpretation and education; and 4) protecting viable natural ecosystems, as well as cultural resources and aesthetic values, while providing compatible recreation.

The wetland priority plan states, “It is important that sites used for recreational opportunities are appropriate in wetland settings. An appropriate opportunity is defined as that which is dependent on the setting, doesn’t harm the wetlands, or the impacts, if any, can be mitigated though temporal or spatial distribution of the activity.” Two of the recreation settings definitions added are for primitive-limited and semi-primitive-limited, which have not been represented previously in the state’s recreation settings.

The Applicant provides opportunities for recreation at several different levels of cost. While a nominal fee is charged for camping in developed campgrounds, camping in many other areas is free. The Applicant makes most of its project lands available for recreation at no cost. The HCRMP designates two different land classifications for different types of recreation to minimize conflicts between recreationists and between recreation and other types of land use. The plan also proposes that the Applicant work with private property owners in the canyon to reduce the effects of recreation on adjacent properties. The Applicant’s proposal includes developing an information and education plan to inform visitors about natural and cultural resources in the canyon; to increase visitors’ awareness of their potential impact on resources; and to educate them about historical, natural, and project operation features (see section E.5.4.4.1.3.). A major focus of the recreation plans included in the license application and the HCRMP is to continue providing recreation while protecting natural and cultural resources. To avoid resource conflicts, the Applicant has proposed that few new areas be developed for recreation. Several implementation measures in the HCRMP—including establishing *SMA*s where the resource–recreation interface requires greater management and evaluating dispersed recreation sites for the need to modify them or restore them to natural vegetation to protect resources—are also examples of the Applicant’s proposed measures to avoid resource conflicts.

Another related implementation measure of the HCRMP is to evaluate riparian–recreation resource interfaces to evaluate the level of conflict that may be occurring and to establish management actions where needed. A number of measures to acquire and protect riparian areas (including wetlands) are also included in the Applicant’s PM&E measures (see section E.3.2.3.2.1.1.). Finally, the Applicant makes its lands available for public recreation, and much of this land would fall into the Oregon State Parks and Recreation Division’s new settings definitions of primitive-limited or semi-primitive-limited.

In the current planning effort, the major statewide need identified for Oregon is rehabilitation of existing outdoor recreation facilities. Needs for Planning Region 10 (including Grant, Baker, Union, and Wallowa counties) include funding priority for maintaining access to large tracts of public lands, rehabilitating existing outdoor recreation facilities, and creating winter recreation facilities. The Applicant does not plan to close access to public lands. In addition, the Applicant proposes to assist in the redevelopment of Hewitt and Holcomb parks in Baker County (see section E.5.4.4.4.1.), as well as provide new recreational development on its own lands and partner with federal agencies on recreational improvements to their lands.

Recreational Values on Oregon Rivers (Oregon Department of Transportation and Oregon State Parks and Recreation Division 1987)—To reduce potential conflicts with hydroelectric projects, this study identified recreational resources on Oregon rivers and assessed their importance on a scale from 1 (outstanding recreational resources) to 5 (little or no recreational resources), with 0 indicating that the importance was unknown. The three river basins that encompass the Applicant's study area are the Grande Ronde, Powder, and Malheur. For the Snake River from the Oregon/Washington state line to the Wallowa/Baker county line (in the Grande Ronde river basin), powerboating, canoeing/kayaking, drift boating, rafting, salmon/steelhead fishing, trout fishing, warmwater fishing, and the "other" categories were all rated as outstanding (1), while sailing was rated as limited (4), resulting in an overall rating for the river segment of outstanding.

For the Powder River basin, the Snake River between Farewell Bend and the Baker/Malheur county line was rated as follows: outstanding (1) for powerboating, warmwater fishing, and "other"; substantial (2) for canoeing/kayaking, drift boating, rafting, and trout fishing; moderate (3) for salmon/steelhead fishing; and limited (4) for sailing. The overall rating was outstanding. Also in this basin, Pine Creek, Powder River, and Burnt River received overall ratings of substantial (2); and Eagle Creek, an overall rating of 1.

In the Malheur River basin, the Snake River from Farewell Bend to the community of Owyhee (upstream of the Malheur River) was rated as outstanding (1) for powerboating, warmwater fishing, and "other"; substantial (2) for canoeing/kayaking and drift boating; moderate (3) for rafting, salmon/steelhead fishing, and trout fishing; and limited (4) for sailing, The overall rating was outstanding.

The Applicant's proposal is consistent with this document because many studies on recreation in the study area have been done, both in terms of types of actual recreational use and public values. These studies provided a great deal of updated information on recreational values. In addition, the PM&E measures proposed for recreation by the Applicant in section E.5.4.4. would maintain and enhance accommodations for recreationists so that they could pursue the various activities evaluated in the older study.

Oregon Water Use Programs (Oregon Water Resources Commission 1985)—This document was replaced by the 1987 document of the same name (discussed several pages below).

Proposed Water Quality Management Plan (ODEQ 1976)—This proposed plan was replaced by the final plan adopted in 1978 (see below).

Statewide Water Quality Management Plan (ODEQ 1978)—The current statewide management plan includes measures for identifying the general beneficial uses, policies, standards, and treatment criteria for Oregon surface waters, as well as specific measures for 18 basins within the state. The parts of the plan relevant to the HCC relicensing include the Powder Basin Program (Baker County) and the Grande Ronde Basin Program (Wallowa County). In the Powder Basin Program, hydropower is identified as a beneficial use; in the Grande Ronde Basin Program, it is not. The plan sets standards for both point (regulated through NPDES permits) and nonpoint sources. The plan also defines the TMDL process by which limitations of pollutants are established for stream reaches, allocations are established for users, and implementation measures to achieve the allocations are determined. Standards are established in both basins for dissolved oxygen, temperature, turbidity, pH, bacteria, dissolved gases, toxic substances, and a number of miscellaneous pollutants.

In accordance with this plan, the Applicant has eliminated point sources of waste that were formerly permitted under the NPDES program. The company has participated in developing the draft TMDL with the states of Idaho and Oregon (IDEQ and ODEQ 2001) and expects to carry out the assigned measures. Section E.2.4.2. includes descriptions of proposed measures to help improve water quality.

Biennial Report, 1985–1987 (Oregon Water Resources Department 1985)—The biennial reports are the products of the biennial work program led by the Oregon Water Resources Department. They establish the planning schedule and identify the resource issues and river basins to be studied for each two-year period. The reports present the priority activities for the next two years to the Oregon Legislature for funding. In the 1985 report, watershed and riparian area management was mentioned as a tool in the state's efforts to conserve water and improve water quality. The Applicant proposes to acquire and manage riparian resource lands (see section E.3.2.3.2.1.1.), and the HCRMP includes a number of management policies to identify and protect riparian resources. The 1985 report also noted that the Oregon Legislature adopted provisions that hydroelectric projects on streams supporting an anadromous fishery would not result in mortality or injury to individual salmon or steelhead and that there would be no net loss to natural resources including wild game fish populations and water-related recreational opportunities. Proposals included in this license application are intended to further the objectives established by the Oregon Legislature (see sections E.3.1., E.3.2., E.3.3., and E.5.).

The 1987 report discussed the establishment of the Governor's Watershed Enhancement Board during the 1987 legislative session. The board's purpose is to encourage and fund watershed improvements and management to improve water quality. The Applicant is investigating opportunities to incorporate watershed enhancement into its proposal to acquire and manage riparian and other lands (see section E.3.2.3.2.1.1.).

Oregon Water Laws (Oregon Water Resources Department 1988)—The 1988 document was updated in 2001. As its subtitle indicates, the current version, *Water Rights in Oregon: An Introduction to Oregon's Water Laws and Water Rights System*, describes how the state administers and manages its water rights. The Applicant has complied and will continue to comply with Oregon's legal process for obtaining and holding water rights in the state.

Surface Area of Lakes and Reservoirs (Oregon Water Resources Department 1973)—This document reports the surface area of reservoirs on each of the rivers evaluated. For the Snake River, the surface area for Hells Canyon Reservoir is reported to be 2,520 acres (with the Oregon portion comprising 1,260 acres); for Oxbow Reservoir, 1,150 acres (Oregon portion, 575 acres); and for Brownlee Reservoir, 15,000 acres (Oregon portion, 7,500 acres), for a total of 18,670 acres.

The Applicant's reservoir acreage figures are relatively consistent with Oregon's figures. Different technologies used to measure reservoir surface area result in small variations. The Applicant's surface area acreages for Oxbow, Hells Canyon, and Brownlee reservoirs are 1,150 acres, 2,412 acres, and 14,621 acres, respectively, for a total of 18,183 acres.

Oregon Water Use Programs (Oregon Water Resources Commission 1987)—Although the 1987 document was unavailable, the 1992 *Oregon Water Management Program* similarly establishes statewide policies and principles regarding major water management issues. The issues relevant to this relicensing include development of hydroelectric power, protection of instream flows, and protection of water resources on public riparian lands. The relevant policy on hydroelectric production is that "[r]elicensing of existing facilities which have adversely impacted, or may preclude the recovery of, anadromous fish resources shall include measures to restore, enhance or improve the anadromous fish resource. The relicensing of any facility shall include measures to prevent the net loss of other natural resources resulting from future operation of the facility." Related principles are that mitigation is required for harm to natural resources such as anadromous fish; wildlife; water quality; scenic and aesthetic values; and historical, cultural, and archaeological sites. Measures for restoring, enhancing, or improving resources because of past harms to Oregon's anadromous and steelhead resource are to be considered and implemented.

Consistent with this Oregon program, the Applicant has proposed a number of measures restoring, enhancing, or improving anadromous and steelhead resources (see section E.3.1.3.2.1.), as addressed in the discussion (earlier in this section) of consistency with the *Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout* (ODFW 1982).

Also in accordance with the policy, the Applicant has proposed a number of PM&E measures directed at protecting and enhancing wildlife, water quality, scenic and aesthetic values, and cultural resources (see section E.2.4.2., section E.3.2.3.2., section E.4.2.5., and section E.6.4.3., respectively). Regarding the protection of instream flow, the Applicant proposes to continue an instream flow of 100 cfs in the Oxbow Bypass to protect fish and other aquatic resources (see section E.2.4.1.).

The Applicant also proposes a new measure to stabilize reservoir levels to help protect warmwater fish spawning (see section E.3.1.3.1.3.) and an existing measure to continue its fall chinook plan (see section E.3.1.3.1.1.). To protect riparian areas, the Oregon program advocates developing land management plans and practices; establishing databases of riparian areas by which to make management decisions; monitoring effectiveness of management directed by management plans; and avoiding and minimizing impacts from human activities, among others. The Applicant proposes to acquire and manage riparian habitat (see section E.3.2.3.2.1.1.) and includes a number of land management policies in its HCRMP to protect riparian habitat from human activities. Specific measures include requiring resource surveys before any significant human disturbance to assess and protect resources, prohibiting most human activities in riparian areas, and developing a GIS atlas to serve as a database for existing and new resource information, including for riparian resources.

Fish and Wildlife Resources—18 Basins: Powder River Basin (Oregon State Game Commission 1963–1975)—This report addresses resource conditions in the Powder River basin at the time the study was conducted (1965–1966), conditions including temperature and streamflow conditions. Recommendations regarding minimum stream flows are also included. Eight stream areas of greatest importance for current fishery production and angling are listed; one of these streams is Pine Creek, a direct tributary to the Snake River. Little information regarding the mainstem Snake River within this area (Baker County) is provided. Information from this basin report was incorporated into a number of the other Oregon plans discussed in this section.

The Applicant's studies are consistent with the intent of this report because they add a great deal of information about the current conditions of fisheries resources and habitat in this basin. In addition, because all of the PM&E measures proposed in section E.3.1.3. are directed at sustaining and enhancing fisheries resources in this and other basins, they are consistent with this report. Specifically, the proposal in the reintroduction plan to enhance Pine Creek with diversion screening and habitat improvement (see section E.3.1.3.2.1.) is based on the finding documented in this report that Pine Creek is an important stream for fishery resources.

Oregon Final Summary Report for the Pacific Northwest Rivers Study (Oregon Department of Energy 1987)—This report contains the results of a regional study conducted to identify "…resource values that might affect hydropower development." While the Snake River region is addressed in the study, the Snake River itself was not reported specifically, as were the Minam, Malheur, and Owyhee rivers and Eagle Creek. For the region, "natural features" noted were pockets of endemic rare plants specific to unique soil types and isolated mountain ranges; excellent riparian habitat that had received only limited grazing; and various types of riparian plant communities, ranging from montane wet meadow to desert canyon river bottom types. There were 2,355 stream reaches that were evaluated for fish. Of these reaches, 50% of the stream segments had an unknown value, 28% had no value (together, the highest frequency of streams evaluated), 2% had an outstanding value, and 3% had a substantial value (the lowest frequencies of any region). Ten major fish species were noted in this region, with the rainbow trout being the most frequently found (78%). In addition, the rainbow trout was of moderate importance 92% of the time. Stream habitat was rated as moderate (71% frequency), use was rated as low (55% frequency), and abundance was rated as moderate (49%) to low (42%).

Wildlife was found to include 35 major species, the most diverse of any region, and 2,455 reaches were evaluated. The elk was listed as the major species for 44% of stream reaches and rated as high importance on 99% of those reaches. However, the mule deer was the major species for 38% of stream segments and rated as high importance for 96% of those reaches. Habitat was rated high in 55% of the cases and moderate in the remaining reaches. Use was rated as moderate (45% of cases), while abundance was rated as moderate also (58% of cases). Species diversity was noted in 7% of cases; and rare species, in 6%. River-related recreation and trout fishing were noted as the outstanding recreational values, although on the Snake River itself, boating resources were also rated as outstanding.

The Applicant's studies undertaken for relicensing provide a great deal of new, specific information about these values and led to a number of proposals to protect and enhance these resources (see section E.4.2.5.). Therefore, the license application is consistent with the purpose and intent of this rivers study report. No information about cultural resources or historical structures was reported by this study for this region (although they were purportedly subjects of the study), while the Applicant's studies provide extensive information about these resources (see Exhibit E.4).

Settlement Agreement Pursuant to the September 1, 1983, Order of the U.S. District Court for the District of Oregon in Case No. 68-5113. Columbia River Fish Management Plan (State of Oregon, State of Washington, State of Idaho, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, Confederated Tribes and Bands of the Yakama Indian Nation 1987)—According to Part 1.F. of this settlement agreement, because it contains certain actions to be completed by 1998, "…unless extended by unanimous agreement of the Parties filed with the Court, this Agreement shall terminate without further action or order of the Court on December 31, 1998." The FERC list of comprehensive plans includes no extension of the settlement agreement nor other document that would take its place. The settlement agreement is apparently terminated and therefore irrelevant to this license application.

E.6.6. Maps, Drawings, or Photographs for Proposed Measures

Technical Report E.6-3. includes photographs showing aesthetic and land-use conditions in the HCC area and the vicinity. Technical Report E.6-2 provides maps showing land-use conditions in the project area. Technical Report E.6-1 includes maps showing proposed land and water classifications.

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Table E.6-1 Land ownership by acres within the Hells Canyon Complex proposed project boundary[a]

Land Ownership	Hells Canyon	Oxbow	Brownlee	HCC	% of Total[b]
Federal Lands					
• USFS					
• Flooded	800	0	0	800	4.86
• Nonflooded	330	0	0	330	2.00
• TOTAL USFS	*1,130*	*0*	*0*	*1,130*	*6.87*
• BLM					
• Flooded	220	260	2,150	2,630	15.98
• Nonflooded	30	270	1,210	1,510	9.17
• TOTAL BLM	*250*	*530*	*3,360*	*4,140*	*25.15*
• All Federal Lands (totals from above)					
• All Federal Flooded	1,020	260	2,150	3,430	20.84
• All Federal Nonflooded	360	270	1,210	1,840	11.18
• TOTAL FEDERAL LANDS	*1,380*	*530*	*3,360*	*5,270*	*32.02*
State Lands					
• Flooded	0	0	50	50	0.30
• Nonflooded	0	10	200	210	1.28
• TOTAL STATE LANDS	*0*	*10*	*250*	*260*	*1.58*
Private Lands					
• IPC					
• Flooded	90	140	6,060	6,290	38.21
• Nonflooded	270	980	2,200	3,450	20.96

Table E.6-1 Land ownership by acres within the Hells Canyon Complex proposed project boundary[a]

Land Ownership	Hells Canyon	Oxbow	Brownlee	HCC	% of Total[b]
• TOTAL IPC	*360*	*1,120*	*8,260*	*9,740*	*59.17*
• Other Private					
• Flooded	170	60	120	350	2.13
• Nonflooded	160	60	620	840	5.10
• TOTAL OTHER PRIVATE	*330*	*120*	*740*	*1,190*	*7.23*
• Total Private Lands					
• Flooded	260	200	6,180	6,640	40.34
• Nonflooded	430	1,040	2,820	4,290	26.06
• TOTAL PRIVATE LANDS	*690*	*1,240*	*9,000*	*10,930*	*66.40*
• All Lands Within the Project Boundary					
• Flooded	1,280	460	8,380	10,120	61.48
• Nonflooded	790	1,320	4,230	6,340	38.52
• TOTAL FOR ALL LANDS WITHIN THE PROJECT BOUNDARY	*2,070*	*1,780*	*12,610*	*16,460*	*100.00*
Extent of IPC Ownership Use Rights					
• IPC Lands					
• Limited Use Rights	30	0	1,150	1,180	7.17
• Full Use Rights	330	1,120	7,110	8,560	52.00
• TOTAL FOR IPC USE RIGHTS	*360*	*1,120*	*8,260*	*9,740*	*59.17*

a. Acreages do not include lands lying between river meander lines in the original public land survey. This acreage is estimated to be approximately 8,060 acres and is owned by the states of Oregon and Idaho.

b. Discrepancies in addition are due to rounding.

Table E.6-2 Extent of each cover type within the proposed project boundary of the Hells Canyon Complex, based on 1993 aerial photography[a]

	Brownlee			Oxbow			Hells Canyon		
	Project Boundary		Study Area	Project Boundary		Study Area	Project Boundary		Study Area
Cover Type	ha	%	%	ha	%	%	ha	%	%
Upland Vegetation									
Forested Upland	0.72	0.01	0.00	2.22	0.23	0.00	2.66	0.20	0.01
Desertic Woodland	—	—	—	0.09	0.01	0.00	—	—	—
Tree Savanna	0.06	0.00	0.00	3.20	0.33	0.01	7.19	0.55	0.01
Shrubland	149.41	2.05	0.31	60.61	6.16	0.13	51.43	3.91	0.11
Shrub Savanna	439.87	6.02	0.91	217.47	22.09	0.45	125.77	9.57	0.26
Desertic Shrubland	7.77	0.11	0.02	—	—	—	20.03	1.52	0.04
Forbland	25.07	0.34	0.05	1.51	0.15	0.00	—	—	—
Grassland	356.51	4.88	0.74	89.10	9.05	0.18	36.81	2.80	0.08
Desertic Herbland	15.37	0.18	0.03	—	—	—	0.47	0.04	0.00
Riparian Vegetation									
Forested Wetland	15.60	0.21	0.03	7.18	0.73	0.01	14.25	1.08	0.03
Scrub-Shrub Wetland	77.77	1.06	0.16	19.85	2.02	0.04	30.36	2.13	0.06
Emergent Herbaceous Wetland	121.83	1.67	0.25	0.24	0.02	0.00	—	—	—
Shore & Bottomland Wetland	638.11	8.73	1.32	16.49	1.67	0.03	0.86	0.07	0.00
Natural Features									
Barrenland	9.45	0.13	0.02	—	—	—	—	—	—
Cliff/Talus Slope	13.67	0.19	0.03	17.91	1.82	0.04	91.37	6.95	0.19
Lentic	0.24	0.00	0.00	—	—	—	0.10	0.01	0.00
Lotic	5,263.51	72.05	10.88	500.18	50.80	1.03	909.98	69.21	1.88
Land Use									

Table E.6-2 Extent of each cover type within the proposed project boundary of the Hells Canyon Complex, based on 1993 aerial photography[a]

	Brownlee			Oxbow			Hells Canyon		
	Project Boundary		Study Area	Project Boundary		Study Area	Project Boundary		Study Area
Cover Type	ha	%	%	ha	%	%	ha	%	%
Disturbed	8.67	0.12	0.02	2.30	0.23	0.00	0.77	0.06	0.00
Agriculture	72.86	1.00	0.15	—	—	—	—	—	—
Grazing Land/ Pasture	26.87	0.37	0.06	5.94	0.60	0.01	—	—	—
Urban	—	—	—	2.14	0.22	0.00	—	—	—
Residential	10.25	0.14	0.02	11.83	1.20	0.02	0.99	0.08	0.00
Industrial	22.90	0.31	0.05	18.14	1.84	0.04	4.73	0.36	0.01
Park/Recreation	29.15	0.40	0.06	7.76	0.79	0.02	16.83	1.28	0.03
Roads	0.86	0.01	0.00	—	—	—	—	—	—
Forested/Orchard	0.17	0.00	0.00	0.49	0.05	0.00	0.19	0.01	0.00
Total area classified	7,305.49	100.00	15.10	984.65	100.00	2.04	1,314.79	100.00	2.72
Unclassified region in legal project boundary	1.31	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total area	7,306.80	100.02	15.10	984.65	100.00	2.04	1,314.79	100.00	2.72

a. Differences in total project area as compared toTable E.6-1 are due to the inclusion of lands lying between river meander lines (approximately 3,262 ha) in this table and differences in methods of calculation for each (GIS for this table, legal descriptions for Table E.6-1).

Table E.6-3 Extent of each cover type within study reaches of the Hells Canyon Study Area, based on 1993 aerial photography

	Above Brownlee (Weiser reach)			Brownlee Reservoir			Oxbow Reservoir		
	Reach		Study Area	Reach		Study Area	Reach		Study Area
Cover Type	**ha**	**%**	**%**	**ha**	**%**	**%**	**ha**	**%**	**%**
Upland Vegetation									
Forested Upland	0.72	0.02	0.00	0.11	0.00	0.00	8.28	0.22	0.02
Tree Savanna	—	—	—	1.00	0.00	0.00	9.61	0.25	0.02
Desertic Woodland	—	—	—	—	—	—	0.09	0.00	0.00
Shrubland	31.21	0.75	0.06	1,646.45	7.10	3.40	517.19	13.48	1.07
Shrub Savanna	313.47	7.53	0.65	5,733.28	24.73	11.85	1,090.69	28.43	2.25
Desertic Shrubland	4.03	0.10	0.01	263.49	1.14	0.54	0.27	0.01	0.00
Forbland	33.32	0.80	0.07	113.56	0.49	0.23	2.39	0.06	0.00
Grassland	755.87	18.16	1.56	7,789.91	33.60	16.10	1,321.25	34.44	2.73
Desertic Herbland	25.28	0.61	0.05	157.98	0.68	0.33	—	—	—
Riparian Vegetation									
Forested Wetland	36.86	0.88	0.08	69.35	0.30	0.14	57.62	1.50	0.12
Scrub-Shrub Wetland	84.73	2.03	0.18	285.79	1.23	0.59	127.45	3.32	0.26
Emergent Herbaceous Wetland	66.40	1.59	0.14	148.52	0.64	0.31	0.34	0.01	0.00
Shore & Bottomland Wetland	11.48	0.28	0.02	646.93	2.79	1.34	16.49	0.43	0.03
Natural Features									
Barrenland	0.76	0.02	0.00	39.79	0.17	0.08	—	—	—
Cliff/Talus Slope	8.76	0.21	0.02	102.16	0.44	0.21	109.81	2.86	0.23
Lentic	7.81	0.19	0.02	1.58	0.01	0.00	—	—	—
Lotic	526.12	12.64	1.09	5,068.67	21.86	10.48	514.17	13.40	1.06
Land Use									

Table E.6-3 Extent of each cover type within study reaches of the Hells Canyon Study Area, based on 1993 aerial photography

	Above Brownlee (Weiser reach)			Brownlee Reservoir			Oxbow Reservoir		
	Reach		Study Area	Reach		Study Area	Reach		Study Area
Cover Type	**ha**	**%**	**%**	**ha**	**%**	**%**	**ha**	**%**	**%**
Disturbed	17.46	0.42	0.04	18.57	0.08	0.04	4.03	0.11	0.01
Agriculture	1,895.40	45.53	3.92	507.27	2.19	1.05	—	—	—
Grazing Land/ Pasture	100.73	2.42	0.21	434.50	1.87	0.90	2.14	0.06	0.00
Urban	—	—	—	—	—	—	—	—	—
Residential	162.09	3.89	0.34	23.56	0.10	0.05	10.14	0.26	0.02
Industrial	73.60	1.77	0.15	49.73	0.21	0.10	41.14	1.07	0.09
Park/Recreation	3.14	0.07	0.01	58.88	0.25	0.12	3.32	0.09	0.01
Roads	0.25	0.01	0.00	1.71	0.01	0.00	—	—	—
Forested/Orchard	3.29	0.08	0.01	2.51	0.01	0.01	—	—	—
Total area classified	4,162.78	100.00	8.63	23,165.30	99.90	47.87	3,836.42	100.00	7.92
Unclassified region in study reach	0.02	> 0.00	0.00	16.57	> 0.07	.03	0.00	0.00	0.00
Total Area	4,162.80	100.00	8.63	23,181.87	100.00	47.90	3,836.42	100.00	7.92

Table E.6-4 Extent of each cover type within study reaches of the Hells Canyon Study Area, based on 1993 aerial photography

	Hells Canyon Reservoir			Downstream Reaches		
	Reach		Study Area	Reach		Study Area
Cover Type	ha	%	%	ha	%	%
Upland Vegetation						
Forested Upland	45.01	0.72	0.09	18.15	0.17	0.04
Tree Savanna	103.55	1.65	0.21	116.88	1.07	0.24
Desertic Woodland	—	—	—	—	—	—
Shrubland	688.56	10.96	1.42	311.66	2.86	0.64
Shrub Savanna	1,421.41	22.63	2.94	1,595.41	14.62	3.30
Desertic Shrubland	67.52	1.08	0.14	215.61	1.98	0.45
Forbland	1.55	0.02	0.00	1.33	0.01	0.00
Grassland	1,822.48	29.02	3.77	5,502.94	50.43	11.38
Desertic Herbland	13.22	0.21	0.03	155.52	1.43	0.32
Riparian Vegetation						
Forested Wetland	93.83	1.49	0.19	132.21	1.21	0.27
Scrub-Shrub Wetland	96.11	1.53	0.20	228.29	2.09	0.47
Emergent Herbaceous Wetland	—	—	—	0.77	0.01	0.00
Shore & Bottomland Wetland	1.96	0.03	0.00	205.36	1.88	0.42
Natural Features						
Barrenland	—	—	—	12.31	0.11	0.03
Cliff/Talus Slope	942.83	15.01	1.95	1,558.73	14.28	3.22
Lentic	0.36	0.01	0.00	—	—	—
Lotic	918.32	14.62	1.90	763.81	7.00	1.58
Land Use						
Disturbed	1.97	0.03	0.00	2.22	0.02	0.00
Agriculture	—	—	—	33.33	0.31	0.07
Grazing Land/Pasture	0.20	0.00	0.00	43.03	0.39	0.09

Table E.6-4 Extent of each cover type within study reaches of the Hells Canyon Study Area, based on 1993 aerial photography

	Hells Canyon Reservoir			Downstream Reaches		
	Reach		Study Area	Reach		Study Area
Cover Type	**ha**	**%**	**%**	**ha**	**%**	**%**
Urban	2.14	0.03	0.00	—	—	—
Residential	14.64	0.23	0.03	1.43	0.01	0.00
Industrial	19.04	0.30	0.04	5.58	0.05	0.01
Park/Recreation	22.54	0.36	0.05	6.66	0.06	0.01
Roads	—	—	—	—	—	—
Forested/Orchard	1.60	0.03	0.00	—	—	—
Total area classified	6,278.84	99.96	12.96	10,911.23	99.99	22.54
Unclassified region in study reach	1.66	> 0.03	0.00	0.69	< 0.01	0.00
Total Area	6,280.50	100.00	12.96	10,911.92	100.00	22.54

Table E.6-5 Riparian cover types and amounts within the proposed project boundary[a] of the Hells Canyon Complex, by project reservoir

Cover Types	Brownlee			Oxbow			Hells Canyon			Total Project Area
	ha	Acres	%	ha	Acres	%	ha	Acres	%	
Forested Wetland	15.60	38.55	0.21	7.18	17.74	0.73	14.25	35.21	1.08	37.03 ha 91.50 ac 2.02%
Scrub-Shrub Wetland	77.77	192.17	1.06	19.85	49.05	2.02	30.36	75.02	2.31	127.98 ha 316.24 ac 5.39%
Emergent Herbaceous Wetland	121.83	301.04	1.67	0.24	0.59	0.02	—	—	—	122.07 ha 301.63 ac 1.69%
Shore & Bottomland Wetland	638.11	1,576.77	8.73	16.49	40.75	1.67	0.86	2.12	0.00	655.46 ha 1,619.64 ac 10.40%
Total	853.31	2,108.53	11.67	43.76	108.13	4.44	45.47	112.35	3.39	942.54 ha 2,329.01 ac 14.31%

a. The study was limited to land within 0.5 mile of each shoreline and, therefore, covers only a portion of the total project area.

Table E.6-6 Costs for land management and aesthetic mitigation measures

Activity	Estimated Cost (Thousands of $)		Cost per Year (Thousands of $)
	Capital	O&M[a]	
Land Management Measures			
Hells Canyon Resource Management Plan implementation		2,100	70 (years 1–30)[b]
Aesthetic Measures			
Transmission line measures • Nonspecular conductors • Review of new structures • Vegetation screening • Vegetation management	20	50	20 (year 1) 10 (years 1–5)
Design standards and guidelines for physical structures	35	—	35 (year 1)
Standards and guidelines for landscaping	20	—	20 (year 1)
General aesthetic clean-up plan and implementation • Burn pit relocation • Oxbow plant, dam, and spillway • Brownlee yard area • Oxbow and Hells Canyon roads • Noxious and nuisance weed control at project facilities	215	145	215 (year 1) 5 (years 2–30)
Guardrail replacement	160	—	20 (years 1–8)
Mitigation of contrast from project facilities			
• Highway 71 cage modification	35	—	5 (year 1 for plan) 15 (years 1–2)
• Woodhead Park modifications	25	25	12.5 (years 2–3) 1.2 (years 10–30)
• McCormick Park entrance enhancement	112	—	10 (years 1–4) 72 (year 5)
• Oxbow Power Plant improvement	25	—	15 (year 2) 10 (year 3)

Table E.6-6 Costs for land management and aesthetic mitigation measures

Activity	Estimated Cost (Thousands of $)		Cost per Year (Thousands of $)
	Capital	O&M[a]	
• Modifications to Oxbow Village entrance	25	25	10 (years 1–5)
• Bob Creek/Landing strip improvements	12	3	9 (year 3) 6 (year 4)
• Hells Canyon Park improvements	20	—	10 (years 3–4)
• Hells Canyon Dam plan and modifications	40	25	8 (years 1–5) 5 (years 1–5)
• Brownlee Bridge area enhancement	10	—	10 (year 1)
Lessening contrast of others' facilities			
• Spring Recreation Site[c]	—	—	
• Copper Creek Trailhead[c]	—	—	
• Big Bar[c]	—	—	
• Eagle Bar	10	—	10 (year 1)
Education and interpretation of conditions			
• Farewell Bend improvement/ interpretation	10	—	5 (years 1–2)
• Salmon net anchor interpretation	1	—	1 (year 1)

a. O&M = operation and maintenance.

b. The Applicant is not proposing a 30-year new license period. However, for the purpose of defining a time period for its analysis, the Applicant chose the lower limit of FERC's discretion for setting a new license term.

c. This activity will be funded through measures detailed in Exhibit E.5.

Table E.6-7 FERC list of comprehensive and other plans relevant to the Hells Canyon Complex relicensing process

Author	Title	Year
Both States		
Northwest Power Planning Council	*Columbia River Basin Fish and Wildlife Program*	1984
Northwest Power Planning Council	*Northwest Conservation and Electric Power Plan*	1986
Northwest Power Planning Council	*Columbia River Basin Fish and Wildlife Program*	1987
Northwest Power Planning Council	*Protected Areas Amendments and Response to Comments*	1988
Northwest Power Planning Council	*Columbia River Basin Fish and Wildlife Program*	1994
Idaho		
U.S. Forest Service	*Payette National Forest Land and Resource Management Plan*	1988
Idaho Department of Fish and Game	*Idaho Fisheries Management Plan, 1986–1990*	1986
Idaho Department of Fish and Game and Bonneville Power Administration	*Pacific Northwest Rivers Study*	1986
Idaho Division of Environmental Quality	*Idaho Water Quality Standards and Wastewater Treatment Requirements*	1985
Idaho Department of Parks and Recreation	*Idaho Outdoor Recreation Plan*	1983
Idaho Department of Parks and Recreation	*Idaho Comprehensive Outdoor Recreation and Tourism Plan*	1997
Idaho Water Resources Board	*State Water Plan*	1986
Oregon		
Bureau of Land Management	*Baker Resource Management Plan Record of Decision*	1989
Hydro Task Force and Strategic Water Management Group	*Oregon Comprehensive Waterway Management Plan*	1988
Oregon Department of Fish and Wildlife	*Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part I, General Considerations*	1982
Oregon Department of Fish and Wildlife	*Oregon Bighorn Sheep Management Plan*	1986

Table E.6-7 FERC list of comprehensive and other plans relevant to the Hells Canyon Complex relicensing process

Author	Title	Year
Oregon Department of Fish and Wildlife	*The Statewide Trout Management Plan*	1987
Oregon Department of Fish and Wildlife	*Warmwater Game Fish Management Plan*	1987
Oregon Department of Fish and Wildlife	*Oregon Elk Management Plan*	1992
Oregon Department of Fish and Wildlife	*Oregon Black Bear Management Plan 1993–1998*	1993
Oregon Department of Fish and Wildlife	*Oregon Wildlife Diversity Plan*	1993
Oregon Department of Fish and Wildlife	*Oregon Cougar Management Plan 1993–1998*	1993
Oregon Department of Fish and Wildlife	*Oregon Wildlife and Commercial Fishing Codes*	1993
Oregon Department of Fish and Wildlife	*Biennial Report on the Status of Wild Fish in Oregon*	1995
Oregon Department of Fish and Wildlife	*Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part III, Steelhead Plan*	1995
Oregon Department of Fish and Wildlife, Wildlife Diversity Program	*Species at Risk: Sensitive, Threatened, and Endangered Vertebrates of Oregon*	1996
Oregon Department of Fish and Wildlife	*Oregon Plan for Salmon and Watersheds: Supplement 1 Steelhead*	1997
Oregon State Parks and Recreation Division	*Statewide Comprehensive Outdoor Recreation Plan*	1983
Oregon Department of Transportation and Oregon State Parks and Recreation Division	*Recreational Values on Oregon Rivers*	1987
Oregon Water Resources Commission	*Oregon Water Use Programs*	1985
Oregon Department of Environmental Quality	*Proposed Water Quality Management Plan*	1976
Oregon Department of Environmental Quality	*Statewide Water Quality Management Plan*	1978

Table E.6-7 FERC list of comprehensive and other plans relevant to the Hells Canyon Complex relicensing process

Author	Title	Year
Oregon Department of Environmental Quality	*Biennial Report, 1985–1987*	1985
Oregon Department of Environmental Quality	*Oregon Water Laws*	1988
Oregon State Water Resources Board	*Surface Area of Lakes and Reservoirs*	1973
Oregon Water Resources Commission	*Oregon Water Use Programs*	1987
Oregon State Game Commission	*Fish and Wildlife Resources—18 Basins*	1963–1975
Oregon Department of Energy	*Oregon Final Summary Report for the Pacific Northwest Rivers Study*	1987
State of Oregon, State of Washington, State of Idaho, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, Confederated Tribes and Bands of the Yakama Indian Nation	*Settlement Agreement Pursuant to the September 1, 1983, Order of the U.S. District Court for the District of Oregon in Case No. 68-5113: Columbia River Fish Management Plan*	1987

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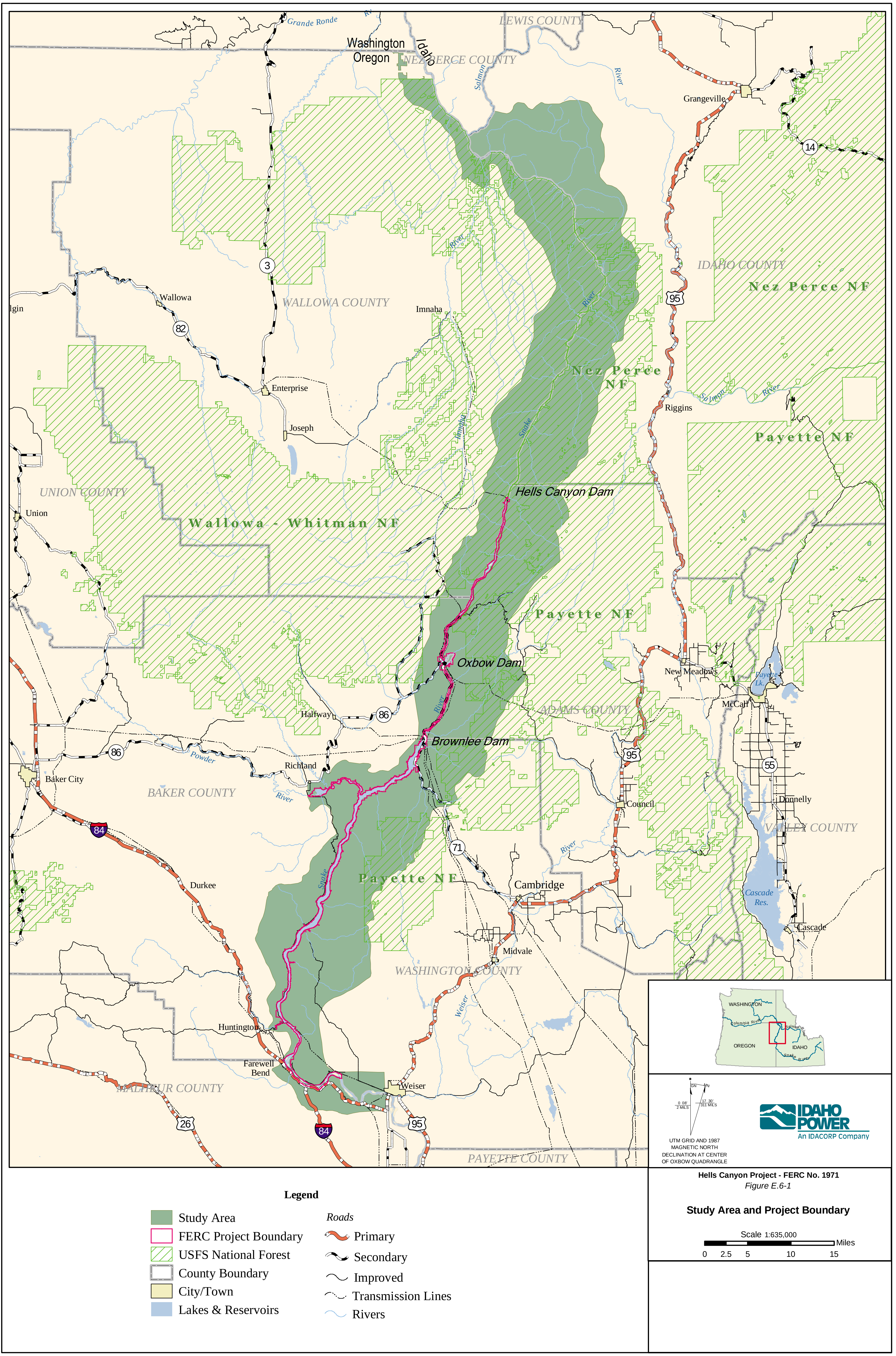

Hells Canyon Project - FERC No. 1971

Figure E.6-1

Study Area and Project Boundary

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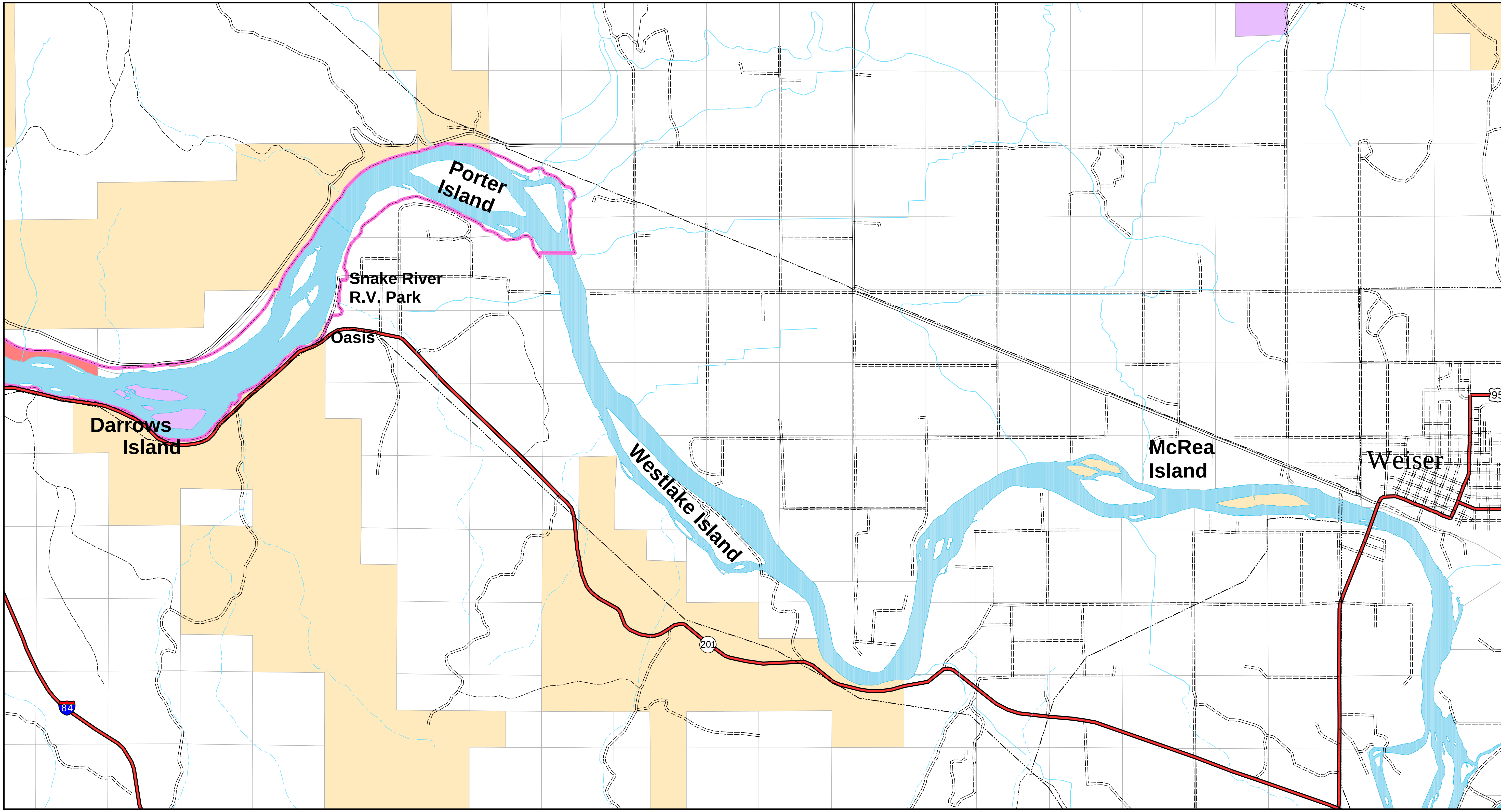
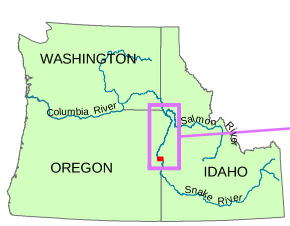
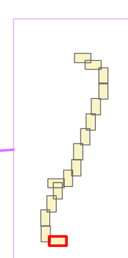






Panel 1 of 11

Legend

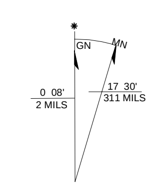
Land Owner Class

- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads

- Primary
- Secondary
- Light Duty
- Unimproved
- Trail



UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 — 1 Miles

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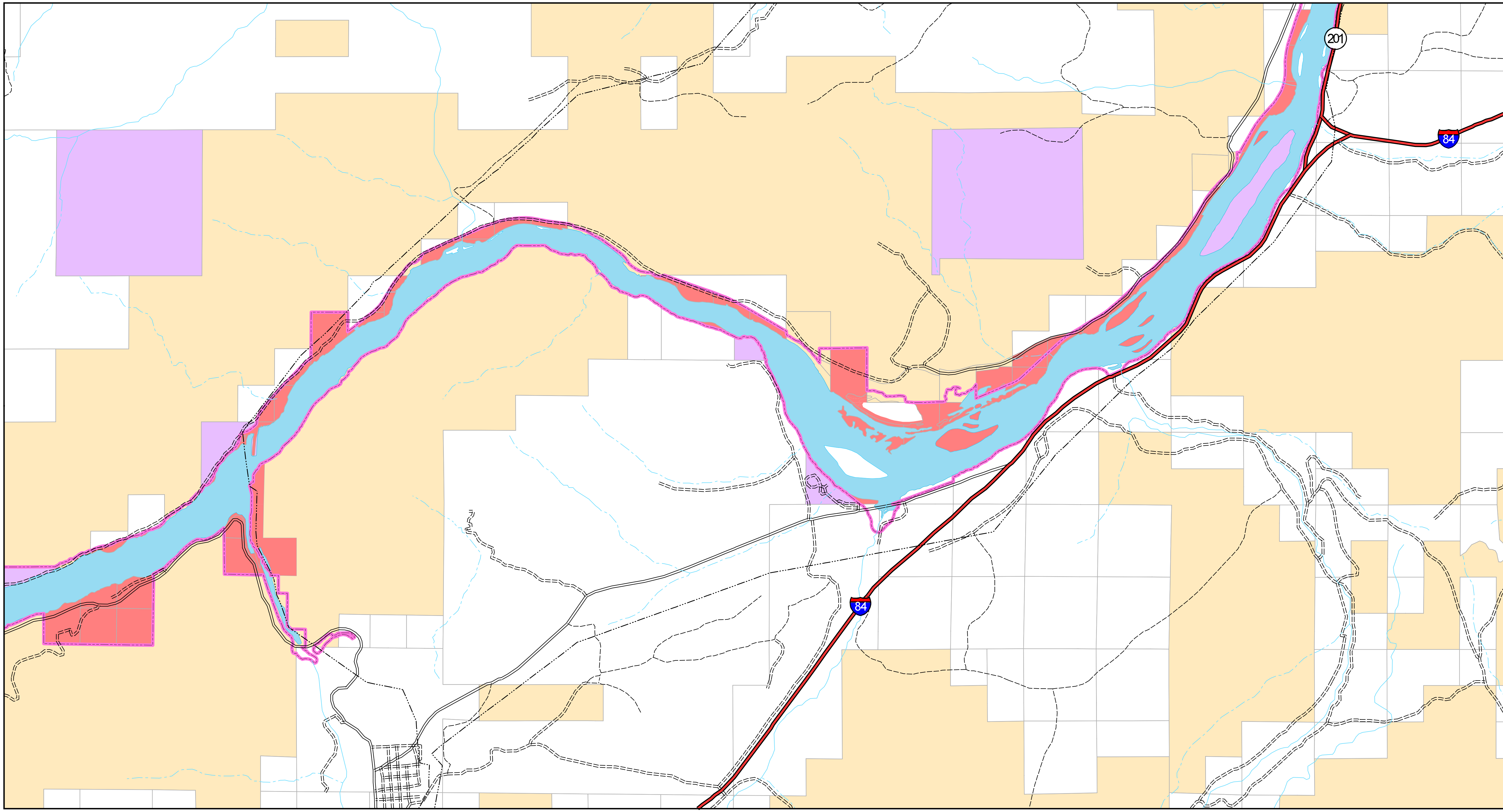

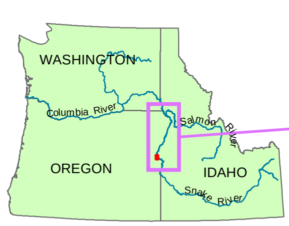

Panel 2 of 11

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 0.75 Miles

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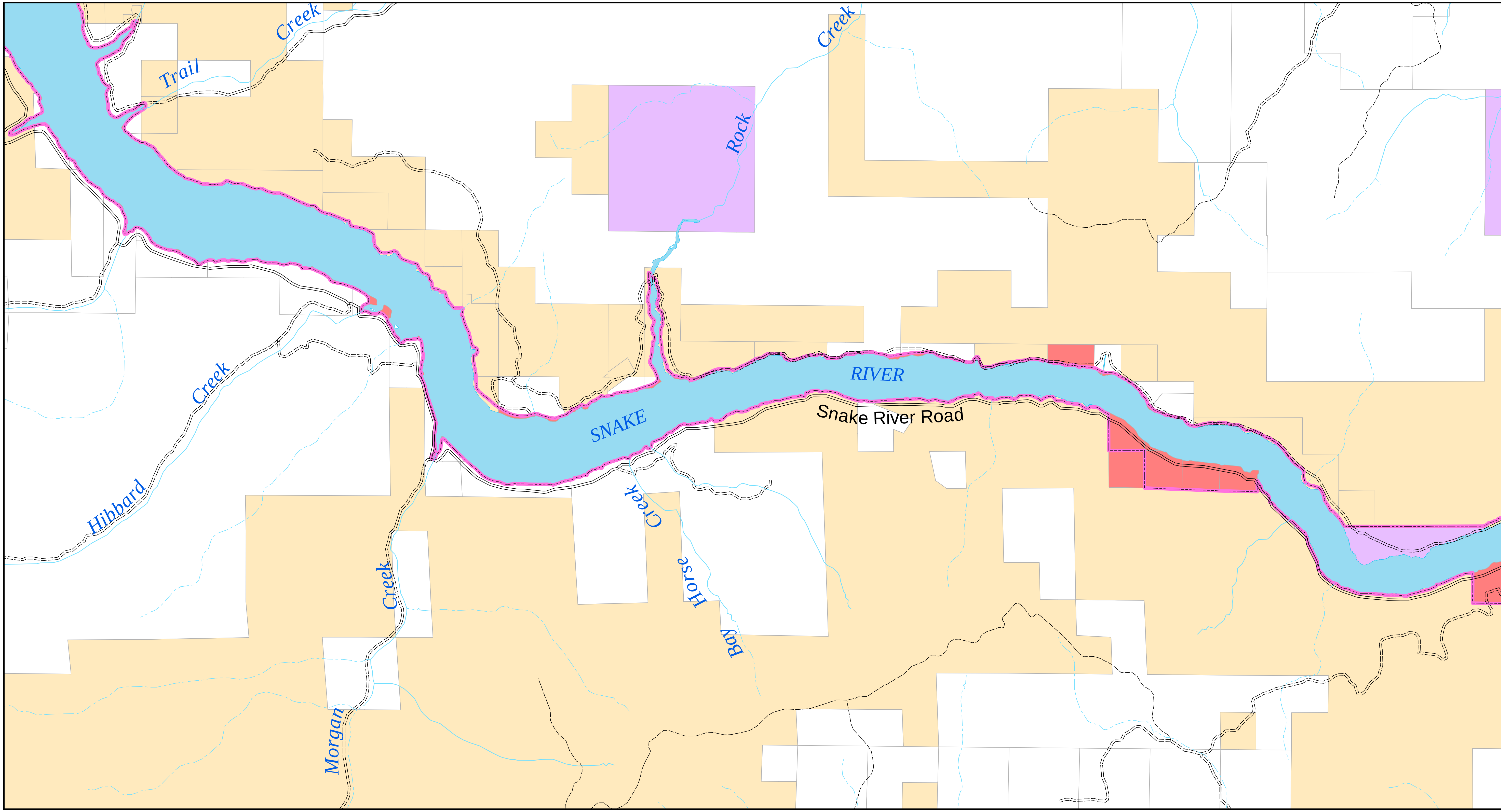
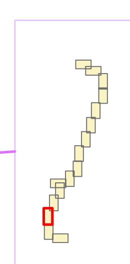




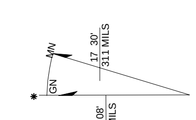
Panel 3 of 11

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail



UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 1 Miles

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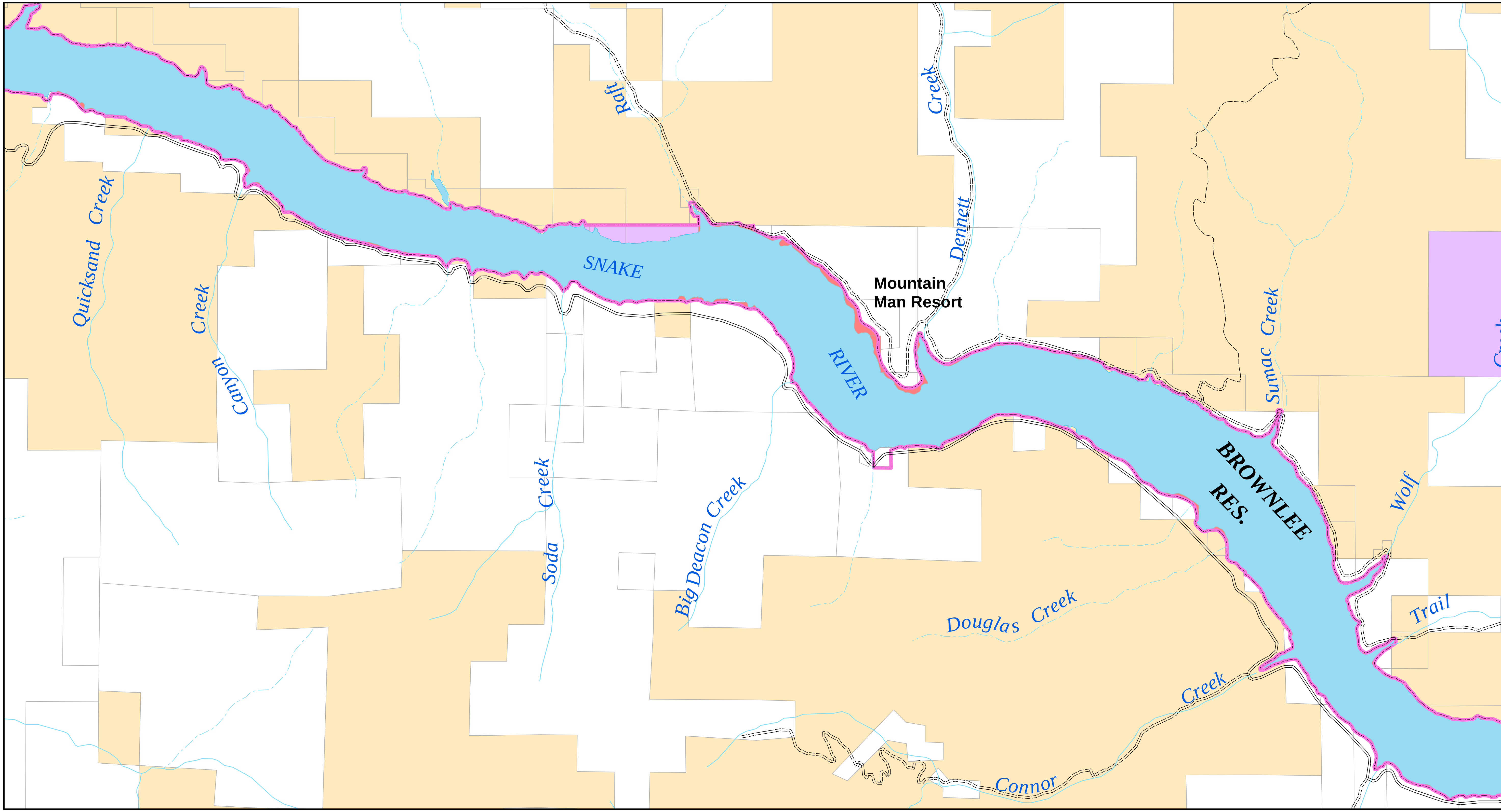

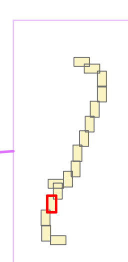

Panel 4 of 11

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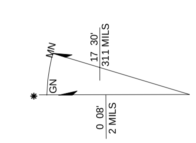
Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

Transmission Line
Perennial River or Stream
Intermittent Stream
Water Body
FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail



UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500
0 1 Miles

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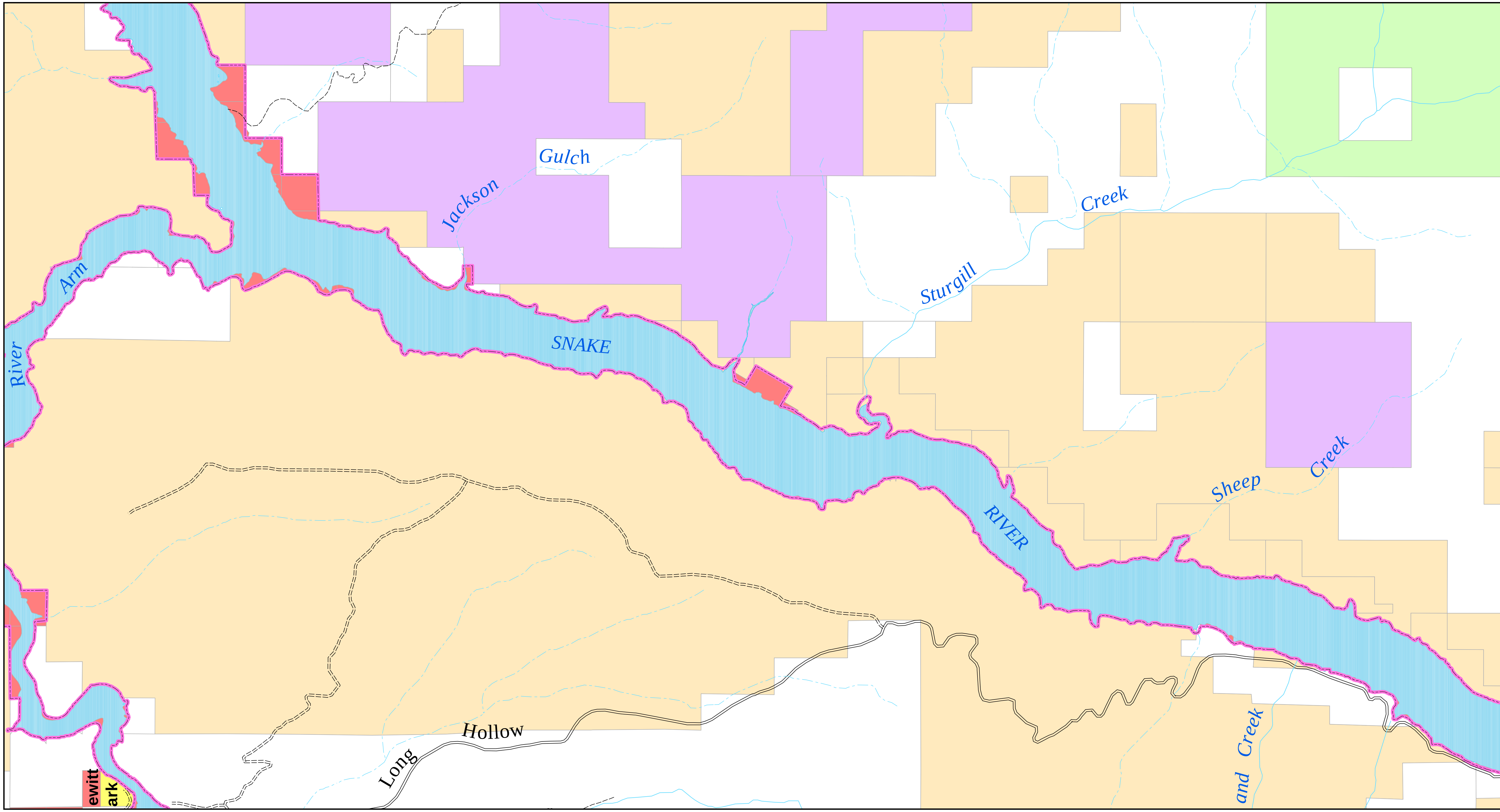

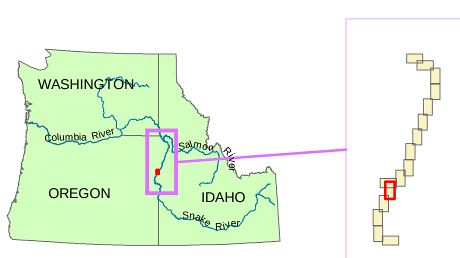

Panel 5 of 11

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 1 Miles

IDAHO POWER
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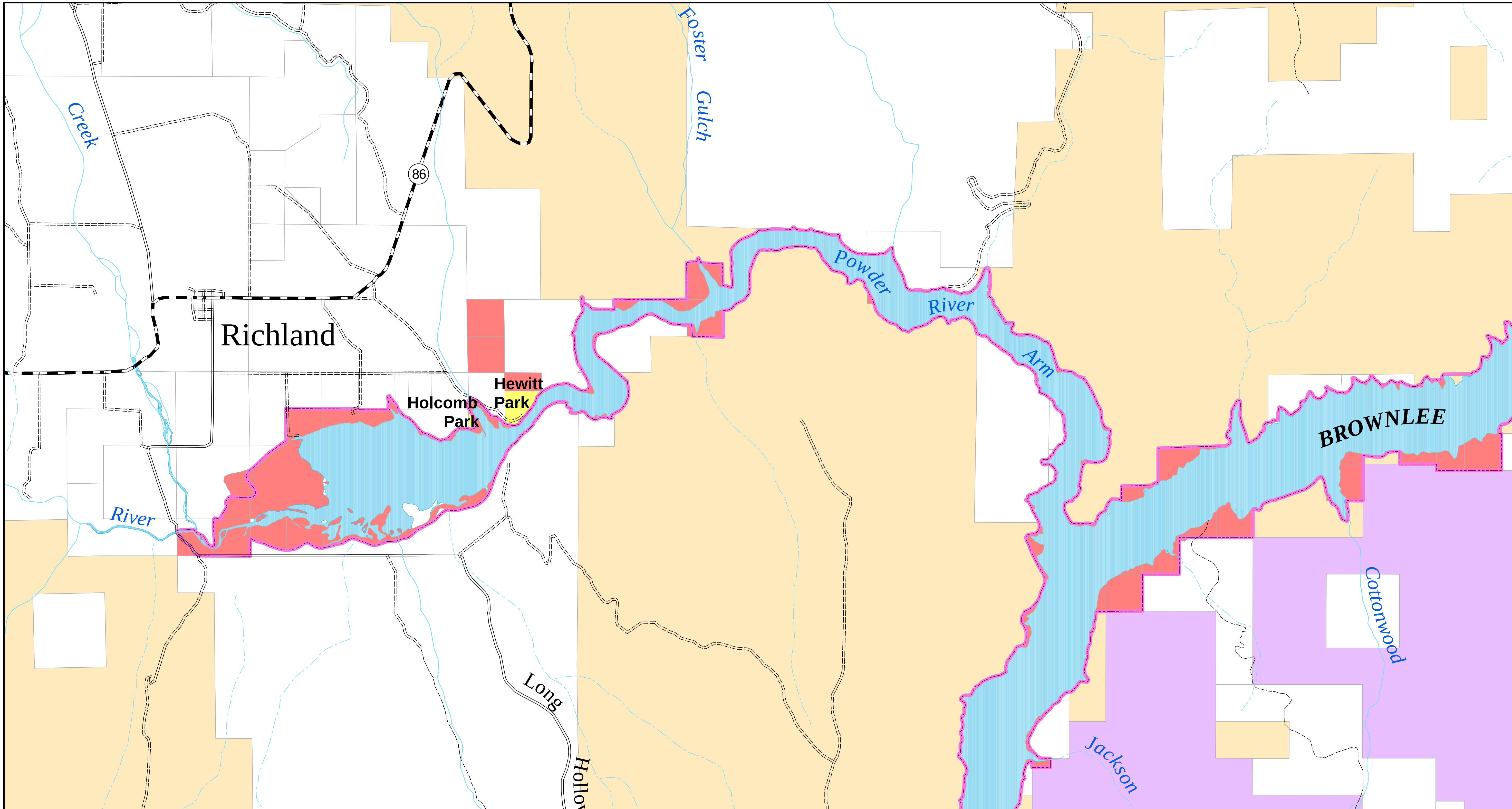

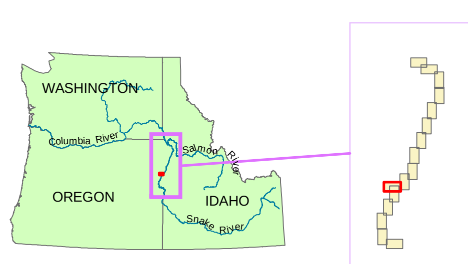

Panel 6 of 11

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Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail

GN MN
0 08' 2 MILS
17 30' 311 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 1 Miles

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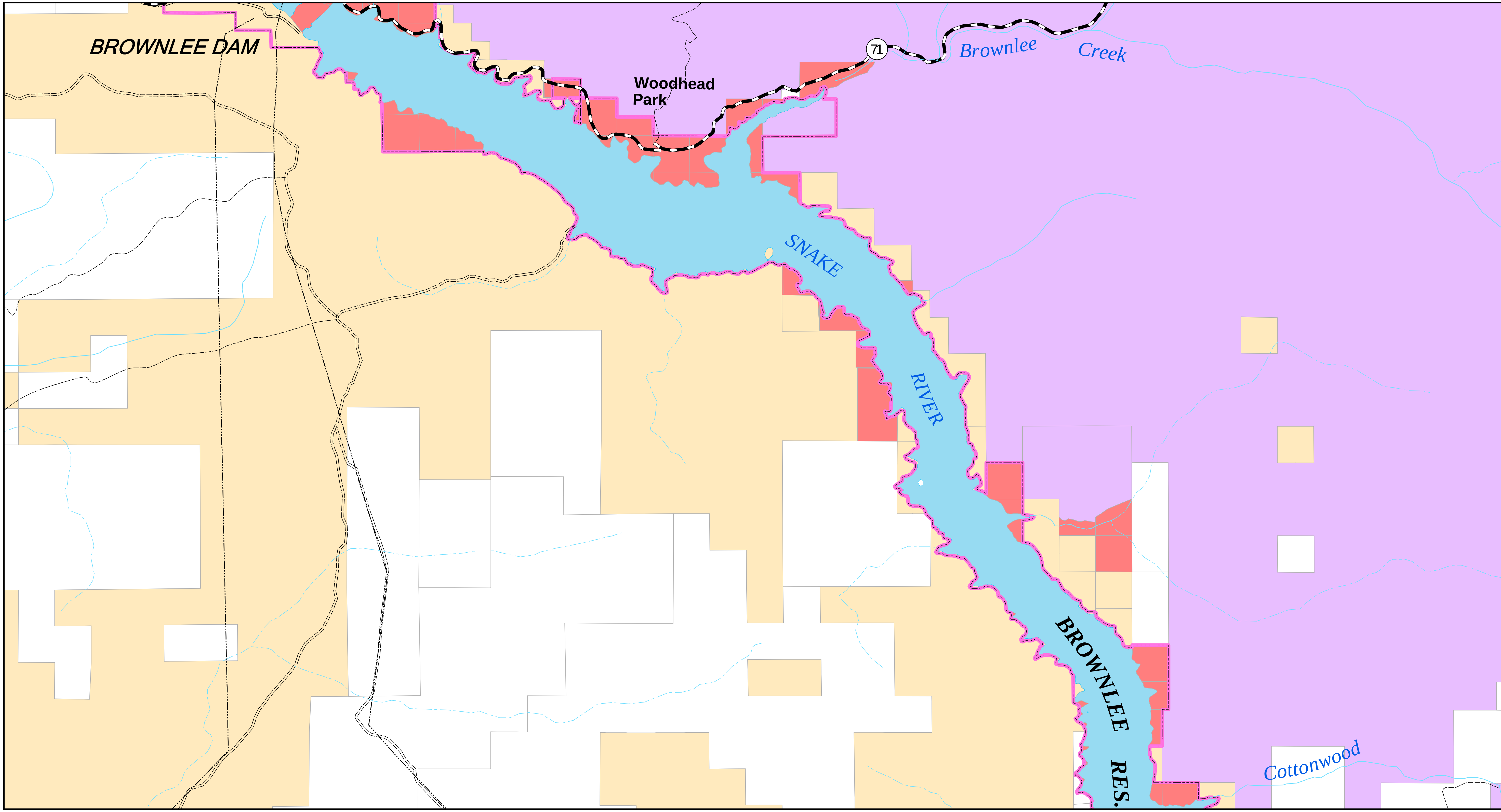

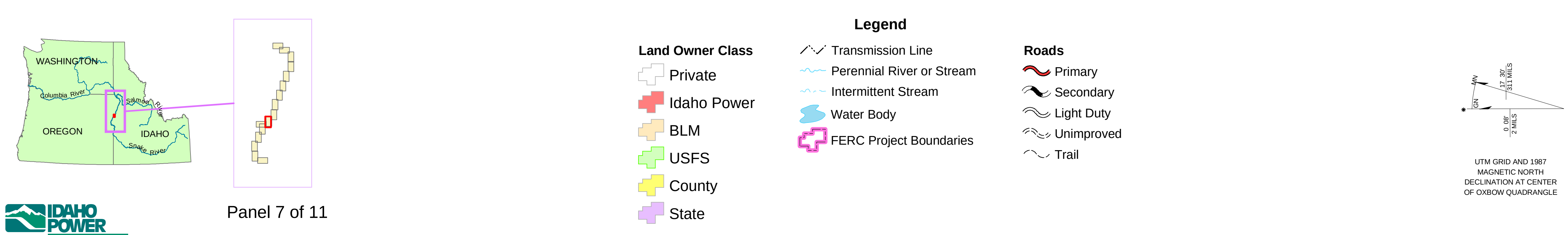

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 — 1 Miles

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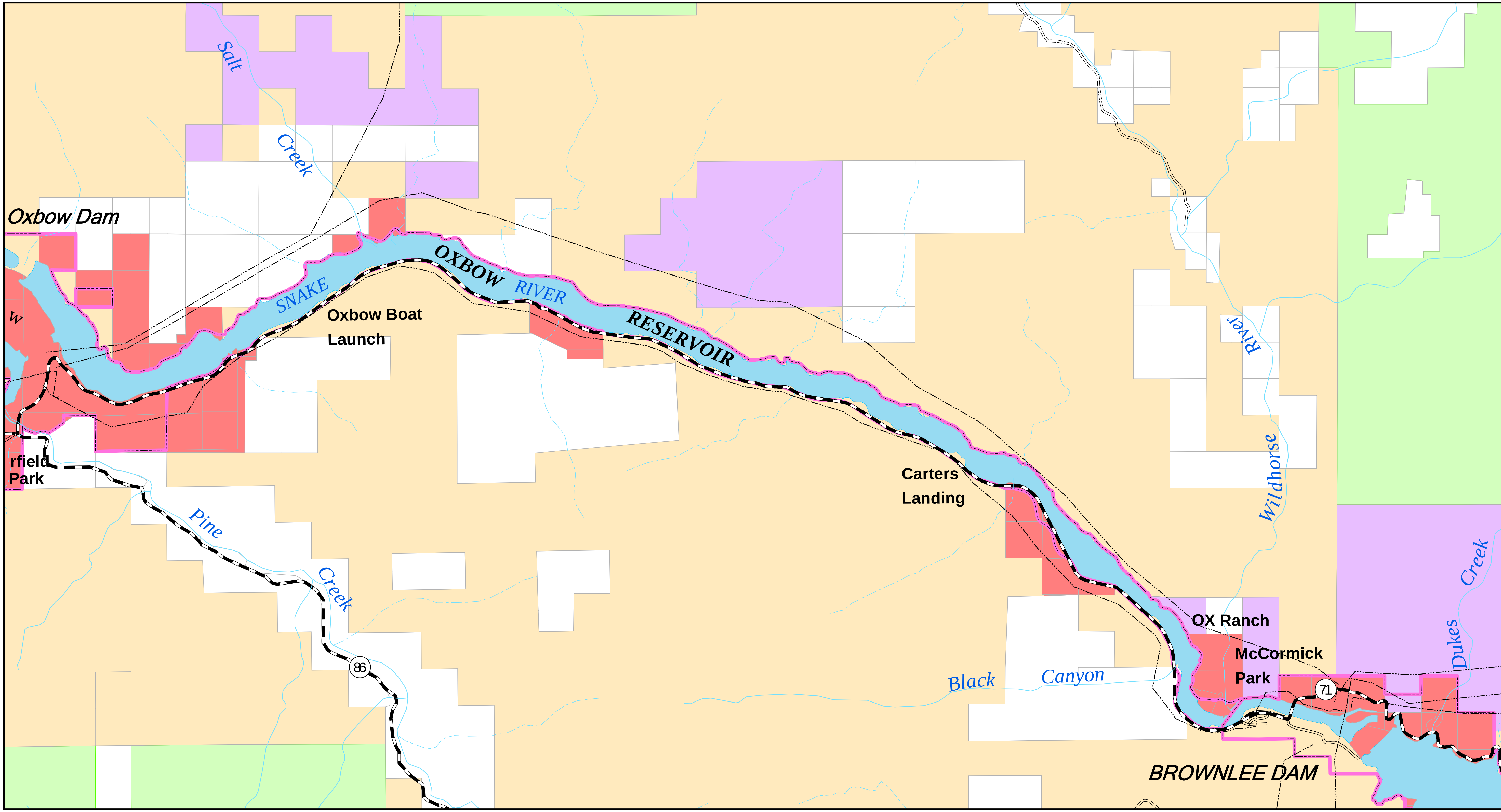

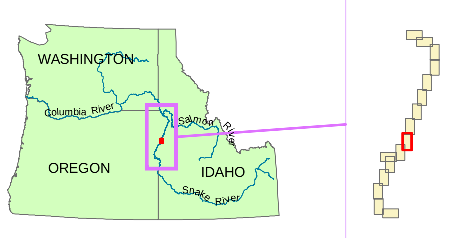

Panel 8 of 11

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail

MN GN 17 30' 311 MILS 0 08' 2 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 1 Miles

IDAHO POWER An IDACORP Company

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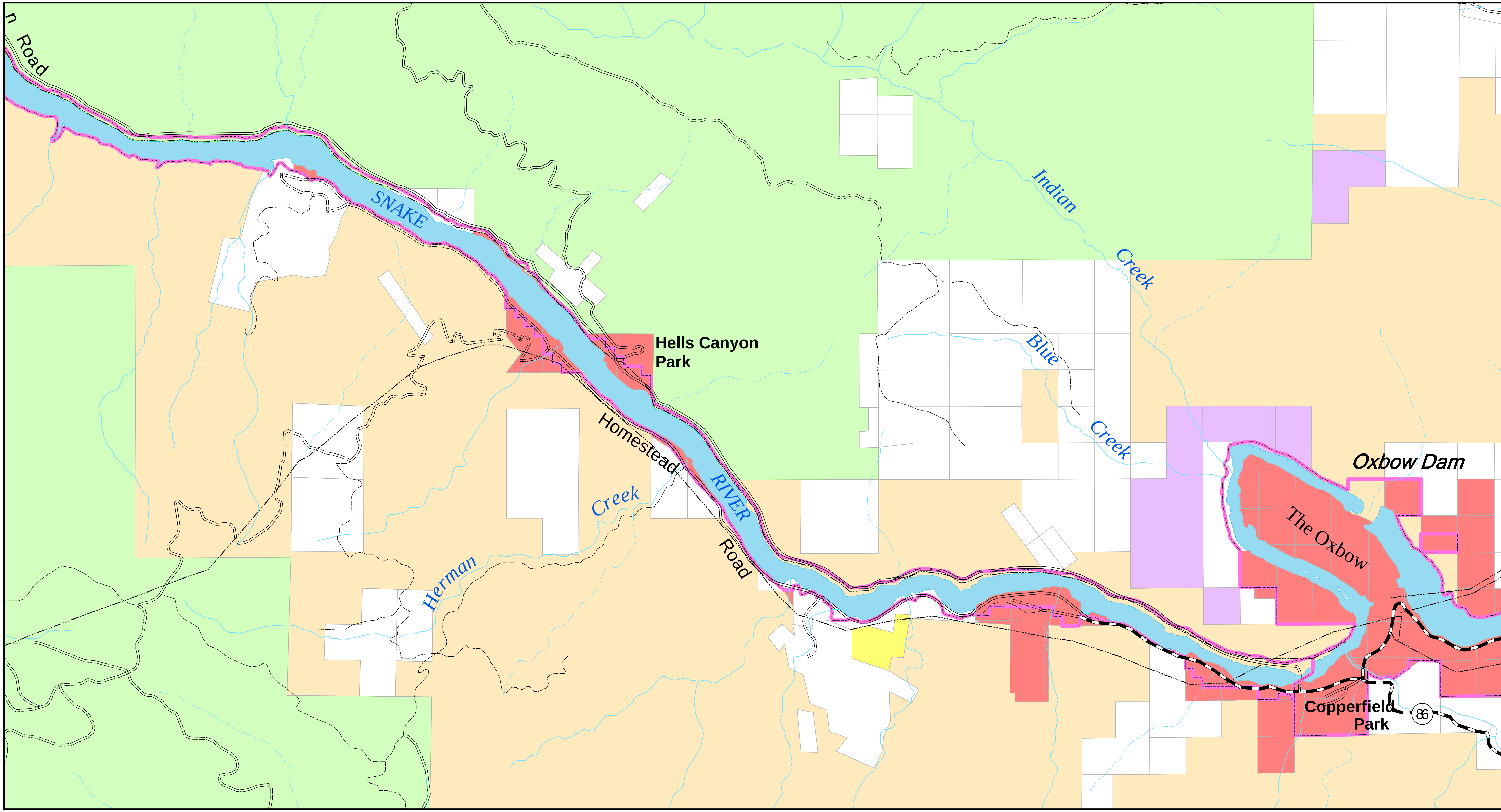

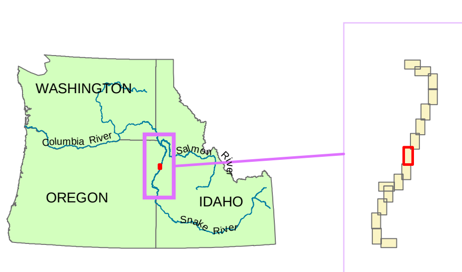

Panel 9 of 11

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail

MN
GN
17 30'
311 MILS
0 08'
2 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971

Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 — 1 Miles

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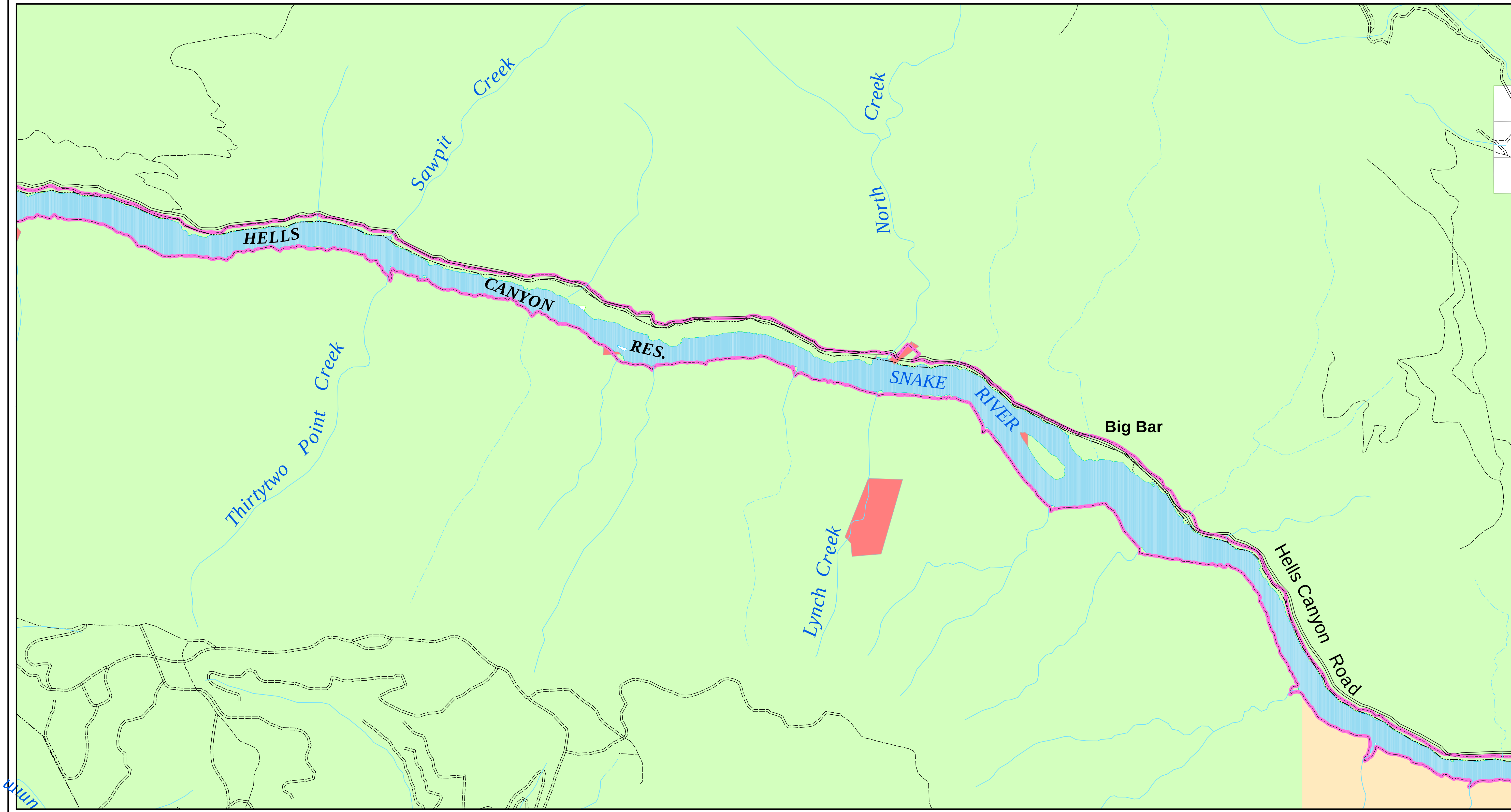
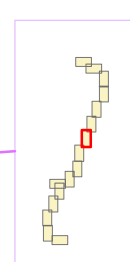




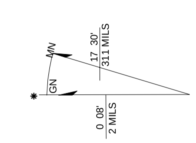
Panel 10 of 11

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail



UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500

0 1 Miles

IDAHO POWER
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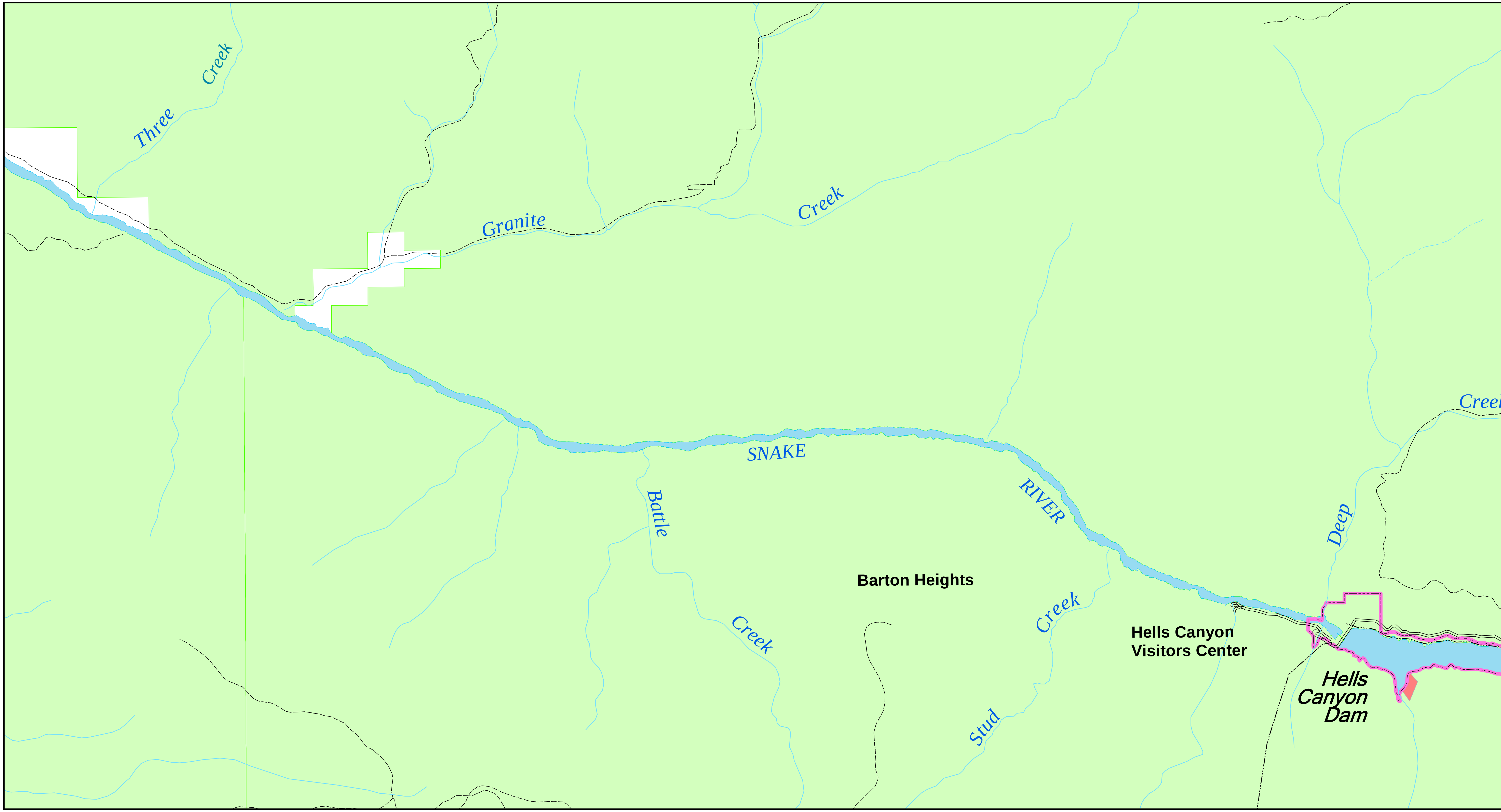

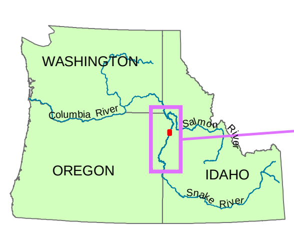

Panel 11 of 11

IDAHO POWER
An IDACORP Company

Legend

Land Owner Class
- Private
- Idaho Power
- BLM
- USFS
- County
- State

- Transmission Line
- Perennial River or Stream
- Intermittent Stream
- Water Body
- FERC Project Boundaries

Roads
- Primary
- Secondary
- Light Duty
- Unimproved
- Trail

UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
Figure E.6-2

Land Ownership and Project Boundary

Scale 1:42,500
0 — 1 Miles

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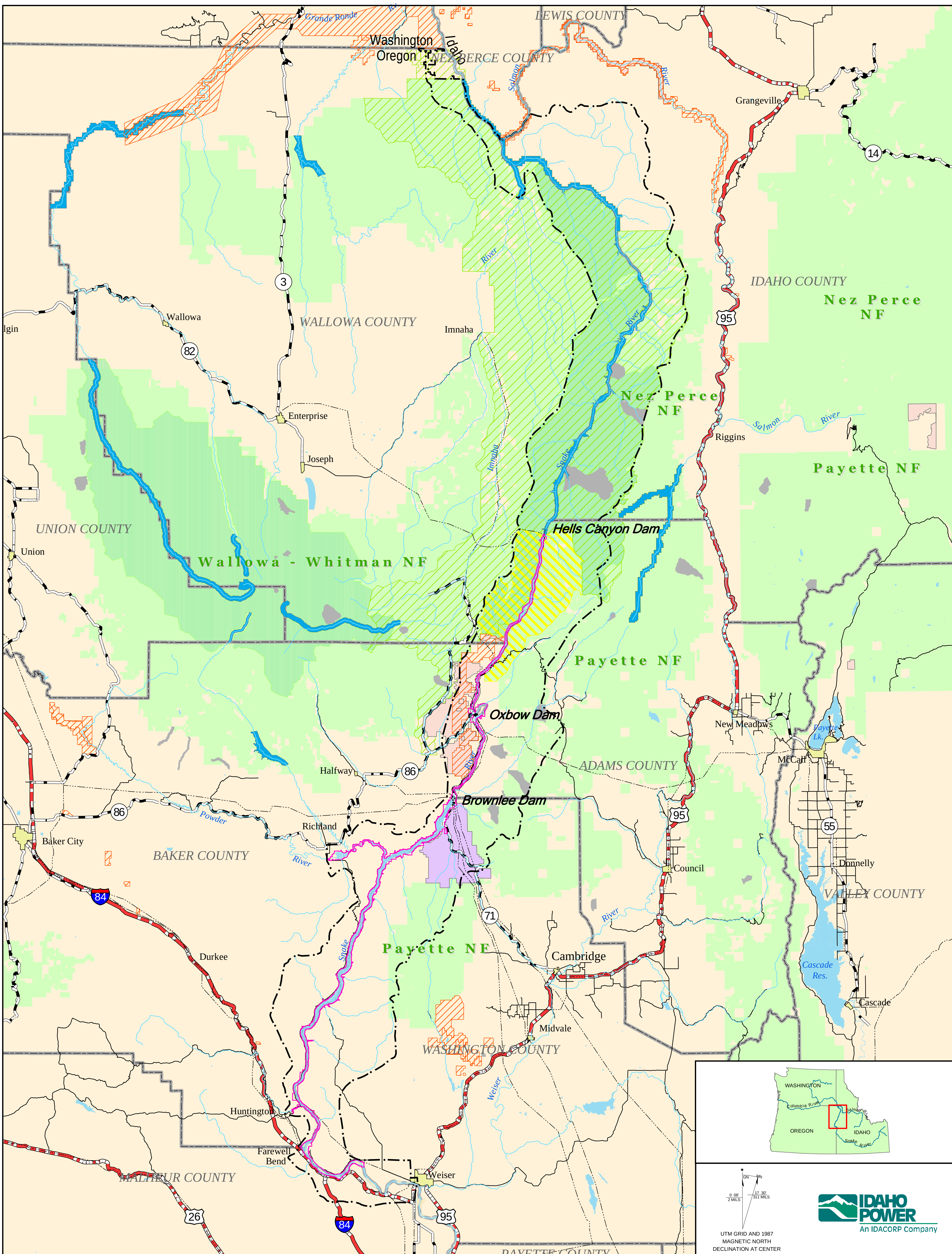

Legend

- Study Area
- FERC Project Boundary
- Hells Canyon National Recreation Area
- Hells Canyon Wilderness
- Area of Critical Environmental Concern
- Cecil Andrus Wildlife Management Area
- Research Natural Area
- Wilderness Study Area
- Wild/Scenic River
- Seven Devils Scenic Area
- USFS National Forest
- City/Town
- County Boundary
- Lakes & Reservoirs
- Rivers

Roads

- Primary
- Secondary
- Improved
- Transmission Lines

IDAHO POWER
An IDACORP Company

Hells Canyon Project - FERC No. 1971

Figure E.6-3

Political Boundaries Affecting Aesthetics and Land Use

Scale 1:636,000

0 5 10 15 Miles

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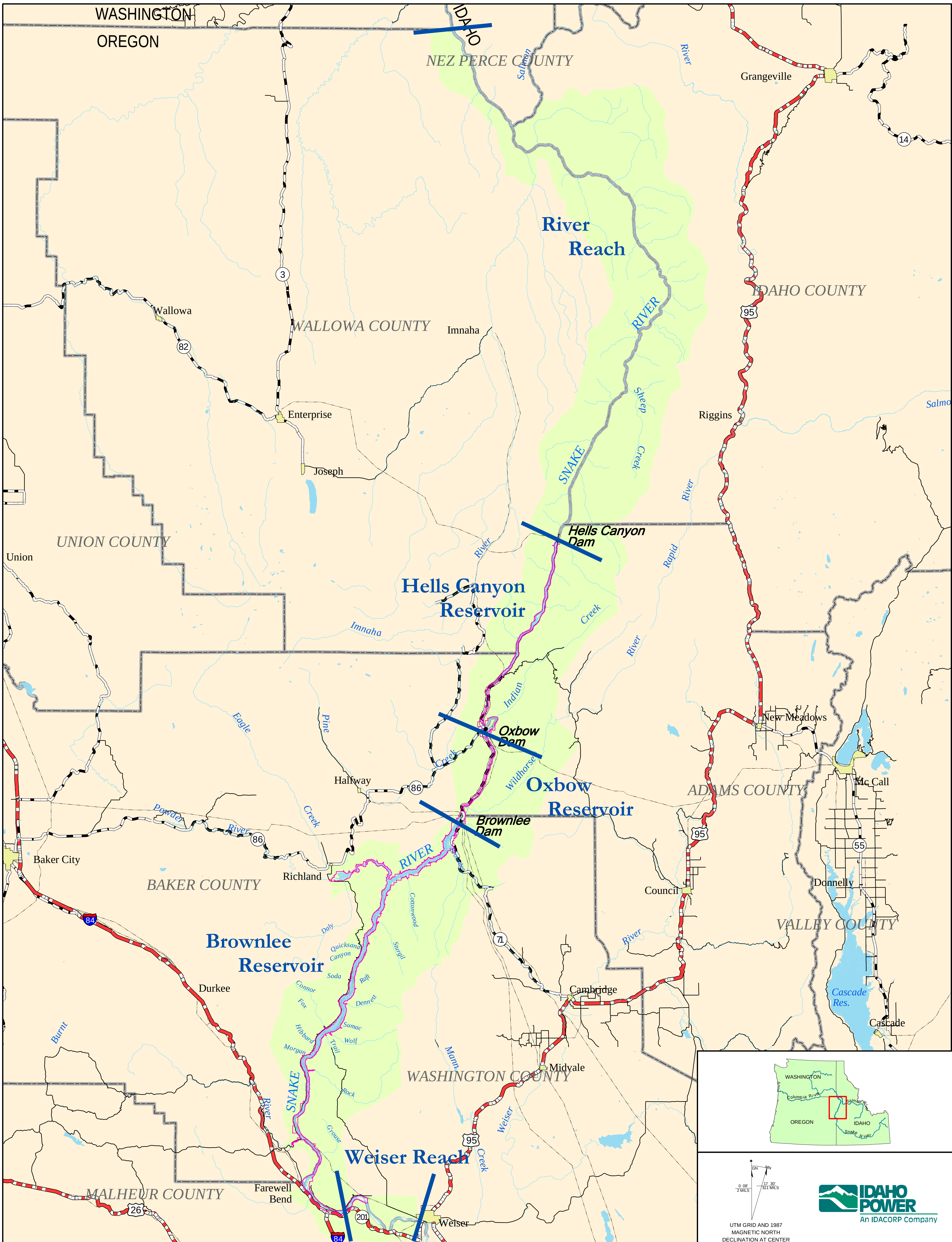

Legend

- Study Area
- FERC Project Boundary
- County Boundary
- Lakes & Reservoirs
- City/Town
- Perennial Stream

Roads

- Primary
- Secondary
- Improved
- Transmission Lines

Hells Canyon Project - FERC No. 1971

Figure E.6-4

River Reaches

Scale 1:600,486

0 5 10 15 20 Miles

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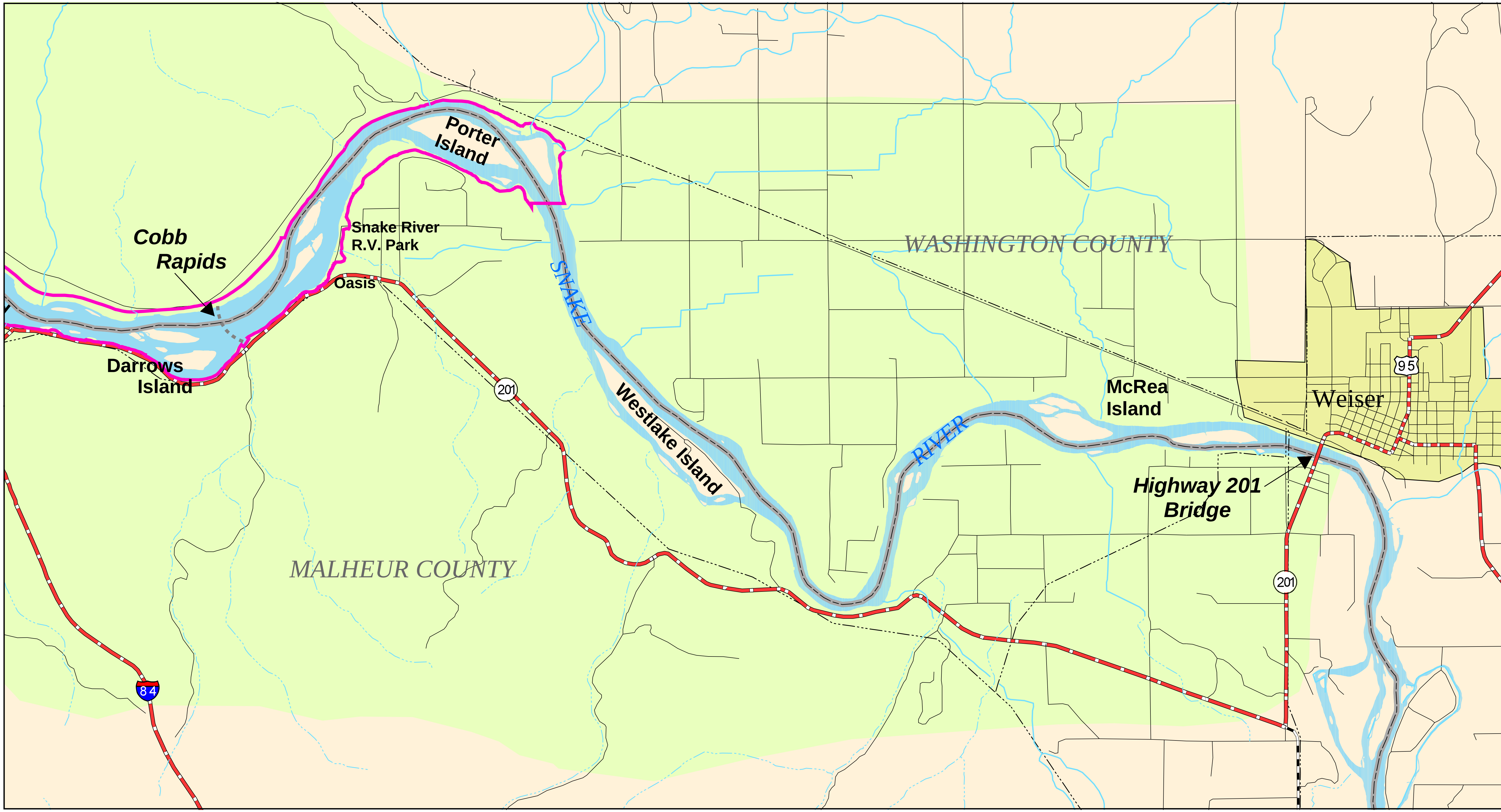

IDAHO POWER
An IDACORP Company

Legend

- FERC Project Boundary
- Study Area
- City/Town
- County Boundary
- Lakes & Reservoirs
- Perennial Stream
- Intermittent Stream
- Transmission Lines

Roads

- Primary
- Secondary
- Improved

GN MN
0 08'
2 MILS
17 30'
311 MILS

UTM GRID AND 1987
MAGNETIC NORTH
DECLINATION AT CENTER
OF OXBOW QUADRANGLE

Hells Canyon Project - FERC No. 1971
Figure E.6-5

River Reaches:
The Weiser Reach

Scale 1:45,000

0 0.25 0.5 1 1.5 Miles

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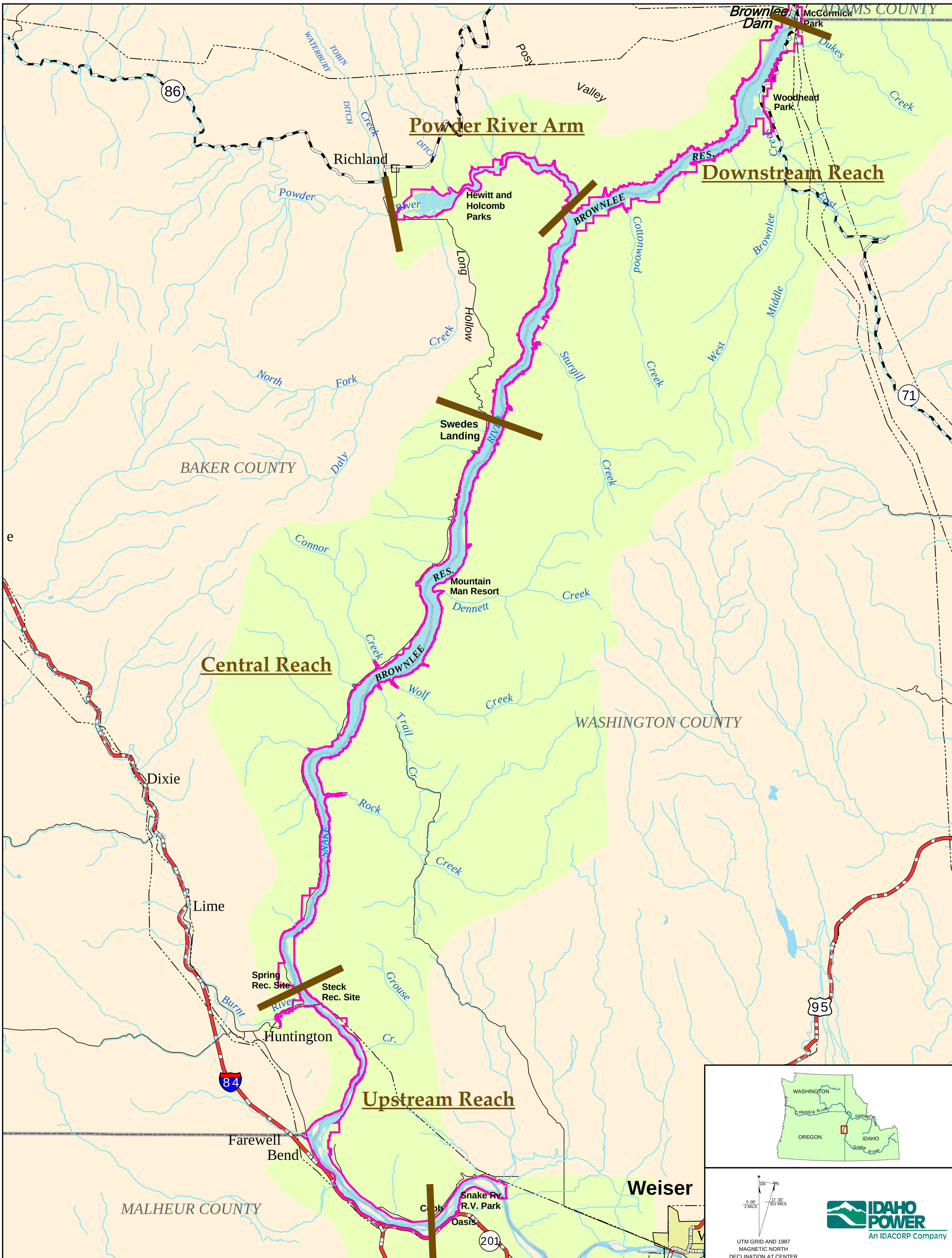

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

IDAHO POWER
An IDACORP Company

Hells Canyon Project - FERC No. 1971

Figure E.6-6

River Reaches: Brownlee Reservoir

Scale 1:200,000

0 1 2 3 4 Miles

Legend

- Study Area
- FERC Project Boundary
- City/Town
- County Boundary
- Lakes & Reservoirs
- Perennial Stream

Roads

- Primary
- Secondary
- Improved
- Transmission Lines

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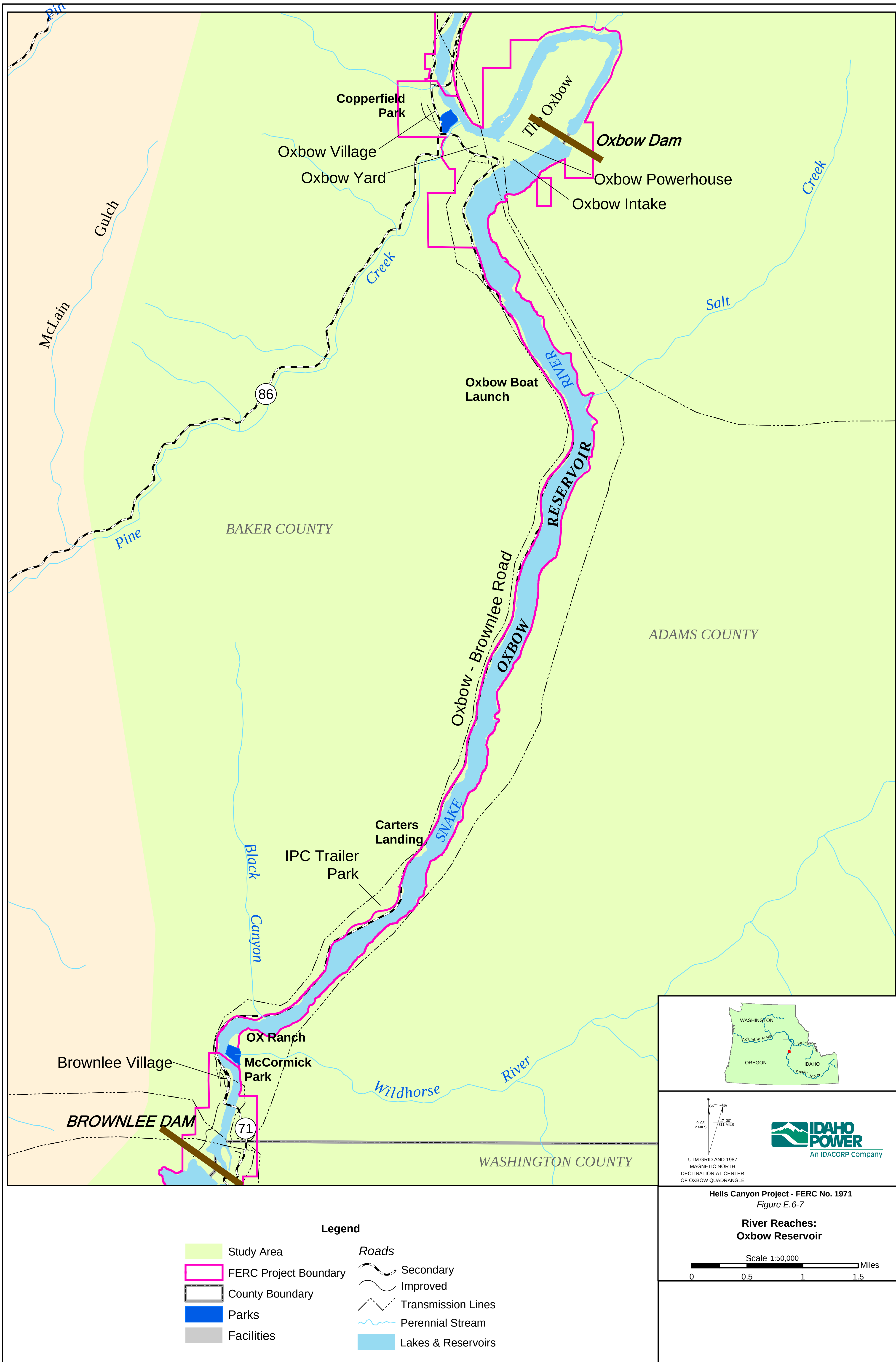

Hells Canyon Project - FERC No. 1971

Figure E.6-7

River Reaches: Oxbow Reservoir

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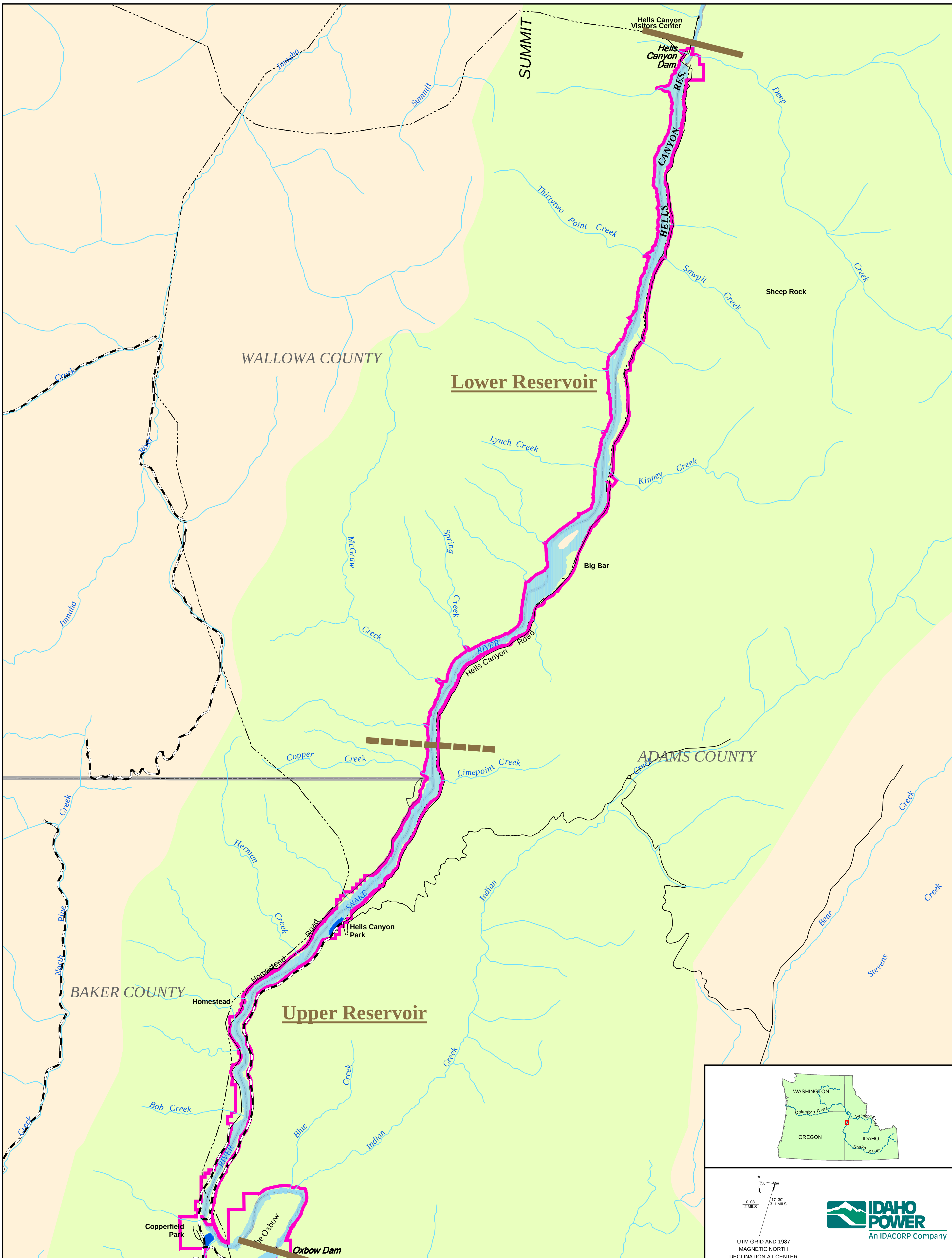

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF OXBOW QUADRANGLE

IDAHO POWER
An IDACORP Company

Hells Canyon Project - FERC No. 1971

Figure E.6-8

River Reaches:
Hells Canyon Reservoir

Scale 1:95,071
0 1 2 3 Miles

Legend

- Study Area
- County Boundary
- Parks
- FERC Project Boundary
- Facilities

Roads

- Secondary
- Improved
- Transmission Lines
- Perennial Stream
- Lakes & Reservoirs

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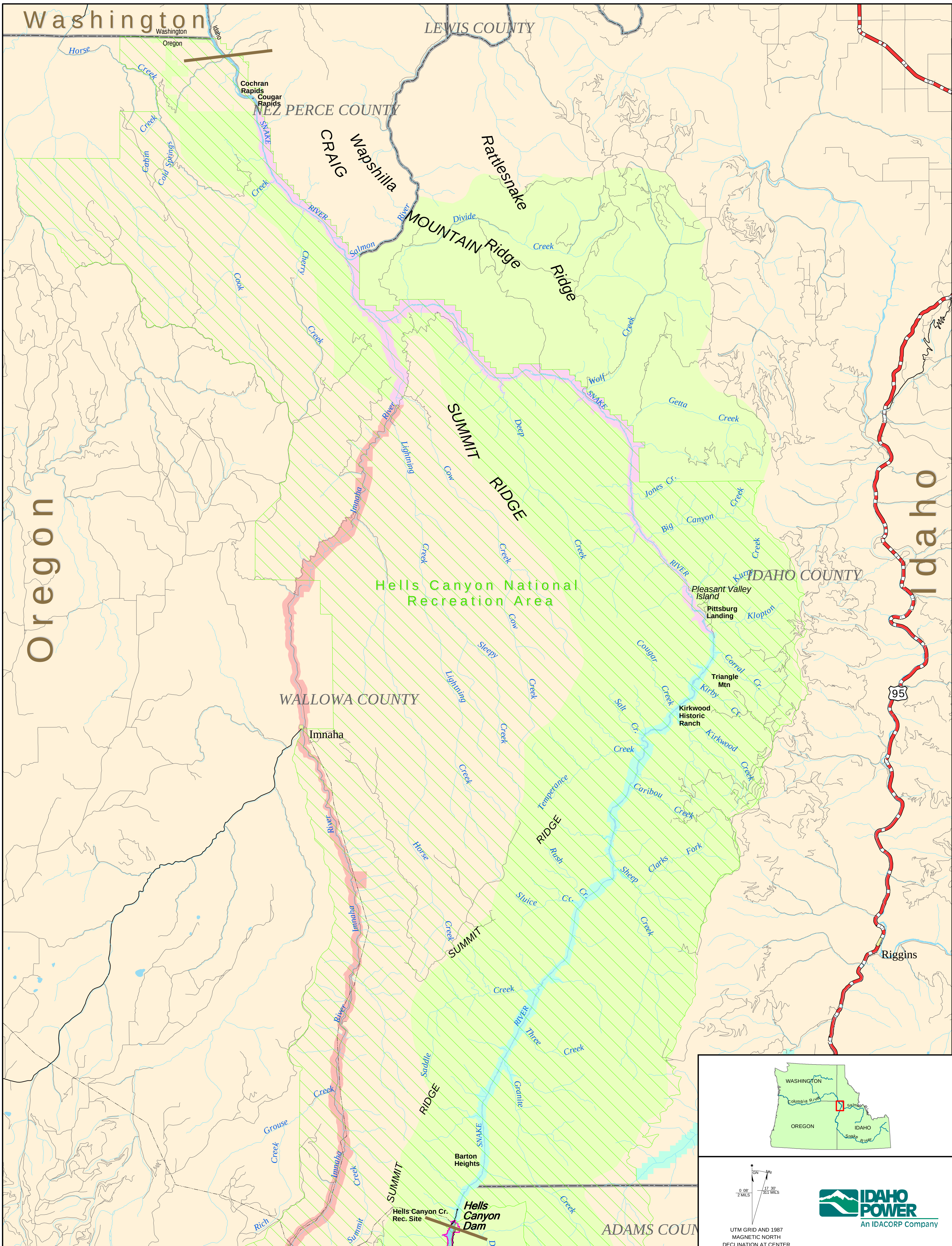

Legend

- Study Area
- Hells Canyon National Recreation Area
- County Boundary
- City/Town
- FERC Project Boundary
- Lakes & Reservoirs

Special River Designation

- Wild
- Scenic
- Recreation

Roads

- Primary
- Secondary
- Improved
- Unimproved
- Transmission Lines
- Perennial Stream

Hells Canyon Project - FERC No. 1971

Figure E.6-9

River Reaches:
The River Reach
(below Hells Canyon Dam)

Scale 1:260,000

0 1 2 3 4 5 6 Miles

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Hells Canyon Complex
FERC No. 1971
License Application

Exhibit F
General Design Drawings

The *Code of Federal Regulations* below—18 CFR § 4.51(g)—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

> § 4.51(g) *Exhibit F* consists of general design drawings of the principal project works described under paragraph (b) of this section (Exhibit A) and supporting information used to demonstrate that existing project structures are safe and adequate to fulfill their stated functions.
>
> (1) The drawings must show all major project structures in sufficient detail to provide a full understanding of the project, including:
>
> (i) Plans (overhead view);
>
> (ii) Elevations (front view); and
>
> (iii) Sections (side view).
>
> (2) Supporting design report. The applicant must furnish, at a minimum, the following supporting information to demonstrate that existing structures are safe and adequate to fulfill their stated functions, and must submit such information in a separate report at the time the application is filed. The report must include:
>
> (i) A description of the physical condition or state of maintenance and repair of any existing and proposed structures or equipment; and
>
> (ii) Information relating to composition and competency of foundations and other structures, gradation of filter and riprap material, design strength and ultimate strength of concrete and steel, stress and stability analysis, spillway rating curves, water levels, and other appropriate data.
>
> (3) The applicant must submit two copies of the supporting design report as described in paragraph (g)(2) of this section at the time general design drawings are submitted to the Commission for review.

F.1. General Design Drawings

The drawings in Exhibit F contain critical energy infrastructure information (CEII). The Applicant has submitted these drawings to the Federal Energy Regulatory Commission (FERC) in a separate attachment.

Procedures for obtaining access to critical energy infrastructure information (CEII) may be found at 18 CFR § 388.133. Requests for access to CEII should be made to the Commission's (FERC) CEII coordinator.

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Hells Canyon Complex
FERC No. 1971
License Application

Exhibit G
Maps of the Project

The *Code of Federal Regulations* below—18 CFR § 4.51(h)—specifies the content of this chapter and the scope and nature of the research from which it was compiled

> § 4.51(h) *Exhibit G* is a map of the project. The map must conform to the specifications of §4.39. If more than one sheet is issued, the sheets must be numbered consecutively and each sheet must bear a small inset sketch showing the entire project (or development) and indicating the portion depicted on the sheet. The map must show:
>
> (1) Location of the project and principal features. The map must show the location of the project as a whole with reference to the affected stream or other body of water and, if possible, to a nearby town or any permanent monuments or objects, such as roads, transmission lines or other structures, that can be noted on the map and recognized in the field; the map must also show the relative locations and physical interrelationships of the principal project works and other features described under paragraph (b) of this section (Exhibit A).
>
> (2) Project boundary. The map must show a project boundary enclosing all of the principal project works and other features described under paragraph (b) of this section (Exhibit A) that are to be licensed. If accurate survey information is not available at the time the license application is filed, the applicant must so state, and a tentative boundary may be submitted. The boundary must enclose only those lands necessary for operation and maintenance of the project and for other project purposes, such as recreation, shoreline control, or protection of environmental resources (see paragraph (f) of this section (Exhibit E)). Existing residential, commercial or other structures may be included within the boundary only to the extent that underlying lands are needed for project purposes (e.g., for flowage, public recreation, shoreline control, or protection of environmental resources). If the boundary is on land covered by a public land survey, ties must be shown on the map at sufficient points to permit accurate platting of the position of the boundary relative to the lines of the public land survey. If the lands are not covered by a public land survey, the best available legal description of the position of the boundary must be provided, including distances and directions from fixed monuments or physical features. The boundary must be described as follows:
>
> (i) Impoundments. (A) The boundary around a project impoundment may be described by any of the following:
>
> (1) Contour lines, including the contour elevation (preferred method);
>
> (2) Specified courses and distances (metes and bounds);
>
> (3) If the project lands are covered by a public land survey, lines upon or parallel to the lines of the survey; or
>
> (4) Any combination of the above methods.
>
> (B) The boundary must be located no more than 200 feet (horizontal measurement) from the exterior margin of the reservoir, defined by the normal maximum surface elevation, except where deviations may be necessary in describing the boundary according to the above methods, or where additional lands are necessary for project purposes, such as public recreation, shoreline control, or protection of environmental resources.
>
> (ii) Continuous features. The boundary around linear ("continuous") project features such as access roads, transmission lines, and conduits may be described by specified distances from center lines or offset lines of survey. The width of such corridors must not exceed 200 feet, unless good cause is shown for a greater width. Several sections of a continuous feature may be shown on a single sheet, with information showing the sequence of contiguous sections.
>
> (iii) Noncontinuous features. (A) The boundary around noncontinuous project works such as dams, spillways, and powerhouses may be described by:
>
> (1) Contour lines;
>
> (2) Specified courses and distances;
>
> (3) If the project lands are covered by a public land survey, lines upon or parallel to the lines of the survey; or
>
> (4) Any combination of the above methods.
>
> (B) The boundary must enclose only those lands that are necessary for safe and efficient operation and maintenance of the project, or for other specified project purposes, such as public recreation or protection of environmental resources.
>
> (3) Federal lands. Any public lands and reservations of the United States (see 16 U.S.C. 796(1) and (2)) (Federal lands) that are within the project boundary, e.g., lands administered by the U.S. Forest Service, Bureau of Land Management, National Park Service, or Indian tribal lands, and the boundaries of those Federal lands, must be identified on the map:
>
> (i) By legal subdivisions of a public land survey of the affected area (a protraction of identified township and section lines is sufficient for this purpose);

(ii) By the Federal agency, identified by symbol or legend if desired, that maintains or manages each identified subdivision of the public land survey within the project boundary; and

(iii) In the absence of a public land survey, by the location of the Federal lands according to the distances and directions from fixed monuments or physical features. When a Federal survey monument or a Federal bench mark will be destroyed or rendered unusable by the construction of project works, at least two permanent, marked, witness monuments or bench marks must be established at accessible points. The maps must show the location (and elevation, for bench marks) of the survey monument or bench mark which will be destroyed or rendered unusable, as well as of the witness monuments or bench marks. Connecting courses and distances from the witness monuments or bench marks to the original must also be shown

(4) Non-Federal lands. For those lands within the project boundary not identified under paragraph (h)(3) of this section, the map must identify by legal subdivision:

(i) Lands owned in fee by the applicant and lands that the applicant plans to acquire in fee; and

(ii) Lands over which the applicant has acquired or plans to acquire rights to occupancy and use other than fee title, including rights acquired or to be required by easement or lease.

G.1. MAPS OF THE PROJECT

PARCEL of LAND W.M., OREGON	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	U.S.	PSR
T.8S., R.48E.			
SEC 19			25.60
30			51.69
T.8S., R.47E.			
SEC 25			92.30
35		0.76	
36	215.63	9.10	
T.9S., R.47E.			
SEC 1			12.88
2			106.24
11			108.97
14	105.04		
15	88.90	16.44	30.89
16	0.35		41.30
20	78.78		16.87
21	47.48		32.57
29	76.57		
30	116.74		31.00
T.9S., R.46E.			
SEC 20	104.19	1.95	
21	100.83		61.81
22	156.65		14.94
23	49.78		29.90
25	148.04	1.50	15.24
26	166.61		35.38
29	79.74		
30	321.97		
31	22.26		
35	159.24		26.39
T.10S., R.46E.			
SEC 2			31.83
3			47.86
10		1.38	127.20
15			117.31
16	26.04		
21			39.79
22			22.79
28			95.08
29			0.68
32	10.50		20.21
33	38.88		75.20
T.9S., R.45E.			
SEC 25	434.83		
26	22.27		
35	56.18		
36	105.42		

PARCEL of LAND B.M., IDAHO	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	U.S.	PSR
T.17N., R.5W			
SEC 1	103.29	20.00	
2	63.70		
11	189.84	0.60	44.76
12	40.00		
14	80.00		64.03
15	164.68		
22	359.00		
23	53.48	2.48	
26	43.69		
27			38.14
28	34.72	5.12	55.48
29			6.16
31			20.99
32	106.17		72.58
33			27.69
T.16N., R.5W.			
SEC 6	85.40		15.74
T.16N., R.6W.			
SEC 1	96.50		45.69
2	95.50		16.05
10	88.60		23.07
11	39.80		
15	118.39		26.61
16	10.36		
21			24.89
22			21.23
28	130.54		29.36
33	38.99		70.20
T.15N., R.6W.			
SEC 4			8.44
5			104.20
8			56.08
17			30.29
18			19.31
19			63.32
30		0.22	57.04
31		0.72	3.62
T.15N., R.7W.			
SEC 25			5.72
36	72.30		
T.14N., R.6W.			
SEC 6		10.44	

PARCEL of LAND W.M., OREGON	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	U.S.	PSR
T.11S., R.46E.			
SEC 4	28.36		73.43
5	66.95		9.05
8	120.56		21.79
17	53.52		17.55
18	0.48		14.58
19	129.05		
20			18.46
30	135.31		8.21
31	8.01		
T.11S., R.45E.			
SEC 25	3.34		
36	62.67		23.69
T.12S., R.45E			
SEC 1	43.05	1.33	35.54
11			2.80
12	254.08		5.82
13	90.58		
14	151.73	0.43	11.06
15	51.90		
22	211.95		
27	138.96		
28	25.87		
32	42.09		
33	39.08	0.35	5.95
T.13S., R.45E.			
SEC 4	70.94		
5	14.06		
9	1.18		37.13
16			42.05
21	32.58		24.75
28	8.30		
29	102.70		12.12
32			40.53
T.14S., R.45E.			
SEC 5	182.89	16.23	4.85
7			0.17
8	70.28		29.90
9	16.01		4.54
15			12.02
16			15.48
17	3.86	3.76	1.26
18	8.63		
22			12.04
27	15.84		4.10
32	10.61		
33	29.39		
34	3.69		
T.15S., R.45E.			
SEC 4	34.08		
5	10.81		
9	27.07		
10			12.47
14	50.69		
15	26.83		4.56
23	5.99		
24	22.00		5.52
T.15S., R.46E.			
SEC 8	80.42		
9	44.11		
16	1.27		
17	6.24		
18			2.61
19	16.69		3.41
TOTALS	5287.62	53.23	1829.36

TOTAL AREA OF ALL PARCELS..............................7170.21

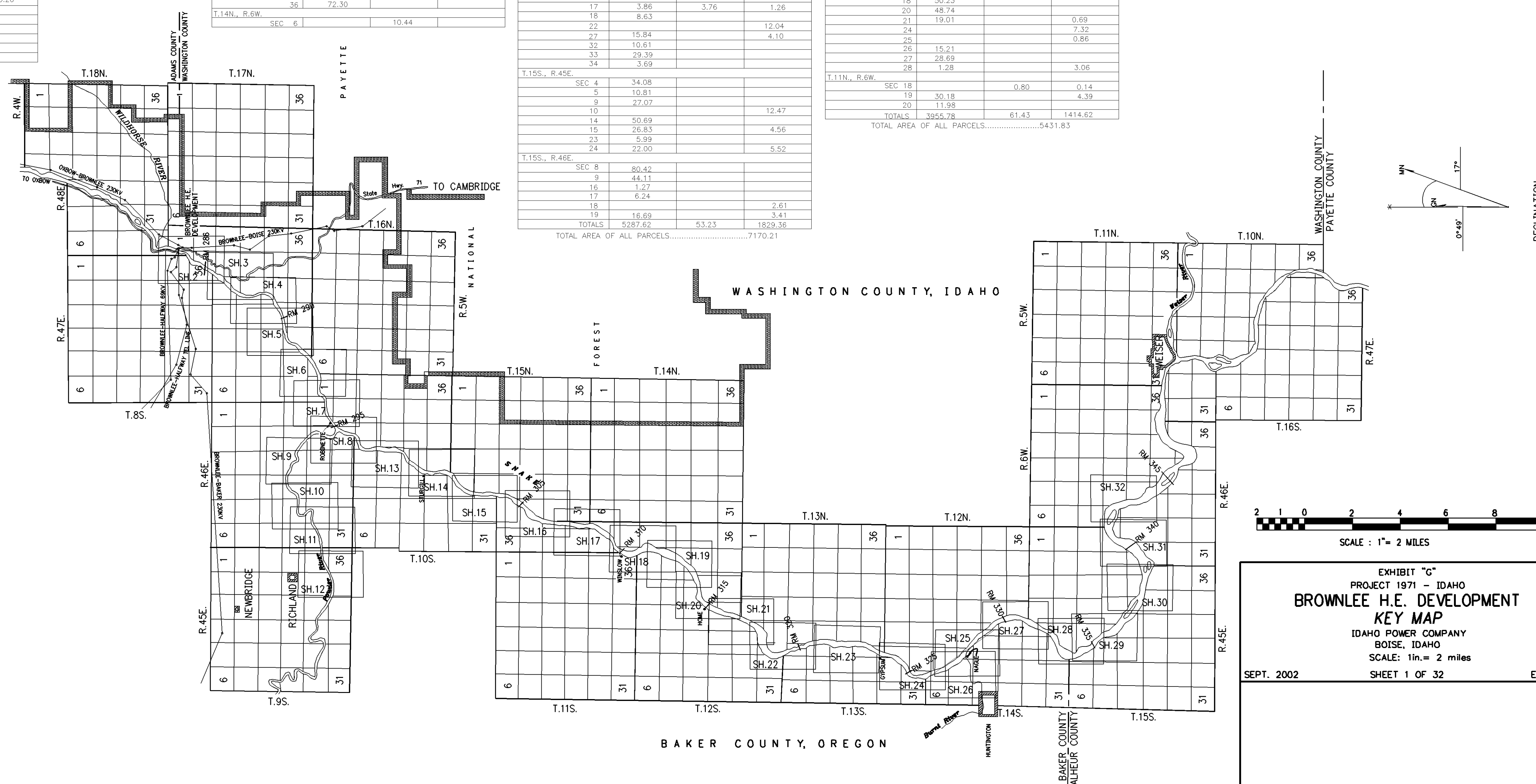
PARCEL of LAND B.M., IDAHO	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	U.S.	PSR
T.14N., R.7W.			
SEC 1	160.15		
11	103.80		
12	131.35		
13	80.41		6.50
14	13.36		15.52
23	59.79		35.31
24			0.18
26	10.37		9.29
27	89.76	0.97	7.68
28	27.08		16.50
33			43.63
T.13N., R.7W.			
SEC 4			9.69
5			29.99
6			0.23
7	75.92	4.89	31.94
8			17.14
17			37.33
18	63.59		
20	38.70		18.51
29	31.57		15.32
31	43.43		
32	21.43		0.66
T.12N., R.7W.			
SEC 6			65.75
7			0.32
18	23.16		14.27
19	42.63		
20	92.93		
28	49.95		2.42
29	45.73		
32		0.48	
33	32.72		30.11
T.12N., R.8W.			
SEC 12	144.81		
13	4.04		
T.11N., R.7W.			
SEC 4			3.21
5	57.03		
7	181.47		
8	61.06	0.19	35.97
17	49.27	14.52	
18	50.23		
20	48.74		
21	19.01		0.69
24			7.32
25			0.86
26	15.21		
27	28.69		
28	1.28		3.06
T.11N., R.6W.			
SEC 18		0.80	0.14
19	30.18		4.39
20	11.98		
TOTALS	3955.78	61.43	1414.62

TOTAL AREA OF ALL PARCELS......................5431.83

REVISION

LEGEND

- P ---------PRIVATE LANDS
- US ---------U.S. GOVERNMENT LANDS
- PSR ---------POWER SITE RESERVE
- ---PROJECT BOUNDARY
- ---MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- ---MINIMUM WATER LEVEL ELEV 1976
- ---ORIGINAL WATER CHANNEL
- ---I.P. CO. MONUMENT
- ---AREAS IN ACRES
- ---PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.



SCALE : 1"= 2 MILES

EXHIBIT "G"
PROJECT 1971 - IDAHO
BROWNLEE H.E. DEVELOPMENT
KEY MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.= 2 miles

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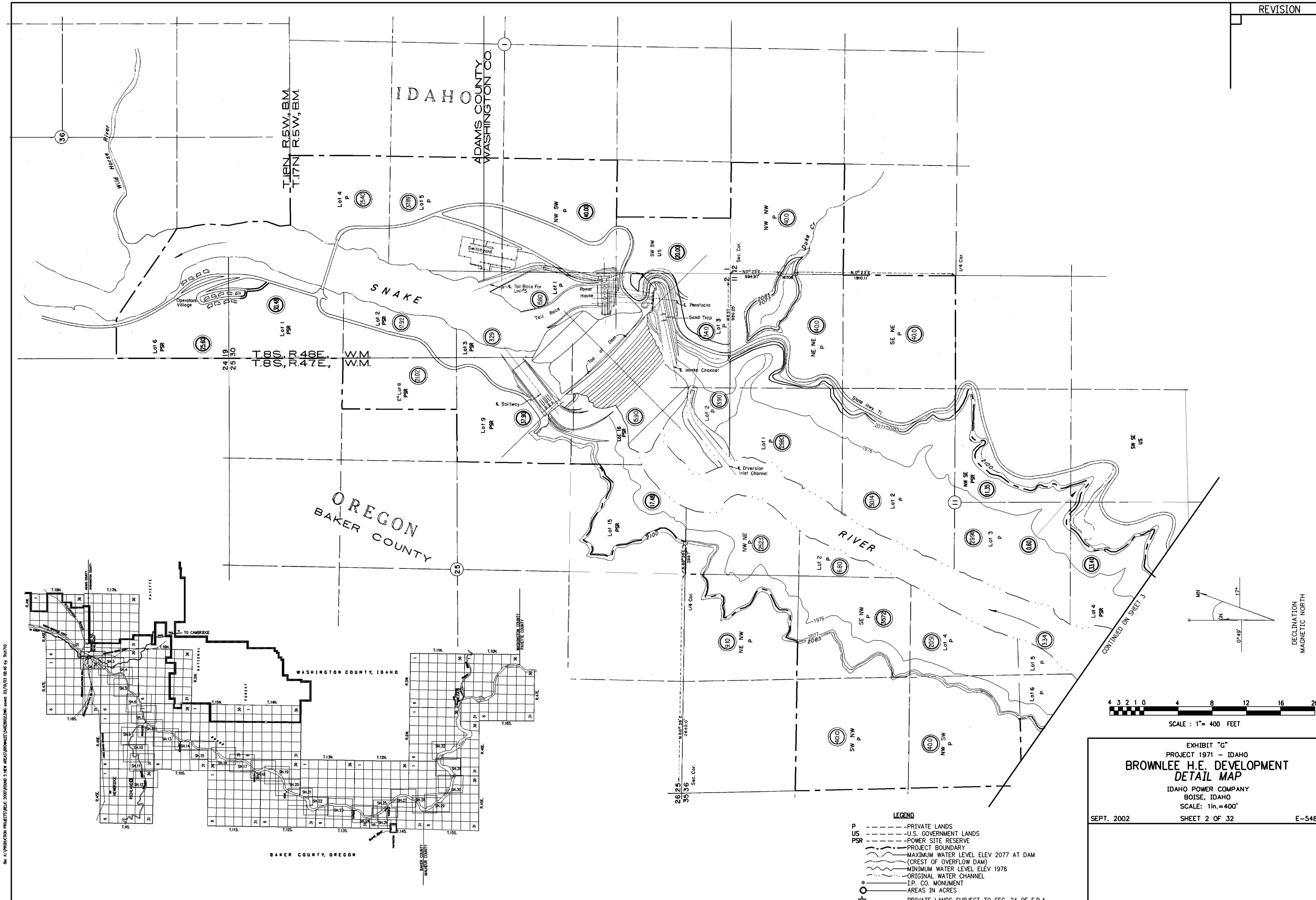

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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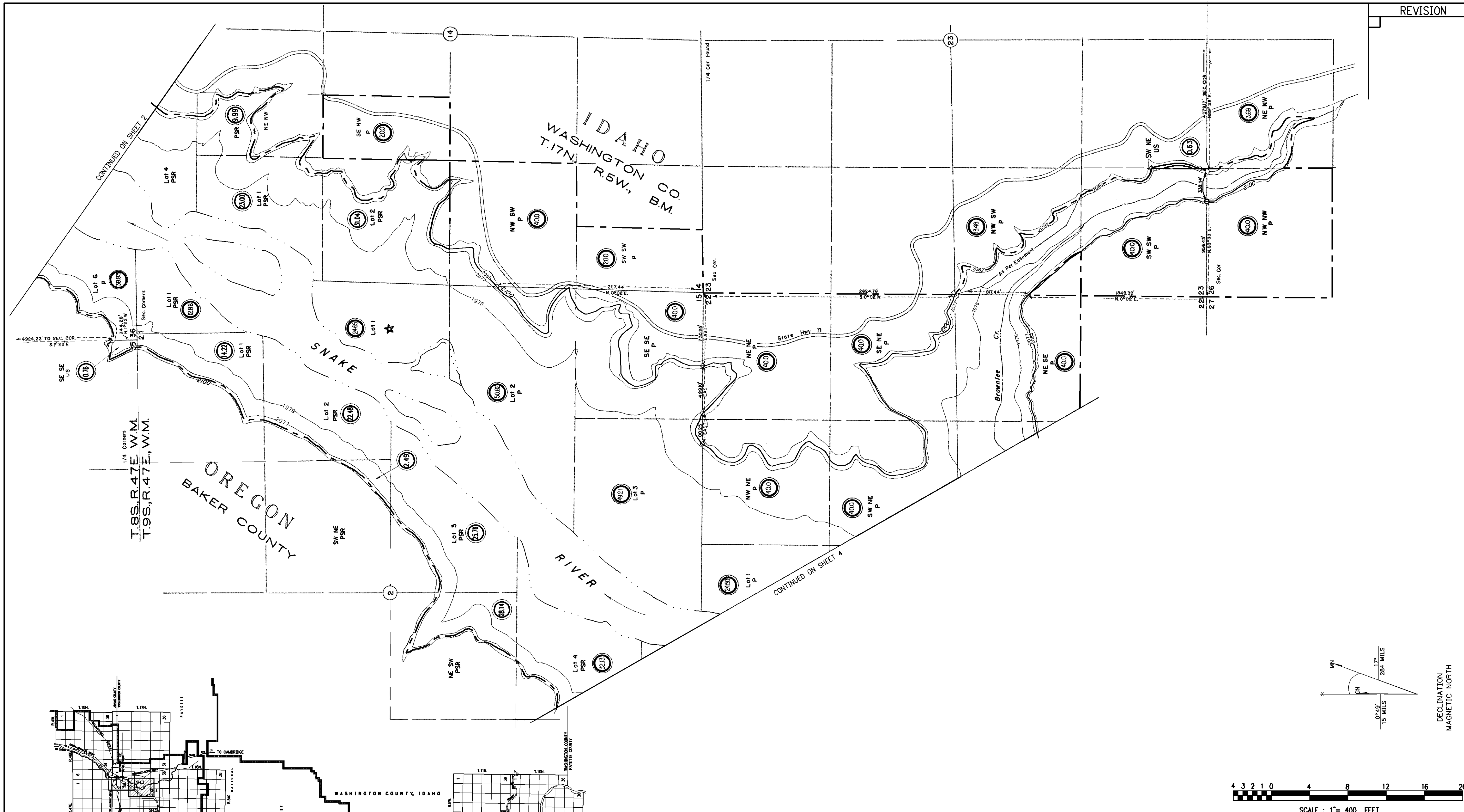

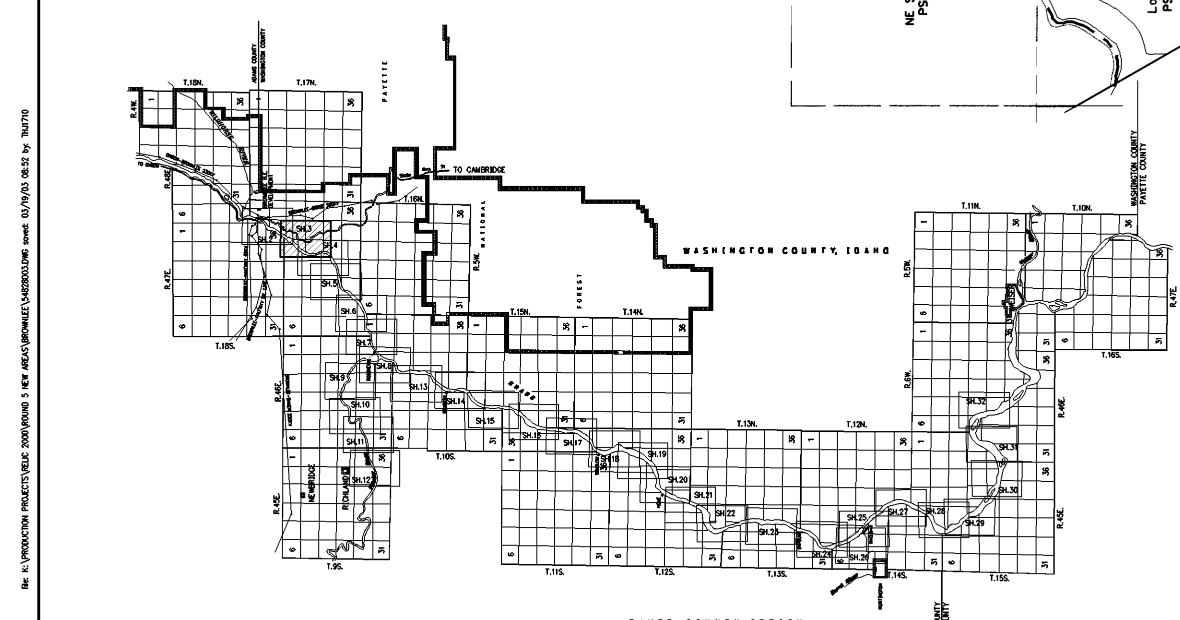

LEGEND

P	PRIVATE LANDS
US	U.S. GOVERNMENT LANDS
PSR	POWER SITE RESERVE
	PROJECT BOUNDARY
	MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
	MINIMUM WATER LEVEL ELEV 1976
	ORIGINAL WATER CHANNEL
	I.P. CO. MONUMENT
	AREAS IN ACRES
☆	PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 SHEET 3 OF 32 E-54828

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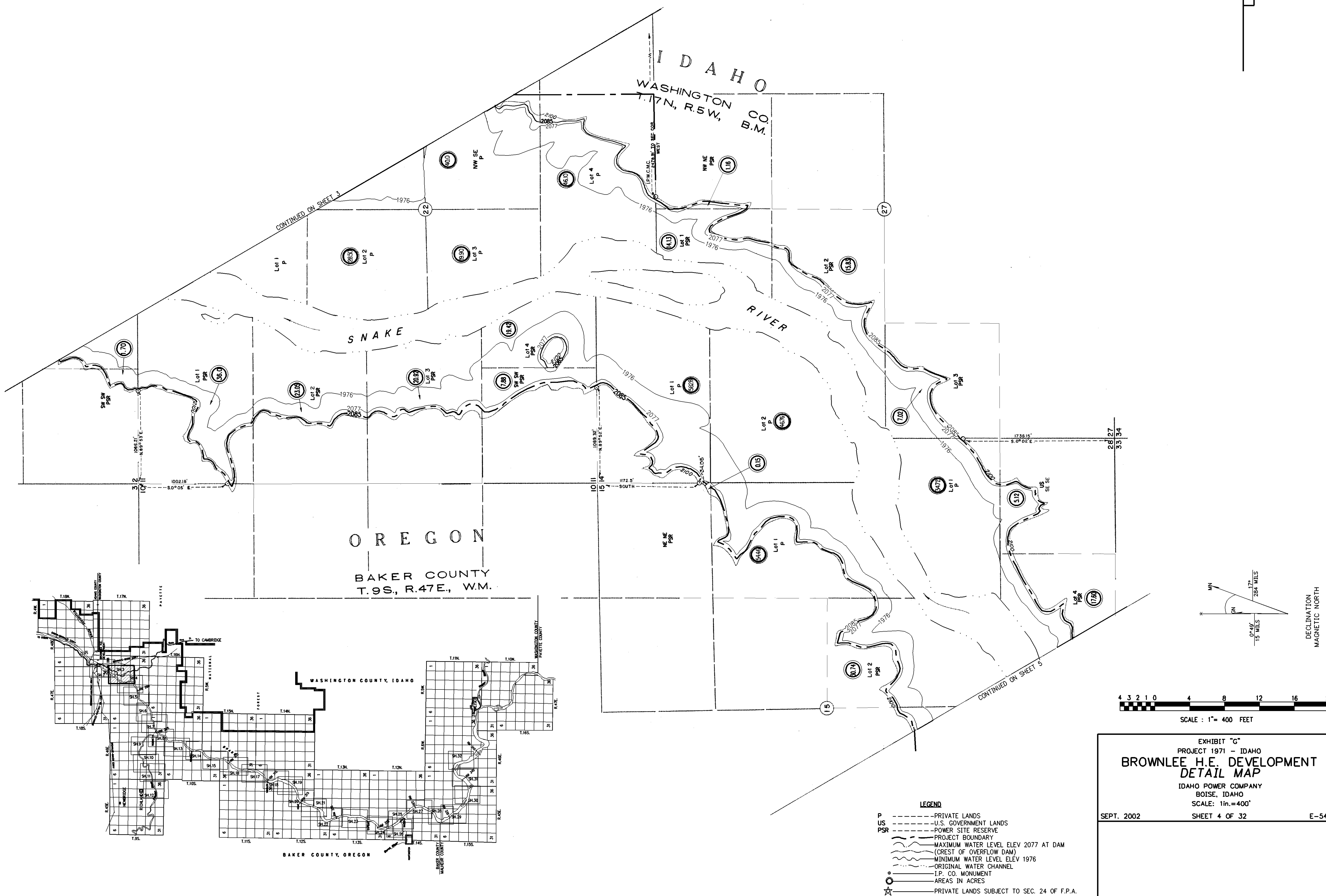

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 SHEET 4 OF 32 E-54828

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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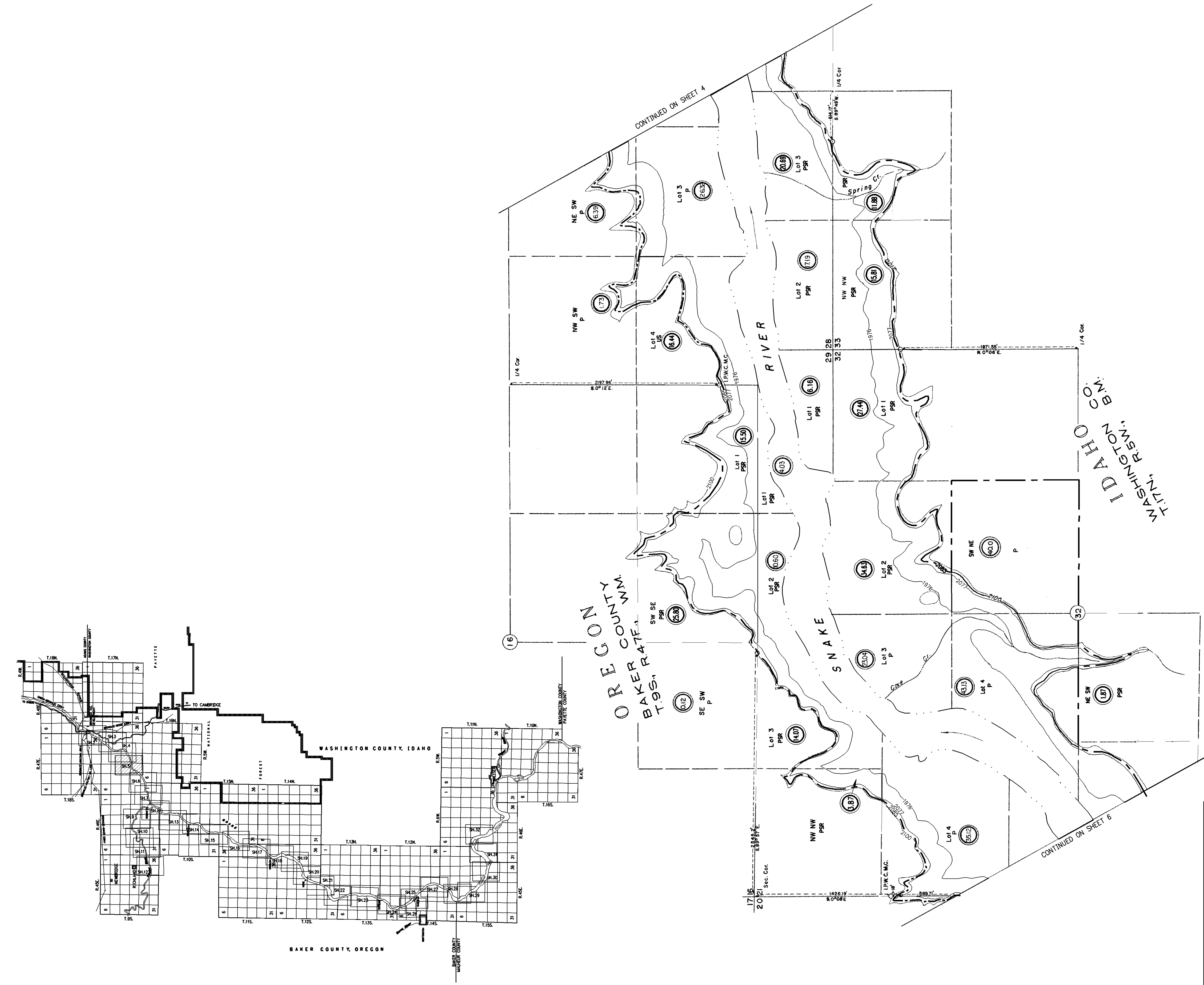

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

DECLINATION MAGNETIC NORTH
17° 284 MILS
0°49' 15 MILS

4 3 2 1 0 4 8 12 16 20
SCALE : 1"= 400 FEET

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 5 OF 32 | E-54828

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REVISION

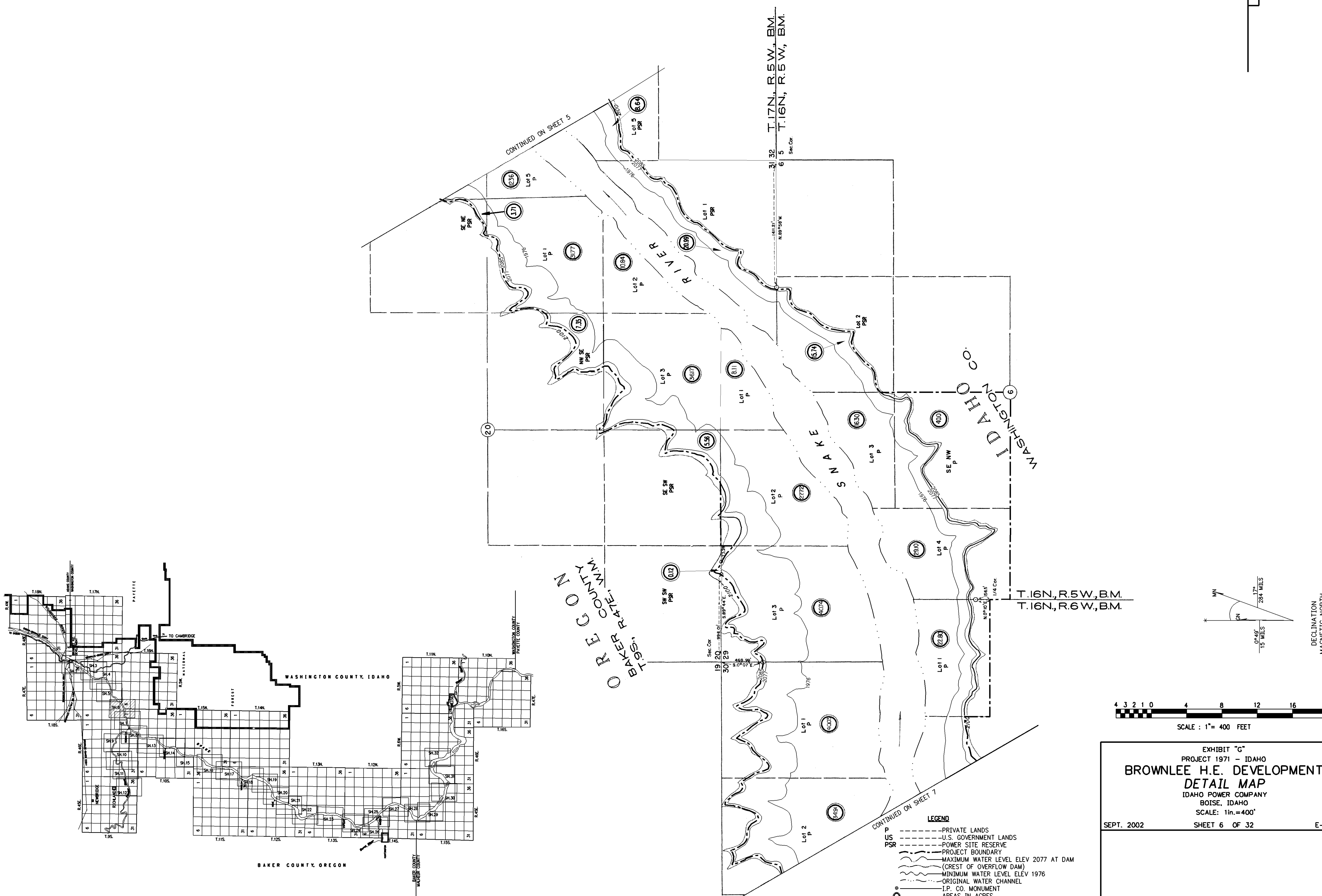

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 6 OF 32 | E-54828

LEGEND

P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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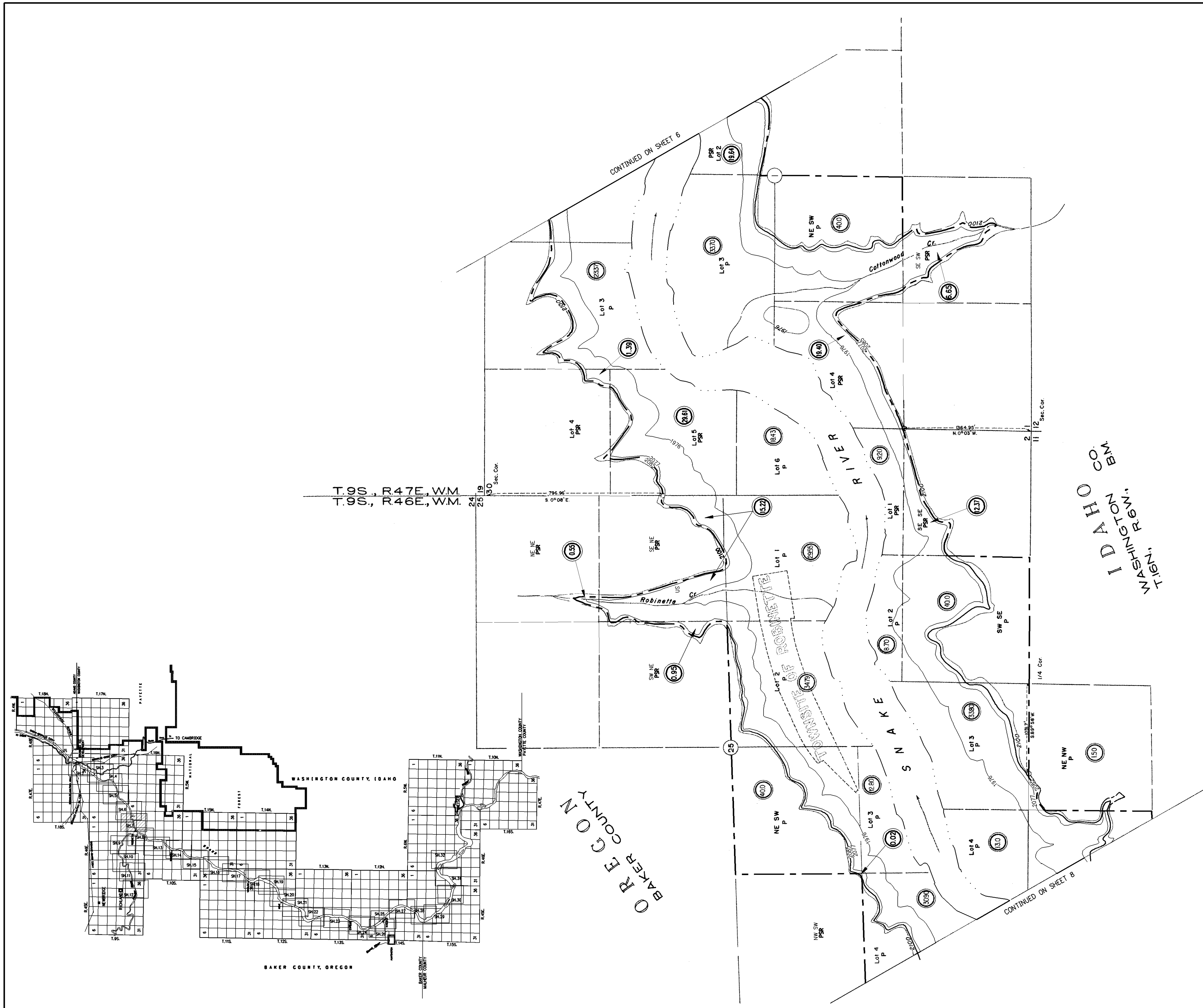
REVISION



LEGEND

P	PRIVATE LANDS
US	U.S. GOVERNMENT LANDS
PSR	POWER SITE RESERVE
	PROJECT BOUNDARY
	MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
	MINIMUM WATER LEVEL ELEV 1976
	ORIGINAL WATER CHANNEL
	I.P. CO. MONUMENT
	AREAS IN ACRES
	PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

DECLINATION MAGNETIC NORTH

17° 284 MILS

0°49' 15 MILS

SCALE : 1"= 400 FEET

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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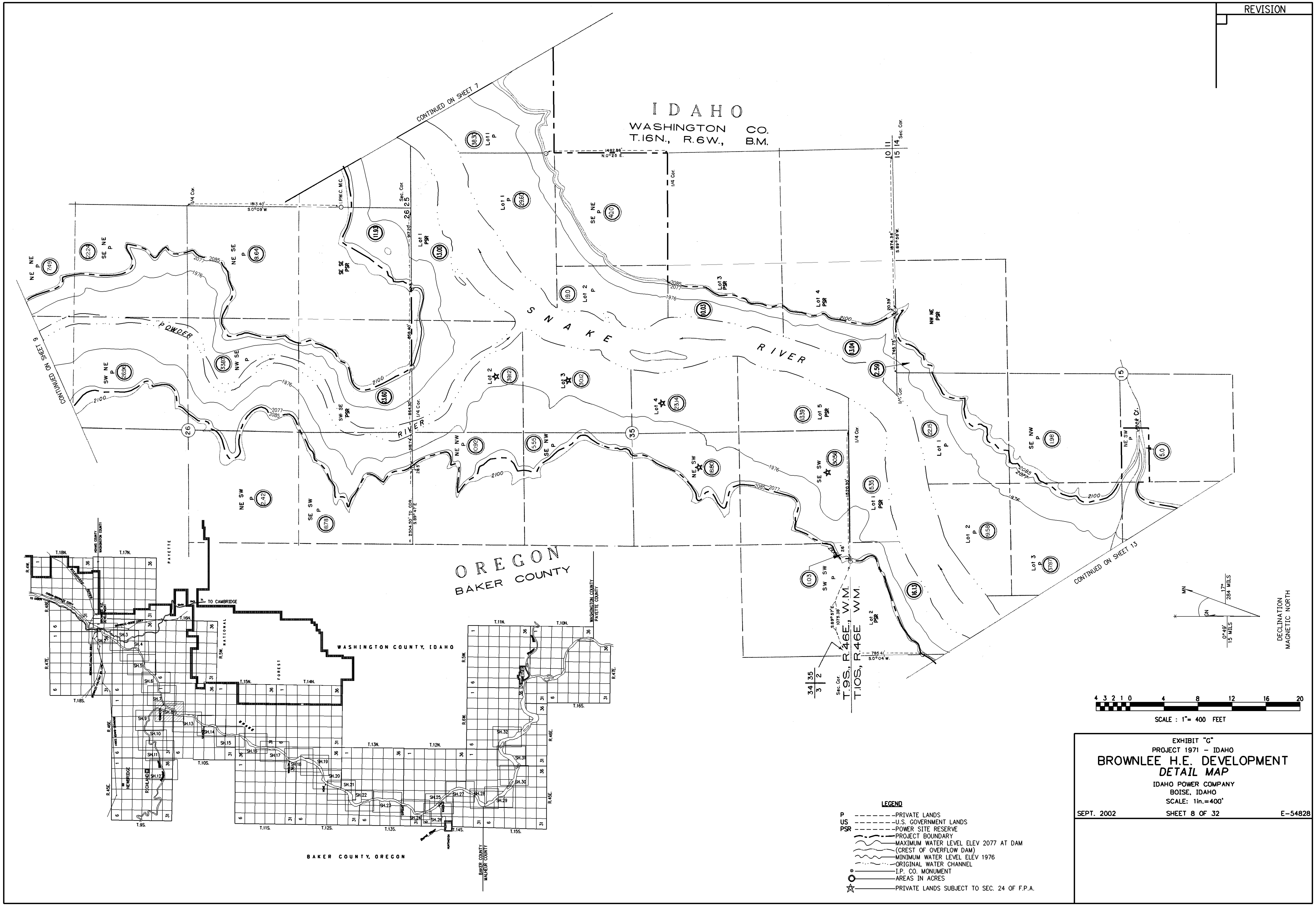

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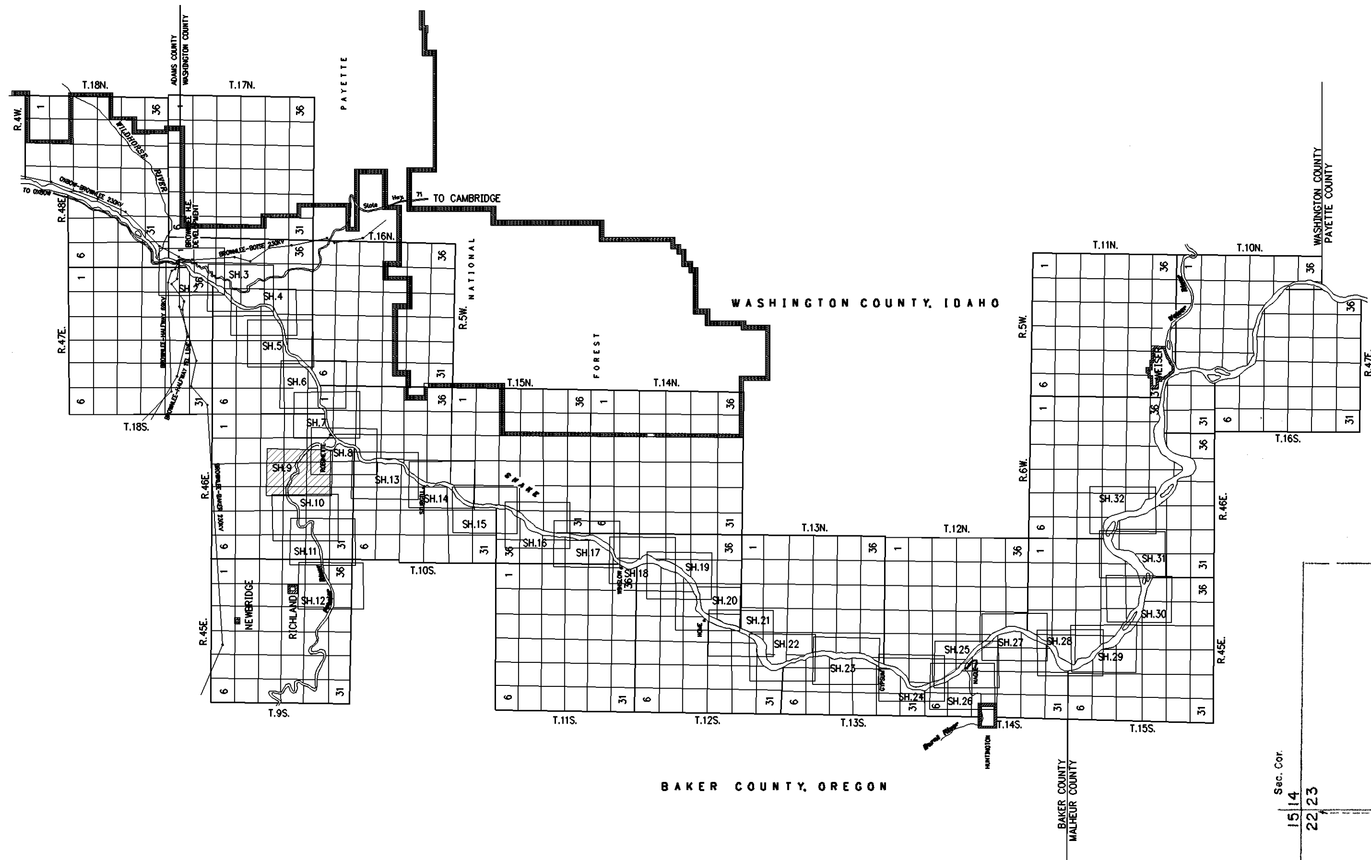

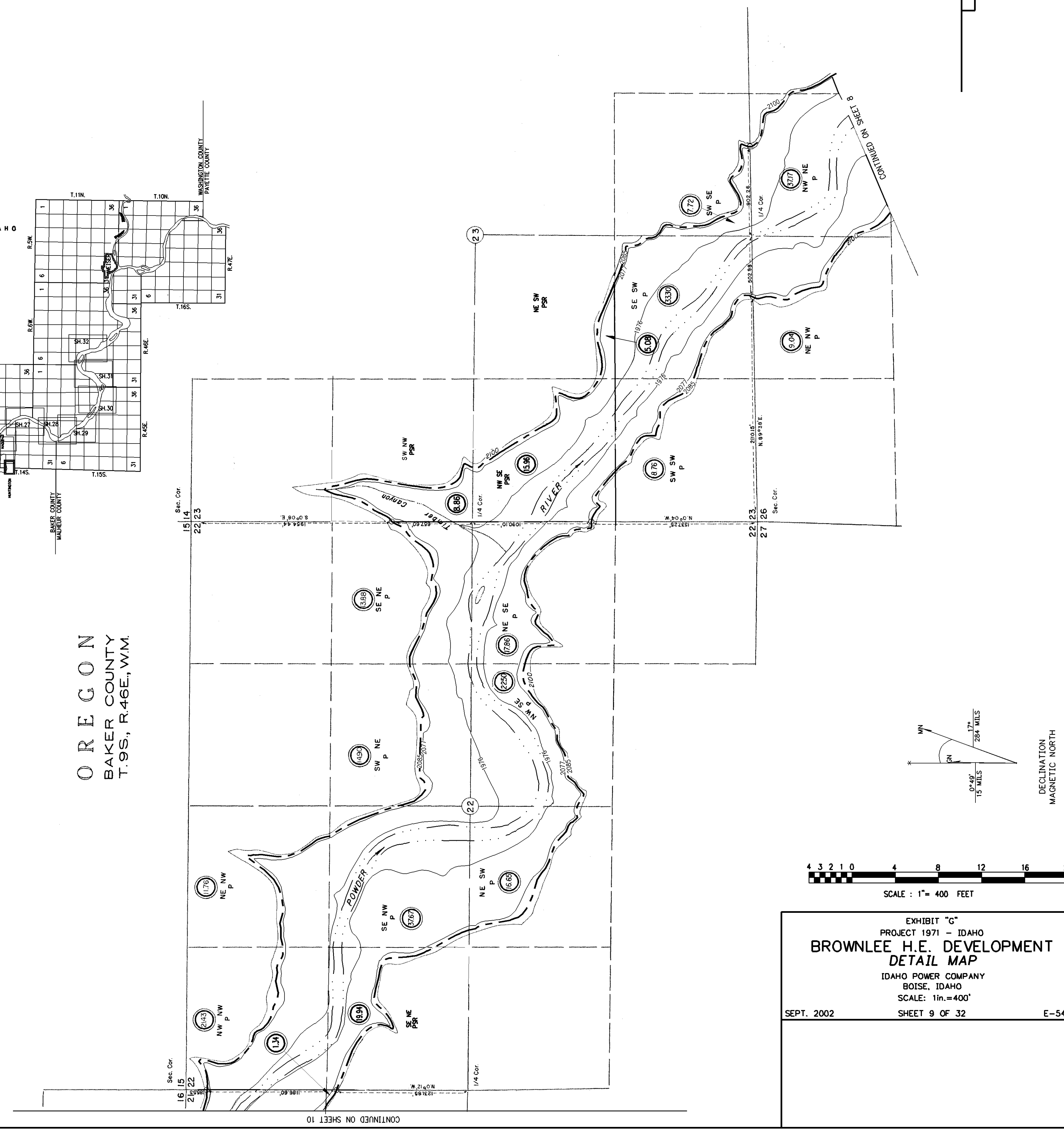

4 3 2 1 0 4 8 12 16 20

SCALE : 1" = 400 FEET

LEGEND

- P --------PRIVATE LANDS
- US --------U.S. GOVERNMENT LANDS
- PSR --------POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM
- (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"

PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY

BOISE, IDAHO

SCALE: 1in.=400'

SEPT. 2002 | SHEET 9 OF 32 | E-54828

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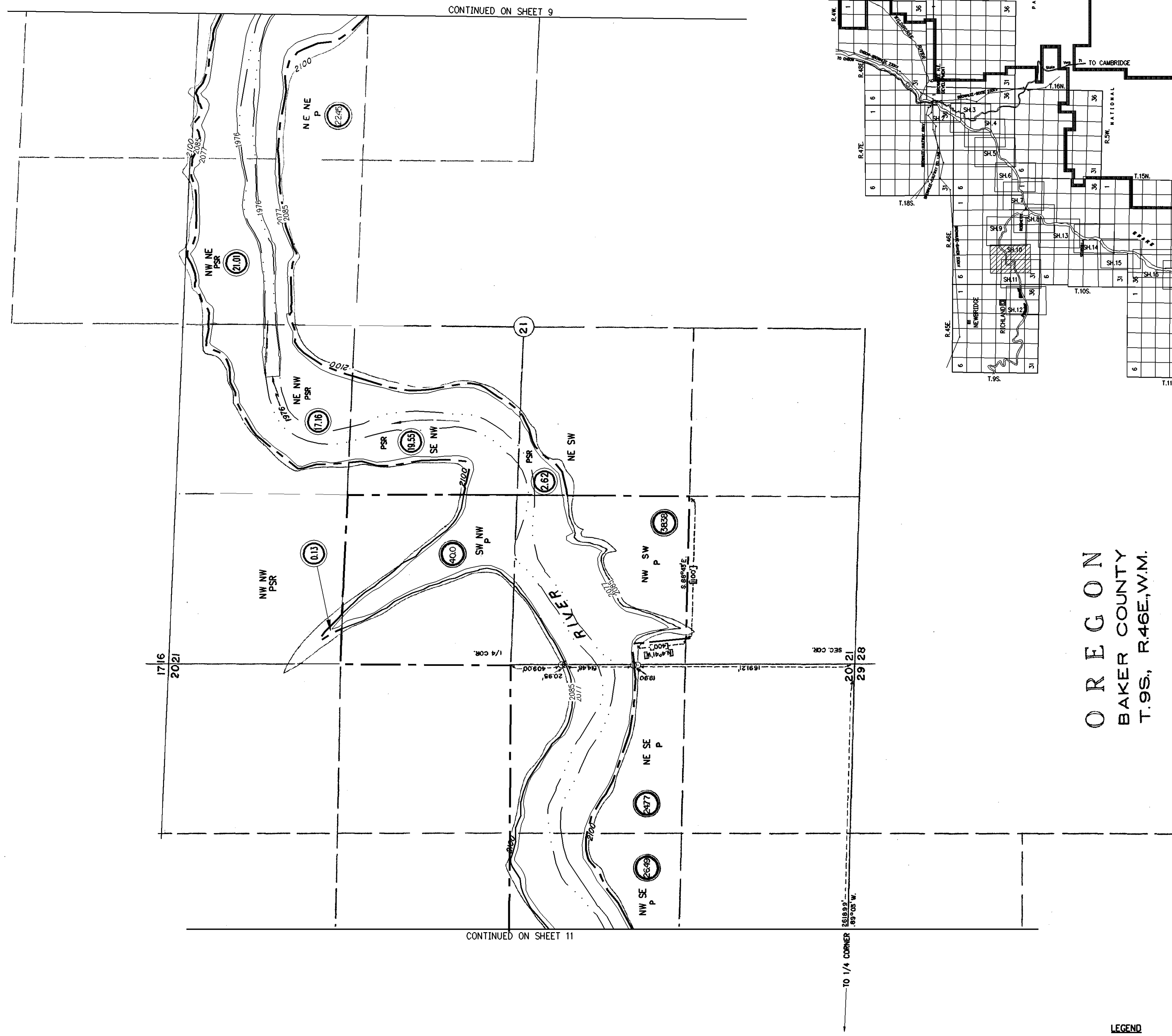

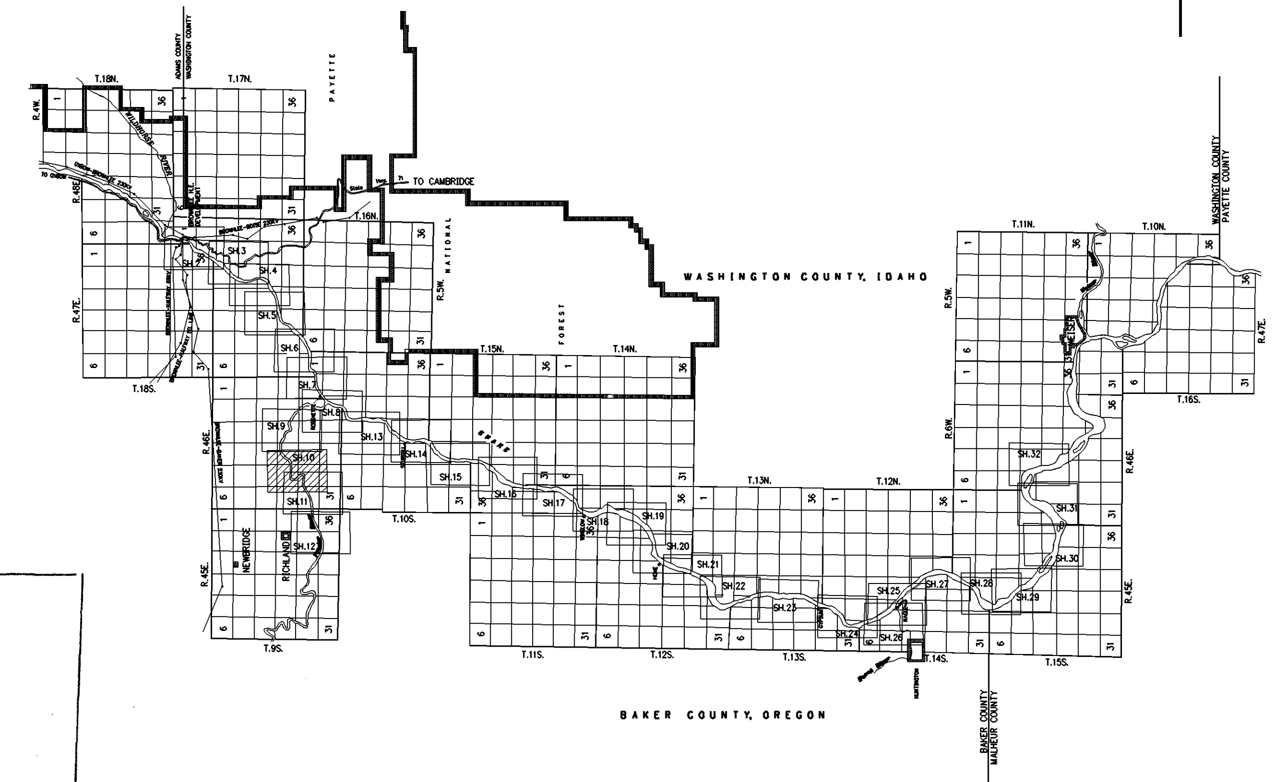

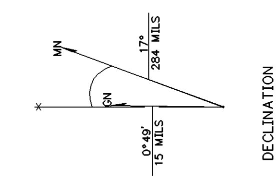

4 3 2 1 0 4 8 12 16 20

SCALE : 1"= 400 FEET

LEGEND

P - - - - - - -PRIVATE LANDS
US - - - - - - -U.S. GOVERNMENT LANDS
PSR - - - - - - -POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971- IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 10 OF 32 | E-54828

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REVISION

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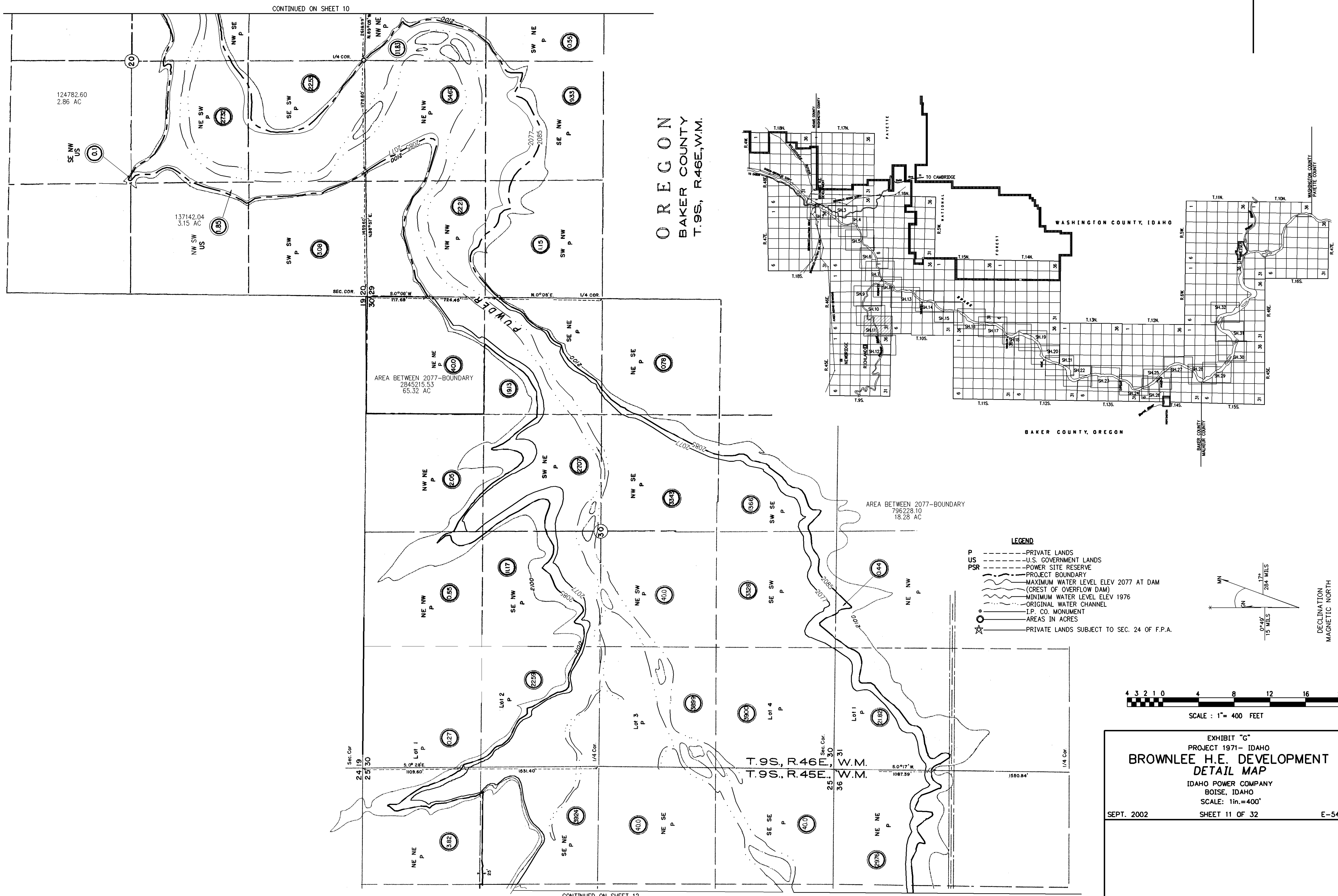

CONTINUED ON SHEET 12

EXHIBIT "G"
PROJECT 1971– IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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REVISION

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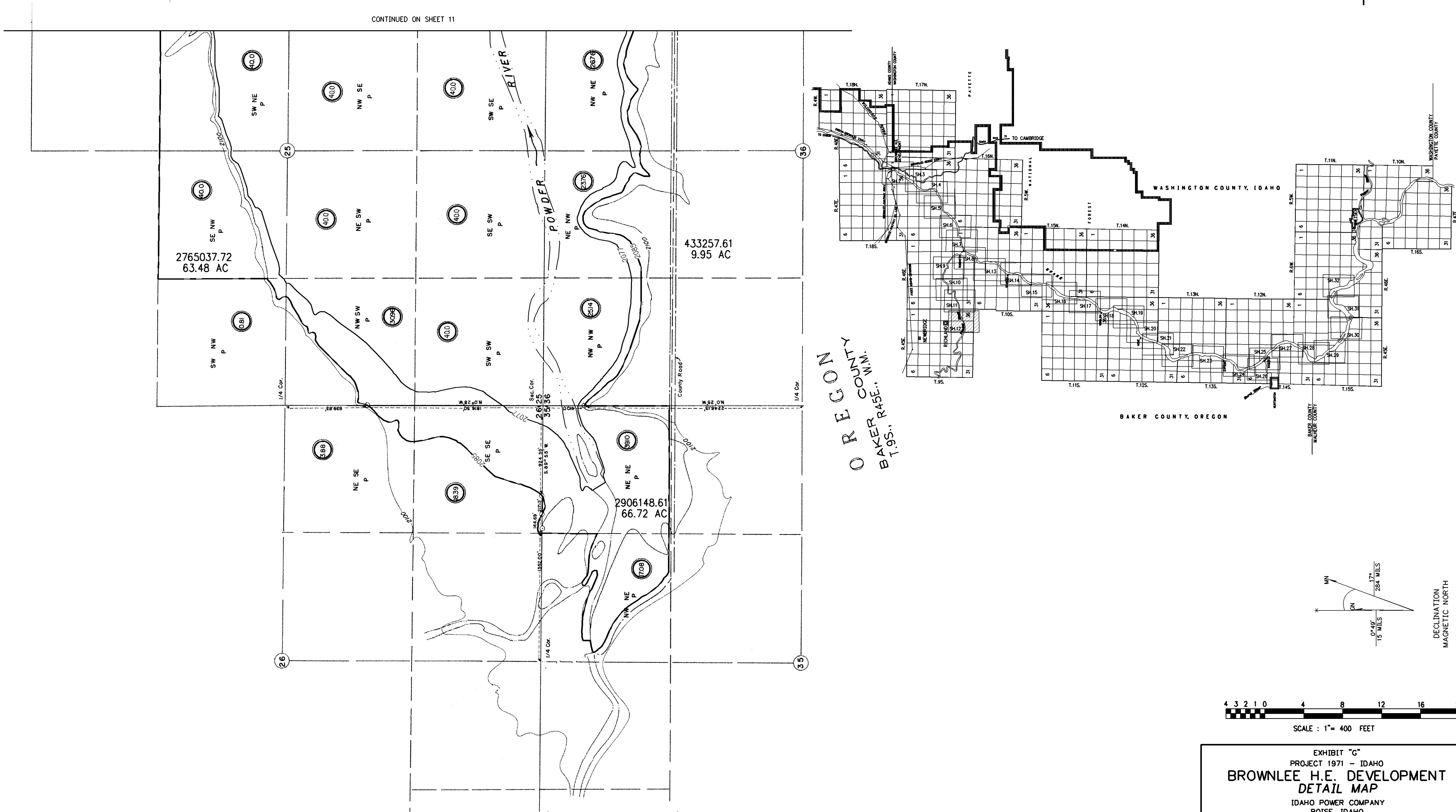

4 3 2 1 0 4 8 12 16 20

SCALE : 1"= 400 FEET

EXHIBIT "G"
PROJECT 1971 – IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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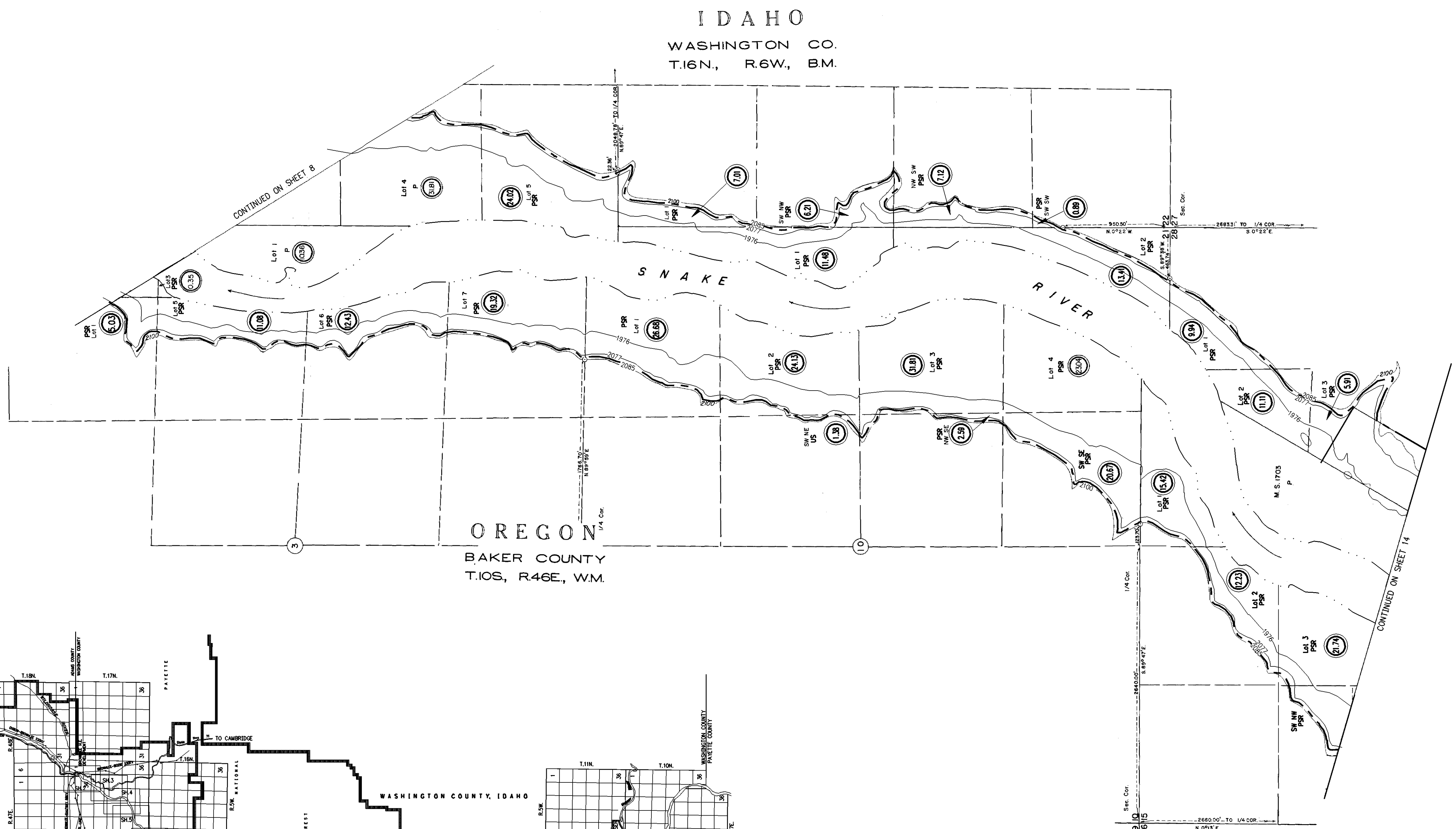

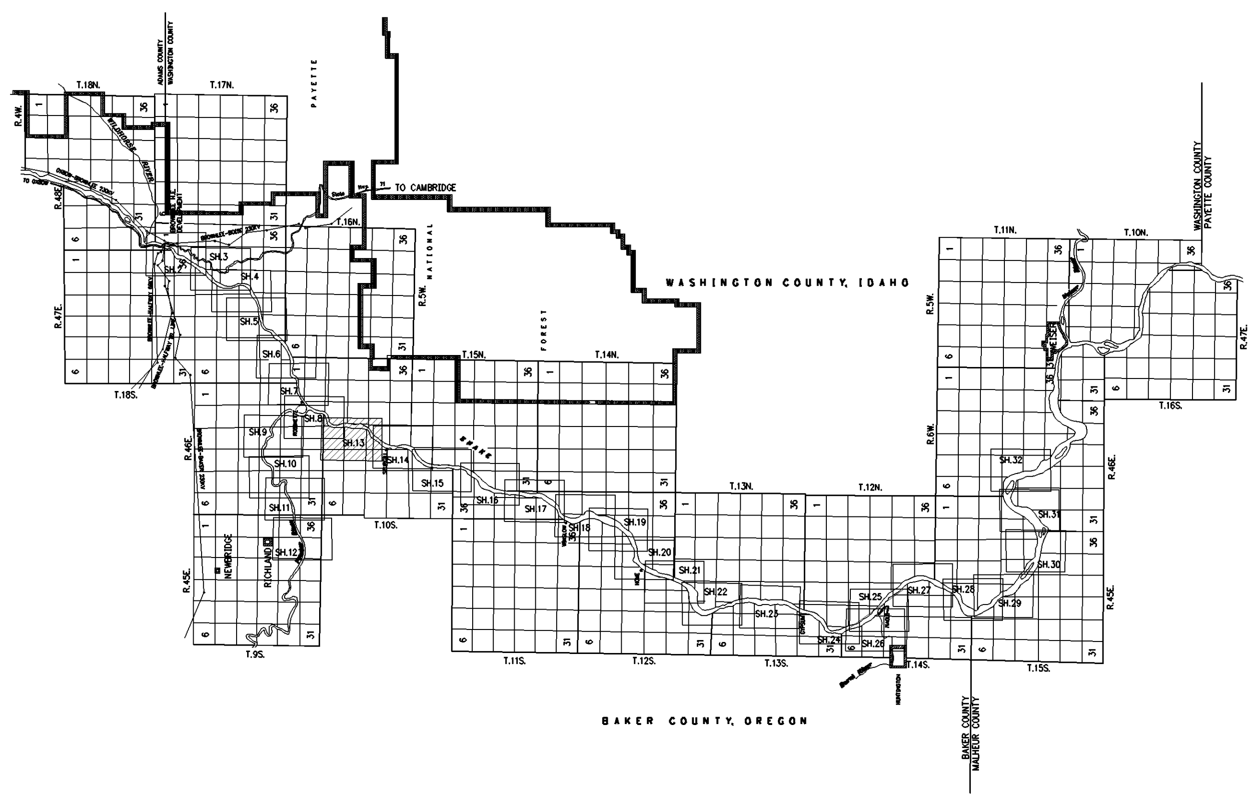

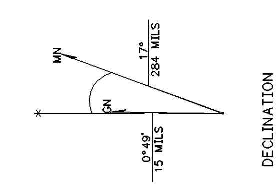

4 3 2 1 0 4 8 12 16 20

SCALE : 1"= 400 FEET

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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LEGEND

- P – PRIVATE LANDS
- US – U.S. GOVERNMENT LANDS
- PSR – POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM
- (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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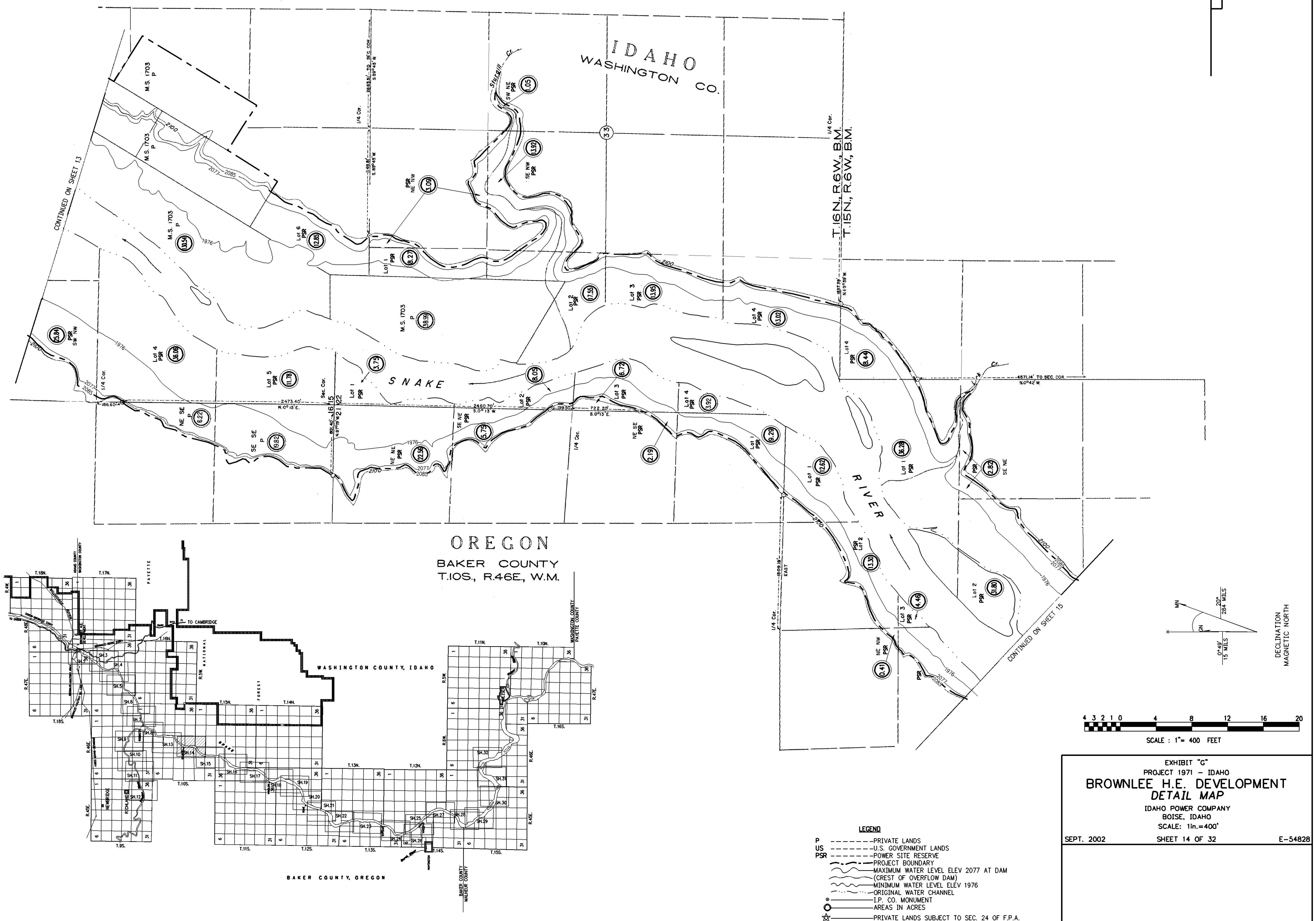

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT

DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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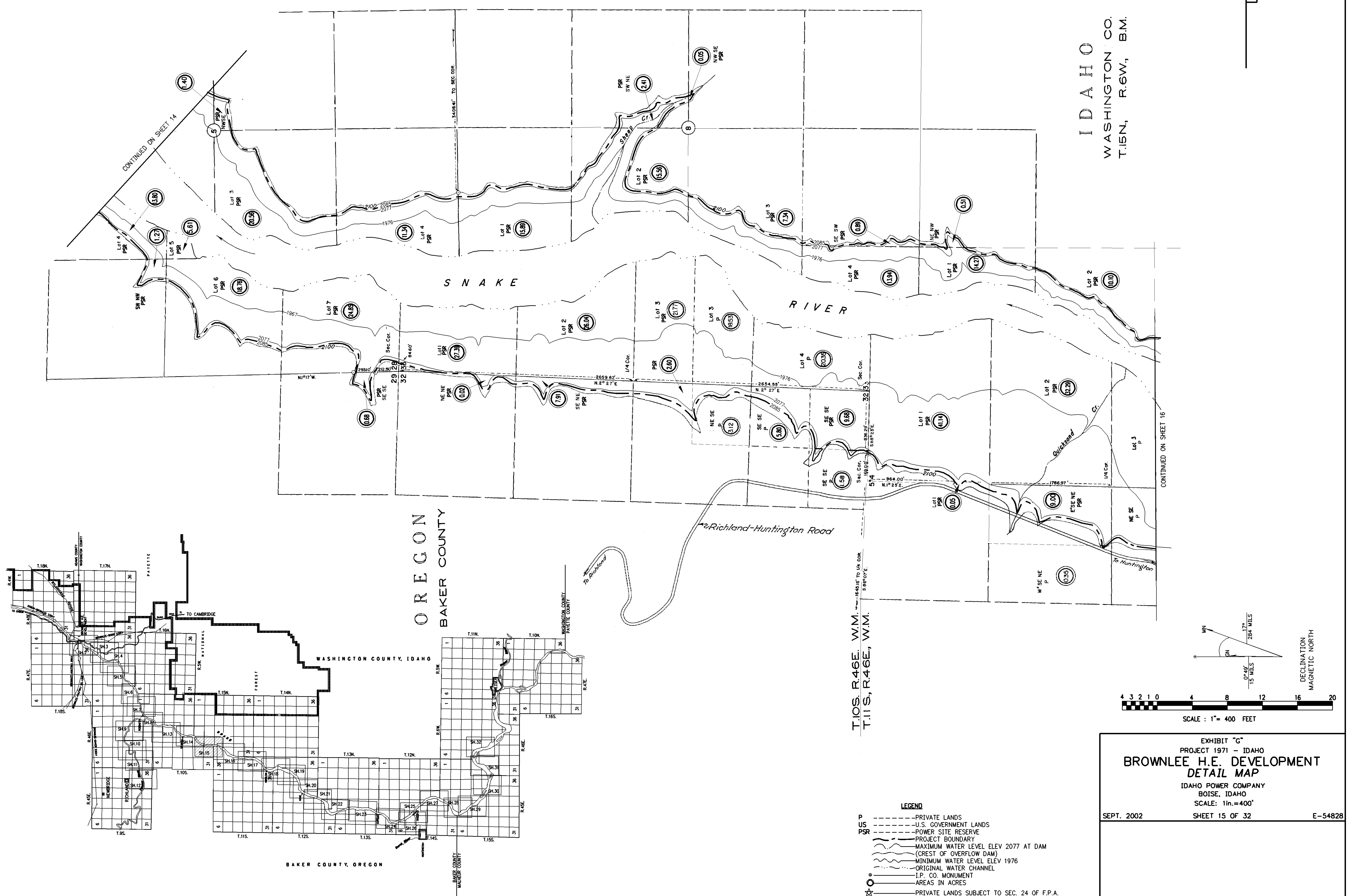

EXHIBIT "G"
PROJECT 1971 – IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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LEGEND

- P – PRIVATE LANDS
- US – U.S. GOVERNMENT LANDS
- PSR – POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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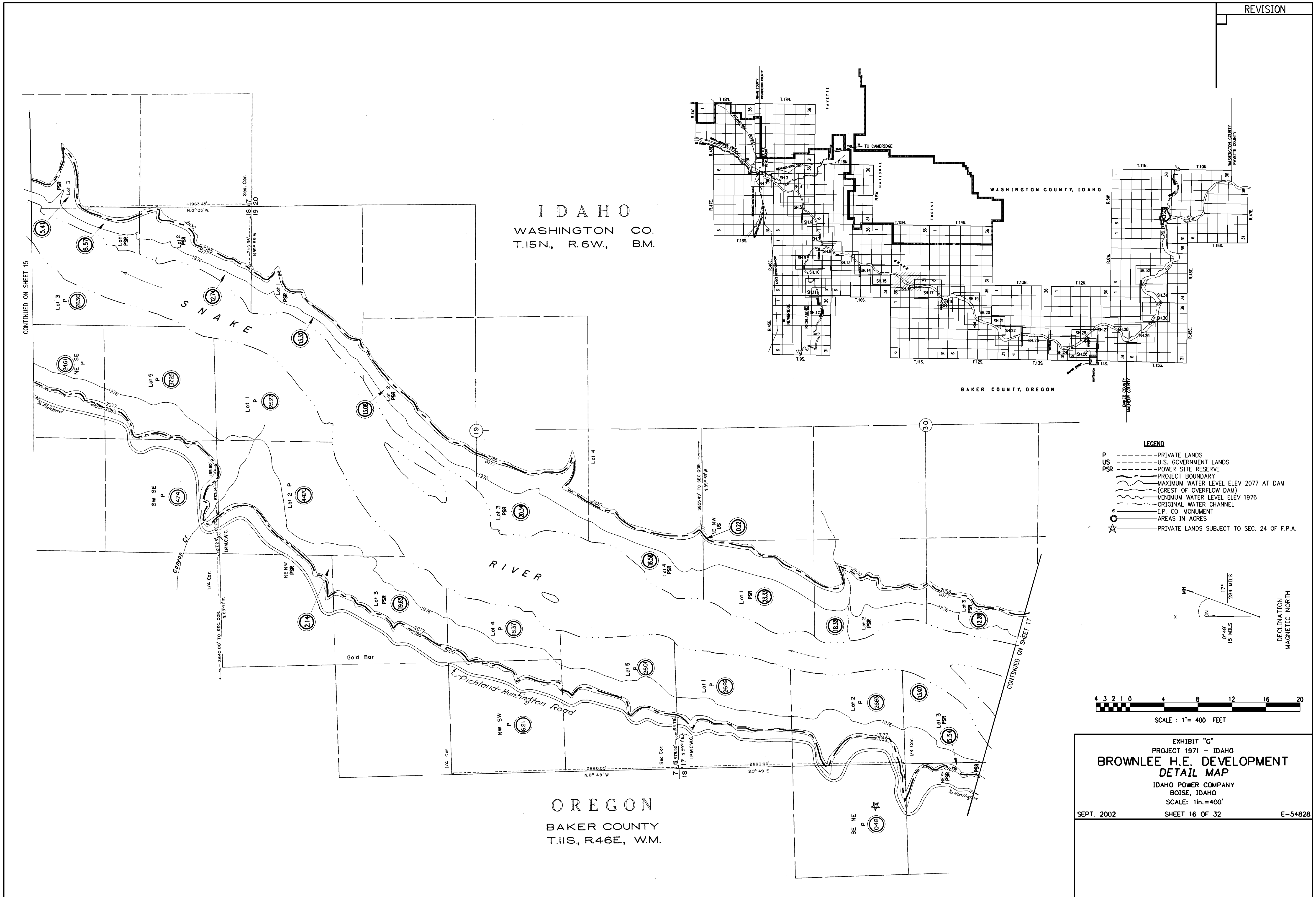
REVISION
IDAHO
WASHINGTON CO.
T.15N., R.6W., B.M.
OREGON
BAKER COUNTY
T.11S, R.46E, W.M.
SNAKE
RIVER
CONTINUED ON SHEET 15
CONTINUED ON SHEET 17
Canyon Cr.
Gold Bar
Richland-Huntington Road
To Richland
To Huntington
TO CAMBRIDGE
WASHINGTON COUNTY, IDAHO
BAKER COUNTY, OREGON
LEGEND
P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
DECLINATION MAGNETIC NORTH
17° 284 MILS
0°49' 15 MILS
SCALE : 1"= 400 FEET
EXHIBIT "G"
PROJECT 1971 – IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 16 OF 32
E-54828

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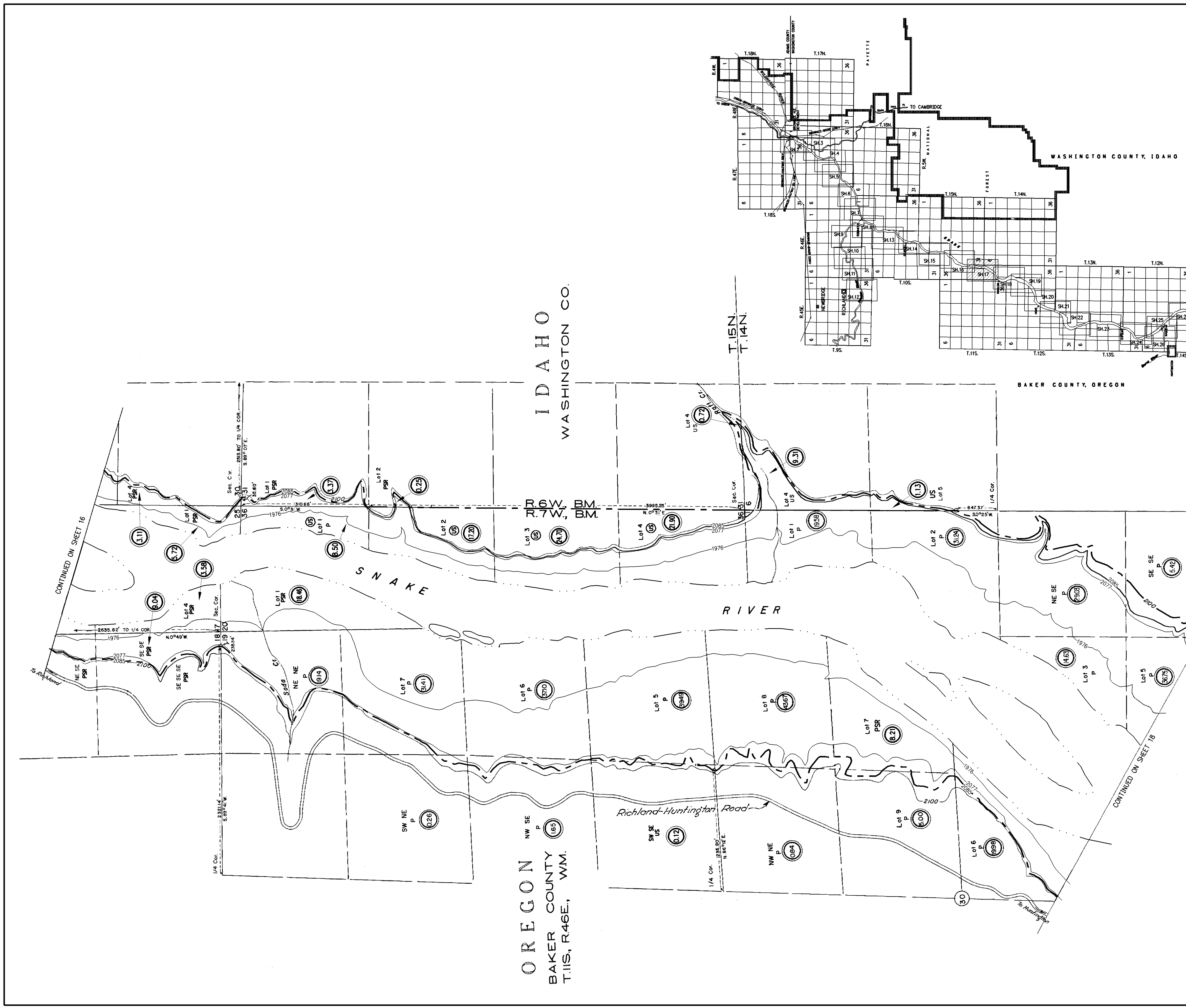

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
- U.S. GOVERMENT LANDS SUBJECT PRIOR PRIVATE EASEMENT.

DECLINATION MAGNETIC NORTH

17° 284 MILS

0°49' 15 MILS

SCALE : 1"= 400 FEET

EXHIBIT "G"
PROJECT 1971 – IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 17 OF 32 | E-54828

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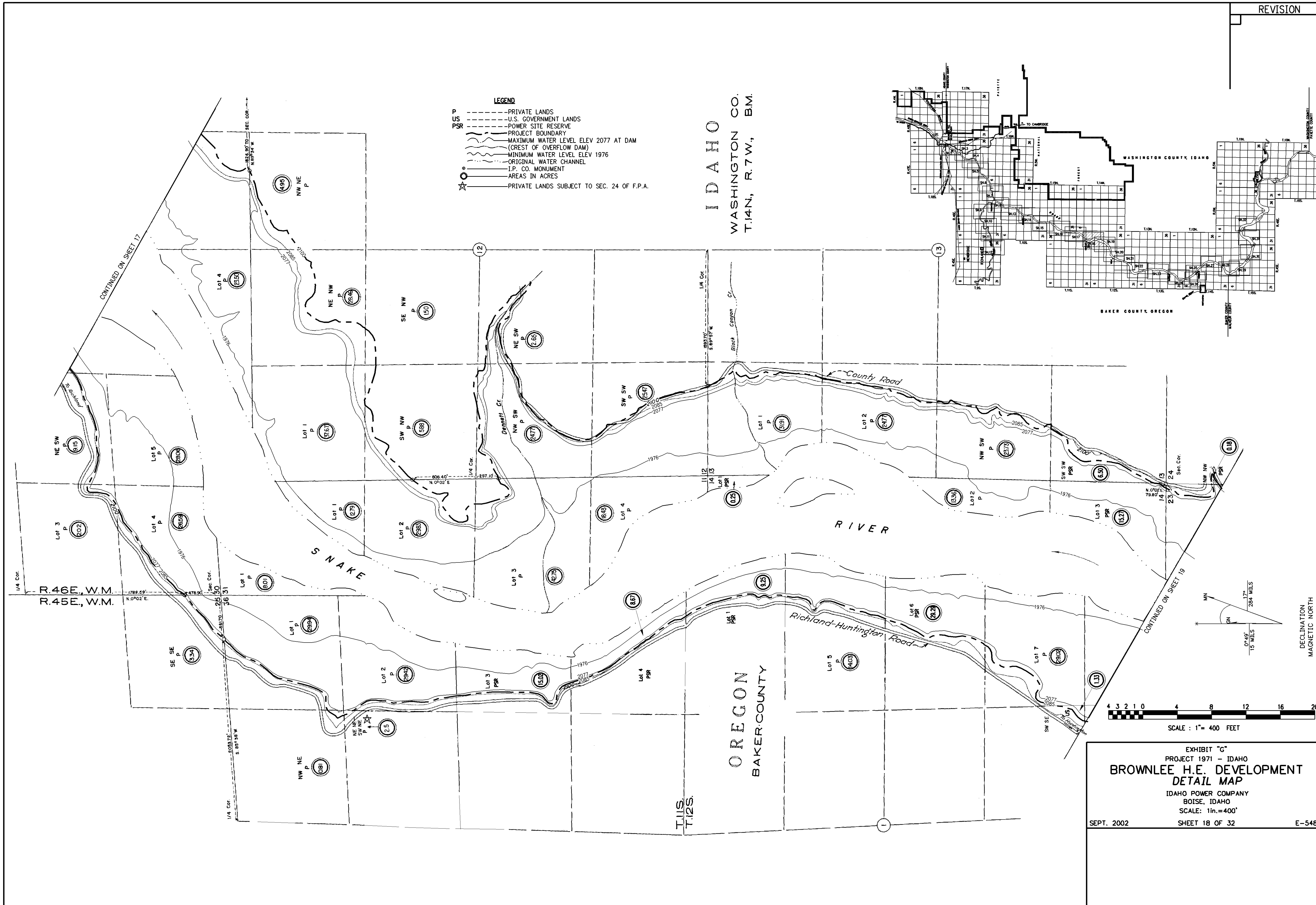

EXHIBIT "G"

PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT

DETAIL MAP

IDAHO POWER COMPANY

BOISE, IDAHO

SCALE: 1in.=400'

SEPT. 2002 — SHEET 18 OF 32 — E-54828

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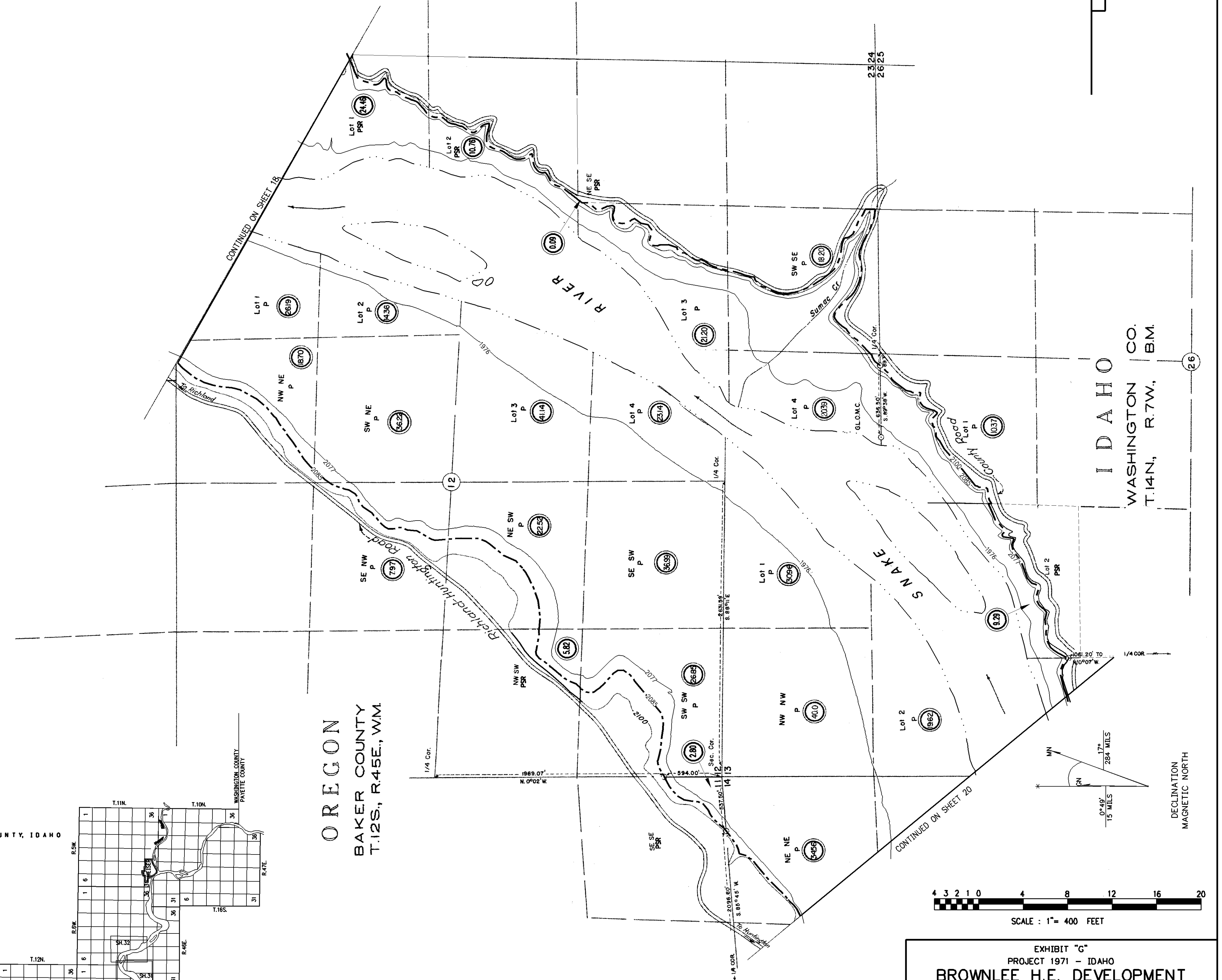

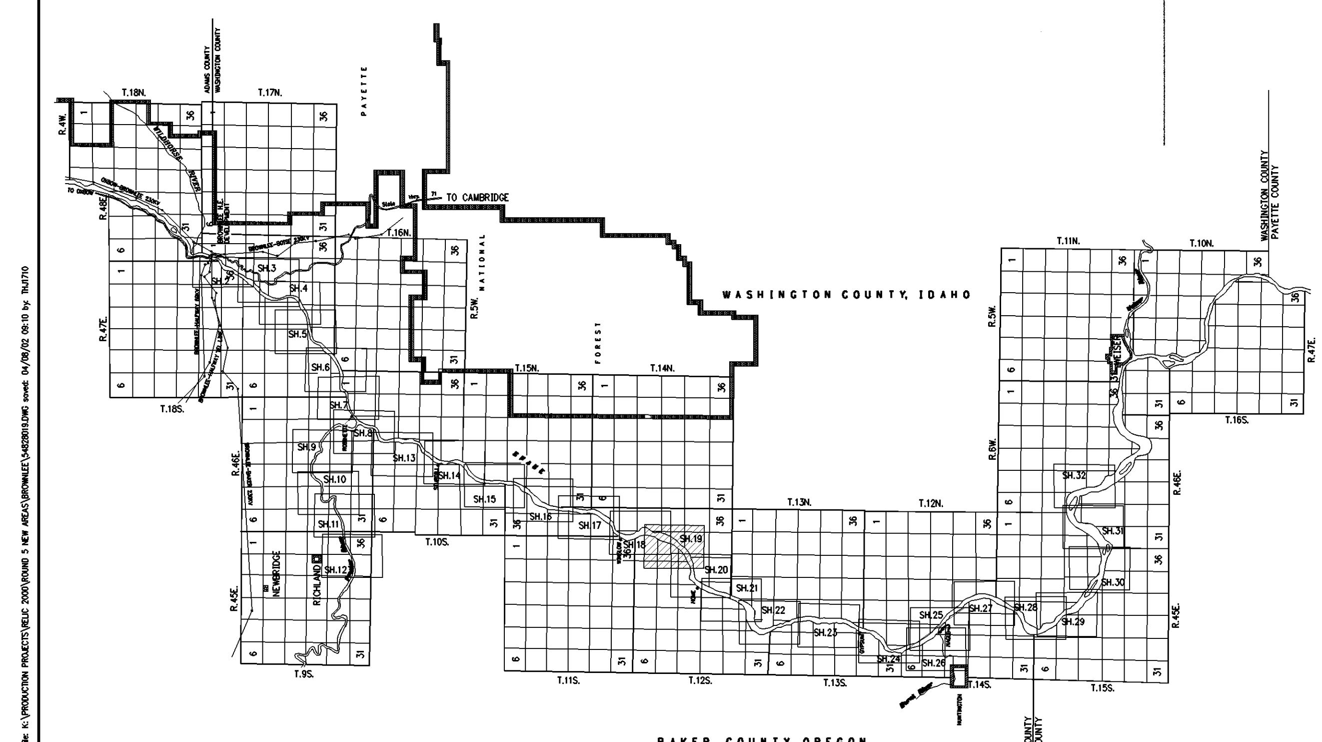

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 - IDAHO

BROWNLEE H.E. DEVELOPMENT

DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 19 OF 32 | E-54828

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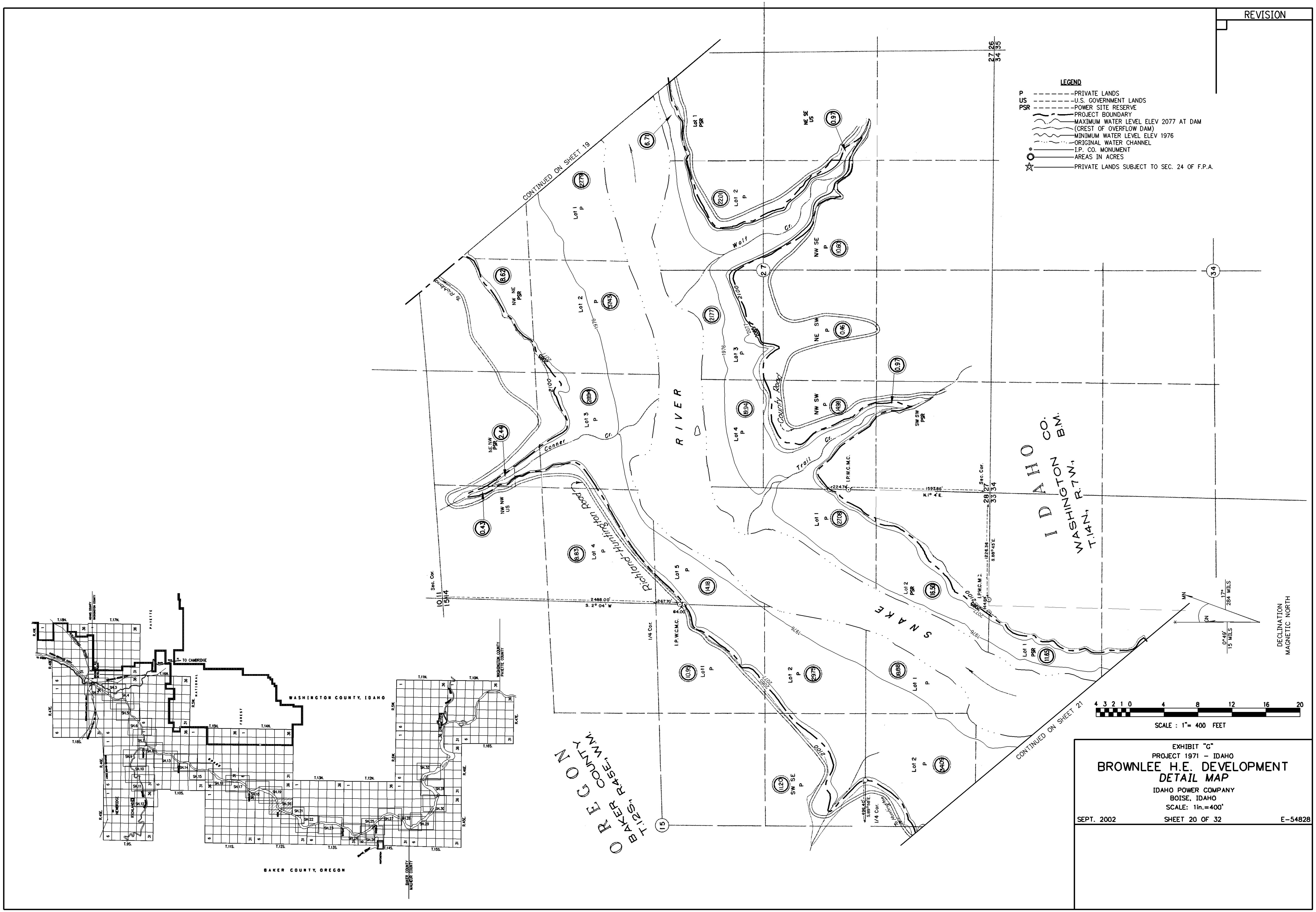
REVISION
LEGEND
P --------PRIVATE LANDS
US --------U.S. GOVERNMENT LANDS
PSR --------POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
CONTINUED ON SHEET 19
CONTINUED ON SHEET 21
SNAKE RIVER
Wolf Cr.
Conner Cr.
Trail Cr.
County Road
Richland-Huntington Road
IDAHO
WASHINGTON CO.
T.14N., R.7W., B.M.
OREGON
BAKER COUNTY
T.12S., R.45E., W.M.
DECLINATION
MAGNETIC NORTH
WASHINGTON COUNTY, IDAHO
BAKER COUNTY, OREGON
TO CAMBRIDGE
4 3 2 1 0 4 8 12 16 20
SCALE : 1"= 400 FEET
EXHIBIT "G"
PROJECT 1971 - IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 20 OF 32
E-54828

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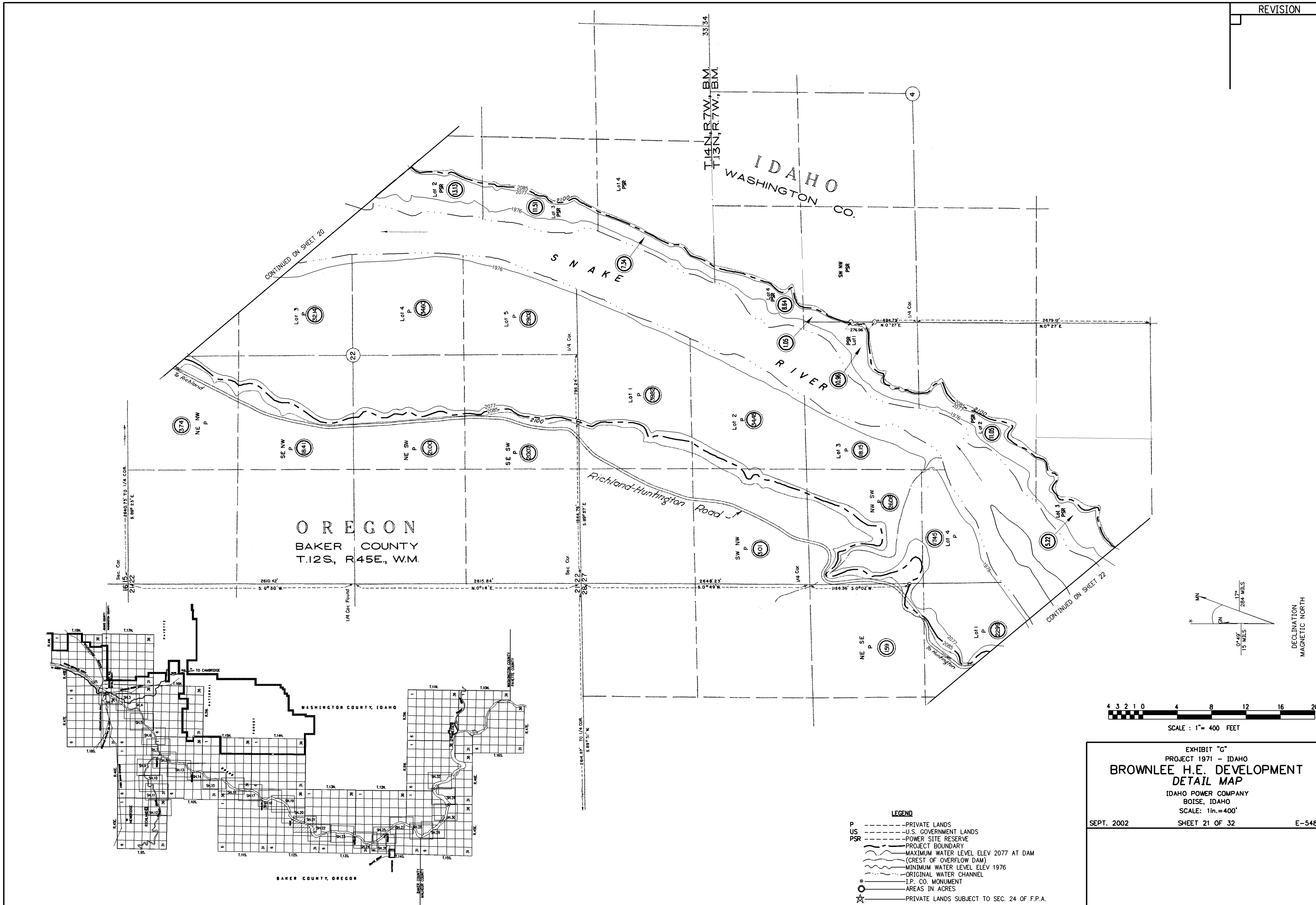
REVISION
IDAHO
WASHINGTON CO.
T.14N.,R.7W., B.M.
T.13N.,R.7W., B.M.
SNAKE RIVER
OREGON
BAKER COUNTY
T.12S., R.45E., W.M.
Richland-Huntington Road
To Richland
To Huntington
CONTINUED ON SHEET 20
CONTINUED ON SHEET 22
DECLINATION
MAGNETIC NORTH
SCALE : 1"= 400 FEET
LEGEND
P - PRIVATE LANDS
US - U.S. GOVERNMENT LANDS
PSR - POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
WASHINGTON COUNTY, IDAHO
BAKER COUNTY, OREGON
TO CAMBRIDGE
EXHIBIT "G"
PROJECT 1971 – IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 21 OF 32
E-54828

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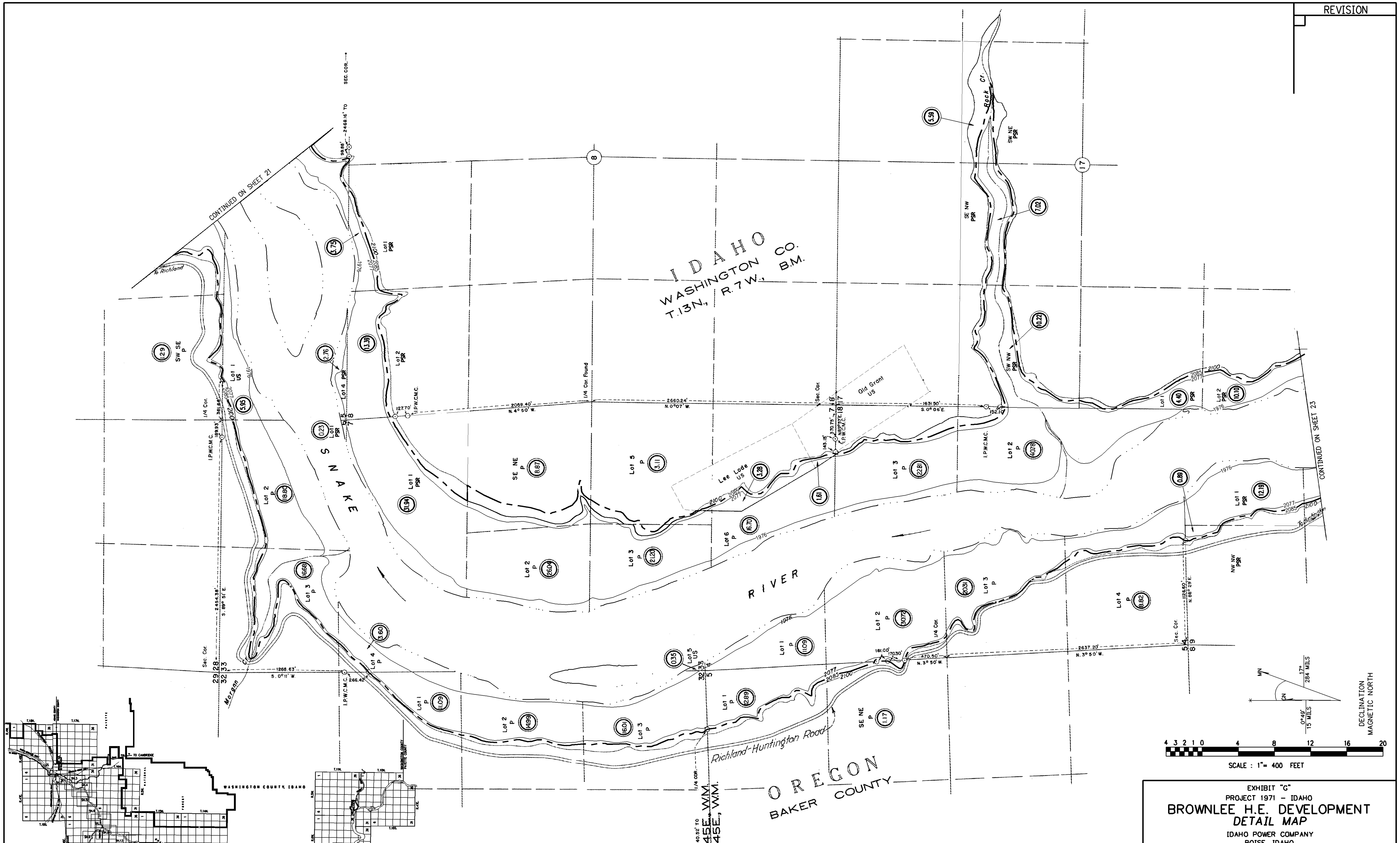
REVISION



LEGEND

P - PRIVATE LANDS
US - U.S. GOVERNMENT LANDS
PSR - POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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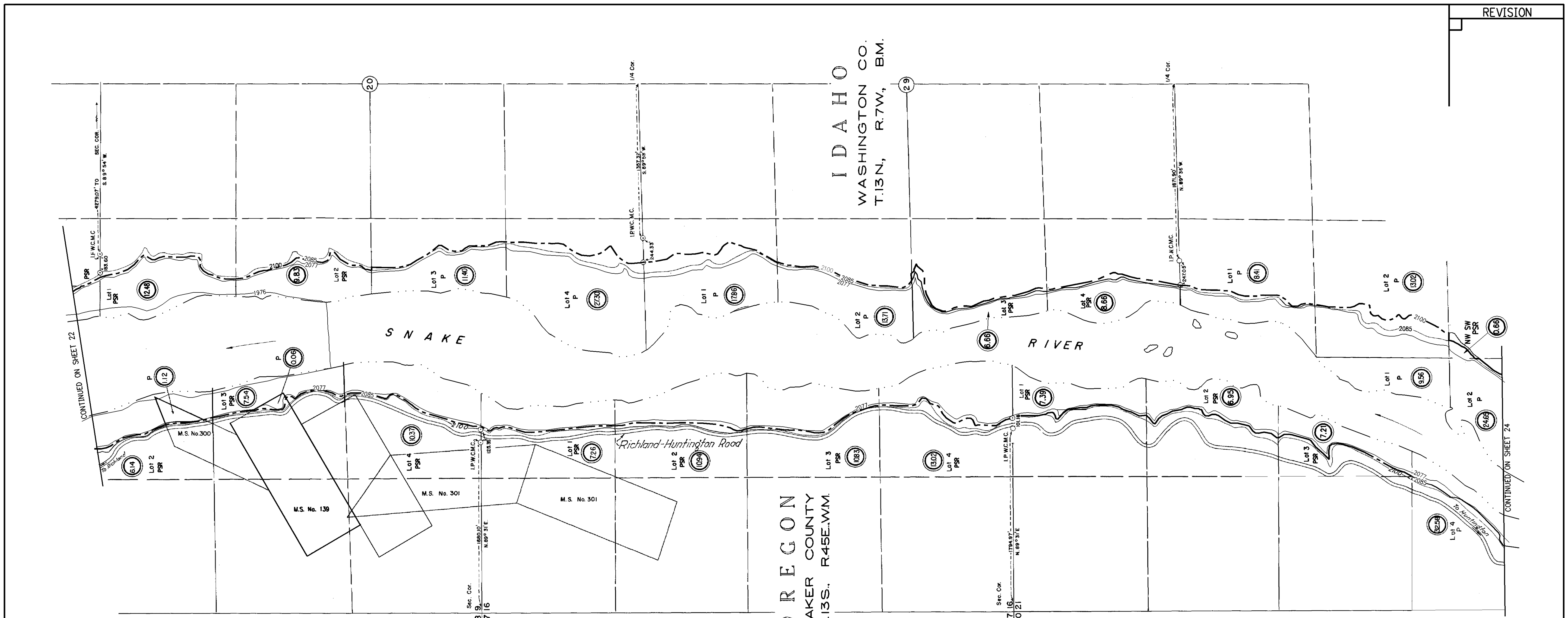

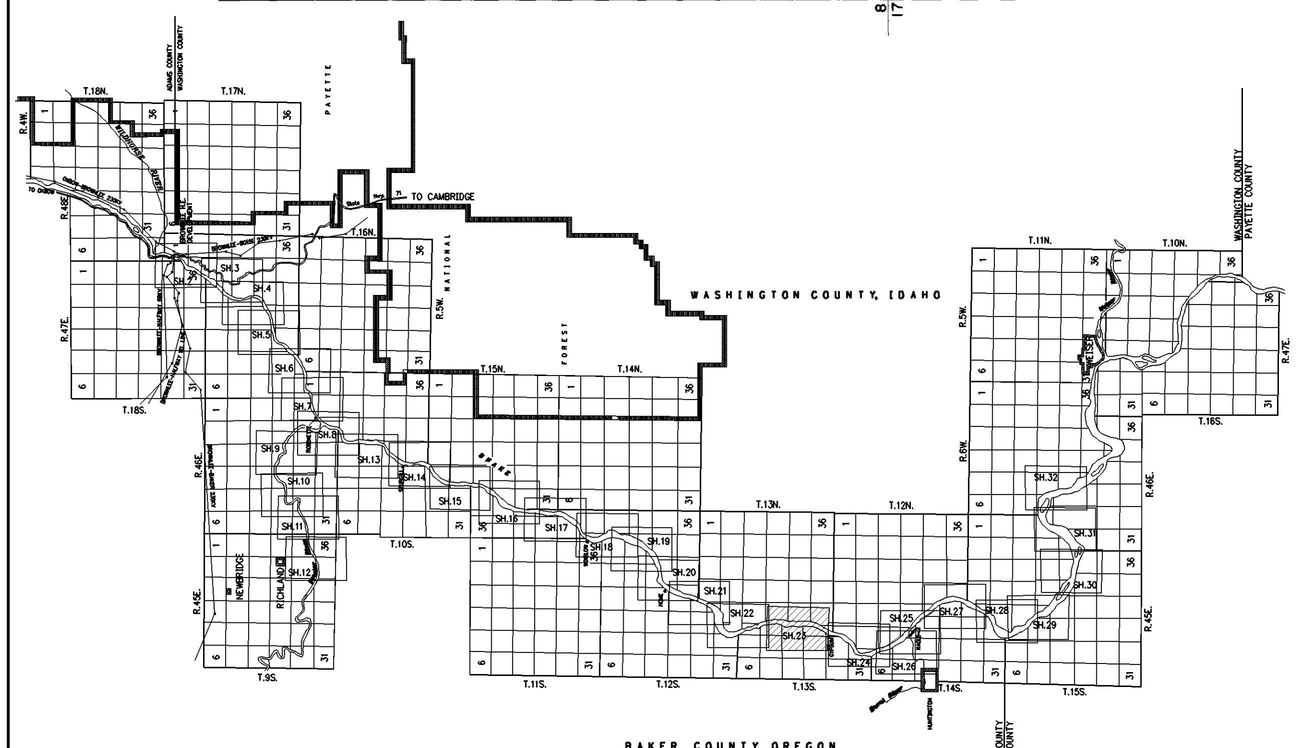

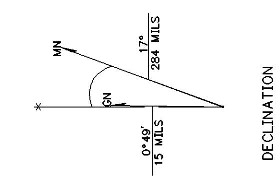

4 3 2 1 0 4 8 12 16 20

SCALE : 1"= 400 FEET

EXHIBIT "G"
PROJECT 1971 - IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 23 OF 32 | E-54828

LEGEND

- P ---------PRIVATE LANDS
- US ---------U.S. GOVERNMENT LANDS
- PSR ---------POWER SITE RESERVE
- ———PROJECT BOUNDARY
- ———MAXIMUM WATER LEVEL ELEV 2077 AT DAM
- ———(CREST OF OVERFLOW DAM)
- ———MINIMUM WATER LEVEL ELEV 1976
- ———ORIGINAL WATER CHANNEL
- ———I.P. CO. MONUMENT
- ———AREAS IN ACRES
- ———PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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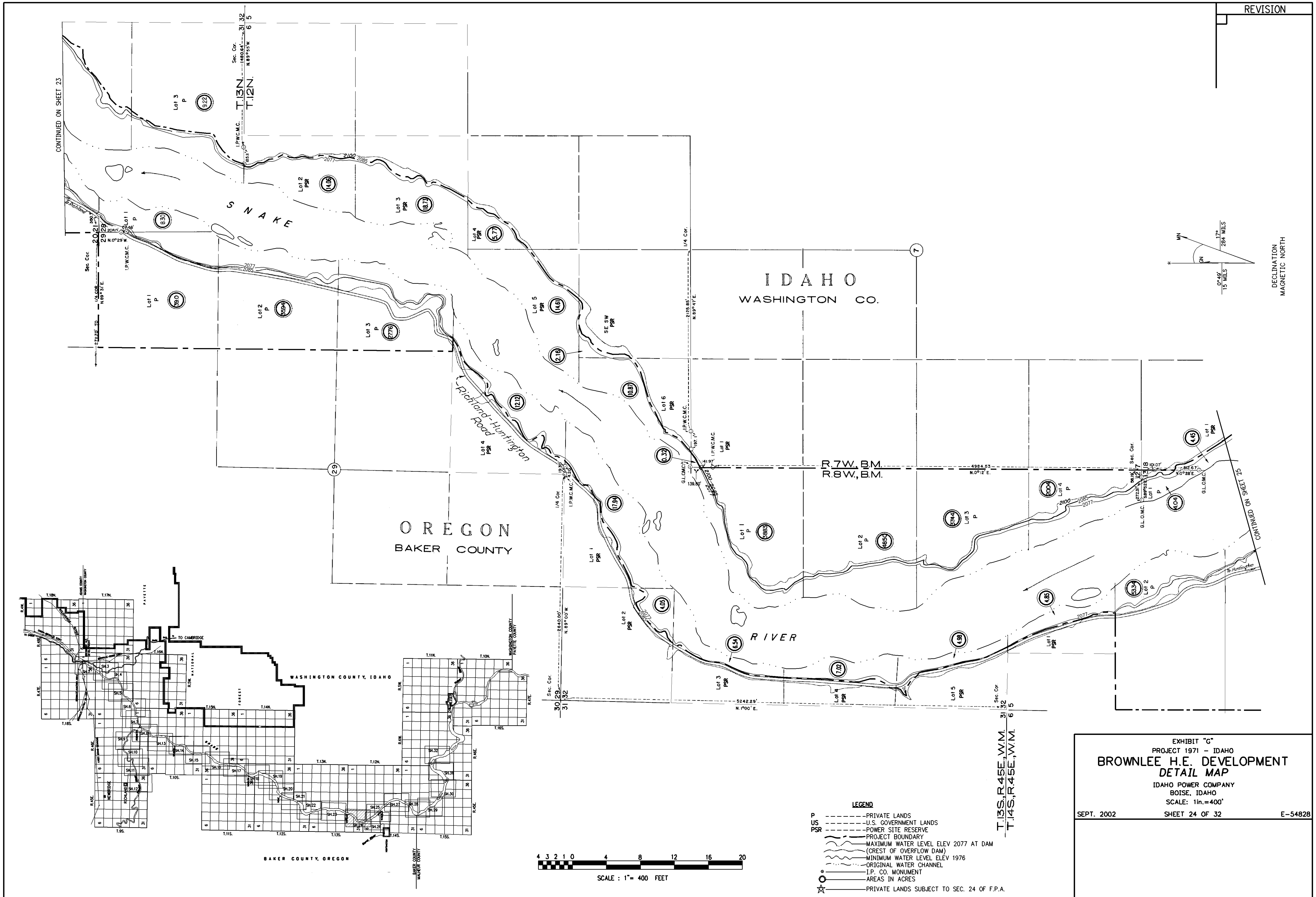
REVISION
CONTINUED ON SHEET 23
CONTINUED ON SHEET 25
T.13N.
T.12N.
S N A K E
R I V E R
IDAHO
WASHINGTON CO.
OREGON
BAKER COUNTY
Richland-Huntington Road
R.7W.,B.M.
R.8W.,B.M.
T.13S.,R.45E.,W.M.
T.14S.,R.45E.,W.M.
DECLINATION
MAGNETIC NORTH
Lot 3 P 9.22
Lot 2 PSR 14.06
Lot 3 PSR 18.73
Lot 1 P 8.30
Lot 4 PSR 5.77
Lot 1 P 29.0
Lot 2 P 35.94
Lot 3 P 27.76
Lot 5 PSR 14.61
SE SW PSR
2.16
10.87
Lot 6 PSR
12.12
Lot 4 PSR
0.32
Lot 1 PSR
17.94
Lot 1 P 38.83
Lot 2 P 48.54
Lot 3 P 37.44
Lot 4 P 20.04
Lot 1 P 4.04
Lot 1 PSR 4.45
Lot 1 PSR
4.05
Lot 2 PSR
6.54
7.02
Lot 3 PSR
Lot 4 PSR
Lot 5 PSR
4.98
Lot 1 PSR
4.85
Lot 2 P 53.34
To Huntington
EXHIBIT "G"
PROJECT 1971 - IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 24 OF 32
E-54828
LEGEND
P - PRIVATE LANDS
US - U.S. GOVERNMENT LANDS
PSR - POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
SCALE : 1" = 400 FEET
WASHINGTON COUNTY, IDAHO
BAKER COUNTY, OREGON
TO CAMBRIDGE

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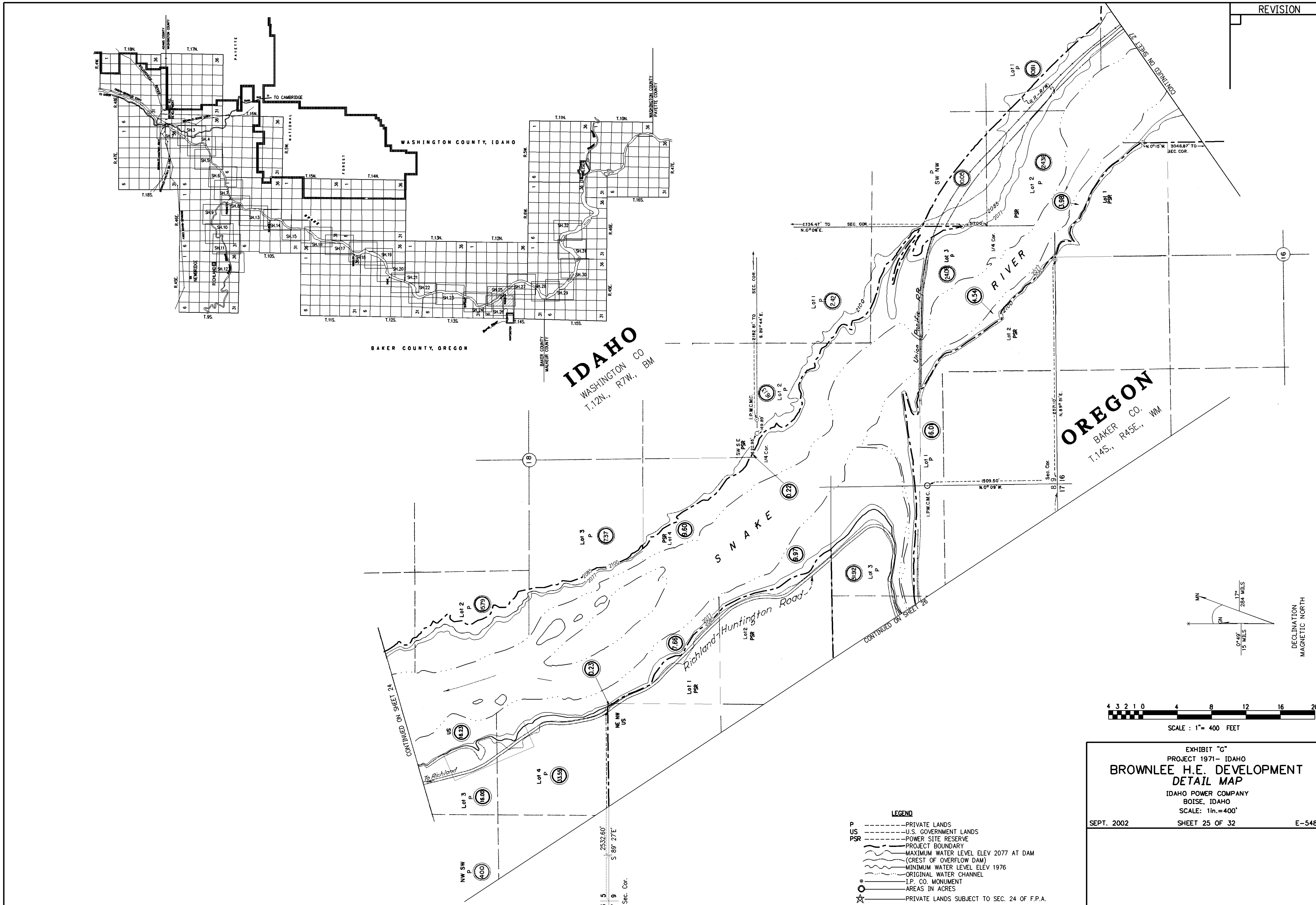

EXHIBIT "G"
PROJECT 1971- IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 25 OF 32 | E-54828

LEGEND

- P ---------PRIVATE LANDS
- US ---------U.S. GOVERNMENT LANDS
- PSR ---------POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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REVISION

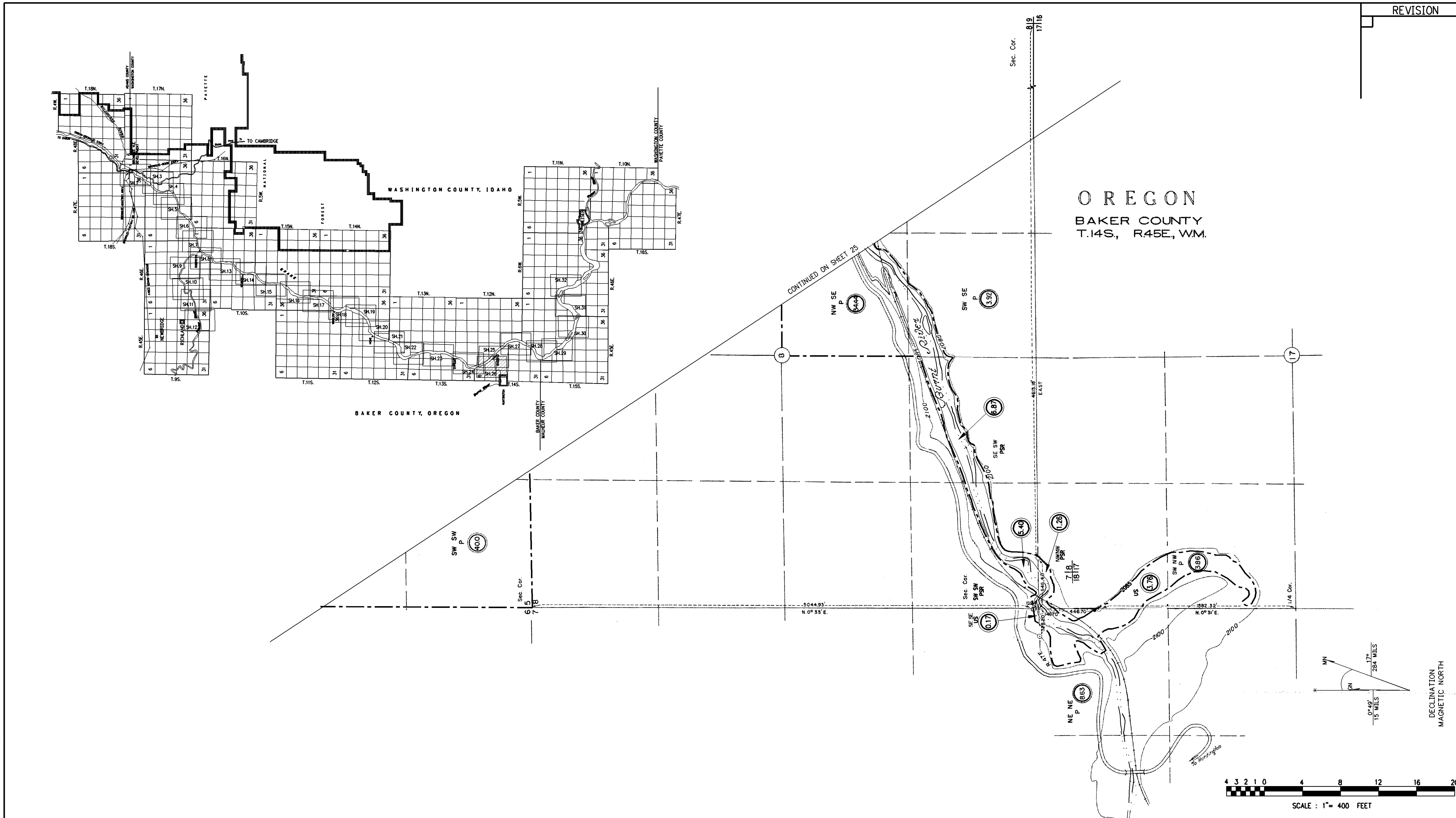

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

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LEGEND

P ----------PRIVATE LANDS
US ----------U.S. GOVERNMENT LANDS
PSR ----------POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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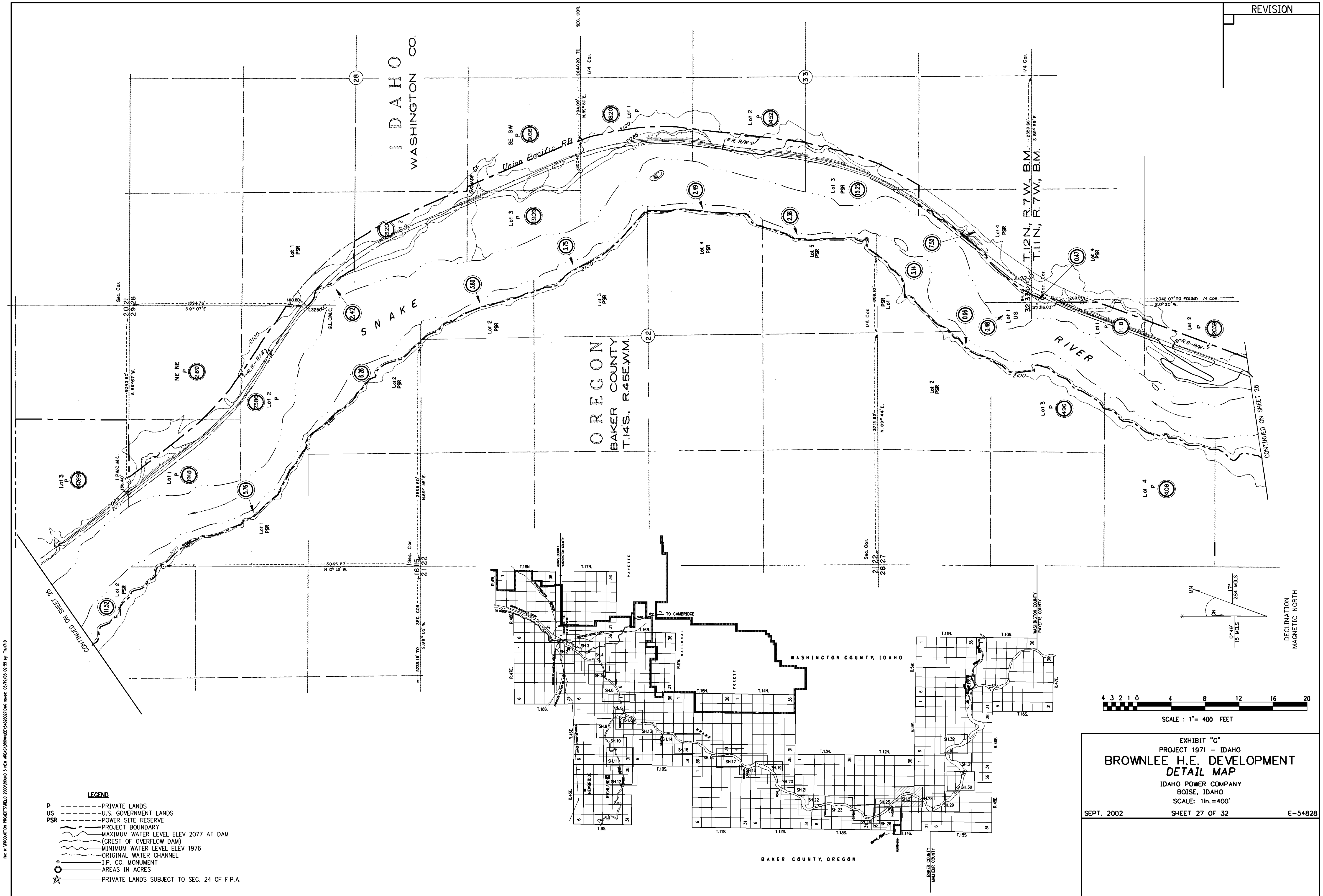
REVISION
IDAHO
WASHINGTON CO.
OREGON
BAKER COUNTY
T.14S. R.45E.W.M.
T.12N., R.7W., B.M.
T.11N., R.7W., B.M.
SNAKE
RIVER
Union Pacific RR
CONTINUED ON SHEET 25
CONTINUED ON SHEET 28
DECLINATION
MAGNETIC NORTH
SCALE : 1"= 400 FEET
WASHINGTON COUNTY, IDAHO
BAKER COUNTY, OREGON
TO CAMBRIDGE
LEGEND
P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 2077 AT DAM
(CREST OF OVERFLOW DAM)
MINIMUM WATER LEVEL ELEV 1976
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
EXHIBIT "G"
PROJECT 1971 - IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 27 OF 32
E-54828

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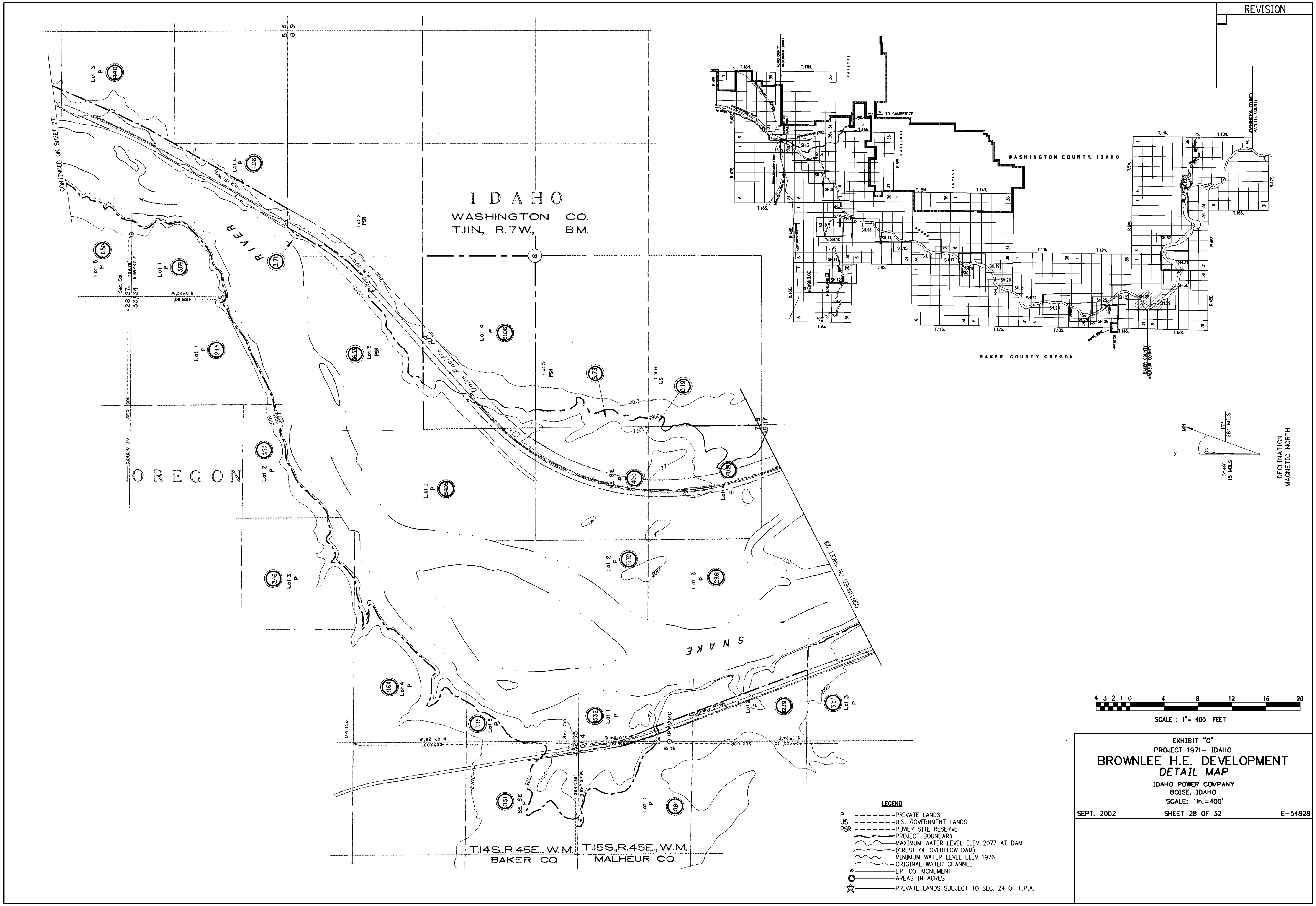

EXHIBIT "G"
PROJECT 1971- IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 SHEET 28 OF 32 E-54828

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 2077 AT DAM (CREST OF OVERFLOW DAM)
- MINIMUM WATER LEVEL ELEV 1976
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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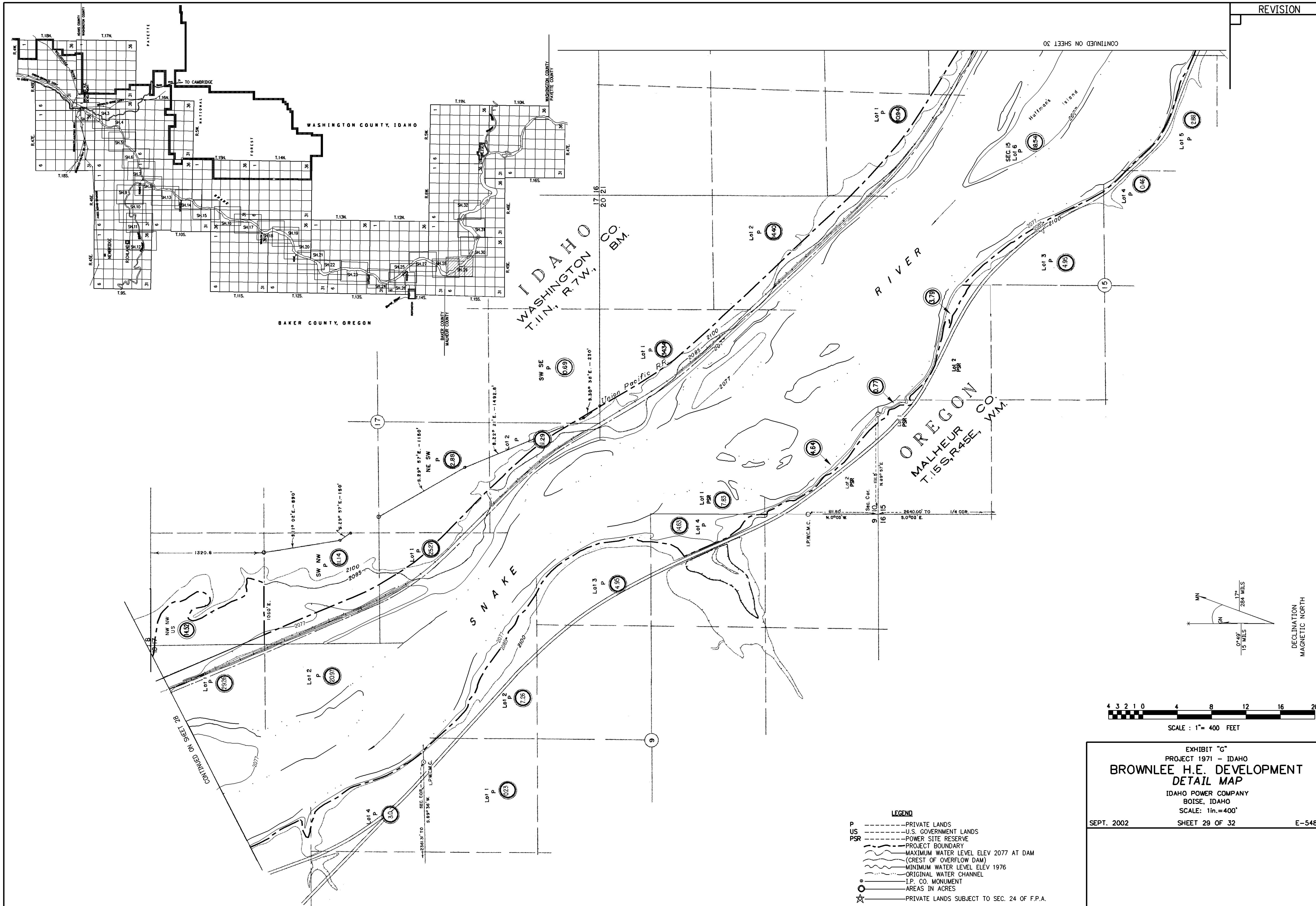

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 29 OF 32 | E-54828

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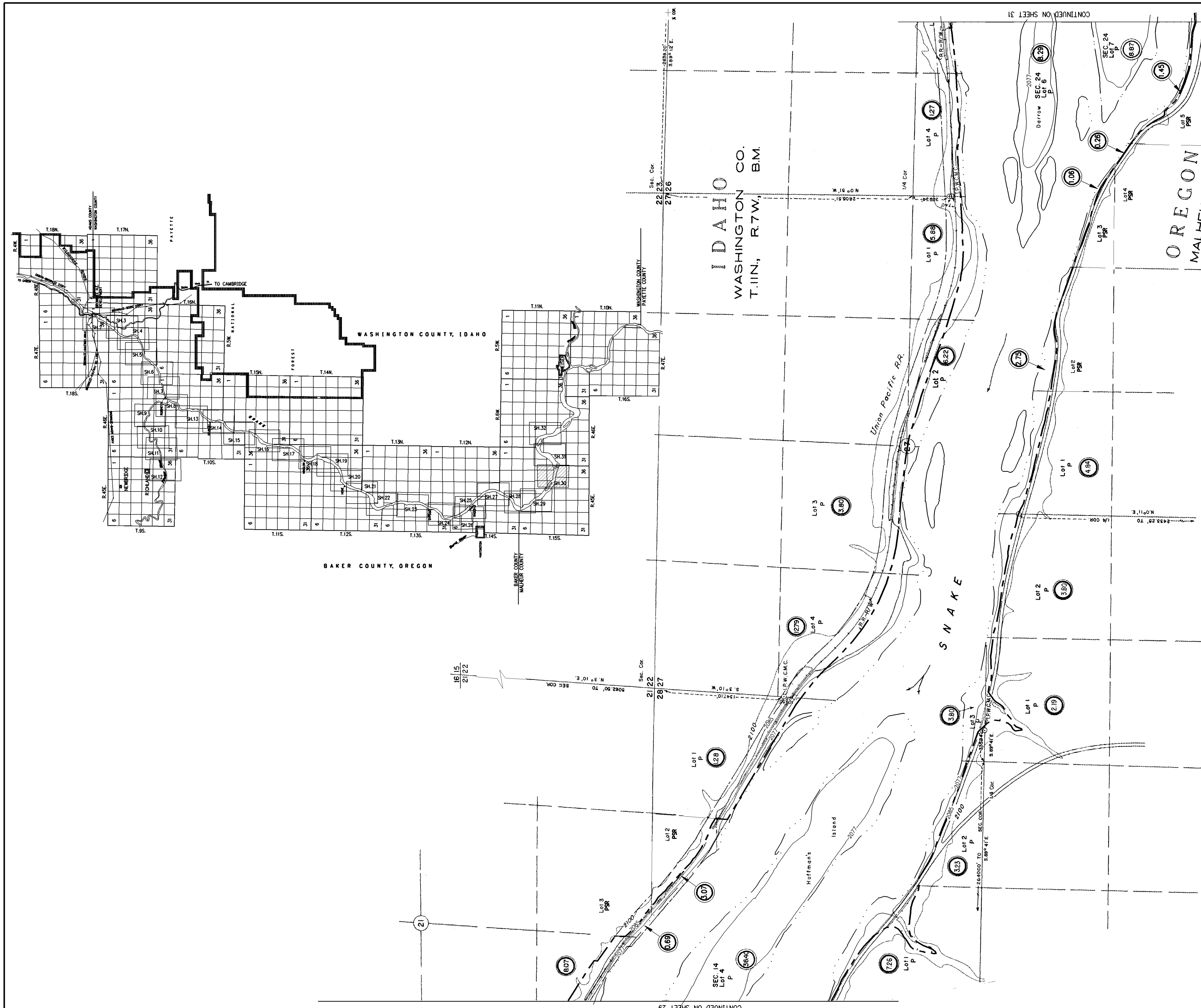

REVISION

EXHIBIT "G"
PROJECT 1971 – IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 30 OF 32 | E-54828

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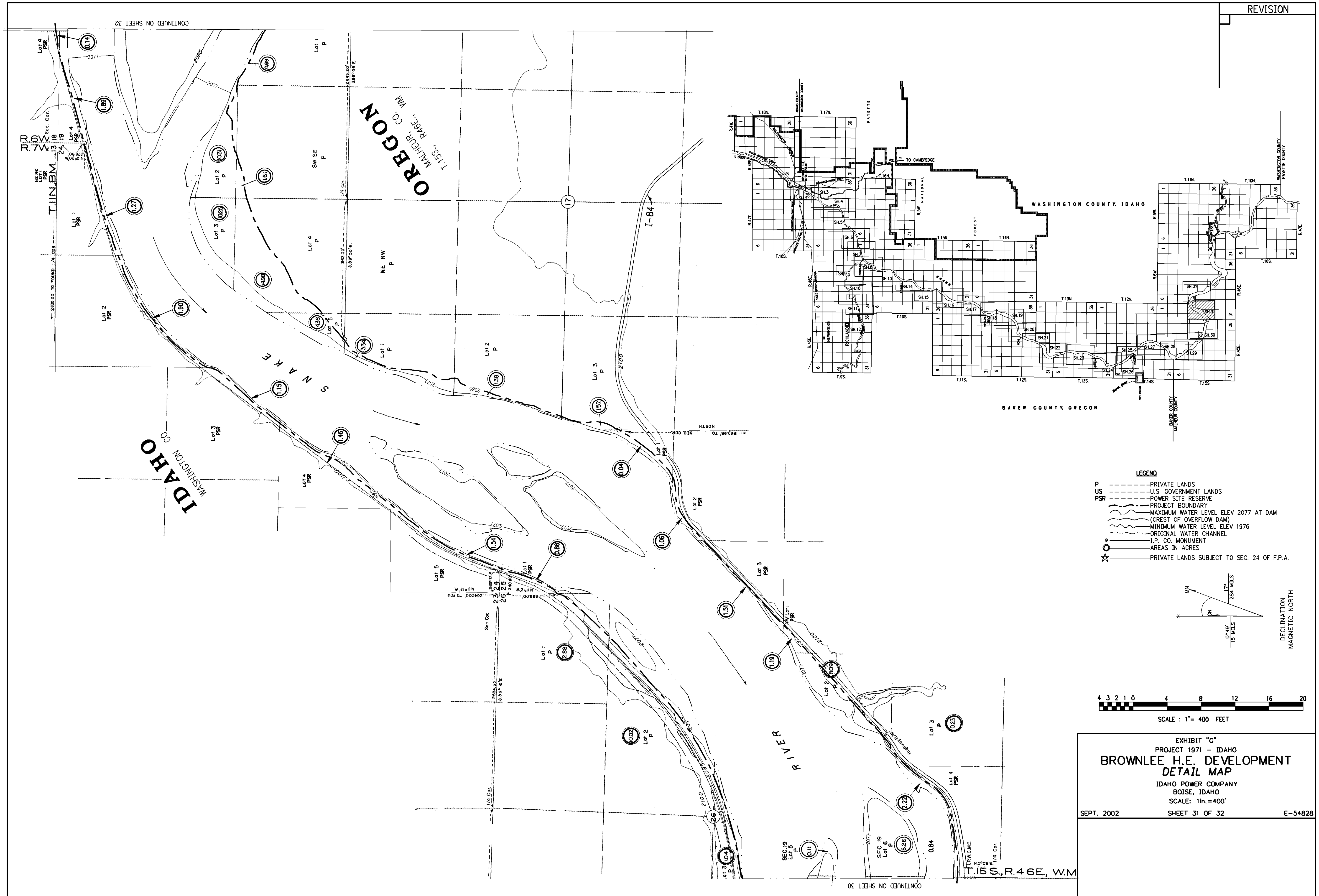

EXHIBIT "G"
PROJECT 1971 – IDAHO
BROWNLEE H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 31 OF 32 | E-54828

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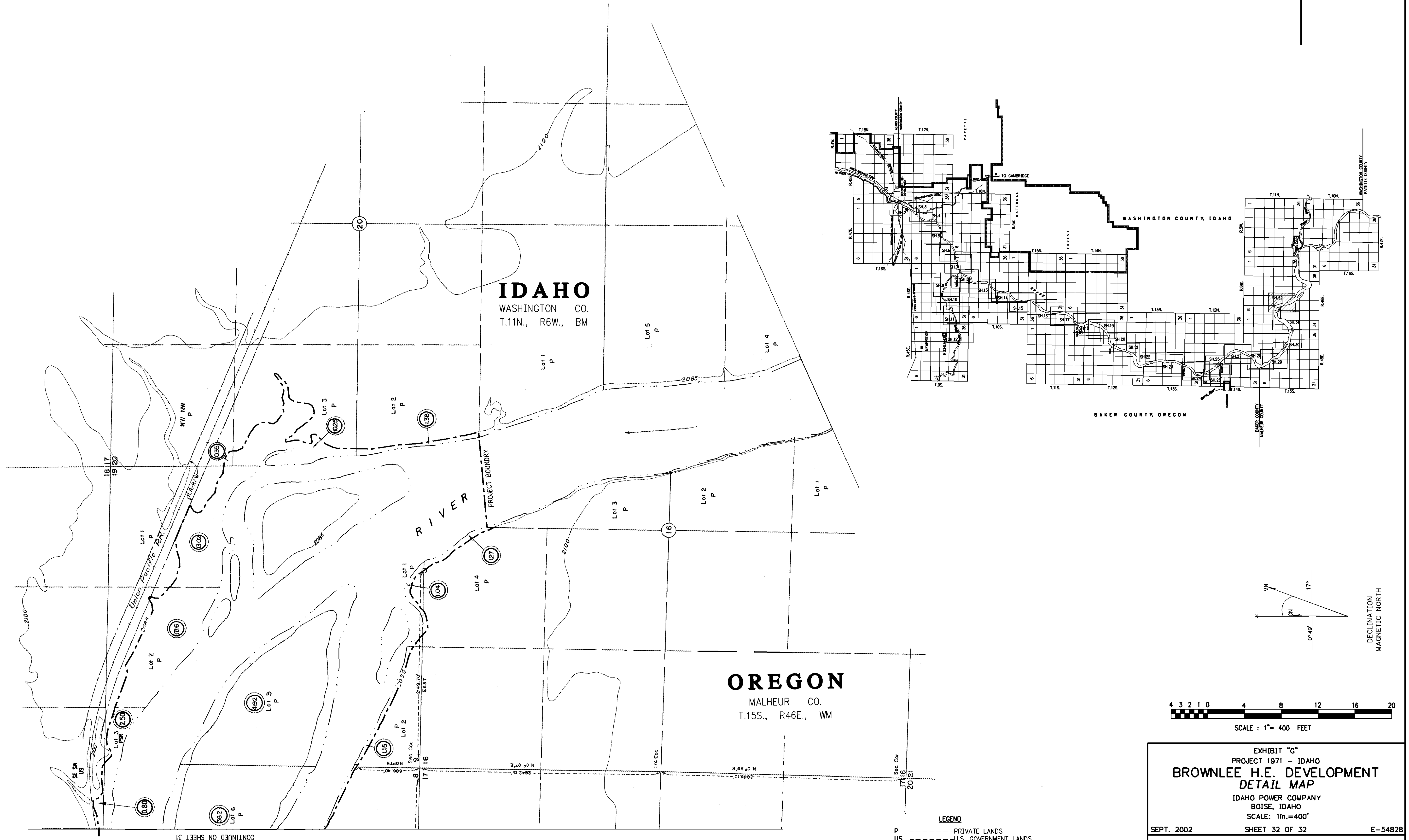
REVISION



SCALE : 1"= 400 FEET

LEGEND

P -------PRIVATE LANDS
US -------U.S. GOVERNMENT LANDS
PSR -------POWER SITE RESERVE
—PROJECT BOUNDARY
—MAXIMUM WATER LEVEL ELEV 2077 AT DAM
—(CREST OF OVERFLOW DAM)
—MINIMUM WATER LEVEL ELEV 1976
—ORIGINAL WATER CHANNEL
—I.P. CO. MONUMENT
—AREAS IN ACRES
—PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 - IDAHO

BROWNLEE H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 32 OF 32 | E-54828

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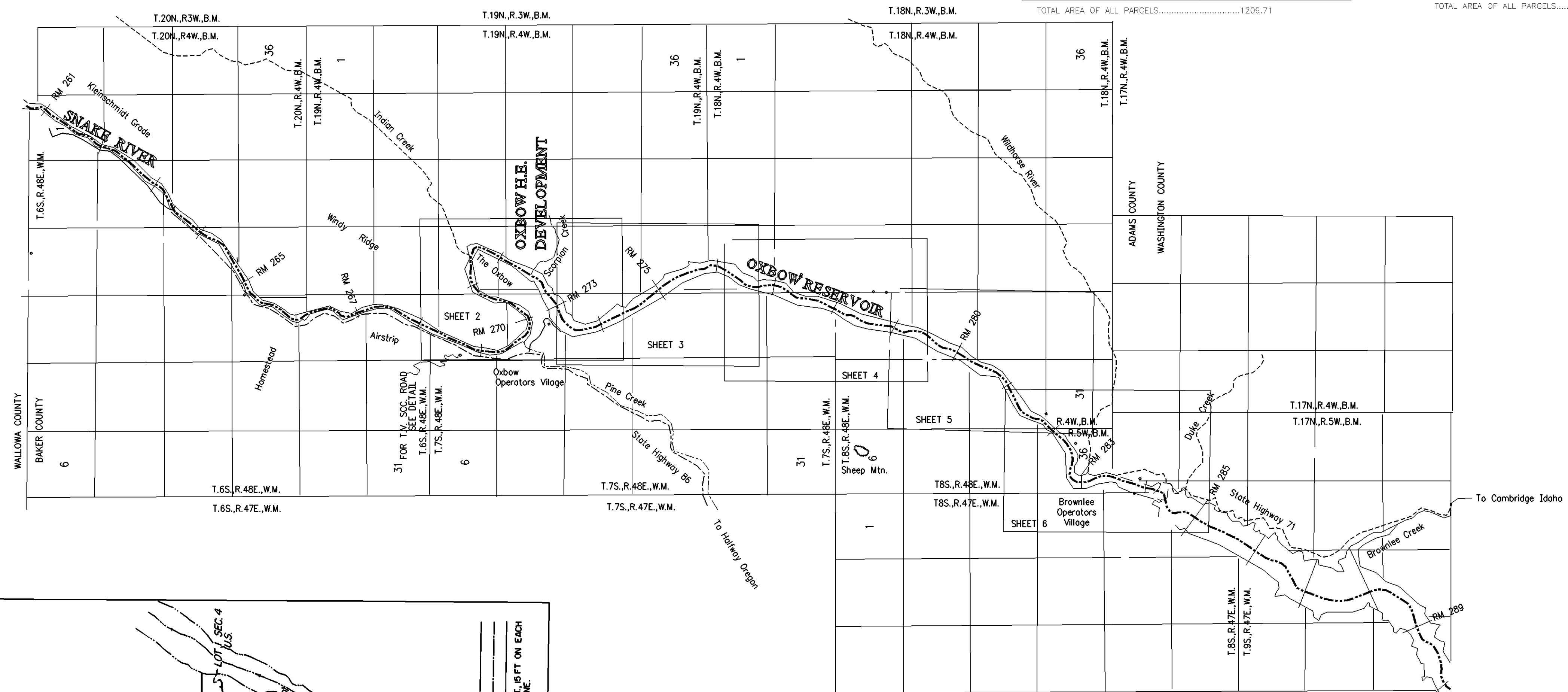
REVISION

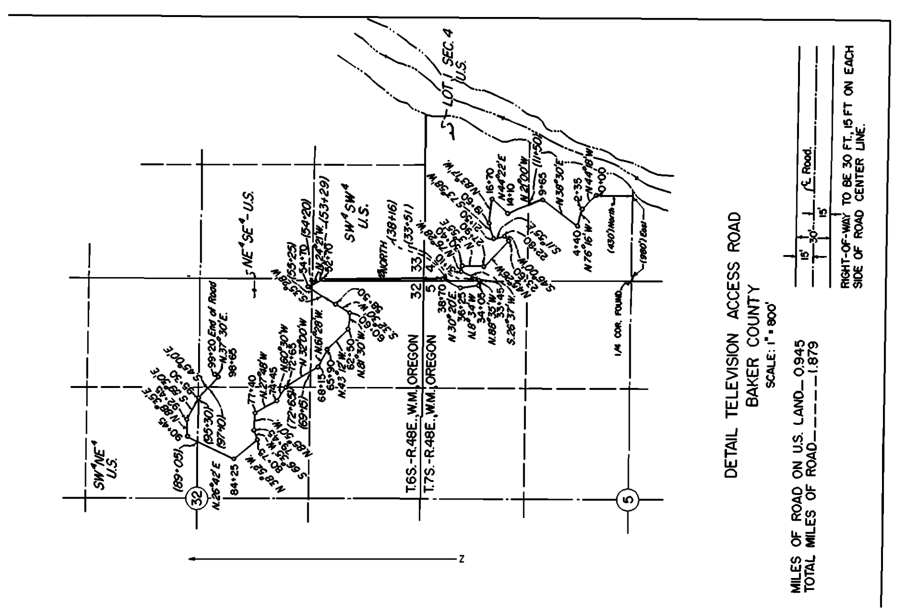
PARCEL of LAND W.M., OREGON	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	U.S.	PSR
T.7S., R.48E.			
SEC 3	135.85		
4	10.48		
8	80.00		
9	318.90		
10	110.68		
16	160.85		
21	1.27	0.11	20.40
22			40.57
27			39.17
28			1.71
33	28.23		31.77
34			1.35
T.8S., R.48E.			
SEC 4			56.63
8			11.34
9			46.81
17	41.71	16.47	9.84
19	11.63	10.25	20.89
20			2.80
TOTALS	899.60	26.83	283.28

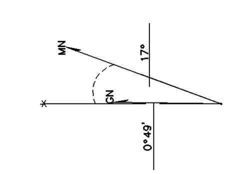
TOTAL AREA OF ALL PARCELS..............................1209.71

PARCEL of LAND B.M., IDAHO	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	U.S.	PSR
T.19N., R.4W.			
SEC 16	22.23		
17	89.44		
20	45.16	21.91	
21	59.70	37.56	
29	19.82	27.29	
32		1.99	
33	33.29		
T.18N.,R.4W.			
SEC 4	47.47	4.57	
8		20.72	
9		13.97	
17		35.99	
19		0.39	
20		23.63	
30		14.32	14.57
31		3.23	
T.18N., R.5W.			
SEC 36	29.61		
TOTALS	346.72	205.57	14.57

TOTAL AREA OF ALL PARCELS..............................566.86







MAGNETIC NORTH DECLINATION

SCALE IN THOUSAND FEET

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY (METES & BOUNDS)
- MAXIMUM WATER LEVEL ELEV 1805 AT DAM (CREST OF OVERFLOW DAM)
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
OXBOW PROJECT
PROJECT LANDS

OXBOW H.E. DEVELOPMENT
KEY MAP

IDAHO POWER COMPANY
BOISE, IDAHO

SEPT. 2002 | SHEET 1 OF 6 | E-54829

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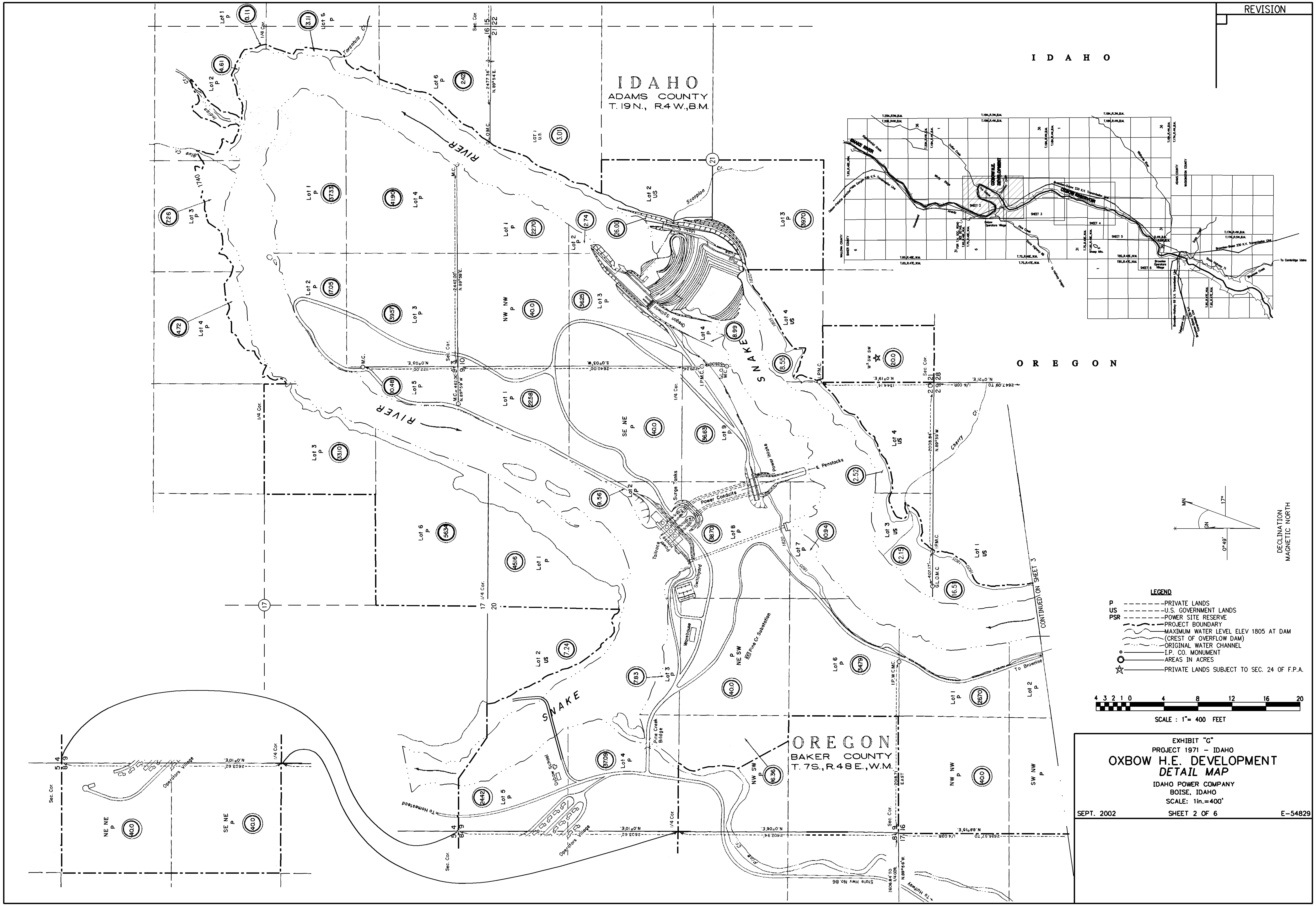
REVISION
IDAHO
IDAHO
ADAMS COUNTY
T. 19 N., R. 4 W., B.M.
OREGON
OREGON
BAKER COUNTY
T. 7 S., R. 48 E., W.M.
SNAKE RIVER
CONTINUED ON SHEET 3
DECLINATION MAGNETIC NORTH
LEGEND
P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1805 AT DAM (CREST OF OVERFLOW DAM)
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
SCALE : 1" = 400 FEET
EXHIBIT "G"
PROJECT 1971 - IDAHO
OXBOW H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 2 OF 6
E-54829

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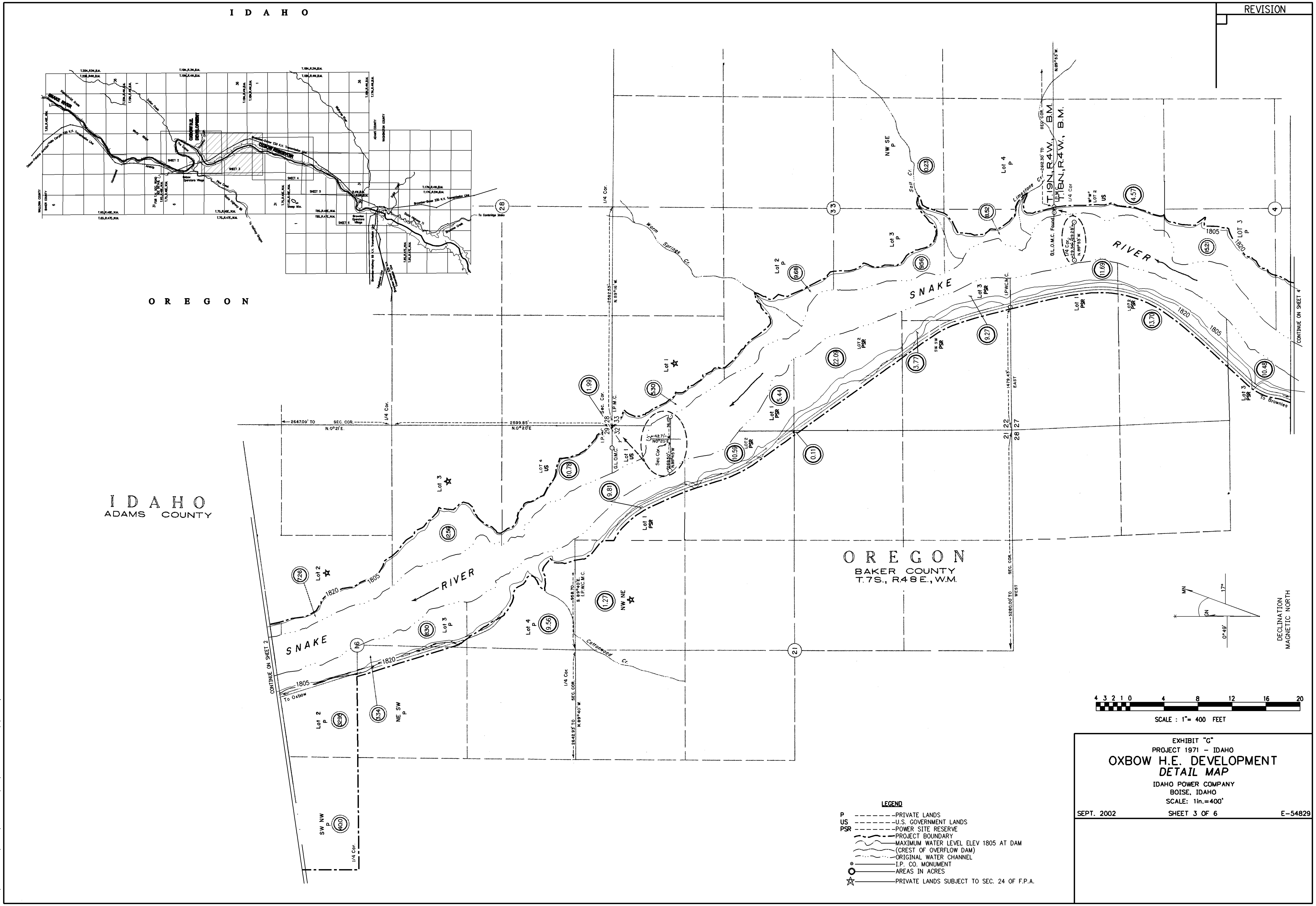

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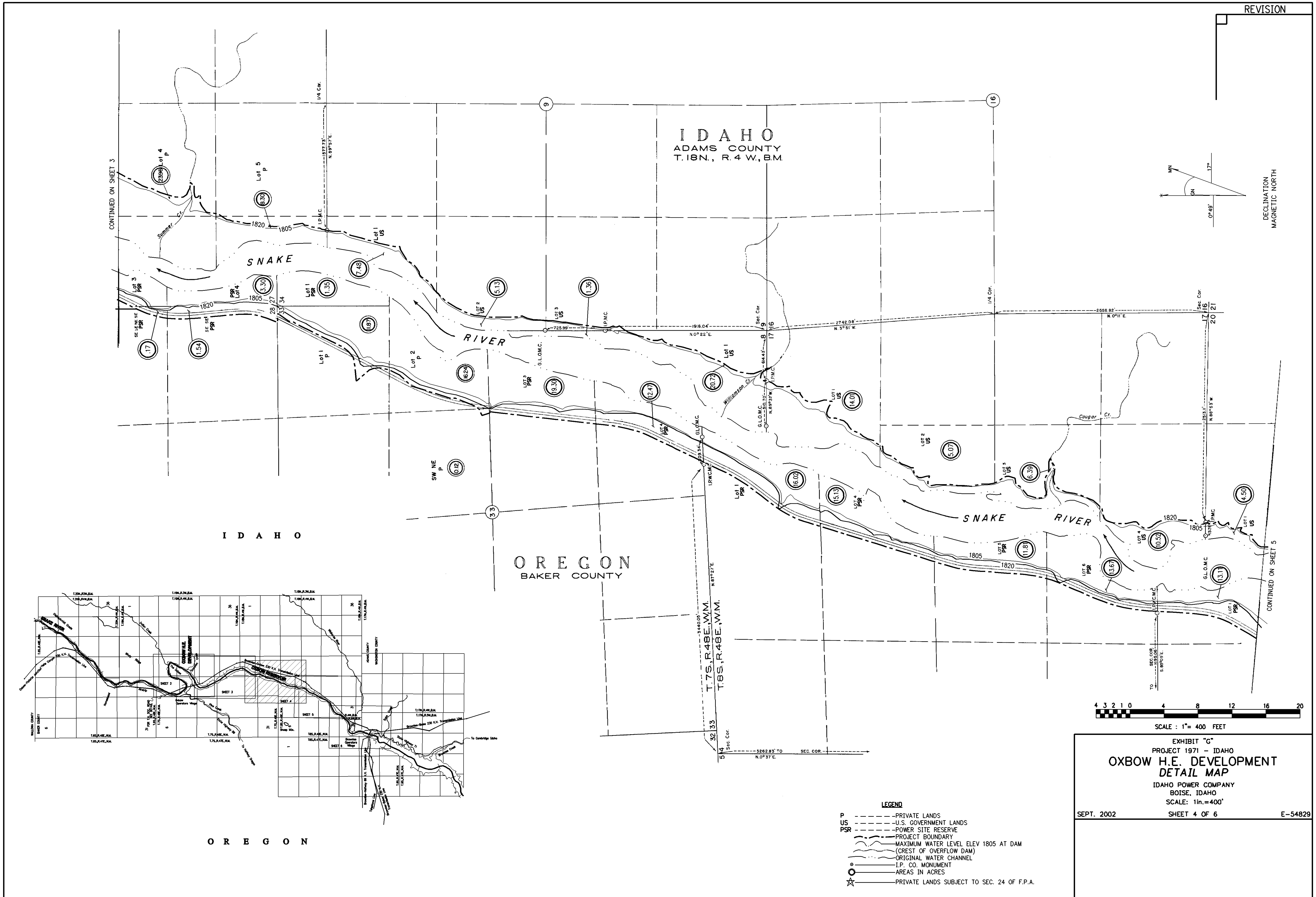

EXHIBIT "G"
PROJECT 1971 – IDAHO

OXBOW H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 — SHEET 4 OF 6 — E-54829

LEGEND

- P — PRIVATE LANDS
- US — U.S. GOVERNMENT LANDS
- PSR — POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 1805 AT DAM (CREST OF OVERFLOW DAM)
- ORIGINAL WATER CHANNEL
- I.P. CO. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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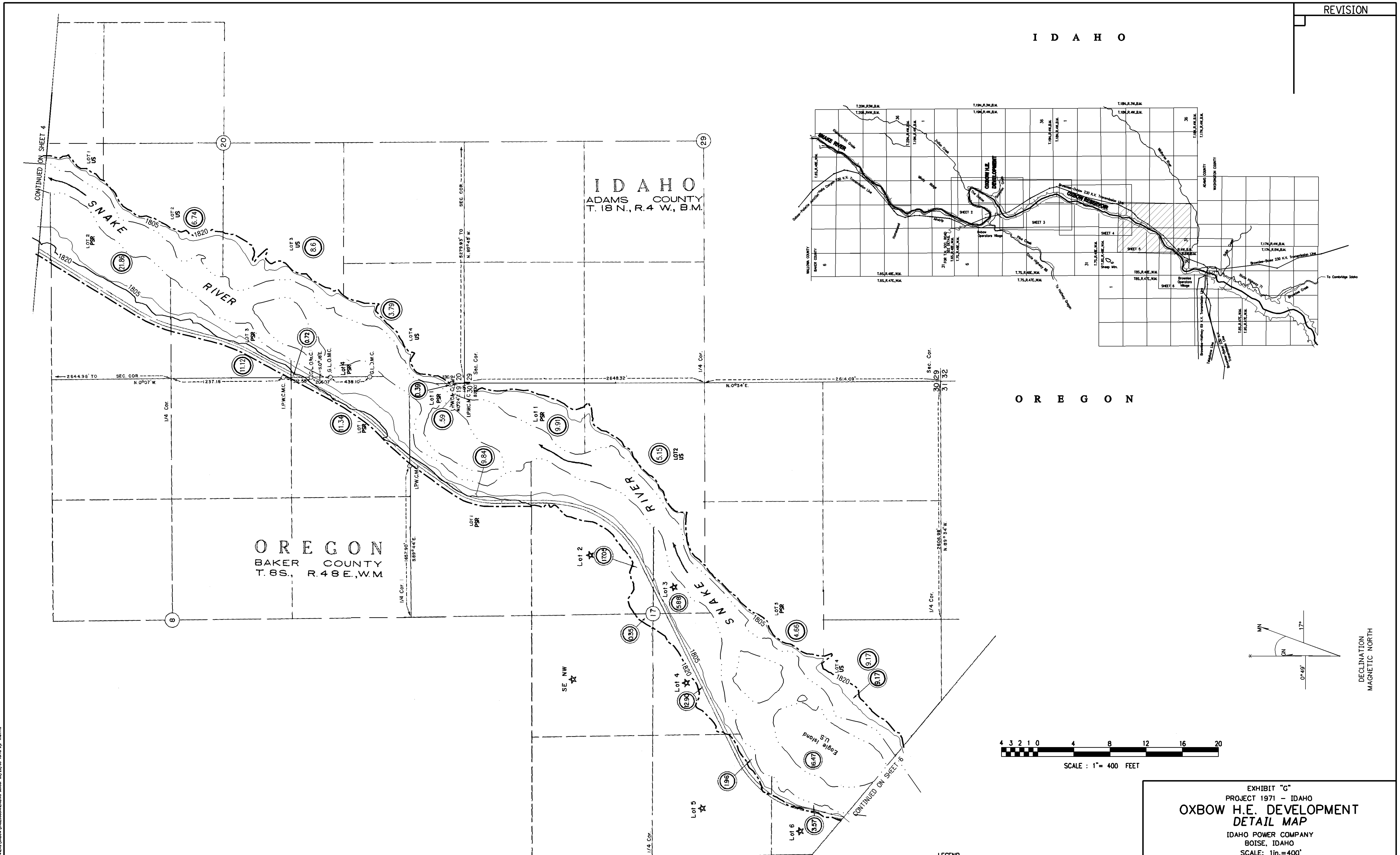

LEGEND

P ---------PRIVATE LANDS
US ---------U.S. GOVERNMENT LANDS
PSR ---------POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1805 AT DAM
(CREST OF OVERFLOW DAM)
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 – IDAHO

OXBOW H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002	SHEET 5 OF 6	E-54829

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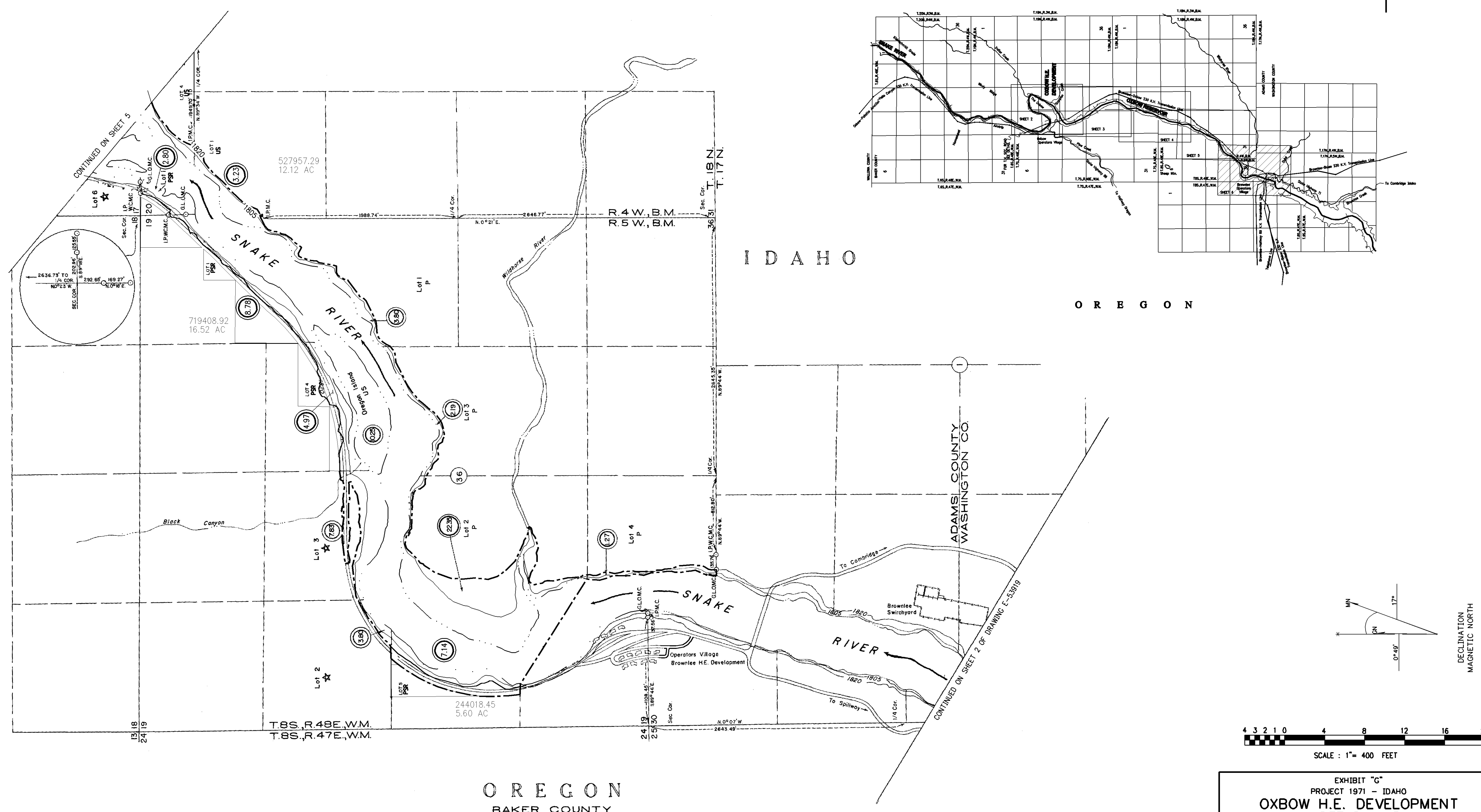
REVISION



LEGEND

P - - - - - - PRIVATE LANDS
US - - - - - - U.S. GOVERNMENT LANDS
PSR - - - - - - POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1805 AT DAM
(CREST OF OVERFLOW DAM)
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 – IDAHO
OXBOW H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002	SHEET 6 OF 6	E-54829

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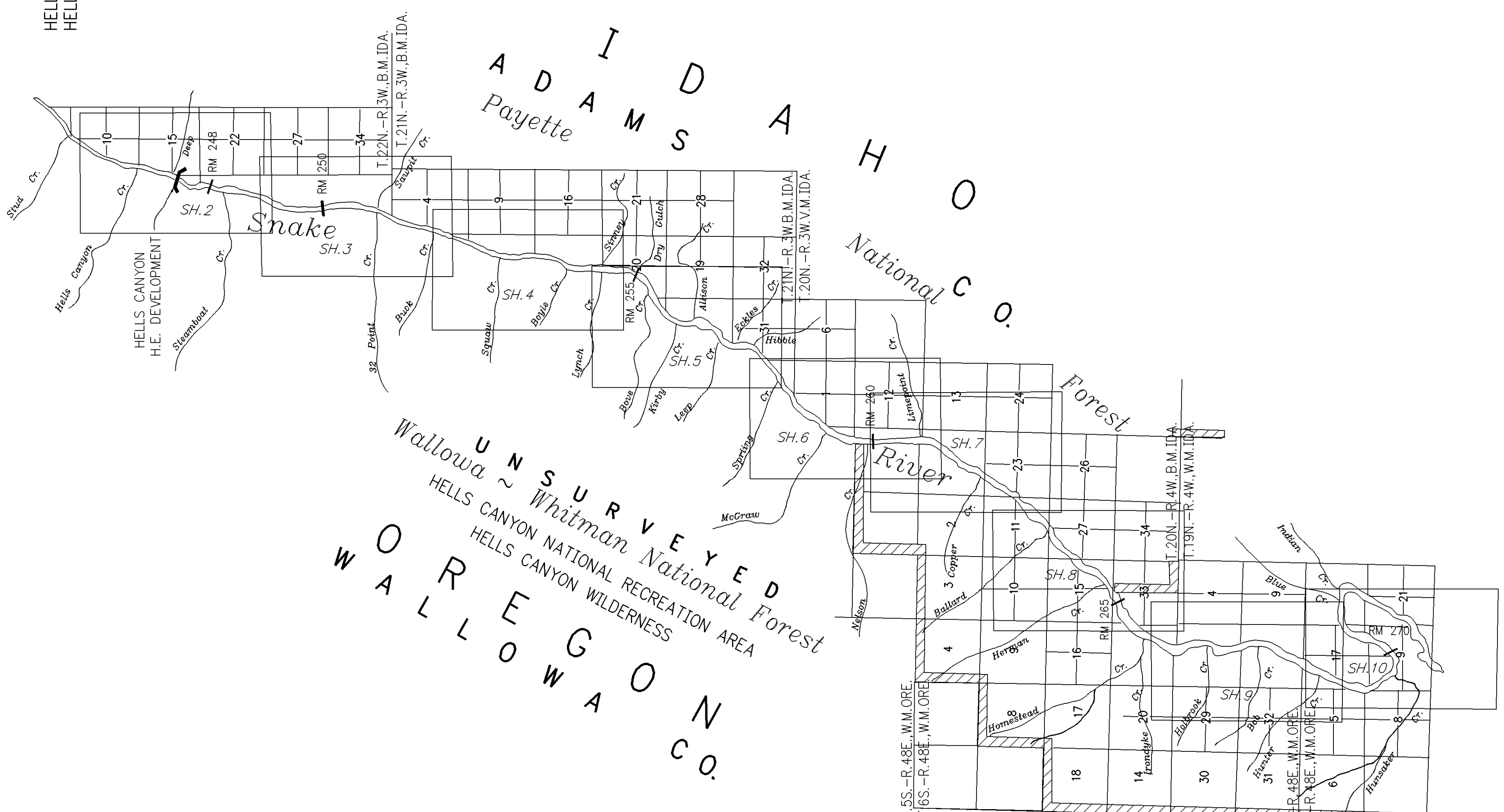
PARCEL OF LAND B.M. OREGON	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	US	PSR
UNSURVEYED	91.27		449.51
T.6 S., R.48 E.			
SEC 1	17.59		26.95
11	49.98		1.89
12			4.42
14			6.20
15	17.48		7.97
21	40.06		0.96
22			2.66
28	34.74		12.06
33	29.19		7.56
T.7 S., R.48 E.			
SEC. 4	34.78		2.57
TOTALS	315.09		522.75

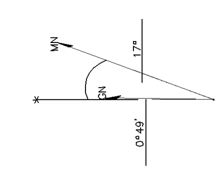
TOTAL AREA OF ALL PARCELS 837.84

PARCEL OF LAND B.M. IDAHO	AREA BETWEEN ORIGINAL RIVER CHANNEL AND PROJECT BOUNDARY IN ACRES		
	PRIVATE	US	PSR
T.22 N., R.3 W.			
SEC 15			20.43
16			10.58
21			54.45
28			46.84
33			57.46
T.21 N., R.3 W.			
SEC. 4			85.49
5			1.64
8			94.19
9			10.62
17	1.06	1.02	74.68
19	0.16		
20	39.41		41.32
29	50.52		2.41
30	144.54		
31	33.46		27.74
T.21 N., R.4 W.			
SEC. 36			20.59
T.20 N., R.4 W.			
SEC. 1			26.66
2			11.10
11			46.98
12			0.15
14	24.53		22.87
22	5.02		15.57
23	20.15		8.66
27	54.07		0.77
28			15.76
32			28.05
33			23.58
T.19 N., R.4 W.			
SEC. 5		28.86	
8	0.72	35.11	
17		47.26	
TOTALS	373.64	112.25	748.59

TOTAL AREA OF ALL PARCELS 1234.48

REVISION





MAGNETIC NORTH DECLINATION

SCALE IN MILES

LEGEND

P ---------PRIVATE LANDS
US ---------U.S. GOVERNMENT LANDS
PSR---------POWER SITE RESERVE
---PROJECT BOUNDARY (METES & BOUNDS) (CREST OF OVERFLOW DAM)
---ORIGINAL WATER CHANNEL
---I.P. CO. MONUMENT
---AREAS IN ACRES
---PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT G
HELLS CANYON PROJECT
PROJECT LANDS

HELLS CANYON H.E. DEVELPOMENT KEY MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: AS SHOWN

SEPT. 2002 | SHEET 1 OF 10 | E-54830

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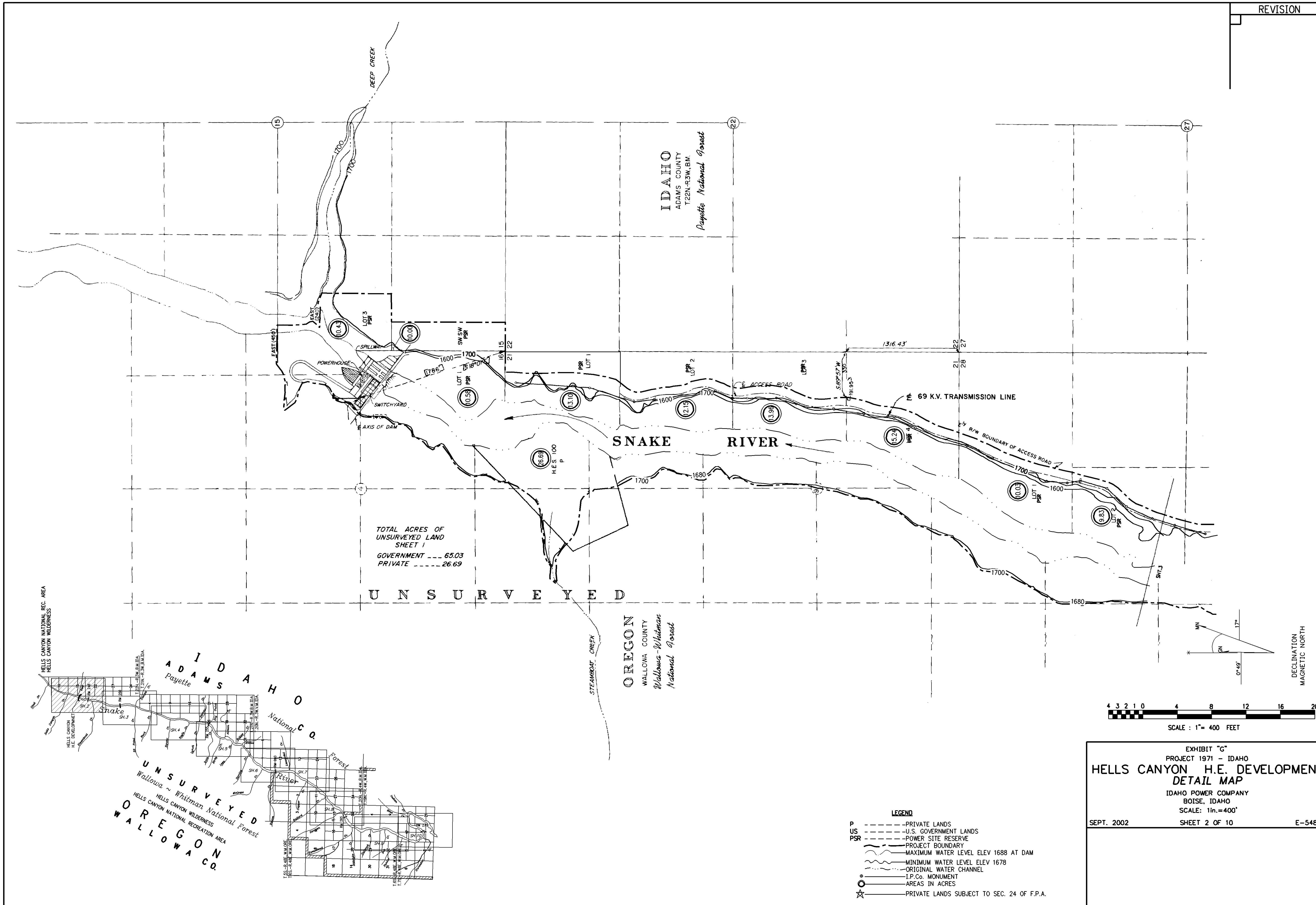

LEGEND

P	PRIVATE LANDS
US	U.S. GOVERNMENT LANDS
PSR	POWER SITE RESERVE
	PROJECT BOUNDARY
	MAXIMUM WATER LEVEL ELEV 1688 AT DAM
	MINIMUM WATER LEVEL ELEV 1678
	ORIGINAL WATER CHANNEL
	I.P.Co. MONUMENT
	AREAS IN ACRES
	PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 – IDAHO
HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002 SHEET 2 OF 10 E-54830

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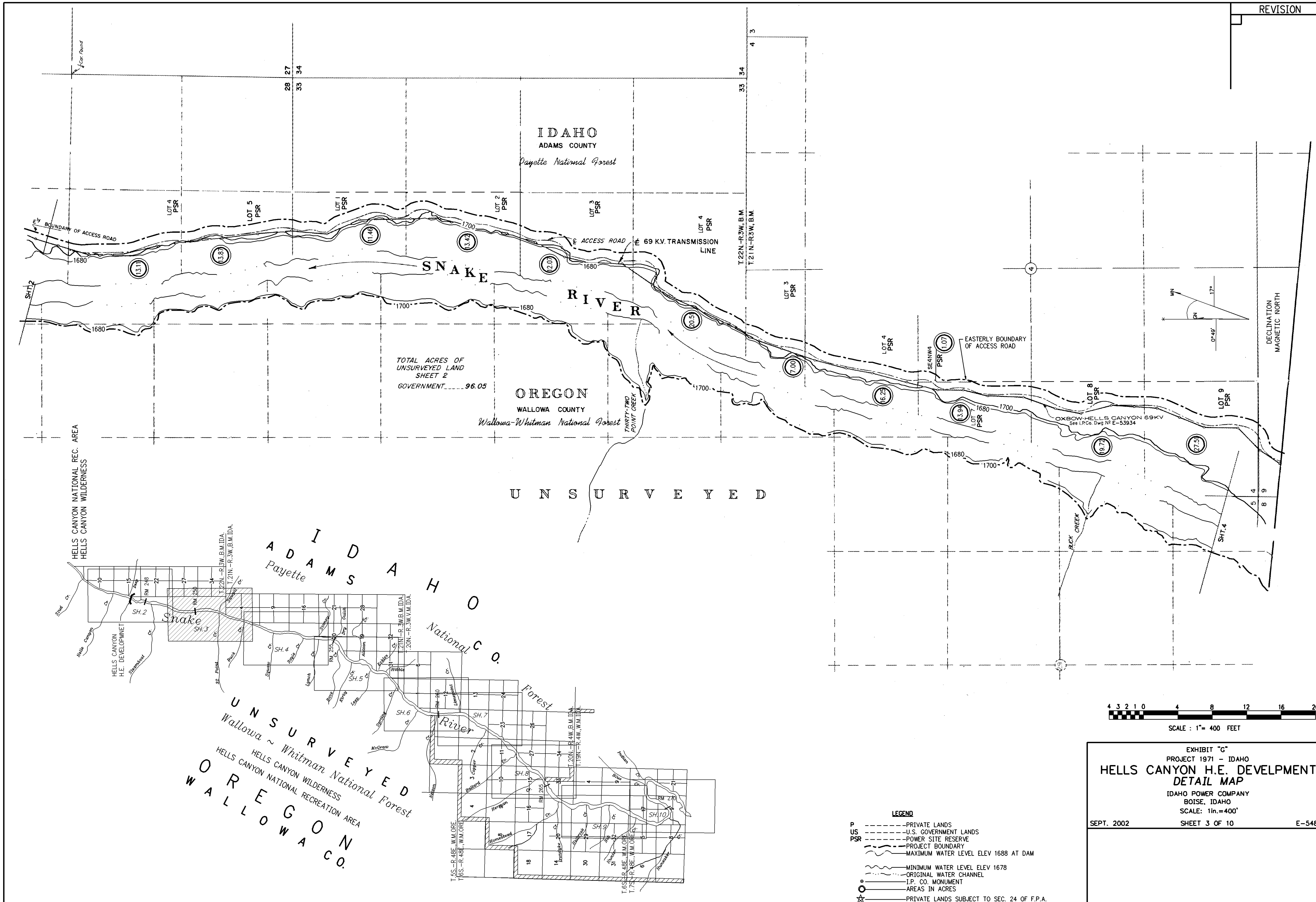

SCALE : 1"= 400 FEET

LEGEND

P --------PRIVATE LANDS
US --------U.S. GOVERNMENT LANDS
PSR --------POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1688 AT DAM
MINIMUM WATER LEVEL ELEV 1678
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 - IDAHO

HELLS CANYON H.E. DEVELPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 3 OF 10 | E-54830

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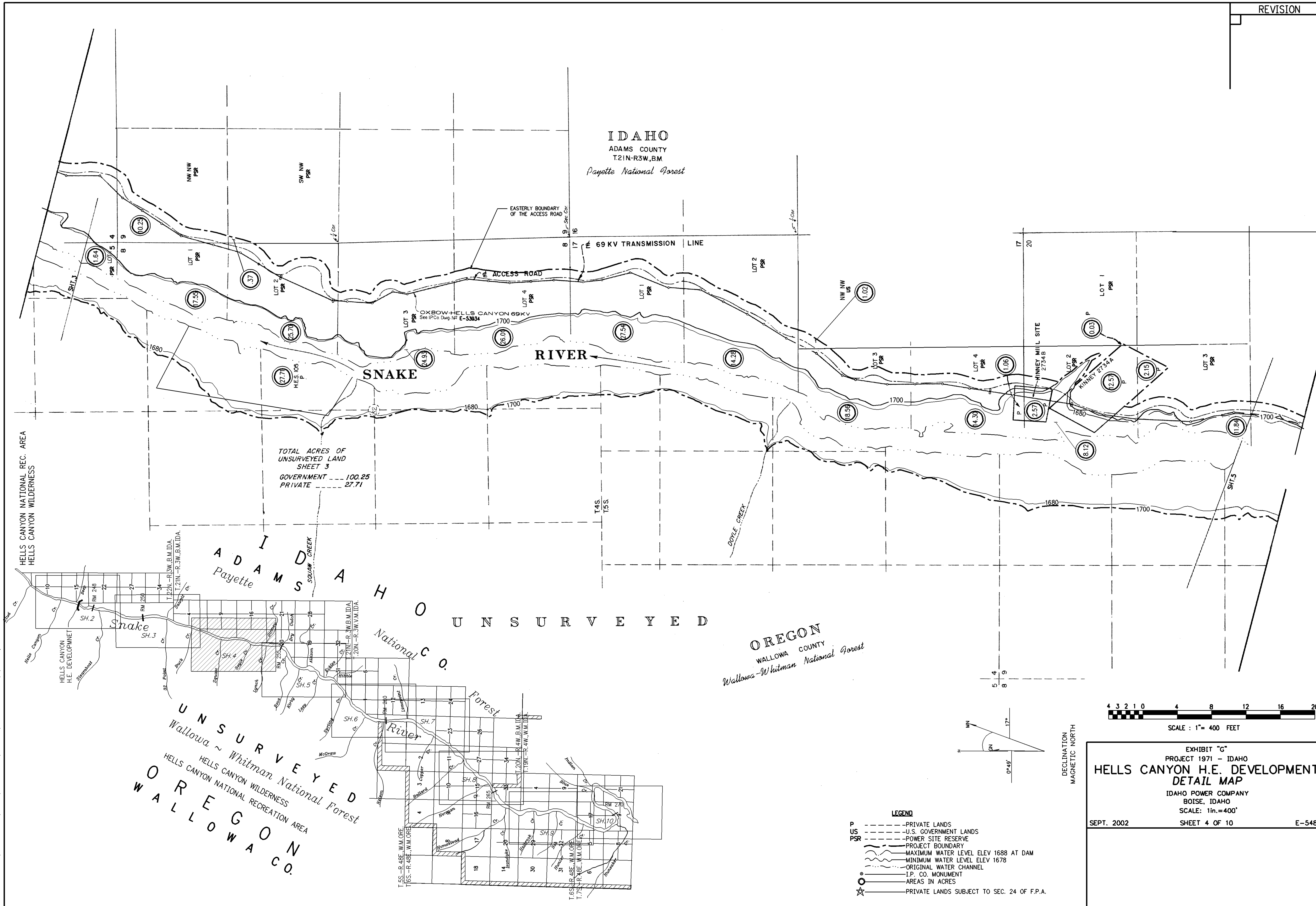

EXHIBIT "G"
PROJECT 1971 – IDAHO
HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 4 OF 10 | E-54830

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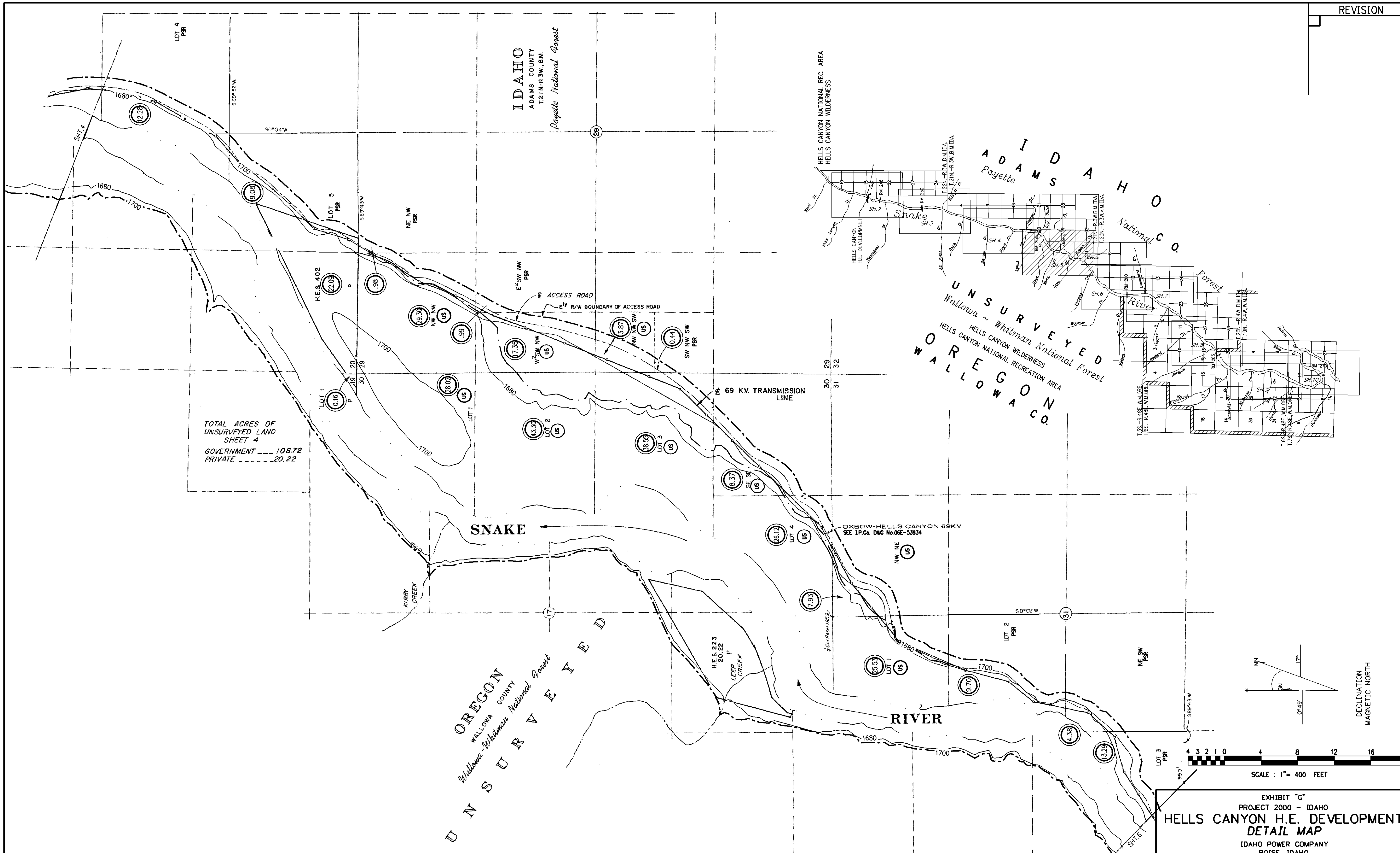

EXHIBIT "G"
PROJECT 2000 - IDAHO
HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 5 OF 10 | E-54830

LEGEND

- P -------- PRIVATE LANDS
- US -------- U.S. GOVERNMENT LANDS
- PSR -------- POWER SITE RESERVE
- PROJECT BOUNDARY
- MAXIMUM WATER LEVEL ELEV 1688 AT DAM
- MINIMUM WATER LEVEL ELEV 1678
- ORIGINAL WATER CHANNEL
- I.P.Co. MONUMENT
- AREAS IN ACRES
- PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
- US GOVERMENT LANDS SUBJECT TO PRIOR PRIVATE EASEMENT

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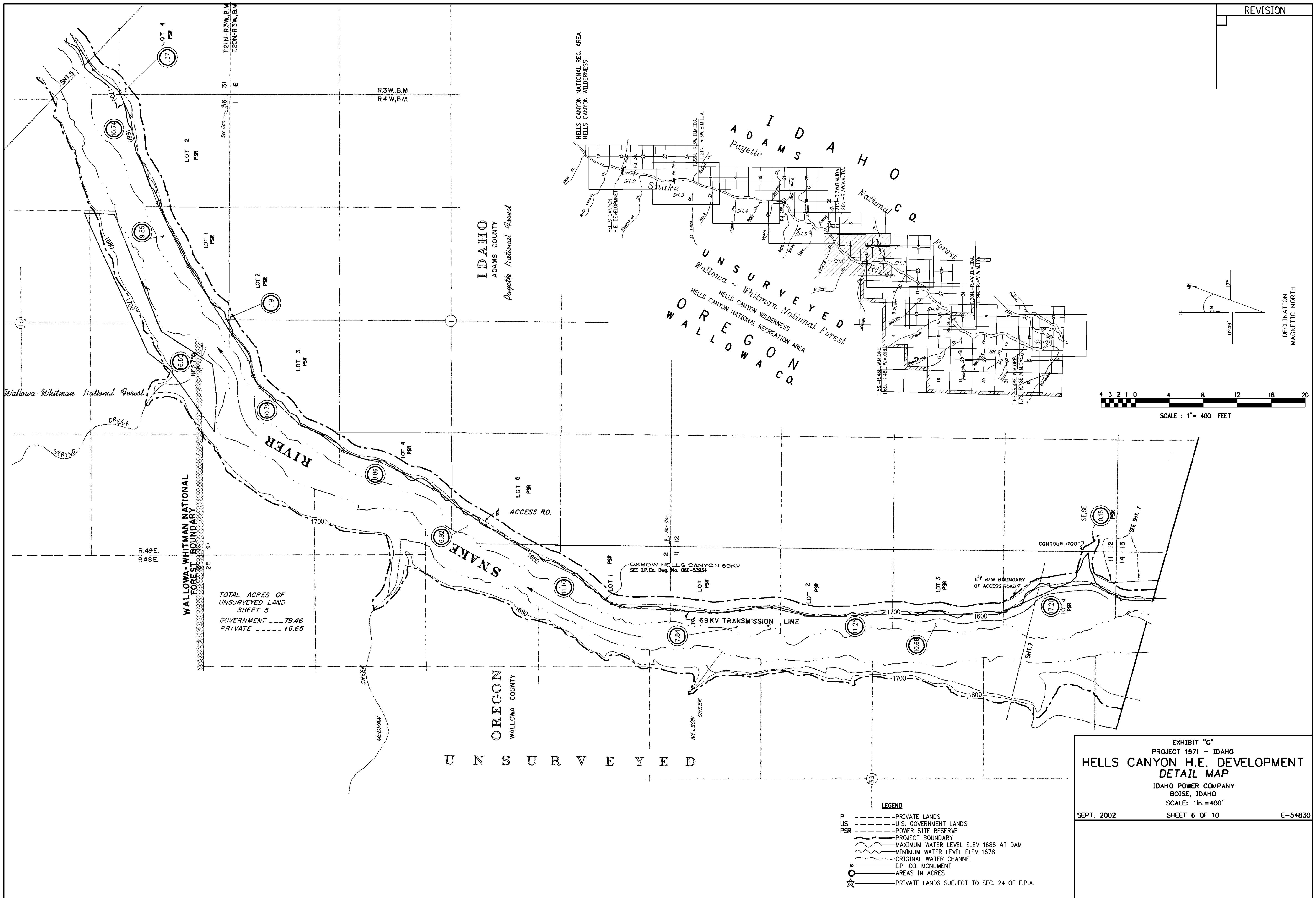

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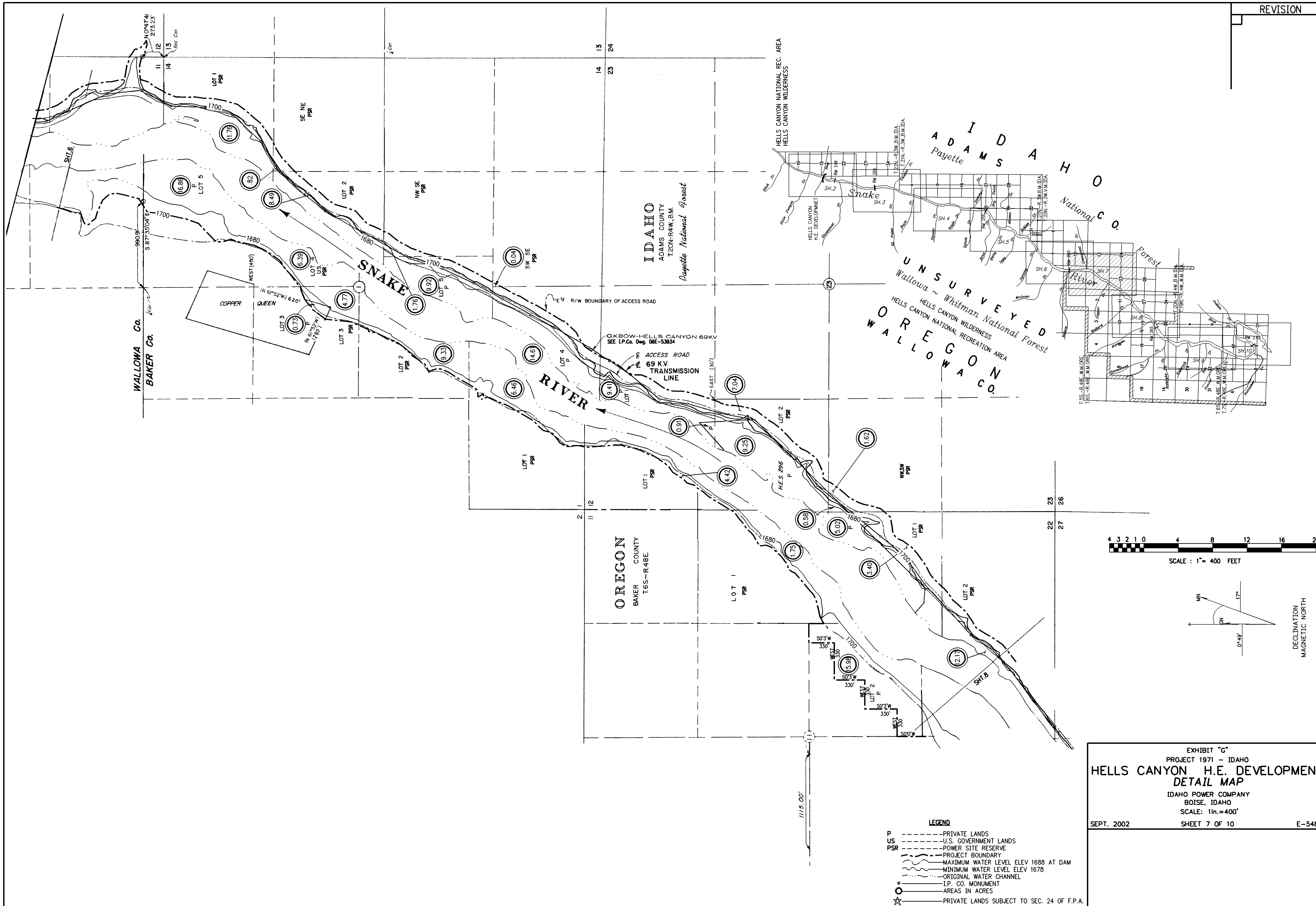

EXHIBIT "G"
PROJECT 1971 - IDAHO

HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP

IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 SHEET 7 OF 10 E-54830

LEGEND

P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1688 AT DAM
MINIMUM WATER LEVEL ELEV 1678
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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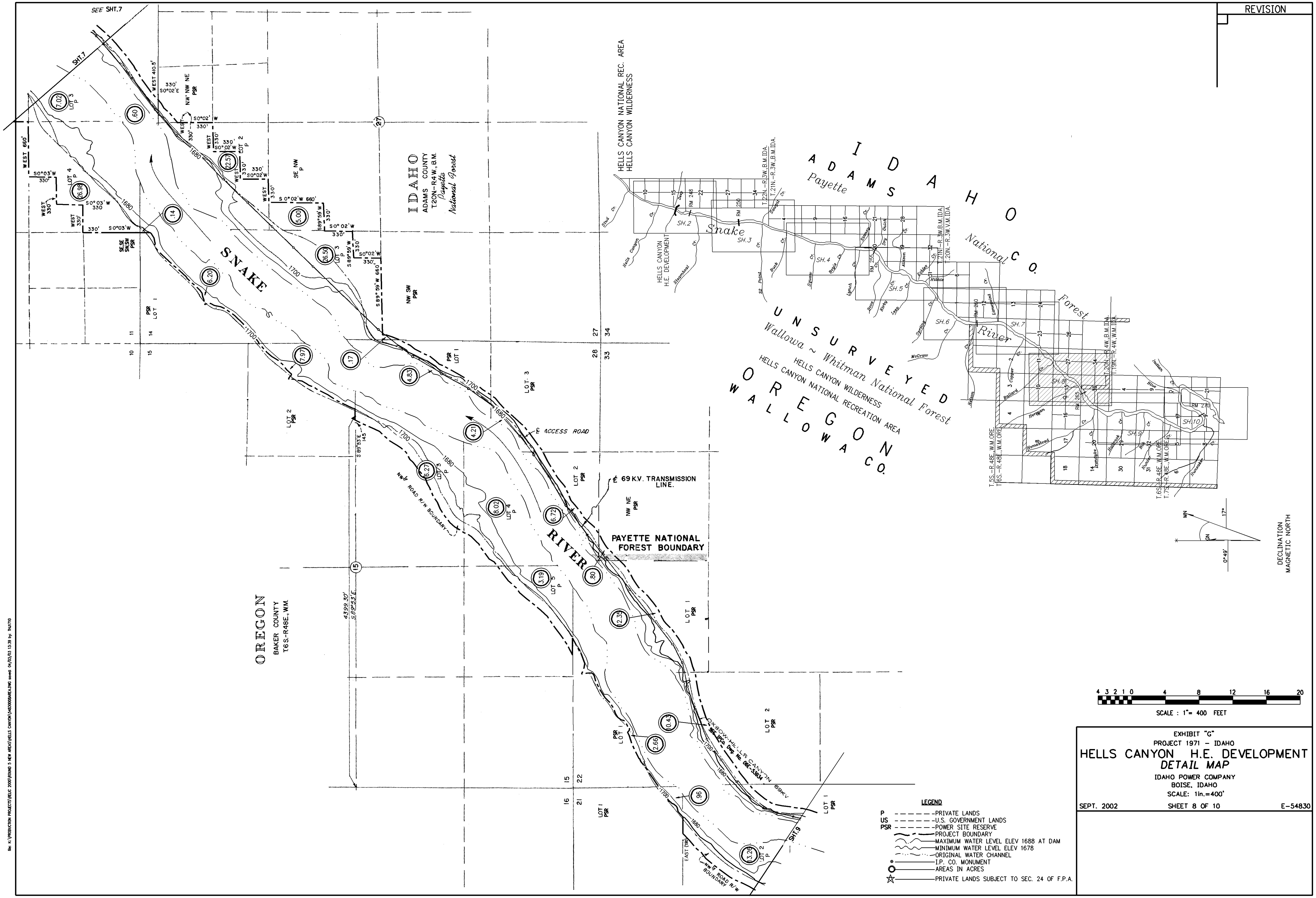
REVISION
SEE SHT.7
SNAKE
RIVER
IDAHO
ADAMS COUNTY
T.20N-R4W, B.M.
Payette National Forest
OREGON
BAKER COUNTY
T6S-R48E, W.M.
℄ ACCESS ROAD
℄ 69 K.V. TRANSMISSION LINE.
PAYETTE NATIONAL FOREST BOUNDARY
HELLS CANYON NATIONAL REC. AREA
HELLS CANYON WILDERNESS
IDAHO
ADAMS CO.
Payette National Forest
UNSURVEYED
Wallowa ~ Whitman National Forest
HELLS CANYON WILDERNESS
HELLS CANYON NATIONAL RECREATION AREA
OREGON
WALLOWA CO.
DECLINATION
MAGNETIC NORTH
SCALE : 1"= 400 FEET
EXHIBIT "G"
PROJECT 1971 – IDAHO
HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 8 OF 10
E-54830
LEGEND
P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1688 AT DAM
MINIMUM WATER LEVEL ELEV 1678
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

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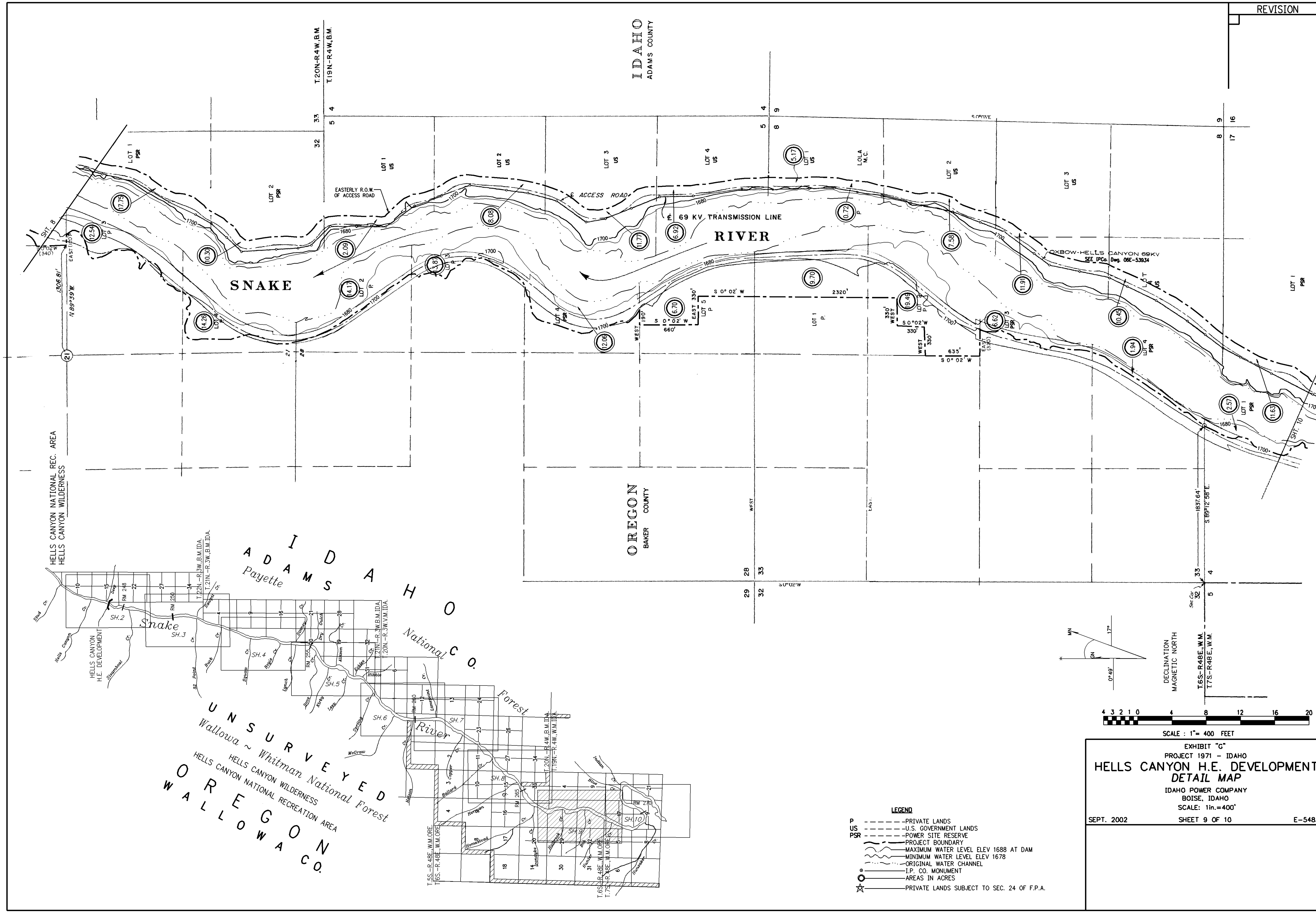
REVISION
IDAHO
ADAMS COUNTY
T.20N-R4W.B.M.
T.19N-R4W.B.M.
SNAKE
RIVER
69 KV TRANSMISSION LINE
ACCESS ROAD
EASTERLY R.O.W. OF ACCESS ROAD
OXBOW-HELLS CANYON 69KV
SEE IPCo. Dwg. 06E-53934
OREGON
BAKER COUNTY
HELLS CANYON NATIONAL REC. AREA
HELLS CANYON WILDERNESS
T.6S-R48E.W.M.
T.7S-R48E.W.M.
DECLINATION
MAGNETIC NORTH
SCALE : 1"= 400 FEET
EXHIBIT "G"
PROJECT 1971 - IDAHO
HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'
SEPT. 2002
SHEET 9 OF 10
E-54830
LEGEND
P — PRIVATE LANDS
US — U.S. GOVERNMENT LANDS
PSR — POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1688 AT DAM
MINIMUM WATER LEVEL ELEV 1678
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.
IDAHO
ADAMS CO.
Payette National Forest
UNSURVEYED
Wallowa ~ Whitman National Forest
HELLS CANYON WILDERNESS
HELLS CANYON NATIONAL RECREATION AREA
OREGON
WALLOWA CO.
HELLS CANYON H.E. DEVELOPMENT
Snake River

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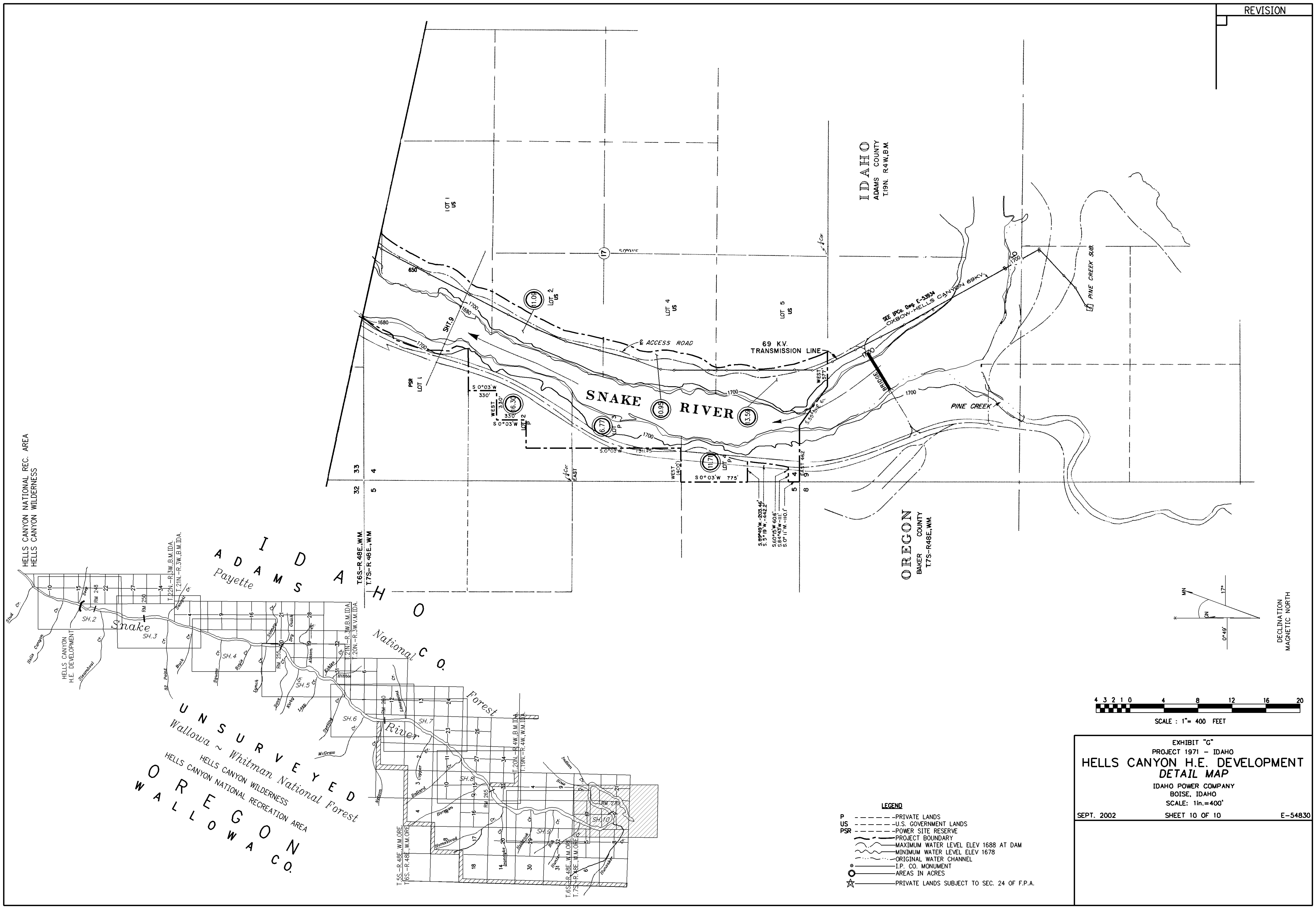

SCALE : 1"= 400 FEET

LEGEND

P ------PRIVATE LANDS
US ------U.S. GOVERNMENT LANDS
PSR ------POWER SITE RESERVE
PROJECT BOUNDARY
MAXIMUM WATER LEVEL ELEV 1688 AT DAM
MINIMUM WATER LEVEL ELEV 1678
ORIGINAL WATER CHANNEL
I.P. CO. MONUMENT
AREAS IN ACRES
PRIVATE LANDS SUBJECT TO SEC. 24 OF F.P.A.

EXHIBIT "G"
PROJECT 1971 – IDAHO
HELLS CANYON H.E. DEVELOPMENT
DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SCALE: 1in.=400'

SEPT. 2002 | SHEET 10 OF 10 | E-54830

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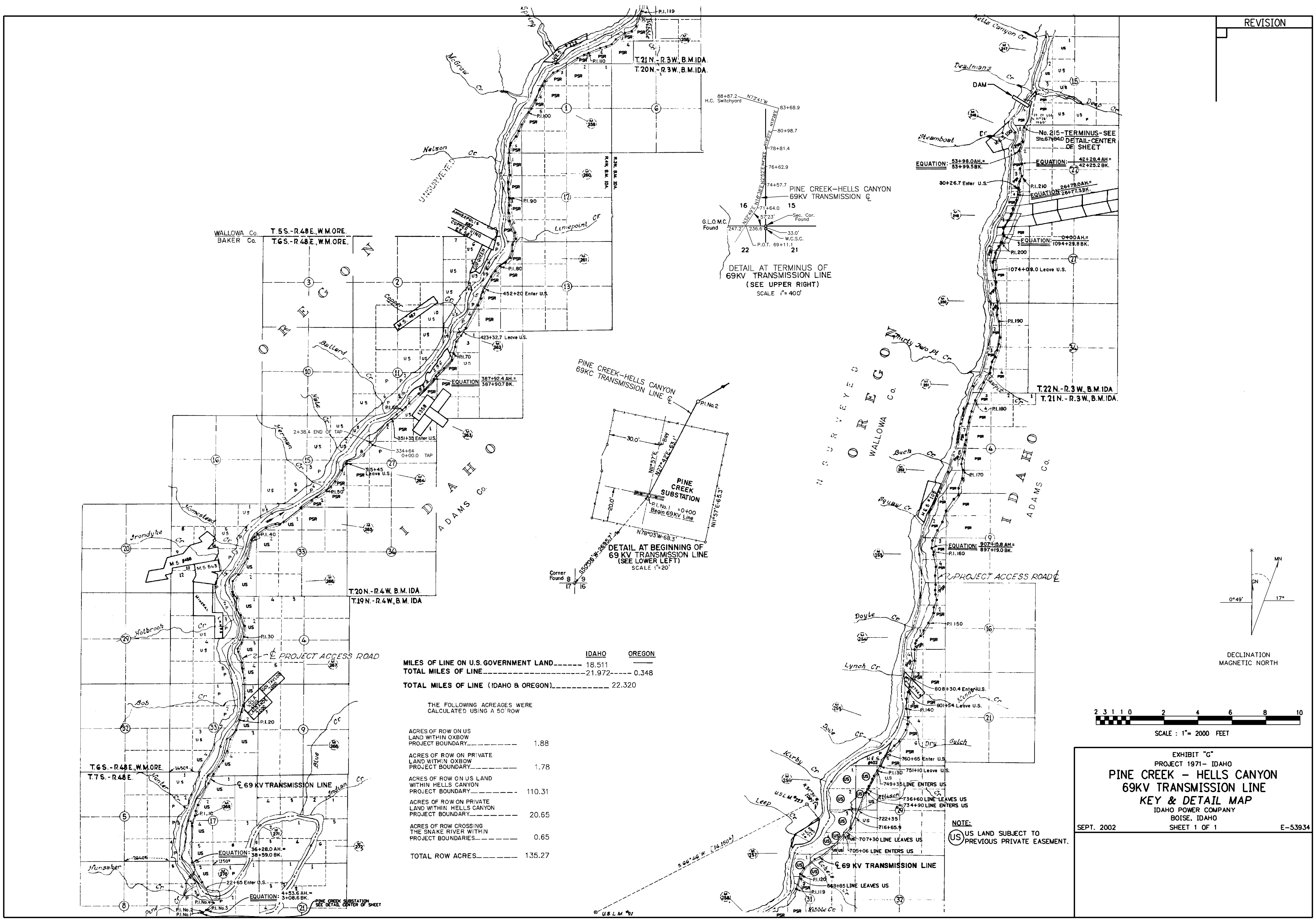
REVISION
T.5S.-R.48E.,W.M.ORE.
T.6S.-R.48E.,W.M.ORE.
WALLOWA Co.
BAKER Co.
T.21N.-R.3W.,B.M.IDA.
T.20N.-R.3W.,B.M.IDA.
T.20N.-R.4W.,B.M.IDA.
T.19N.-R.4W.,B.M.IDA.
T.6S.-R.48E.,W.M.ORE.
T.7S.-R.48E.
T.22N.-R.3W.,B.M.IDA.
T.21N.-R.3W.,B.M.IDA.
OREGON
IDAHO
ADAMS Co.
WALLOWA Co.
UNSURVEYED
℄ PROJECT ACCESS ROAD
℄ 69 KV TRANSMISSION LINE
PINE CREEK SUBSTATION SEE DETAIL CENTER OF SHEET
No. 2/5-TERMINUS-SEE DETAIL-CENTER OF SHEET
PINE CREEK-HELLS CANYON 69KV TRANSMISSION ℄
DETAIL AT TERMINUS OF 69KV TRANSMISSION LINE
(SEE UPPER RIGHT)
SCALE 1"=400'
PINE CREEK-HELLS CANYON 69KC TRANSMISSION LINE ℄
PINE CREEK SUBSTATION
DETAIL AT BEGINNING OF 69 KV TRANSMISSION LINE
(SEE LOWER LEFT)
SCALE 1"=20'
MILES OF LINE ON U.S.GOVERNMENT LAND — IDAHO 18.511 — OREGON —
TOTAL MILES OF LINE — IDAHO 21.972 — OREGON 0.348
TOTAL MILES OF LINE (IDAHO & OREGON) 22.320
THE FOLLOWING ACREAGES WERE CALCULATED USING A 50' ROW
ACRES OF ROW ON US LAND WITHIN OXBOW PROJECT BOUNDARY 1.88
ACRES OF ROW ON PRIVATE LAND WITHIN OXBOW PROJECT BOUNDARY 1.78
ACRES OF ROW ON US LAND WITHIN HELLS CANYON PROJECT BOUNDARY 110.31
ACRES OF ROW ON PRIVATE LAND WITHIN HELLS CANYON PROJECT BOUNDARY 20.65
ACRES OF ROW CROSSING THE SNAKE RIVER WITHIN PROJECT BOUNDARIES 0.65
TOTAL ROW ACRES 135.27
NOTE:
(US) US LAND SUBJECT TO PREVIOUS PRIVATE EASEMENT.
DECLINATION MAGNETIC NORTH
SCALE : 1"= 2000 FEET
EXHIBIT "G"
PROJECT 1971- IDAHO
PINE CREEK - HELLS CANYON
69KV TRANSMISSION LINE
KEY & DETAIL MAP
IDAHO POWER COMPANY
BOISE, IDAHO
SEPT. 2002
SHEET 1 OF 1
E-53934

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Hells Canyon Complex
FERC No. 1971
License Application

Exhibit H
General Information

The *Code of Federal Regulations* below—18 CFR § 16.10—specifies the content of this chapter and the scope and nature of the research from which it was compiled.

§16.10 Information to be provided by an applicant for new license.

(a) Information to be supplied by all applicants. All applicants for a new license under this part must file the following information with the Commission:

(1) A discussion of the plans and ability of the applicant to operate and maintain the project in a manner most likely to provide efficient and reliable electric service, including efforts and plans to:

(i) Increase capacity or generation at the project:

(ii) Coordinate the operation of the project with any upstream or downstream water resource projects; and

(iii) Coordinate the operation of the project with the applicant s or other electrical systems to minimize the cost of production.

(2) A discussion of the need of the applicant over the short and long term for the electricity generated by the project, including:

(i) The reasonable costs and reasonable availability of alternative sources of power that would be needed by the applicant or its customers, including wholesale customers, if the applicant is not granted a license for the project;

(ii) A discussion of the increase in fuel, capital, and any other costs that would be incurred by the applicant or its customers to purchase or generate power necessary to replace the output of the licensed project, if the applicant is not granted a license for the project;

(iii) The effect of each alternative source of power on:

(A) The applicant's customers, including wholesale customers;

(B) The applicant's operating and load characteristics; and

(C) The communities served or to be served, including any reallocation of costs associated with the transfer of a license from the existing licensee.

(3) The following data showing need and the reasonable cost and availability of alternative sources of power:

(i) The average annual cost of the power produced by the project, including the basis for that calculation;

(ii) The projected resources required by the applicant to meet the applicant's capacity and energy requirements over the short and long term including:

(A) Energy and capacity resources, including the contributions from the applicant's generation, purchases, and load modification measures (such as conservation, if considered as a resource), as separate components of the total resources required;

(B) A resource analysis, including a statement of system reserve margins to be maintained for energy and capacity; and

(C) If load management measures are not viewed as resources, the effects of such measures on the projected capacity and energy requirements indicated separately;

(iii) For alternative sources of power, including generation of additional power at existing facilities, restarting deactivated units, the purchase of power off-system, the construction or purchase and operation of a new power plant, and load management measures such as conservation:

(A) The total annual cost of each alternative source of power to replace project power;

(B) The basis for the determination of projected annual cost; and

(C) A discussion of the relative merits of each alternative, including the issues of the period of availability and dependability of purchased power, average life of alternatives, relative equivalent availability of generating alternatives, and relative impacts on the applicant's power system reliability and other system operating characteristics; and

(iv) The effect on the direct providers (and their immediate customers) of alternate sources of power.

(4) If an applicant uses power for its own industrial facility and related operations, the effect of obtaining or losing electricity from the project on the operation and efficiency of such facility or related operations, its workers, and the related community.

(5) If an applicant is an Indian tribe applying for a license for a project located on the tribal reservation, a statement of the need of such tribe for electricity generated by the project to foster the purposes of the reservation

(6) A comparison of the impact on the operations and planning of the applicant s transmission system of receiving or not receiving the project license, including;

(i) An analysis of the effects of any resulting redistribution of power flows on line loading (with respect to applicable thermal, voltage, or stability limits), line losses, and necessary new construction of transmission facilities or upgrading of existing facilities, together with the cost impact of these effects;

(ii) An analysis of the advantages that the applicant's transmission system would provide in the distribution of the project's power; and.

(iii) Detailed single-line diagrams, including existing system facilities identified by name and circuit number, that show system transmission elements in relation to the project and other principal interconnected system elements. Power flow and loss data that represent system operating conditions may be appended if applicants believe such data would be useful to show that the operating impacts described would be beneficial.

(7) If the applicant has plans to modify existing project facilities or operations, a statement of the need for, or usefulness of, the modifications, including at least a reconnaissance-level study of the effect and projected costs of the proposed plans and any alternate plans, which in conjunction with other developments in the area would conform with a comprehensive plan for improving or developing the waterway and for other beneficial public uses as defined in section 10(a)(1) of the Federal Power Act.

(8) If the applicant has no plans to modify existing project facilities or operations, at least a reconnaissance-level study to show that the project facilities or operations in conjunction with other developments in the area would conform with a comprehensive plan for improving or developing the waterway and for other beneficial public uses as defined in section 10(a)(1) of the Federal Power Act.

(9) A statement describing the applicant's financial and personnel resources to meet its obligations under a new license, including specific information to demonstrate that the applicant's personnel are adequate in number and training to operate and maintain the project in accordance with the provisions of the license.

(10) If an applicant proposes to expand the project to encompass additional lands, a statement that the applicant has notified, by certified mail, property owners on the additional lands to be encompassed by the project and governmental agencies and subdivisions likely to be interested in or affected by the proposed expansion.

(11) The applicant's electricity consumption efficiency improvement program, as defined under section 10(a)(2)(C) of the Federal Power Act, including:

(i) A statement of the applicant's record of encouraging or assisting its customers to conserve electricity and a description of its plans and capabilities for promoting electricity conservation by its customers; and

(ii) A statement describing the compliance of the applicant's energy conservation programs with any applicable regulatory requirements.

(12) The names and mailing addresses of every Indian tribe with land on which any part of the proposed project would be located or which the applicant reasonably believes would otherwise be affected by the proposed project.

(b) Information to be provided by an applicant who is an existing licensee. An existing licensee that applies for a new license must provide:

(1) The information specified in paragraph (a).

(2) A statement of measures taken or planned by the licensee to ensure safe management, operation, and maintenance of the project, including:

(i) A description of existing and planned operation of the project during flood conditions;

(ii) A discussion of any warning devices used to ensure downstream public safety;

(iii) A discussion of any proposed changes to the operation of the project or downstream development that might affect the existing Emergency Action Plan, as described in Subpart C of Part 12 of this chapter, on file with the Commission;

(iv) A description of existing and planned monitoring devices to detect structural movement or stress, seepage, uplift, equipment failure, or water conduit failure, including a description of the maintenance and monitoring programs used or planned in conjunction with the devices; and

(v) A discussion of the project's employee safety and public safety record, including the number of lost-time accidents involving employees and the record of injury or death to the public within the project boundary.

(3) A description of the current operation of the project, including any constraints that might affect the manner in which the project is operated.

(4) A discussion of the history of the project and record of programs to upgrade the operation and maintenance of the project.

(5) A summary of any generation lost at the project over the last five years because of unscheduled outages, including the cause, duration, and corrective action taken.

(6) A discussion of the licensee's record of compliance with the terms and conditions of the existing license, including a list of all incidents of noncompliance, their disposition, and any documentation relating to each incident.

(7) A discussion of any actions taken by the existing licensee related to the project which affect the public.

(8) A summary of the ownership and operating expenses that would be reduced if the project license were transferred from the existing licensee.

(9) A statement of annual fees paid under Part I of the Federal Power Act for the use of any Federal or Indian lands included within the project boundary.

H.1. Efficiency and Reliability

The Applicant has over 85 years of experience operating and maintaining hydroelectric resources and a history of providing efficient and reliable electricity at relatively low cost. The Applicant operates 17 hydroelectric facilities, totaling 1,707 megawatts (MW) of installed (nameplate) capacity. These facilities provide approximately two-thirds of the Applicant's total system generation under median water conditions. The Applicant intends to draw on this extensive experience in operating all of its hydroelectric facilities in the future. The Applicant has operated the Hells Canyon Complex (HCC)[1] efficiently and reliably since its construction and anticipates continuing to do so.

H.1.1. Plans for Increased Capacity or Generation

The Applicant does not propose to increase capacity or generation at the HCC. The Applicant may elect to request license amendments for project modifications to accommodate any new license conditions that may adversely affect project generation to restore or enhance generating efficiencies and economies of the complex.

H.1.2. Project Coordination with Other Water Resource Projects

The HCC is operated in coordination with several other water resource projects in the Columbia River basin for flood-control, navigation, environmental, and power-system benefits. In recent years, summer operations at the HCC have been coordinated with the federal Columbia River basin water resource projects to help the Federal Columbia River Power System (FCRPS) operators attempt to mitigate the effects of the federal lower Snake River dams on anadromous fish. Depending on whether economically equitable agreements are achieved, these coordinated "flow augmentation" operations may be resumed in the future. A copy of the Applicant's now-expired agreement with the FCRPS operators regarding flow augmentation is provided in Technical Report H.1-1.

Several existing license articles also require coordination. Pursuant to article 42, Brownlee Reservoir is operated in cooperation with the U.S. Army Corps of Engineers (ACOE) to provide flood control during spring runoff. In addition, pursuant to article 43, the HCC is operated to maintain minimum flows in the Snake River downstream of Hells Canyon in the interest of

1. The complex of three hydroelectric developments and the northernmost of these developments are both called the Hells Canyon Project. To avoid confusion, the Applicant refers to the entire complex (FERC No. 1971) as the Hells Canyon Complex and to the northernmost development as the Hells Canyon Project

navigation. And pursuant to articles 39 and 49 and regional power-system operating and coordinating agreements, the Applicant operates the HCC to coordinate with several other hydroelectric resources for the benefit of the regional, national, and continental electric power system.

The Applicant owns and operates nine other hydroelectric power plants on the Snake River upstream of the HCC: Swan Falls, C.J. Strike, Bliss, Lower Salmon Falls, Upper Salmon Falls, Twin Falls, Shoshone Falls, Milner, and American Falls. The Milner Power Plant is appurtenant to Milner Dam, which is owned by irrigation and canal entities. The American Falls Power Plant is appurtenant to American Falls Dam, financed and operated by the U.S. Bureau of Reclamation. In addition to the Applicant's power plants, four federal dams with hydroelectric power plants on the Snake River are located upstream of the HCC (Jackson Lake, Palisades, American Falls, and Minidoka). Four other federal dams and hydroelectric power plants are located on the Snake River downstream of the HCC (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor). Excluding three of the upstream federal dams (Jackson Lake, Palisades, and American Falls), the upstream and downstream hydroelectric plants are largely run-of-river plants; that is, they do not have long-term water storage associated with them. Because the hydroelectric projects near the HCC do not have relevant storage and because the federal dams with significant usable storage are hundreds of miles away, daily and weekly operation of the HCC is largely independent of the operation of the upstream and downstream plants.

H.1.3. Project Coordination with Other Electrical Systems

The Applicant owns and operates the load and generation scheduling, dispatching, transforming, conditioning, and distribution infrastructure throughout southern Idaho and associated with the HCC. The Applicant also owns approximately 2,700 MW of hydroelectric and thermal generating capacity in the region, including the HCC, and has approximately 65 long-term, regulated-price contracts with independent power producers for approximately 110 MW of nondispatchable generation. These resources are an integral part of, and are operated in coordination with, the regional electrical power system.

The Applicant is a member of the Western Electricity Coordinating Council (WECC). The intent of the WECC and its members is to establish performance standards that ensure a reliable electric power system for the western part of the continental United States, Canada, and Mexico. As an integral part of the Applicant's system, the HCC is operated according to WECC guidelines.

H.2. Short- and Long-Term Need for Project Generation

The nameplate capacity of the HCC is 1,166.9 MW, the sum of the nameplate capacity of each of the power plants—Brownlee, Oxbow, and Hells Canyon (see Exhibit B). The average annual production since completion of Brownlee unit 5 in 1980 is 6,053 gigawatt hours (GWh) (net), roughly equivalent to 691 average MW. The estimated maximum noncoincident project capacity, based on generator operating limits, is 1,398 MW. If no new license were issued, the Applicant would be faced with replacing this energy and capacity at current costs.

The Applicant's 2002 *Integrated Resource Plan* (IRP) (Technical Report H.2-1) identifies the Applicant's current and projected generating capacity and production, as well as current and estimated future loads. The IRP describes the Applicant's ability to provide enough energy for each month and to meet the expected peak power demand in each month.

The IRP indicates that, with continued availability of the HCC, median streamflow conditions, and the addition of 250 MW of capacity through a long-term power purchase contract beginning in June 2005, the Applicant would have adequate generating resources to supply demand in all months of 2006 except December. Similarly, based on the Applicant's load growth projections, the IRP indicates the need to procure additional energy in November and December 2007, July and December 2008, three months of 2009 and 2010, and four months of 2011. If other new resources were not available, the Applicant would fill these deficits with market purchases.

Based on the load growth projections and other assumptions described above, the IRP also indicates that the Applicant expects to have adequate capacity to meet peak loads each month from August 2005 through June 2006. In the absence of new generating resources, the Applicant expects to experience capacity deficits in three months in 2006 and 2007, four months in 2009 and

2010, and seven months in 2011. If other new resources were not available, the Applicant would purchase power and/or capacity to meet peak demand when loads exceed the Applicant's generating capacity. In addition, the Applicant has proposed procuring a new 100-MW generating resource within its service territory to help meet peak loads beginning in 2005.

Currently, seasonal and short-term market purchase contracts are used to fill generation and capacity deficits. These deficits may occur in any year if there is a drought that reduces the Applicant's hydroelectric generating capacity. However, due to transmission-system capacity constraints, the Applicant anticipates that, in addition to these seasonal and short-term market purchase contracts, new generation resources will be needed. The Applicant projects that by 2005, transmission-system capacity limits will prevent the Applicant from being able to fill the expected capacity deficits with market purchases.

Loss of the HCC capacity and production, representing approximately 70% of the Applicant's hydroelectric power-production resources and 40% of the Applicant's overall power-production resources, would be expected to create year-round energy and capacity deficits in the Applicant's service territory. The concurrent elimination of existing surpluses during surplus months would also eliminate off-system and wholesale sales opportunities, thereby compounding the resource replacement costs.

H.2.1. Costs and Availability of Alternatives

Estimates of the costs and availability of alternatives are subject to change due to the volatility in the power and natural gas markets, continuing uncertainty about industry restructuring and changing regulatory policies, and the fact that any decision to replace HCC capacity and energy is unlikely to be made until after the application has been reviewed when circumstances are likely to be substantially different. Given these factors, the Applicant considers the following estimates to be preliminary and subject to periodic reassessment based on new developments. Three primary options were evaluated as possible alternatives to the existing project. These options included demand-side measures, market purchases and expansion of the transmission system, and new generating resources in or near the Applicant's service territory. The Applicant's 2002 IRP (Technical Report H.2-1) was used as the basis for these evaluations.

Based on evaluations of the possible alternatives to the existing project, construction of new gas-fired generating resources within the Applicant's service territory was determined to be the least expensive and most feasible alternative. Not replacing the project power was not considered to be a viable alternative, especially given existing power deficits in the northwestern United States, even with the project in existence.

The estimated cost of new gas-fired generation is also considered to provide a reasonable forecast of the cost of wholesale power purchases. Because new gas-fired power plants have been recently planned and constructed in the northwestern United States, presumably because they were the lowest-cost option to meet increasing power demand in the Northwest, it is expected that the cost of new gas-fired resources will be the primary driver of wholesale power market prices for at least the next several years. In addition, the cost of new gas-fired generating resources is appropriate for estimating future wholesale market costs because other methods of predicting wholesale power market prices are considered to be unreliable based on recent market unpredictability. The cost of new gas-fired resources is also considered to be a reasonable estimate for the market purchase alternative because there is currently inadequate transmission capacity to import enough power from outside the Applicant's service territory to replace the existing project. Therefore, the wholesale market purchase alternative must either be based on new generating resources within the Applicant's service territory or include an estimate of the cost of expanding the transmission system to enable an equivalent amount of power to be imported.

Based on the above considerations, the estimated cost of alternative sources of power is based on the estimated cost of procuring and operating new gas-fired generation resources, specifically, a least-cost mix of combined-cycle and simple-cycle gas turbines. The Applicant estimates that a minimum of four years would be needed to develop new natural gas-fired generating resources to replace the existing HCC generation and capacity. This estimate reflects the current lack of surplus capacity in the gas-transmission pipelines serving the Applicant's service territory.

The Applicant has not dismissed the possibility of replacing some or all of the HCC capacity and generation using demand-side measures (reduction in energy demand via energy conservation incentives), distributed generation resources (such as small, point-of-use hydrocarbon-fueled generators), and/or renewable resources (such as wind, solar, or geothermal generation).

However, as noted in the 2002 IRP, none of these alternatives is currently available at lower market prices than the cost of new natural gas-fired turbine generators.

The Applicant also recognizes that the higher cost of replacement energy and capacity would serve to depress power demand within the Applicant's service territory. However, as noted above, because new gas-fired generation resources have recently been permitted and constructed to meet demands over and above the existing demand, the marketplace would be expected to replace the full capacity and energy production of the HCC if that capacity and production were lost to the region.

H.2.2. Replacement Costs of Alternatives and Increase in Costs If License Not Granted

The estimate of the 30-year average annual levelized cost of owning and operating the HCC, starting in August 2005, including the costs of the Applicant's proposed protection, mitigation, and enhancement (PM&E) measures is $59.2 million ($47.7 million before proposed PM&E measures). The expected minimum cost to replace the HCC generation and capacity with new gas-fired turbine generators, also starting in August 2005, is $393 million annually (see section H.3.3.1.). These estimates are based on 2002 costs escalated to 2005 at an annual inflation rate of 2.5%. The cost estimate for new gas-fired generating resources within the Applicant's service territory does not include a specific amount for the expected cost of expanding the natural gas pipeline system to allow enough natural gas to be imported to fuel the new generating resources. Instead, the necessary pipeline expansion or construction costs are assumed to be embedded in the estimated cost of the natural gas.

Other significant costs of replacing the hydroelectric generation from the HCC with natural gas-fired turbine generators would include the environmental impacts of the probable air pollution and greenhouse gas emissions. Generating 6,053 GWh of energy each year with natural gas-fired, combined-cycle turbine generators would likely produce approximately 2,570,000,000 kilograms (kg) of carbon dioxide, 121,000 kg of particulates, 605,000 kg of carbon monoxide, and 4,840,000 kg of nitrous oxides. Over a 30-year period, these emissions equate to 77,100,000,000 kg of carbon dioxide, 3,630,000 kg of particulates, 18,150,000 kg of carbon monoxide, and 145,200,000 kg of nitrous oxides. The quantity of carbon dioxide produced by generating 6,053 GWh of electricity each year with combined-cycle gas turbine generators would have approximately 100 times the greenhouse gas effect of the 1,350 tons of methane estimated to be produced annually by anaerobic decomposition in the HCC reservoirs.

Currently, market prices that could provide accurate, market-based estimates of air pollution costs to society do not exist. However, Oregon has attempted to estimate approximate air pollution costs to allow rational evaluations of air pollution-emitting sources. These estimates are shown in the IRP (Table 5 in Technical Report H.2-1). Based on Oregon's estimated costs of eliminating air pollutants from existing sources, the additional cost of replacing the HCC generation with combined-cycle gas turbines would range from $7 to $25 million per year. This cost range is based on estimated 2002 costs escalated to mid-2005 costs, using an annual inflation rate of 2.5%.

The Applicant's cost estimates for power replacement assume that the costs of the other environmental impacts associated with gas-fired turbine generators are included in the estimated fuel costs. These impacts include the long-term costs of consumption of finite natural resources and of environmental impacts resulting from natural gas production and transmission.

H.2.3. Effects of Alternative Sources of Capacity and Generation

H.2.3.1. Effects on Customers

Under current laws and regulations governing the Applicant's operations, dependence on any viable alternative to the existing project would significantly raise the electric service costs for the Applicant's existing customers. The Applicant is a regulated, asset-based, vertically integrated electric utility company. As such, most of the costs of power production, procurement, and distribution are passed directly on to residential, irrigation, commercial, and industrial customers within the Applicant's service territory. Distribution of costs between customer classes is regulated by state public utility commissions. Because each of the alternatives to the HCC is, under current conditions, more expensive than the existing project, replacing the existing project with any other viable alternative would increase the power costs for the entire service territory.

If the HCC were replaced with an alternative power source, the effects on the Applicant's wholesale customers would be the same or similar to the effects on the Applicant's other customers. Their cost of power would rise significantly. The distribution of higher costs between customer classes is under the jurisdiction of the state public utilities commissions, in accordance with existing laws and regulations.

Currently, and for the foreseeable future, when the Applicant has surplus generation, a scenario that occurs intermittently throughout any year, the Applicant sells this generation via a wholesale power market or other approved contract mechanism. Because no buyer of the Applicant's surplus power is compelled to purchase surplus power from the Applicant, no individual wholesale customer can be identified as harmed if the Applicant must depend on a higher-cost alternative to the existing project. However, if the HCC were not licensed to continue operation, a significant low-cost source of power would be eliminated from the northwestern United States. In the short term, given current capacity deficits in the western United States, if the HCC capacity and generation were lost, the cost of power for all wholesale power buyers in the western United States would probably increase significantly.

In addition, if the Applicant had to procure replacement sources of power, there would be additional negative, though nonmonetary, impacts to the Applicant's customers. As discussed in section H.3.3.3., loss of the existing project would be expected to reduce the reliability and stability of the regional electrical system and thereby raise the Applicant's existing industrial, commercial, and irrigation customers' production costs and risks. Also, each of the reasonably available alternatives would require dependence on a less economically reliable long-term power source. Such reliance would further increase the long-term economic risks of the Applicant's customers. Last, except for demand-side measures, the viable least-cost alternatives to the existing project would require consumption of nonrenewable hydrocarbon fuels, with concurrent release of significant amounts of greenhouse gases and other pollutants.

H.2.3.2. Effects on Operating and Load Characteristics

The Applicant has recently decided to pursue permitting of most of the associated transmission and transmission substation resources separately from the HCC project license. Therefore, the

Applicant assumes for this analysis that the associated transmission and transmission substation resources would be retained by the Applicant regardless of whether the HCC were relicensed.

The following are alternatives to the existing project that were considered for their probable impact on the Applicant's operating and load characteristics:

- Demand side measures
- Wholesale power purchases with concurrent transmission-system expansions
- New gas-fired generation within the Applicant's service territory
- A combination of the three alternatives listed above

Replacement of the HCC with any credible alternative power source would be expected to have significant impact on the operating characteristics of the Applicant's electrical system. The principal expected impact would be a loss of power supply and system reliability. The hydroelectric generators of the HCC provide critical load and voltage support, system stability, and load-following capability to the Applicant's and the region's electrical system. Replacement of the HCC with the same amount of capacity provided by demand-side measures, wholesale power purchases, new thermal generators, or a combination would not provide equivalent system stability, reliability, and responsiveness benefits. None of the credible alternatives to the HCC are as responsive, stable, or resistant to system disturbances as hydroelectric resources are. In addition, for the long term, thermal and, by extension, market purchase resources are much less reliable economically because of potential volatility in fuel price, as well as in supply and environmental risks. Also, the Applicant currently depends on the HCC hydroelectric generators for *Automatic Generator Control* (AGC). AGC is a system that automatically runs the hydroelectric generators to match the Applicant's generation with the regional power demand precisely. The HCC hydroelectric generators are an extremely valuable resource for this purpose for two reasons. First, as with most hydroelectric generators, but unlike thermal power plants, the HCC hydroelectric generators are capable of making extremely rapid changes in power output to respond quickly to even significant changes in the regional power demand. Also, because the amount of fluctuation in flow through the Brownlee and Oxbow power plants is not limited by downstream ramping rates, these plants are ideally suited to AGC purposes. Given the interconnectedness of the North American power system, the entire Northwest power system benefits from the AGC provided by the HCC. Of the losses in benefits that would occur if the HCC were replaced with an alternative power source, only the cost of replacing the existing generating reserves is fully accounted for in the estimated cost of the least-cost replacement alternative (see section H.2.2.).

From a system load perspective, replacement of the HCC with alternative sources of power would be expected to significantly change the load characteristics in the Applicant's service territory. Because any alternative power source would be substantially more expensive than the existing project, loss of the project license would substantially increase power costs of the Applicant's customers. This increased cost would probably reduce average system loads substantially, at least for some years. Also, a substantial increase in power costs would be expected to lead to greater reductions in noncritical electric use, a situation that would be expected to reduce nonpeak use by a greater percentage than it would reduce peak use. These reductions would be expected to lead to a larger difference between peak and nonpeak loads. Because implementing any alternative to the existing project would be expected to reduce power use in the Applicant's service territory, the Applicant's existing transmission and distribution system would not be expected to require any modifications to serve the reduced load. However, depending on the location of replacement power sources, new transmission sources might be required to import or distribute power from any replacement power sources. Estimating the probable effects on the Applicant's load characteristics over the long term if the existing project license were not renewed would require too much speculation to be useful.

H.2.3.3. Effects on Communities Served

The communities served are the residential and business customers described in section H.2.3.1. Under current law, conversion to any alternative would be expected to significantly increase the power costs for all consumers and communities within the Applicant's service territory. The economic impacts of such power cost increases would probably be compounded by inducing existing energy-dependent industries to relocate to regions with lower power costs and by making other energy-dependent businesses, such as many of the pump-irrigated farms, economically unsustainable. If the license were awarded to a different applicant, the existing communities and consumers within the Applicant's service territory would, in effect, be required to compete economically for the project power with all other Northwest and regional power users. In this circumstance, rates in the Applicant's service territory and in higher-cost areas outside the Applicant's service territory would be expected to equalize, resulting in significantly higher electric rates for the communities now being served by the Applicant and marginally reduced power rates for the region outside the Applicant's service territory.

Although increased power rates in the Applicant's service territory would be expected to cause significant indirect and secondary detrimental impacts to the regional economy, assessment of these impacts was determined to be beyond the scope of this application at this time.

If a new license were not granted to any applicant, the loss of the low-cost capacity and generation from the HCC would, in the short term, be expected to appreciably raise the cost of power in the northwestern United States until the project capacity were replaced with new resources, including the necessary additional fuel production and transmission resources and/or electric transmission resources.

H.3. Need, Cost, and Availability of Alternatives

The following sections address specific costs, needs, and availability of the identified alternative resources.

H.3.1. Cost

The estimate of the average annual levelized cost of owning and operating the HCC, starting in August 2005, including the costs of the Applicant's proposed PM&E measures is $59.2 million ($47.7 million before proposed PM&E measures). This annual cost includes the cost of capital, property taxes, operation and maintenance (O&M), and other expense components. The annual estimated cost of capital for the HCC represents levelized costs over an assumed 30-year period (2005–2034) and is the Applicant's annual revenue requirement. Estimated annual O&M,

property taxes, and other expenses are derived from the averages of the annual escalated cash outflows expected over the license period. Because these estimates are based on current information, they could change as new information is obtained. The economic parameters used in the estimations are 1) an escalation rate of 2.5%, based on an annual trend forecast of consumer price inflation; 2) a discount rate of 7.13%, based on the Applicant's authorized capital structure; and 3) an assumed 30-year license period.

Over a 30-year license period, annual costs for the complex, in 2005 dollars, including costs of proposed protection, mitigation, and enhancement (PM&E) measures, are estimated to be $31.3 million in cost of capital, $2.3 million in property taxes, $18.2 million in O&M, and $7.4 million in other expenses. Based on these costs, the estimated 30-year annual power production cost for the existing HCC, starting in August 2005, is $59.2 million for a projected average annual generation of 6,053 GWh. This estimate equates to a projected production cost of $9.78 per megawatt hour (MWh). Costs of additional PM&E measures would directly increase this projected production cost. Accordingly, the actual project production cost could differ if additional PM&E measures were required under the conditions of a new license. Detailed cost estimates for the PM&E measures that the Applicant proposes as conditions of a new license are included throughout Exhibit E.

The Applicant is also providing the total cost of the project over the assumed 30-year license period, with no assumed escalation. The base year for cost-estimating purposes is 2005. The total costs for the project, with no assumed escalation, including costs of PM&E measures, are estimated to be $762.1 million in cost of capital, $55.6 million in property taxes, $347.6 million in O&M, and $178.3 million in other expenses.

H.3.2. Need

The Applicant's projected capacity and energy requirements over the short and long term are shown in the Applicant's 2002 IRP (Technical Report H.2-1). The Applicant expects to meet these power demands by using four primary sources of energy and capacity. These sources are the Applicant's power plants (both hydroelectric and thermal), power purchase contracts with multiple cogeneration and small power producers (CSPPs) throughout the Applicant's service territory, and short- and long-term power purchase contracts.

As shown in the sales and load forecast in the 2002 IRP (Technical Report H.2-1), the *average* system monthly load in 2006 is projected to range from a low of 1,661 MW in April to a high of 2,333 MW in July. The *peak* load in 2006 is projected to range from a low of 2,070 MW in April to a high of 3,286 MW in July. Assuming that the Applicant retains the license for the HCC, the IRP projects that the Applicant can meet its projected power demands each month from August 2005 through December 2006 using power from the Applicant's power plants and from existing and planned CSPP and long-term power purchase contracts. The Applicant expects to have minor power deficits in peak-load months beginning in December 2006 and intermittently in peak-load months up to a maximum deficit at the end of the planning period in 2011 of 190 average MW in December. In the absence of other new power resources in the Applicant's service territory, the Applicant will fill these deficits with short-term power purchase contracts.

If the HCC generation were not available, the Applicant would be unable to produce adequate power to meet load in any month. Without the HCC power, the projected August 2005 deficit would be 464 average MW, rising to a peak deficit at the end of the IRP planning period in 2011 of 773 average MW in November. Table H-1 shows the projected loads and deficits for each month for the first year after the expiration of the current project license at the end of July 2005.

As indicated by the Applicant's IRP and shown in Table H-1, HCC generation and capacity is needed year-round to serve the Applicant's existing loads, for both the short term and the long term. The IRP (Technical Report H.2-1) provides greater detail on the Applicant's expected future loads and generating capacity, including estimated ranges for different river flows and regional growth projection for power demand.

H.3.2.1. Resources Required

The Applicant plans to supply the regional power demands for the foreseeable future by using four primary sources of energy and capacity. These sources are the Applicant's power plants, power purchase contracts with multiple CSPPs throughout the Applicant’s service territory, and both short- and long-term power purchase contracts.

Including the HCC, the Applicant has interests in the following long-term generating and power supply resources:

- The Applicant owns 17 hydroelectric power plants in the Snake River basin, with an aggregate nameplate capacity of 1,707 MW.
- The Applicant owns portions of three coal-fired generating plants. The Applicant’s share of the capacity of these three coal-fired plants is approximately 1,025 MW.
- The Applicant owns two simple-cycle 45-MW gas-fired peaking turbine generators near Mountain Home, Idaho.
- The Applicant owns two dispatchable 2.5-MW diesel generators in Salmon, Idaho.
- The Applicant has long-term power purchase contracts with approximately 65 CSPP projects, with a total noncoincident and nondispatchable capacity of approximately 110 MW.
- The Applicant has one seasonal power exchange contract with Northwestern Energy (a successor company to Montana Power Company), which expires in December 2003.
- The Applicant has recently issued a solicitation for proposals for 200 MW of new, fully dispatchable capacity within the Applicant’s electrical-system control area. The Applicant’s solicitation requires the new generating resource selected to be available by June 2005.
- The Applicant may also seek approval to increase capacity at its other hydroelectric plants, if economically prudent.

The Applicant expects to supply power for part of its future loads with both long- and short-term wholesale power market purchases as well as through bilateral capacity and generation contracts. The Applicant has participated in wholesale power markets and has intermittently had seasonal power exchange contracts for many years. The available generation shown in Table H-1 will change once a specific proposal for new generation in the Applicant's service territory, as described above, were selected later in 2003.

In the Applicant's IRP (Technical Report H.2-1) and this application, reductions in load due to energy conservation programs are accounted for in the Applicant's projected loads and not as supply-side resources. As of June 2002, the Applicant's own energy conservation programs are estimated to have reduced the Applicant's systemwide load by 28 average MW. As described in the IRP, the Applicant currently supports six energy efficiency and demand-side management programs. Since the mid-1990s, the Applicant's primary method for reducing power demand has been to help fund the Northwest Energy Efficiency Alliance (NEEA).

The NEEA's mission is to promote the market transformation of energy efficiencies in the region and thereby maximize the conservation benefits resulting from participants' expenditures. NEEA's programs are believed to create compounding benefits, resulting in higher energy savings each successive year. The NEEA estimates that its initiatives prior to 2001 achieved average energy savings of 33 MW beginning in 2001, equivalent to a savings of approximately 290,000 MWh per year. The NEEA estimates that by 2011, its initiatives will produce energy savings of 450 average MW, equivalent to a savings of approximately 3,900,000 MWh per year. Because the NEEA's initiatives are designed to promote market transformations rather than simply reduce discreet power demands at specific locations, the load-reduction benefits of NEEA's programs are considered to be distributed throughout the northwestern United States and globally, rather than just in the Applicant's service territory.

Recently, in accordance with direction and approval from the Idaho State Public Utilities Commission (IPUC), the Applicant began a new conservation and demand-side program, partially in response to the wholesale power market disruptions that occurred in 2000 and 2001. In early 2002, the IPUC directed the Applicant to begin using Bonneville Power Administration Conservation and Renewables Discount Program funds to fund new energy conservation programs designed to reduce the demand for electricity within the Applicant's service territory. In May 2002, the IPUC additionally approved a new tariff to be collected from the Applicant's power customers. Income from this tariff will also be used to implement energy conservation measures in the Applicant's service territory. These measures will be designed with help from a new Energy Efficiency Advisory Group comprising representatives of various interest groups from throughout the Applicant's service territory.

In addition to its contributions to NEEA and the new energy conservation program requested by the IPUC, the Applicant continues to support energy conservation programs sponsored by the Northwest Power Planning Council and the Bonneville Power Administration, as well as low-income weatherization programs and the Oregon Commercial Audit Program.

Also, with prior approval from the state regulatory commissions, the Applicant adopted temporary load-reduction financial incentives in 2001 to reduce regional power demand for the balance of 2001 and reduce the 2002 power demands by a lesser amount. These programs were estimated to reduce the 2001 summertime loads by approximately 300 average MW.

H.3.2.2. Resource Analysis and Planning Criteria

The Applicant's current resource analysis is the 2002 IRP (Technical Report H.2-1). Current and projected available resources and needs are described in detail in the IRP and briefly in section H.1. and section H.2.

The reserve margins required of the Applicant are specified by the Northwest Power Pool and WECC operating criteria to maintain the stability of the regional electrical system. These criteria require that the Applicant's generating system maintain a 5% hydroelectric capacity operating reserve and 7% thermal capacity operating reserve at all times. During heavy load periods, these requirements equate to a hydroelectric reserve obligation ranging from 40 to 90 MW and a thermal reserve obligation ranging from 35 to 70 MW, for a maximum obligation of up to 160 MW. The Applicant often fulfills most of these hydroelectric and thermal reserve obligations using the HCC capacity. In the future, depending on regulatory restrictions that may be imposed on the Applicant's other hydroelectric projects, nearly all of the Applicant's hydroelectric reserves may have to be provided at the HCC.

The HCC capacity is often depended on to meet much of the Applicant's reserve obligations for two primary reasons. The first reason is the beneficial configuration of the three-dam complex. Because the Brownlee and Oxbow power plants discharge directly into the Oxbow and Hells Canyon reservoirs, plant flows can be changed quickly without significant downstream environmental impacts. This capability allows substantial reserve capacity to be assigned to the Brownlee and Oxbow plants because there are no ramp-rate restrictions at these plants that would limit the amount of flow change through these powerhouses. The second reason is the inherently greater reliability of hydroelectric reserves relative to thermal reserves. Thermal plants are not as mechanically reliable, as resistant to system disturbances, or as quickly and reliably dispatchable as the relatively robust hydroelectric generators are. Therefore, providing the required thermal plant reserve margins at the HCC instead of at each thermal plant enhances system reliability. In addition, as noted above, the Applicant may have to depend on the reserves provided by the HCC for many of the Applicant's other hydroelectric plants if new operating restrictions are imposed at these other plants.

The cost estimate for new gas-fired generating resources shown in section H.3.3.1. is based on new thermal generating capacity and reserves numerically equivalent to the capacity and reserves of the HCC. However, because of the lower reliability and flexibility of thermal reserves relative to the HCC, the alternative thermal capacity and reserves are not considered as regionally valuable as the hydroelectric capacity and reserves provided by the HCC. The loss of HCC capacity, even if replaced by new thermal capacity resources, would be expected to reduce the stability of the regional electrical generation and transmission systems.

H.3.2.3. Load Management

Current load management and energy conservation programs are described in section H.3.2.1. In cooperation with state public utilities commissions, the Applicant continues to contribute to load management programs, such as NEEA, to stimulate the implementation of demand reduction measures. However, noted in section H.3.2.1., the results of these load reductions are accounted for in the projected load calculations and not as supply-side resources. As also shown in section H.3.2.1., the Applicant's demand reduction measures are estimated to have reduced demand in the Applicant's service territory by 28 average MW, and NEEA's programs are estimated to have reduced demand in the northwestern states by 33 average MW, with reductions in demand of 450 average MW projected by 2011 as a result of NEEA's programs. Based on current conditions in the northwestern United States, however, replacing HCC capacity and generation with new demand-side measures does not appear to be economically or politically feasible, for two reasons.

First, the Applicant's experience with demand-side measures adopted in 2001, in response to extraordinary wholesale power costs and a regional drought that substantially reduced the Applicant's hydroelectric generating capacity, suggests that replacing the HCC power with demand-side measures would probably be considerably more expensive than constructing new generating resources. Although the temporary load-reduction financial incentives created in 2001 are estimated to have successfully reduced the 2001 summertime load by approximately 300 average MW, the cost of these programs was substantially greater than the cost of new generating resources would have been if the Applicant had adequate time to construct equivalent new generating resources. In addition, these temporary load-reduction measures were perceived to negatively affect the communities served through indirect economic impacts. Second, the recent construction of more than 1,000 MW of new gas-fired power plants in the northwestern United States, to meet existing and projected future power deficits, strongly suggests that replacing the HCC power with demand-side measures would probably not be economically or politically feasible: if replacing HCC power with demand-side measures were more economical than constructing new generators, new power plants would not have been built in the northwestern states during the last several years.

H.3.3. Alternative Sources of Power

Chapter 5 of the Applicant's IRP (Technical Report H.2-1) describes the resource options evaluated by the Applicant for future load growth. The options evaluated include market purchases concurrent with additions to transmission-system capacity; seasonal exchanges; acquisition of power from the FCRPS; new hydroelectric and thermal generating resources;

power generation via renewable resources, including solar, wind, and geothermal resources; energy storage systems; and distributed (“near-point-of-use”) generation resources. In addition to these alternatives, the Applicant continues to support several demand-side programs, as described in section H.3.2.1.

Based on information provided in the IRP, past evaluations, and the current market status of various resource alternatives including renewables and distributed generation, there are limited viable alternatives with which the HCC power production could be replaced. With existing technology, new thermal generating resources or market purchases and concurrent transmission-system expansions are considered the only viable alternatives to the HCC. Of these alternatives, new thermal generating resources are considered to be the most feasible least-cost alternative.

Methods for estimating the cost of replacing the HCC power with future wholesale power market purchases are limited. Because the cost of additional power to meet future load growth is expected to be controlled mainly by the cost of building and operating new least-cost power plants, the cost of future wholesale power is expected to be roughly equivalent to the cost of building and operating these new least-cost power plants. Currently, the least-cost power plants are new gas-fired turbine generators. Therefore, the expected cost to replace the HCC power with wholesale market purchases is considered roughly equivalent to the cost of building equivalent new gas-fired turbine generators.

A second method of estimating the cost of replacing the HCC power with wholesale market purchases, using current wholesale market prices and wholesale market futures prices, has been used in the industry. However, the Applicant did not use this method for three reasons. First, because wholesale market prices have fluctuated dramatically over the last five years, current wholesale market prices are no longer considered a reliable predictor of future wholesale market prices. Second, there has recently been an extraordinary reduction in the amount of power being traded in wholesale power markets. Currently, large blocks of power and capacity equivalent to the HCC production, for 2005 and beyond, are not being traded in wholesale markets. The largest blocks of power currently available via the wholesale markets for 2005 and beyond are typically less than 50 MW. Therefore, current futures prices for wholesale market power equivalent to the HCC power, prices that could be used to predict the cost of replacing the HCC power with wholesale power purchases, do not exist. Third, transmission capacity limits the amount of power that can be imported from outside the Applicant's service territory. Therefore, any estimate of the cost to replace the HCC power with wholesale market purchases would have to include costs for transmission-system expansions. Unless the source of the replacement power were known in advance, estimating a cost for the necessary transmission-system expansions would require too much speculation to be of much value. For lack of a better method, the cost of replacing the HCC power with wholesale market purchases is therefore considered to be roughly equivalent to the cost of constructing new generating resources within the Applicant's service territory to replace the HCC power.

The cost of load management measures to replace the HCC is also considered roughly equivalent to the cost of constructing new least-cost generating resources within the Applicant's service territory because customers whose loads were disconnected by the Applicant would probably contract to buy their power from new power sources, which would most likely be new gas-fired generators. If existing loads that depend on the HCC could be eliminated for a lower cost than that of new power plants, new power plants would not have been constructed in the northwestern United States recently.

Other methods of estimating the cost of replacing the HCC power through load management measures were considered but concluded to be less accurate than using the estimated cost of new gas-fired generation as a surrogate for the expected cost of equivalent load management measures. The problems with these other methods are similar to the problems with attempting to estimate the cost of equivalent market purchases. There are no valid, reliable, established market prices for large load reductions in the region surrounding the HCC. Also, disconnecting loads equal to the HCC production may not be legally viable within existing state and federal laws and regulations.

With existing technology, the viable new thermal generating resources are considered to be gas- and coal-fired and nuclear steam generation. Of these, gas-fired simple- and combined-cycle turbine generators are the current least-cost alternative. Therefore, the project replacement cost estimates are based on a least-cost mix of combined-cycle and simple-cycle gas turbines.

It is possible to construct wind-driven electric generators within the Applicant's service territory with a nameplate capacity equal to the HCC capacity. However, wind generation within the Applicant's service territory is considerably more expensive than new gas-fired generation, and wind generators do not provide dependable, responsive, and dispatchable capacity equivalent to that provided by the HCC. Also, the high wind periods in the Applicant's service territory do not occur concurrently with the Applicant's heavy load periods; therefore, much of the capacity of equivalent wind generation would not be available to the Applicant when it is needed the most.

H.3.3.1. Total Annual Cost of Alternatives

The estimated annual cost of owning and operating the HCC, beginning in August 2005, including costs associated with environmental PM&E measures proposed for a new license, is $59.2 million. The estimated annual cost to replace the HCC energy and capacity, using a least-cost mix of combined- and simple-cycle gas turbines, starting in August 2005, is $393 million. The economic parameters used in both estimations are 1) an escalation rate of 2.50%, based on an annual trend forecast of consumer price inflation; 2) a discount rate of 7.13%, based on the Applicant's authorized capital structure; and 3) an assumed 30-year license period. All cost estimates for the new gas-fired turbines are from the Applicant's 2002 IRP (Technical Report H.2-1), except where otherwise noted. The estimated cost for replacing the HCC power with new gas-fired turbines does not include any continuing costs for maintaining or mitigating for the existing HCC.

H.3.3.2. Bases of Alternative Cost Estimates

The estimated cost of new gas-fired generating resources equivalent to the HCC capacity and energy is based on the following information:

Existing HCC nameplate capacity	1,166.9 MW
Existing HCC peak capacity	1,398 MW
Existing HCC peak capacity minus required 5% reserves (1,398 MW × 95%)	1,328 MW
Equivalent thermal capacity including required 7% reserves (1,328 MW × 1.07)	1,421 MW

Existing HCC average annual energy production, 01/01/81–12/31/01	6,053.13 GWh
Required equivalent thermal replacement capacity and energy	1,421 MW capacity 6,053 GWh/year energy

For this application, the estimated cost of new gas-fired turbine generators is based on replacing the HCC energy with combined-cycle gas turbines and the balance of the HCC capacity with simple-cycle standby gas turbines. The annual estimated cost of capital component for the combined-cycle and standby turbines represents levelized costs over an assumed 30-year period (2005–2034) and is the Applicant's estimated annual revenue requirement. The Applicant also provides the total cost of capital for the replacement turbines with and without assumed escalation. The gas price used for the analysis is fixed at $3 per million British thermal units (Btu) (no specific forward-looking market price variability applied). Annual fuel costs have been stated in both current dollars (no escalation) and on an average escalated basis over the assumed 30-year period using a current trend of consumer price inflation. Annual estimates for fixed and variable O&M are stated in both current dollars and on an average annual escalated basis over the assumed 30-year period. The base year for cost-estimating purposes is 2005.

Capacity needed to replace the energy of 6,053 GWh/year	0.6905 GWh/hour
0.6905 gigawatt (GW), 24 hours/day for 365 days/year, at a capacity factor of 91% (0.6905 GW ÷ 0.91 = 0.7588 GW)	758,800 kW
Cost of 758,800 kilowatt (kW) of combined cycle gas turbine generators at $880/kW	$667,744,000
Annual levelized cost of capital, 30-year facility life	$69,200,000/year
Balance of capacity required to replace HCC (standby) 1,421 MW – 759 MW (reduction for capacity factor not applicable to standby generators)	662 MW
Cost of 662 MW of simple-cycle standby gas turbine capacity at $653/kW	$432,286,000
Annual levelized cost of capital, 30-year facility life	$44,700,000/year
Fuel cost for combined-cycle turbines, 7,335 Btu/kilowatt hour (kWh), $3.00/million (MM) Btu (6,053.13 MWh/year × 7,335 Btu/kWh × $3.00/MMBtu)	$133,200,000/year
Average annual escalated fuel cost over a 30-year period	$212,500,000/year
Fixed annual O&M cost of combined-cycle combustion turbines (CCCT) ($9.03/kW × 758,800 kW)	$6,852,000/year

Average annual escalated fixed CCCT O&M cost over a 30-year period	$10,900,000/year
Variable annual O&M cost of combined-cycle turbines ($5.03/MWh × 6,053,130 MWh)	$30,447,000/year
Average annual escalated variable CCCT O&M over a 30-year period	$48,600,000/year
Fixed annual O&M cost of simple-cycle turbines, $6.67/kW/year ($6.67/kW × 662,000 kW)	$4,416,000/year
Average annual escalated fixed simple-cycle combustion turbine (SCCT) O&M over a 30-year period	$7,000,000/year
Total estimated annual direct replacement costs, gas-fired turbines	$393,000,000/year
Total cost of replacement turbines (30 years, assuming escalation)	$11,157,000,000
Total cost of capital	$2,789,000,000
Total fuel	$6,376,000,000
Total fixed O&M	$535,000,000
Total variable O&M	$1,457,000,000
Total cost of replacement turbines (30 years, assuming no escalation)	$8,037,000,000
Total cost of capital	$2,789,000,000
Total fuel	$3,996,000,000
Total fixed O&M	$338,000,000
Total variable O&M	$914,000,000

In the information provided above, the estimated fuel quantity required is quite conservative because it assumes that all energy would be produced using the more efficient combined-cycle turbines. This assumption is, of course, a gross simplification in that the less efficient simple-cycle “standby” turbines would have to be used daily during heavy load hours. This underestimate is probably offset somewhat by including costs for O&M of standby turbines.

The cost estimate for new gas-fired generating resources within the Applicant’s service territory does not include a specific amount for the expected cost of expanding the natural gas pipeline system to allow enough natural gas to be imported to fuel the new generating resources. Instead, any costs for necessary pipeline expansion or construction are assumed to be embedded in the estimated cost of the natural gas.

H.3.3.3. Relative Merits of Alternative Generating Resources

Item (a)(3)(iii)(C) of 18 CFR § 16.10 requires a discussion of the relative merits of each alternative source of power compared with the proposed or existing project, including issues of the period of availability and dependability of purchased power, average life of alternatives, equivalent availability of generating alternatives, and impacts on the Applicant's power-system reliability and other system-operating characteristics. Although each of these issues is addressed somewhat in previous sections of this application, a general comparison of the merits of the new gas-fired power plant alternative, the market purchase alternative, and the continued operation of the existing HCC alternative follows.

Relative to alternative power sources, the existing project has exceptionally reliable availability in both the short term and the long term. But it has shortcomings from a seasonal perspective. Because hydroelectric power plants, including the HCC plants, are more robust and less prone to outages from system disruptions or mechanical breakdowns than even the most reliable thermal plants, they have higher availability over the short term. Also, because they are relatively immune to long-term fuel and power market cost variability, hydroelectric plants are inherently more reliable than both thermal resources and market purchases from a long-term economic stability and planning perspective. However, the energy availability from the HCC hydroelectric plants is seasonally dependent on highly variable annual river flows and therefore requires support from market purchases and/or thermal resources. The HCC's dependence on variable river flows makes the existing project somewhat less reliable than the other alternatives for seasonal periods.

As noted above, even the most reliable thermal power plants are more prone to outages and have lower availability factors than the HCC. However, the lower availability factor for thermal power plants is largely accounted for in the estimated cost for the new gas-fired generating resources alternative, an estimate that includes an industry standard availability factor. In the intermediate term, the availability of well-maintained thermal plants is well established and can historically be relied and planned on with reasonable accuracy. The intermediate-term dependable availability of thermal plants may be lower in the future, however, given recent disruptions that may indicate more volatility in fuel wholesale markets due to industry deregulation. Over the long term, thermal plants have a lower reliable period of availability because they are subject to unpredictable fuel and wholesale power market variability.

Assessing the relative reliability and dependability of purchased power relative to the existing project requires an assessment of the long- and short-term reliability and dependability of recently deregulated wholesale power markets. That assessment is beyond the scope of this application. Excluding the intermediate-term impacts of highly variable annual streamflows, the existing hydroelectric resources of the HCC are extremely reliable and dependable. The Applicant believes that the market purchase alternative does not provide the same dependable availability over the short term or the long term.

For this analysis, the project life of each alternative was taken to be 30 years, given that, if a new license were granted to the Applicant, the period of the license would be limited and the Applicant could not in these circumstances base an economic analysis on an indefinite project operating life. However, limiting the project life analysis to 30 years somewhat undervalues the existing project relative to replacement gas-fired generator or market purchase alternatives from a regional economic perspective. The reliable physical life and period of predictable operating costs of the HCC are considerably greater than 30 years, whereas the reliable physical life and period of predictable operating costs of gas-fired generators or market purchases would not be expected to extend beyond 30 years. If the cost of each of the alternatives were estimated using a much longer period, such as 50 or 100 years, the costs of the gas-fired generator and market purchase alternatives would be somewhat higher than costs of the existing project to reflect the considerably greater risk of significant changes in costs due to external influences such as fuel price volatility or emission reduction mandates.

Additional relative impacts on the Applicant's power-system reliability and other system-operating characteristics would be expected from replacement of the existing project with new gas-fired generation or market purchases that are not fully accounted for in the cost estimate for each alternative. From the Applicant's perspective, the primary impact that is not fully considered in the estimate for each alternative is a reduction of the regional electrical system stability and reliability. The existing hydroelectric generators are relatively robust and more resistant to outages from system disturbances. They are also able to adjust power output faster and over a relatively broader range in response to system disturbances than equivalent gas-fired generators are. The greater reliability and flexibility of the HCC relative to the alternatives is partially accounted for in the cost estimate for new gas-fired generation (in the higher capacity reserve required of thermal generators). Nonetheless, this higher reserve does not fully account for the better voltage support and response time of equivalent hydroelectric generators. Also, hydroelectric power plants provide better "black start" capabilities than equivalent thermal generating plants do. "Black start" refers to the restarting of a power plant after a power outage has caused plant shutdown. Outside or stored energy sources are needed to restart power plants after an outage. Hydroelectric plants obviously have substantial stored energy in the reservoir that can be used to restart the plant after such an outage. It is more difficult to maintain adequate backup energy storage to restart thermal plants. Because of this benefit, regional power grids typically rely on hydroelectric plants to begin system restoration after regional power outages. Therefore, any gas-fired generating alternative to the HCC would be less valuable from this perspective also.

When compared against the value of the existing HCC, the market purchase alternative is believed to share most of the deficiencies of new gas-fired generating resources and has one additional deficiency. Because the market purchase alternative would largely depend on power from thermal generation, the detrimental effects of the market purchase alternative on system stability and reliability would be the same or worse than the effects of the gas-fired generation alternative. In addition to the thermal generation deficiencies shared by the market purchase alternative, the market purchase alternative is inherently more dependent on transmission-system performance and thereby more susceptible to interruption risks than either the existing HCC or new gas-fired generation. Currently, no ancillary power services market has been established that could be used to reliably and economically mitigate for these market purchase deficiencies.

In addition, as was described in section H.2., potential variability in future fuel price and regulation makes the cost of alternates to the existing project less reliable over the long term. In sum, the Applicant believes that replacing the existing project with equivalent thermal resources or depending on market purchases would reduce the stability and reliability of the Applicant's and the regional electrical system.

H.3.4. Effect of Alternate Sources on Direct Providers

The Applicant anticipates having only one or two small off-system sales contracts active as of January 2006. Because power from any of the viable alternatives to the existing project would be considerably more expensive than power from the existing project, any alternative source of power would probably substantially raise the power costs to any direct providers served by contract sales from the Applicant and, in turn, to their customers.

H.4. Effect on Applicant Industrial Facilities and Related Operations

The Applicant does not operate any industrial facilities dependent on the power production from the HCC.

H.5. Indian Tribe Need for Electricity

The Applicant is not an Indian tribe.

H.6. Impacts on the Transmission System

This section includes an analysis of the potential impacts on the Applicant's transmission system if a new license were not issued to the Applicant. This section also analyzes the advantages that the Applicant's own transmission system provides in distributing power from the HCC.

H.6.1. Redistribution of Power Flows

Because of the extraordinary size of the HCC and its importance to the Applicant's electrical system and the regional power system, attempting to assess the probable effects of any redistribution of power flows on line loading, line losses, and any necessary new construction or upgrades of transmission resources, and their associated costs, if a new license were not granted, requires considerable speculation.

For this analysis, to attempt to comply fully with the intent of the regulations for this section, the Applicant assumed that, if a new license were not awarded for the HCC, the existing transmission lines, switchyards at each of the dams and throughout the HCC, and substations would remain and continue to be owned and operated by the Applicant but that the HCC powerhouses would cease to operate in this situation.

Insufficient transmission-line capacity exists to import enough power to replace the HCC. This limitation would be expected to have two impacts. First, the existing capacity would likely be fully used much of the time to import power from outside the Applicant's service territory. Second, either new transmission lines would have to be built to increase the import capacity or new generating resources would have to be constructed within the Applicant's service territory. The utilization of all the existing transmission capacity would be expected to have the secondary effect of precluding transmission of power across the Applicant's service territory to accommodate wholesale power market transactions with others, thus impeding power transfers in the region unless and until new transmission capacity were constructed.

Although expansion of the electrical transmission system could be avoided by constructing new generating resources within the Applicant's service territory, replacing the HCC with new generation in this service territory would be expected to create similar deficits in the existing regional fuel-transport systems. Currently, adequate excess gas pipeline and/or coal train or truck capacity does not exist to allow enough fuel to be imported to power new generating resources equivalent to the HCC. Obviously, each of these deficits could be remedied. However, the lead time and cost of the needed expansions would likely be substantial.

Loss of the HCC generating capacity would also eliminate a crucial element of voltage support provided by the HCC generators. The current transfer capacity of the transmission system depends, in part, on the availability of the 600 megavolt amps reactive (MVAR) of reactive capacity from the HCC generators.

If the HCC generators were to be replaced with new generating resources within the Applicant's service territory near the loads currently being served by power from the HCC, the transmission-line losses would be lower than if the HCC were not replaced. Because of existing transmission-line constraints, the HCC cannot be replaced with power from outside the service territory without expanding the existing transmission system. Therefore, whether replacing the HCC with power from outside the service territory would increase or decrease the transmission-line losses depends entirely on the extent of the transmission-system expansion and cannot be accurately predicted.

As noted in section H.2.3.2., the inherent stability of the large HCC hydroelectric generators helps to prevent regional power outages due to transmission-system disturbances. The rotational momentum of the relatively large HCC generators and the robustness of their associated control equipment help dampen system oscillations and improve system resistance to transient electrical disturbances. Loss of the HCC generators would reduce the system resistance to the effects of electrical transients.

H.6.2. Advantages of Applicant's Transmission System

Most of the transmission resources surrounding and serving the HCC were constructed by the Applicant and others for the specific purpose of distributing the HCC's power to load areas surrounding the complex, including load areas east, south, west, and north of the complex. The HCC's power could not be distributed without use of the Applicant's transmission system, in accordance with current laws and regulation, or construction of substantial new transmission resources, including hundreds of miles of high-voltage lines and multiple new substations.

H.6.3. Single-Line Diagram

A single-line diagram showing existing system facilities, transmission elements, and other principal interconnected system elements is included in Figure H-1.

H.7. Plans to Modify Project and Conformance with Comprehensive Plans

The Applicant proposes no generating plant modifications unless new license conditions are mandated that would economically justify appropriate project modifications to restore or enhance generating efficiencies and economies. If such modifications were pursued, an assessment of whether the proposed modifications complied with applicable comprehensive plans would be made at that time.

H.8. Conformance with Comprehensive Plans under Existing Conditions

Section 10 of the Federal Power Act, as amended, stipulates that the Federal Power Commission (FPC, now FERC) will select the project best adapted to a comprehensive plan for improving or developing a waterway for the use or benefit of interstate or foreign commerce; for the improvement and use of waterpower development; for the adequate protection, mitigation, and enhancement of fish and wildlife; and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e) of the Act. Before the original project license was issued, the FPC determined that the project proposed by the Applicant was the alternative best adapted to development of the Snake River at this location. The existing project conforms to the applicable sections of the Idaho and Oregon comprehensive state water plans and to other applicable comprehensive plans described in section E.6.5.2.

H.9. Financial and Personnel Resources

H.9.1. Financial Resources

Past performance has proven that the Applicant's sources of financing and annual revenues are sufficient to meet the continuing O&M requirements of all its hydroelectric projects. Technical Report H.9-1 includes a copy of the Applicant's latest annual report to its shareholders.

H.9.2. Personnel Resources

The Applicant has over 85 years of experience operating and maintaining hydroelectric projects. Past performance has demonstrated the Applicant's ability and commitment to operate all projects in a safe, efficient manner and in accordance with license orders. Currently, the Applicant employs approximately 1,725 people. Of these, approximately 180 people are assigned directly to operating and maintaining the hydroelectric power plants, with many others providing corporate office; transmission, distribution, and communications systems; and other support to the hydroelectric production resources. Approximately 55 Applicant employees work full time on site within the HCC boundaries, operating and maintaining the project facilities. Employees of the Idaho Department of Fish and Game operate the fish hatcheries associated with the HCC at the Applicant's cost. In addition, the Applicant regularly retains independent contractors for other system maintenance, repairs, and improvements and for technical assistance. The plant operating and maintenance personnel receive extensive training to ensure competency and familiarity with the project facilities and with the license and other regulatory and legal requirements. Each of the plant operators is required to receive training customized for hydroelectric specialists, including classroom time and formal testing. The maintenance personnel have expertise in stator rewinds, turbine repair, bearing repair, spill gate rehabilitation, and complete hydroelectric generator unit renovations.

Although changes in O&M requirements, as well as changing requirements for providing administrative, security, and surveillance support, can be expected to dictate future staffing adjustments, the Applicant believes that its history of operating and maintaining its developments is strong evidence of its ability to continue to comply with the terms of a new license.

H.10. Expansion Notification

The Applicant has no plans to expand the HCC project boundary to encompass additional land. If the Applicant is required to provide additional habitat adjacent to the project for mitigation of project impacts, the Applicant does not propose to change the project boundary to incorporate any such additional habitat.

H.11. Electricity Consumption Efficiency Improvement Program

H.11.1. Customer Energy Efficiency Programs

The Applicant has a longstanding record of encouraging energy conservation and facilitating customer efforts to conserve electricity and has sponsored customer energy conservation programs since the mid-1970s. The Applicant's current conservation and energy efficiency programs are described in the 2002 IRP *Conservation Plan* (Technical Report H.3-1). To date, the

Applicant's own efficiency programs are estimated to have reduced the Applicant's load by 28 average MW. As described in the IRP, the Applicant continues to support several energy efficiency and demand-side management programs. Until very recently, the Applicant's principal program for reducing power demand consisted of contributions to NEEA. As described in section H.3.2.1., in May 2002, the IPUC approved a new energy conservation program to be implemented within the Applicant's Idaho service territory. This new program is funded by a new conservation tariff added to each customer's monthly bill. The objective of the program is to develop programs that reduce the power demand within the Applicant's service territory. The specific measures implemented are selected and designed with help from a new Energy Efficiency Advisory Group comprising representatives of various interest groups from throughout the Applicant's service territory.

The NEEA's mission is to promote the market transformation of energy efficiencies in the region to maximize the conservation benefits resulting from participants' expenditures. NEEA's programs are believed to create compounding benefits, resulting in higher energy savings each successive year. The NEEA estimates that its initiatives prior to 2001 achieved average energy savings of 33 average MW beginning in 2001, equivalent to a savings of approximately 290,000 MWh per year. The NEEA predicts that by 2011, its initiatives will produce energy savings of 450 average MW, equivalent to a savings of approximately 3,900,000 MWh per year. Because the NEEA's initiatives are designed to promote market transformations rather than simply reduce discreet power demands at specific locations, the load-reduction benefits of NEEA's programs are considered to be distributed throughout the northwestern United States and globally, rather than just in the Applicant's service territory.

In addition to its contributions to NEEA and the new Idaho energy conservation program directed by the IPUC, the Applicant continues to support energy conservation programs sponsored by the Northwest Power Planning Council and the Bonneville Power Administration, as well as low-income weatherization programs and the Oregon Commercial Audit Program.

Also, the Applicant participates in Project Share, a program operated by the Salvation Army to assist low-income residents with home heating bills. Project Share helps these families by paying for furnace repairs or improvements and for firewood, coal, propane, oil, electricity, or gas heating costs. The Applicant solicits contributions to Project Share as a component of each customer's bill and receives and transfers all Project Share contributions to the Salvation Army. In addition, the Applicant matches 10% of all customer contributions and normally contributes an additional $25,000 to the program each year. In 2001, to help mitigate the impact of an extraordinary spike in energy costs, the Applicant contributed an additional $100,000 to the program, for a total corporate contribution of approximately $139,000, plus approximately $138,000 contributed by the Applicant's customers. In 2002, the Applicant contributed $42,930 to Project Share.

Also, with prior approval from the state regulatory commissions, the Applicant adopted temporary load-reduction financial incentives in 2001 to reduce regional power demand for the balance of 2001 and reduce the 2002 power demands by a lesser amount. These programs were estimated to reduce the 2001 summertime loads by approximately 300 average MW.

For conservation programs offered in the 1990s, the real levelized total resource costs ranged from 5 to 82 mills/kWh, with a typical cost of roughly 30 mills/kWh. These programs achieved a total estimated energy savings of 28 average MW, and nearly all of them were concluded prior to 2000.

As noted above, in 2001, in response to an extraordinary spike in wholesale power costs that was concurrent with a regional drought, the Applicant implemented a temporary incentive program to reduce the 2001 peak summer power demand. The incentive amount paid for load reductions for this limited period was 150 mills/kWh. This incentive payment, which was based on bids made by irrigation customers throughout the Applicant's service territory, resulted in a 30% decrease in the annual overall energy consumption by the irrigation sector of the Applicant's load base, equating to a peak irrigation load reduction estimated at 250 MW. There was a parallel industrial load-reduction measure also implemented for this period: one of the Applicant's industrial customers was paid roughly 150 mills/kWh to reduce its load by approximately 50 MW.

Now the Applicant is once again offering new conservation and demand-side management programs and updating its cost estimates for conservation.

H.11.2. Compliance with Energy Conservation Regulatory Requirements

The Applicant's energy conservation programs comply with all known regulatory requirements.

H.12. Tribe Mailing List

No part of the project is located on Native American land. However, all Native American organizations in the region were invited to participate in the consultation process for the license application. Those Native American organizations that did participate in the consultations, as well as their addresses, are listed in the Consultation Appendix. The list of Native American participants includes the U.S. Department of the Interior's Bureau of Indian Affairs, the Burns Paiute Tribe, the Columbia River Inter-Tribal Commission, the Colville Confederated Tribes, the Confederated Tribes of the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs of Oregon, the Native American Rights Fund, the Nez Perce Tribe, the Shoshone-Bannock Tribe, and the Shoshone-Paiute Tribes.

H.13. Management, Operation, and Maintenance Measures

The Applicant maintains state-of-the-art dam and plant safety, employee safety, and public safety programs. These programs, based both on industry risk-management and FERC standards, are designed to minimize risks to the community, the public, the Applicant's operating personnel, the environment, and the physical plant. Each of the Applicant's safety programs is managed by full-time professional personnel who ensure that any identifiable risks are discovered and minimized. The resources assigned to each of the safety programs are described in the following sections.

H.13.1. Operation During Flood Conditions

Operation during emergency conditions is detailed in the Applicant's emergency action plans (EAPs) (on file with FERC). The guidelines and notification flowcharts of the EAPs are designed to provide the earliest possible warning of an emergency condition at the project and to ensure that, in the event of a hazardous condition, all appropriate action is taken to protect the public. The EAPs are tested annually. Also, the plant personnel conduct quarterly training on the EAPs, and all personnel involved with project and system operation receive formal annual training on the importance of the plans and procedures. The objective of the training is to ensure that personnel are familiar with the plans and that current notification data in the plans are maintained. In addition, FERC regulations require each licensee to conduct a functional test of one of their EAPs every five years. A functional test of the Brownlee Project EAP was conducted in 1992.

The probable maximum flood for various locations along the Snake River has been reviewed repeatedly, most recently as part of a 1999 independent consultant's safety inspection of the project works of the HCC. These studies have concluded that each of the dams in the HCC can safely pass the probable maximum flood without endangering the stability of any of the dams or reservoirs.

H.13.2. Warning Devices for Downstream Public Safety

The Applicant is vitally concerned about public safety at the project, as well as downstream and upstream of the project. To minimize risk to the public, potentially hazardous areas are secured, to the extent practical, against public entry. Multiple warning devices, including sirens, signs, warning buoys, and boat barriers, have also been installed to warn the public away from hazards. The Applicant's overall public safety plans for the HCC appear in Technical Report H.13-2. A summary of the HCC safety measures and devices is also provided below.

The existing license limits changes in water surface elevation at Johnson Bar, located approximately 18 miles downstream of Hells Canyon Dam, to a maximum of 1 foot per hour. This application proposes the same limitation. To ensure compliance with the ramp-rate limit at Johnson Bar, changes in tailwater elevation at the dam are typically limited to a maximum of 1.4 feet per hour. Also, the existing license requirements specify a range of required minimum flows downstream of Hells Canyon Dam, depending on time of year and other considerations, with the lowest allowable minimum flow being 5,000 cubic feet per second (cfs). The relatively slow maximum ramp rate, combined with the minimum-flow requirements, substantially eliminates downstream risks due to routine flow changes. In addition, at each of the dams, sirens and strobe lights that are connected to the spill gate power circuits are mounted on the spillway bridges to warn people downstream of the spillway before any change in flow through the spillway. These sirens and strobe lights start 1 minute before any spill gate begins operating. The sirens and strobe lights are activated automatically but can also be activated manually. Therefore, boaters are warned prior to any change in flow through the spillways. Also, as shown in the public safety plans (Technical Report H.13-2), warning signs are mounted downstream of the plant discharges and spillways. These signs prohibit boating near the plant discharges and spillways and require boaters to maintain safe distances. In addition, to protect people downstream in the event that the Oxbow fuse plug dam failed, the existing license limits the maximum increase in flow past Hells Canyon Dam to 15,000 cfs.

As also shown and described in the public safety plans (Technical Report H.13-2), boat barriers, buoy lines, warning signs and lights, and fencing and other access barriers are in place where appropriate throughout the project to warn people away from other hazards appurtenant to the project, such as shallow rock outcroppings in the reservoirs, falling hazard locations, and powerhouse and spillway intakes. All hazardous areas at the dams, spillways, power plants, recreation sites, and substations are fenced to prevent unauthorized entry.

The Applicant inspects all intake buoys and cables, megaphones, outdoor lighting, audio/visual warning devices, fences, signs, and safety barriers at least monthly. In addition, the entire project is inspected biannually to identify any potential hazards that may have been overlooked previously. After this biannual inspection, recommended corrections are aggressively monitored to ensure that they are implemented.

In addition to safety and warning measures and devices at the project, the Applicant, with various local and state entities, supports other public water-safety education programs, including Water Awareness Week created by the Idaho Department of Water Resources, other agencies, and the Applicant. Water Awareness Week provides elementary school children throughout Idaho with classroom instruction regarding basic water safety concepts, focusing primarily on water safety in and around reservoirs, dams, and rivers. The Applicant continues to provide financial contributions to support this program.

H.13.3. Proposed Changes That Might Affect the Emergency Action Plans

The Applicant proposes no changes to the operation of the project that would be expected to affect the existing EAPs, nor has any downstream development occurred that would affect the EAPs. In accordance with current FERC standards, the EAPs are reviewed and updated annually to ensure that any downstream development or changes in operation are accurately reflected in the plans. Copies of the updated plans are then distributed to all planholders, including all regional emergency response agencies.

H.13.4. Existing and Planned Monitoring Devices

Extensive monitoring devices are maintained at the dams and powerhouses to ensure that any structural deterioration would be discovered immediately. In addition, the Applicant maintains landslide monitoring survey grids alongside Brownlee Reservoir and seismic monitoring equipment at Brownlee Dam. There are multiple monitors on most of the powerhouse mechanical equipment and on the spillways. Also, there are multiple water level and flow monitors upstream of, downstream of, and within each plant. The monitoring equipment at the plants would provide almost immediate indication of any unusual or hazardous conditions via the supervisory control and data acquisition (EMS) system. This system electronically transmits plant and equipment operating and alarm information to and from the Generation Dispatch Center in Boise. The Generation Dispatch Center is staffed 24 hours per day, 7 days per week. Any unusual or hazardous condition that could occur but would not immediately cause an alarm at the Generation Dispatch Center would be observed within 12 hours by the plant operating personnel during their visual observations of the dams and powerhouses.

Most of the maintenance of and data collection from structural monitoring devices, shown in Technical Report H.13-4, is done manually each month. Dam alignment and settlement surveys are done annually to confirm that there are no changes in long-term historical trends. The dam safety monitoring plans (Technical Report H.13-3) show the dam alignment and settlement survey monument layouts and measurement data. All plant operators are trained to recognize potential hazards, including seepage, sinkholes, and changes in alignment and settlement, as well as to implement a prearranged notification procedure if a problem is discovered. The landslides upstream of Brownlee Dam, which have been proven to pose no threat to the project under any circumstances, have historically been surveyed annually to monitor trends, and for the immediate future, will be surveyed every five years. Annually, the Applicant's dam safety engineer performs an additional complete inspection of the entire project, using a checklist similar to that used by the dam operators for monthly inspections.

Underwater inspections are conducted intermittently by trained commercial divers to look for any signs of structural deterioration at the upstream intake structures and conduits and the downstream spillways and tailraces. Also, in accordance with FERC regulations, the entire project and dam-safety monitoring documentation is inspected every five years by an independent engineering consultant specializing in dam safety and stability. The highly qualified engineering firms retained to perform the inspections thoroughly review all components of the project, as well as all prior design assumptions and parameters, to ensure that all components of the project continue to comply with federally specified factors of safety.

H.13.5. Safety Record

In addition to the structural safety program described in section H.13.4., the Applicant operates state-of-the-art employee and public safety programs to eliminate risks to employees and the public. The Applicant has an overall employee safety record that is among the best of like-sized utilities in the nation. Currently, the Applicant's Corporate Safety Department is staffed by eight full-time professional safety consultants who manage the Applicant's employee and public safety programs. In addition to developing and implementing employee safety training programs and monitoring the effectiveness of these programs, each year the Applicant's safety consultants conduct facility reviews of the project to identify any employee hazards that may have been overlooked previously. Until recently, the safety inspection team also inspected the entire project annually to identify any potential hazards to the public. However, due to the success of this program in eliminating public safety hazards to date, these inspections are now conducted biennially.

As part of the Applicant's safety programs, all operating employees are required to attend regular safety training classes throughout the year to ensure that they have the ability and direction to recognize and correct potential hazards.

Since the original license was issued, the Applicant has recorded fewer than 25 employee and contractor lost-time accidents, and 23 public safety accidents within the project boundary have been recorded. All of the employee and contractor safety accidents are considered to be project related. Since licensing, there have been three employee or contractor deaths associated with operation or construction of the project. Two of these deaths occurred recently when a plane crashed during a deer survey being conducted for environmental studies associated with this license application. The airplane accident, which the FAA concluded was a result of pilot error, killed the contracted pilot and a company employee.

No public injuries or deaths within the project boundary have resulted from project operations. Most of the public safety incidents recorded within the project boundary were associated with outdoor recreation and/or auto accidents. Also, most recorded public safety incidents were related to serious injury or death because minor accidents experienced by recreationists are generally not reported and therefore do not come to the Applicant's attention. Since the project was licensed, 16 people are known to have died within the project boundary, although their deaths were unrelated to project operations. Of these deaths, nine were drownings, resulting from falls, boating and fishing accidents, and auto accidents. Two deaths resulted from injuries from falls, three were from physical ailments, one was from injury sustained during an auto accident, and one was an apparent suicide.

H.14. Current Operation

The project is currently operated to comply with existing license requirements and several other constraints adopted subsequent to original licensing. Descriptions of proposed project operations and proposed license constraints are contained in Exhibit B and in sections H.1.2., H.1.3., H.2.3.2., H.3.2., H.3.3.1., and H.6. In summary, the three-dam, three-reservoir complex is operated to maximize the power and energy production value of the Snake River and yet comply with flood-control mandates, maximize the recreational and environmental benefits of the complex, and minimize detrimental environmental impacts. Because most of the usable reservoir capacity in the complex is contained in Brownlee Reservoir, operations of all three powerhouses and dams are driven by operations at Brownlee Dam. Proposed operations of the Brownlee Project, as described in Exhibit B, are designed to meet the following objectives:

- Maximize the power reliability and energy production value of the complex and river.
- Provide springtime flood control under direction from the ACOE.
- Provide storage capacity to minimize the potential springtime impact of project operations on anadromous fish propagation and survival downstream of the HCC.
- Minimize reservoir drafts during the spawning period and recreation season to minimize impacts to the resident fishery in Brownlee Reservoir and maximize the recreational benefits provided by the reservoir.

Over the course of a year, HCC operations typically cause the following fluctuations in Brownlee Reservoir and flows:

- Starting in mid-January, Brownlee Reservoir is drafted, in accordance with direction from the ACOE, to provide flood-control space. The extent of this draft depends on the expected spring runoff river flows. In a medium- or high-water year, this draft normally requires flow past Brownlee Dam to be increased significantly. Flood-control operations at Brownlee Reservoir may continue until June, depending on the expected inflow. Normally, the ACOE releases the Applicant from flood-control requirements by mid-May.
- After the Applicant has met its flood-control requirements, it attempts to fill Brownlee Reservoir by the end of June to maximize recreational opportunities and resident fish spawning success at Brownlee Reservoir. Whether the Applicant is able to fill Brownlee Reservoir by this time depends on the amount of spring runoff entering the reservoir, as

well as the Applicant's maintenance of minimum flows below Hells Canyon Dam throughout the incubation period to protect fall chinook salmon redds.

- Starting in September, Brownlee Reservoir is drafted or maintained below full pool to provide storage for inflows above discharges throughout the fall chinook salmon spawning period. This drafting typically requires that flows past Brownlee Dam be increased during this period.

- Beginning in mid-October and lasting through early December, the Applicant maintains a constant flow, normally between 8,000 and 13,000 cfs, below Hells Canyon Dam to ensure that fall chinook salmon construct their redds below a certain target flow elevation. This operation requires that inflows to Brownlee Reservoir in excess of the constant flow below Hells Canyon Dam be retained in Brownlee Reservoir so Brownlee Reservoir is refilled in this period. The spawning season and associated minimum flows vary among all years. The Applicant establishes the spawning flows below the dam based on hydrologic conditions and forecasts.

- From the time the fall chinook spawning period ends in early December through fry emergence in the spring, flows past Hells Canyon Dam are maintained to keep the river below Hells Canyon Dam above the target flow elevation selected in the fall. The effect of these maintained flows on Brownlee Reservoir depends on the amount of runoff received. With normal and higher-than-normal inflows, minimum target flows below Hells Canyon Dam can be maintained without drafting Brownlee Reservoir before the spring flood-control draft. Under drought conditions, Brownlee Reservoir might be drafted during this period to provide the minimum target flow below Hells Canyon Dam.

On a daily basis, all three reservoirs and power plants are operated in coordination with the wholesale power market and the Applicant's other generating plants to follow daily power loads and maximize the system and project efficiency and reliability while complying with the license limits and other constraints described earlier. Except during spring runoff, flows through all three plants, and therefore electrical power production, are ramped up and down to follow the regional electrical demand. During spring runoff, when inflows exceed the hydraulic capacity of the power plants, the plants are normally run at their peak capacity and excess flows are spilled through the service spillways.

Throughout the year, flows through Brownlee and Oxbow powerhouses are varied on an hourly and daily basis to maximize power production during peak load periods and coordinate with wholesale power market prices and other generating resources. Except during spring runoff periods when inflows exceed the plants' hydraulic capacities, flows through Brownlee Power Plant commonly range from a few hundred cubic feet per second or less during minimum load hours up to the plant hydraulic capacity of approximately 35,000 cfs during peak load hours. Flows through the Oxbow Power Plant range from a daily minimum of approximately 4,000 cfs to the plant peak hydraulic capacity of approximately 29,500 cfs, except during spill periods when the flow past Oxbow Power Plant exceeds the plant's hydraulic capacity. Flow through Oxbow Power Plant rarely falls below 4,000 cfs because the Oxbow Power Plant is used for load following during the off-peak period between about 11:00 PM and 3:00 AM. Because a minimum flow of 100 cfs is required in the river channel between Oxbow Dam and the Oxbow Powerhouse, the flow past Oxbow Dam into Hells Canyon Reservoir never falls below that amount.

H.15. PROJECT HISTORY

Construction of the first hydroelectric plant in the Hells Canyon reach was started in 1908 at the bend in the river called the oxbow by a predecessor to the Applicant, the Idaho–Oregon Light and Power Company. As with the later Oxbow Project, the early project was designed to use a tunnel through the oxbow to a power plant on the west side of the oxbow, with a dam across the river on the east side to raise the water upstream of the powerhouse. However, the project was not completed because of the difficulty of successfully damming the river. Ultimately, a wing dam was constructed to divert part of the river flow into the power tunnel. The power plant was thus able to exploit only the 22 feet of fall around the oxbow. The wing dam was intermittently damaged by high flows and then expanded between 1915 and 1922.

Various development plans for the Snake River through Hells Canyon were considered by the Applicant, the U.S. Bureau of Reclamation, the ACOE, and others throughout the 1930s. In the early 1940s, the Applicant began to more seriously evaluate the possibilities for economic hydroelectric development of the Snake River in Hells Canyon and in June 1947, submitted a preliminary permit application to the Federal Power Commission (FPC) for expansion of the Oxbow Project.

Subsequent to its initial permit application in 1947, the Applicant conducted studies and assessments as specified by the implementing regulations of the Federal Power Act and on December 15, 1950, submitted an application for an FPC project license for the Oxbow Project. In Exhibit Q of the 1950 license application, the Applicant indicated its intent to comprehensively develop the Hells Canyon reach of the Snake River with a series of five dams with powerhouses: Oxbow and Hells Canyon dams, a small Brownlee Dam, and the Sturgill and Bayhorse Rapids dams upstream of the small Brownlee Dam. After nearly five more years of national debate about how to best develop the Snake River in Hells Canyon, the FPC issued the project license on August 4, 1955, for the three-dam complex that now exists.

Shortly after license issuance, and as required by the new license, the Applicant submitted Brownlee Project design drawings to the FPC, and the Brownlee spillway design to the ACOE for approval. On November 3, 1955, the FPC approved the Brownlee design drawings, and seven days later the Applicant started access and site preparation work for Brownlee Dam. Excavation for the Brownlee diversion tunnel started in December 1955. Brownlee Dam was substantially completed, and reservoir filling begun, on May 9, 1958. The first Brownlee generating unit went into operation on August 27, 1958. The last HCC generator, Brownlee unit 5, went into service on March 31, 1980.

A list of project benchmarks and their dates are listed below.

August 4, 1955	License was granted for the Hells Canyon Complex.
November 10, 1955	Construction on Brownlee Dam began.
December 11, 1957	Excavation for Oxbow Dam began.
May 9, 1958	Brownlee Dam was completed, and reservoir fill began.
August 27, 1958	Brownlee unit 4 turbine generator went into service.
October 3, 1958	Brownlee unit 3 turbine generator went into service.

December 17, 1958	Brownlee unit 2 turbine generator went into service.
January 22, 1959	Brownlee unit 1 turbine generator went into service.
March 12, 1961	Oxbow Dam was completed, and reservoir fill began.
June 9, 1961	Oxbow unit 1 turbine generator went into service.
June 30, 1961	Oxbow unit 2 turbine generator went into service.
July 27, 1961	Construction of the road to Hells Canyon Dam began.
September 8, 1961	Oxbow unit 3 turbine generator went into service.
November 18, 1961	Oxbow unit 4 turbine generator went into service.
August 27, 1964	Excavation for Hells Canyon Dam began.
October 10, 1967	Hells Canyon Dam was completed, and reservoir fill began.
October 23, 1967	Hells Canyon unit 3 turbine generator went into service.
December 16, 1967	Hells Canyon unit 2 turbine generator went into service.
December 28, 1967	Hells Canyon unit 1 turbine generator went into service.
December 1976	Construction for Brownlee unit 5 began.
March 31, 1980	Brownlee unit 5 turbine generator went into service.

The environmental and recreation facilities associated with each project, including the temporary and permanent fish traps and Woodhead, McCormick, Copperfield, and Hells Canyon parks, were constructed concurrently with the dams and powerhouses. Throughout the life of the project, upgrades and improvements have been made because of advances in industry operating standards, equipment manufacturing, and communications and monitoring technology and because of changes in liability standards and in regulatory requirements and recommendations. The following list summarizes the major repairs and upgrades, as well as the dates of those improvements.

Spring 1972	Brownlee unit 1 generator was rewound due to repeated failures and to correct a design deficiency.
Fall 1972	Brownlee unit 2 generator was rewound due to repeated failures and to correct a design deficiency.
Spring 1973	Brownlee unit 4 generator was rewound to correct a design deficiency and to reduce the risk of failure.

Fall 1973	Brownlee unit 3 generator was rewound to correct a design deficiency and to reduce the risk of failure.
Spring 1983–Fall 1984	The new Hells Canyon fish trap was constructed.
Fall 1985	Hells Canyon unit 2 generator was rewound due to failure.
Spring 1986	Hells Canyon unit 3 generator was rewound due to failure.
Summer 1987	Hells Canyon unit 1 generator was rewound to reduce the risk of failure.
Spring 1988	Oxbow unit 4 generator was rewound to reduce the risk of failure.
Spring 1988–Fall 1989	Copperfield Park near the Oxbow Project was reconstructed.
Fall 1988–Spring 1989	Oxbow unit 3 generator was rewound to reduce the risk of failure.
Spring 1989	Backup generator was installed at the Brownlee Project’s spillway.
Fall 1989–Spring 1990	Oxbow unit 2 generator was rewound to reduce the risk of failure.
Fall 1990–Spring 1991	Oxbow unit 1 generator was rewound due to failure.
1993	The U.S. Forest Service reconstructed the Hells Canyon Launch and interpretive site downstream of Hells Canyon Dam.
Spring 1991–Fall 1994	Woodhead Park on Brownlee Reservoir was reconstructed.
Fall 1992 and 1993	New recreation boat ramp and parking area were constructed on Hells Canyon Reservoir near Copperfield Park.
Spring 1995	New RV dump station was constructed at Hells Canyon Park.
Fall 1997–Spring 1998	Control system upgrades were made at Oxbow Powerhouse.
Fall 1998–Spring 1999	Control system upgrades were made at Brownlee Powerhouse.
Fall 1999–Spring 2000	Control system upgrades were made at Hells Canyon Powerhouse.
Fall 1999–Spring 2000	Brownlee unit 4 generator was rewound due to limited winding failure and to reduce the risk of additional failure.
Fall 2000–Spring 2001	Brownlee unit 1 generator was rewound to reduce the risk of failure.
Fall 2002–Spring 2003	Brownlee unit 2 generator was rewound to reduce the risk of failure.

The control system upgrades referred to in the list above are ongoing projects. The control upgrades provide the Applicant greater control over the projects from the Generation Dispatch Center in Boise. The Brownlee unit 3 generator is tentatively scheduled for rewind in the next two to three years to reduce the risk of failure caused by normal wear of the equipment. In addition, Hells Canyon unit 2 will be rewound in 2003 because of a coil short in January 2003.

H.16. GENERATION LOST DUE TO OUTAGES

Table H-2 shows the amount of generation estimated to have been lost at the HCC project over the last five years because of unscheduled outages. Because of the substantial amount of reservoir storage and amount of generating capacity in excess of available flows during most periods of the year, it is unusual for an outage to cause a loss of generation at the HCC. In most cases, the Applicant is able to respond to an equipment outage by simply reducing flow through the powerhouse or powerhouses until alternative equipment is started or, in the worst case, until the outage is remedied. The exceptions to this capability occur when there is an outage during periods when the plants are already at their hydraulic capacity or there is an outage at the Hells Canyon Power Plant; both situations often require that water be spilled to avoid exceeding the project ramp rate and maintain the minimum flow until flow can be restored through the turbine generators. In the five-year period from January 1, 1998, through December 31, 2002, the estimated total of lost power due to unscheduled outages was 20,500 MWh. This estimate is approximately 0.072% of the approximately 28,300,000 MWh net electrical energy produced at these plants during the same period.

H.17. RECORD OF COMPLIANCE

The Applicant has at all times placed a high priority on full compliance with all terms and conditions of the license. The FERC has jurisdiction to assess license compliance. Any incident or action that appears to be a violation of the license is investigated by FERC to determine whether a violation has occurred. During a recent review of the project documentation, the Applicant's records indicated that, in the history of the project, there has not been a single instance determined by FERC to be a license violation. The Applicant intends to continue this record of compliance. Currently, the Applicant uses a computer-based tracking system to monitor and document compliance at each licensed project.

H.18. ACTIONS AFFECTING THE PUBLIC

The principal action taken by the Applicant that affects the public is providing reliable electric service while attempting to balance the overall cost and environmental impacts responsibly. Through the conscientious development and operation of its power plants and electrical system, the Applicant attempts to minimize the cost of electrical service in its service territory while also minimizing the environmental impacts of its operations. As a result of its efficient development and operation of the regional electrical system, the Applicant has contributed significantly to the creation of vibrant, economically and environmentally healthy, and globally competitive communities throughout the service territory.

The Applicant further affects the public by using the hydrologic resources of the Snake River basin to generate power, thereby impacting the environmental characteristics, usability, and accessibility of much of the Snake River. However, as a condition of this use, the Applicant has also accepted responsibility for operating its hydroelectric projects in a way that minimizes the environmental impacts and maximizes the environmental benefits of these projects.

The third major action that affects the public is the Applicant's substantial participation in the communities within its service territory. As a business entity, the Applicant has always participated in and contributed to civic and community affairs. Additionally, the hundreds of Applicant employees also contribute individually to their communities, as members of the business community, through civic and charitable organizations, and as citizens and neighbors.

As a result of the Applicant's efficient construction and operation of its electrical systems, attention to responsible environmental stewardship, and contributions and support to the communities and residents throughout its service territory, the Applicant is generally recognized as one of the nation's lowest-cost and most environmentally conscientious private providers of electric service. Some of the specific environmental and community enhancement measures and programs that the Applicant provides or supports, both those applicable to all the Applicant's projects and those specific to the HCC, are described in the following sections.

H.18.1. Applicant's Environmental Contributions

As a condition of being able to use the Snake River and state and federal lands for power generation, the Applicant must comply with manifold local, state, and federal regulations—especially its FERC hydroelectric project license and state public utilities commission orders—regarding all aspects of its operations and use of the river. In addition, a FERC project licensee has an ongoing obligation to conduct its operations in an environmentally responsible manner in accordance with the letter and spirit of the Federal Power Act and all other applicable environmental laws and regulations. Also, to satisfy the requirements for a new license application, an Applicant must evaluate and provide a complete description of the environmental resources affected by the project and propose measures to protect and enhance those resources.

Each of the requirements listed above necessitate multiple actions affecting the public. However, the Applicant takes considerable pride in having implemented several environmental initiatives and programs affecting the public that, in the Applicant's opinion, go well beyond the existing license and regulatory requirements and illustrate a longstanding commitment to exceed regulatory and community expectations. Some of these environmental initiatives and programs are discussed in the following sections.

H.18.1.1. Land Planning, Management, and Dedications for Environmental Benefits

H.18.1.1.1. Comprehensive Land Use Planning

In the southern Idaho/eastern Oregon service territory, the Applicant owns and manages more than 30,000 acres, much of which are in or near valuable riverine and riparian habitat in the Snake River basin. In addition, the HCC encompasses approximately 5,530 acres of state and federal lands.

In consideration of the substantial environmental and stewardship responsibilities inherent in managing these lands and easements, the Applicant has initiated and managed collaborative processes to prepare comprehensive management plans for all of the project-associated lands managed by the Applicant. These plans—the *Hells Canyon Resource Management Plan* (Technical Report E.6-1), *General Land Management Policies* (IPC 1996), the *Middle Snake River Land Management Plan* (IPC 1995), and the *C.J. Strike Land Management Plan* (IPC 1998)—all seek to ensure that the resources encompassed by these lands and the resources on adjacent lands that are affected by the Applicant's operations are protected from adverse impacts. These land management plans and policies are also designed to ensure consistency with other applicable regional and local comprehensive and land-use plans (see section E.6.5.4.). The

Applicant's land and resource management plans were prepared in consultation with both governmental and nongovernmental organizations, including natural and cultural resource preservation organizations, wildlife advocates, and recreation districts, to ensure that the valuable resources associated with these lands are appropriately protected and enhanced. These plans include specific policies for recreation access, wildlife habitat protection and enhancement, cultural and natural resource preservation, and weed control, as well as for the protection and enhancement of valuable native plant habitat. These policies are designed to guide the Applicant's land-use decisions and operations and to clearly communicate the Applicant's land-use intentions and objectives to FERC; other federal, state, and local agencies; and the public.

H.18.1.1.2. Management and Contribution of Real Estate for Environmental Benefits

To the extent possible without conflicting with the primary land use or terms of the existing FERC licenses and state and federal regulations, the Applicant manages all of the lands under its control to promote environmental and community benefits. Also, within the terms of existing FERC licenses and federal regulations, the Applicant supports and allows appropriate multiple uses on lands it owns or controls. To ensure compatibility with project licenses and to protect natural and cultural resources, the Applicant normally requires a permit application that may require an environmental review prior to allowing new private or public uses of lands under its control.

Some of the environmentally oriented uses of lands under the Applicant's control are the dedication of lands and water rights for wildlife habitat or propagation at locations throughout southern Idaho and eastern Oregon. Also, at sites from American Falls in eastern Idaho to the U.S. Forest Service's Hells Canyon Visitors Center downstream of Hells Canyon Dam, the Applicant manages the land use and provides municipal services to minimize detrimental environmental impacts while concurrently accommodating river and reservoir recreation access.

Many of the Applicant's land dedications for environmental benefits, such as portions of the C.J. Strike Wildlife Management Area and islands in the headwaters of Brownlee Reservoir, were provided as mitigation for project impacts concurrently with FERC licensing. Many others, such as dedications by the Applicant of real estate and financial and technical support for The Nature

Conservancy's constructed wetlands above the Thousand Springs Project (a project not licensed by FERC), were done to assist others in beneficial environmental initiatives without any assurance that the dedication would be credited as mitigation for hydroelectric project impacts.

H.18.1.1.3. Weed Control and Fire Prevention

Within much of the Applicant's service territory, the combined effect of human use, livestock grazing, and range fires impedes the reestablishment of native, fire-resistant, and ecologically beneficial natural forage. To help overcome these obstacles to improving the environmental health of the area encompassing the Applicant's projects, the Applicant voluntarily participates in regional efforts to both suppress noxious weeds and prevent fires. The Applicant is an active participant in several cooperative weed management areas (CWMAs) in Idaho. These CWMAs work to manage noxious weeds regionally, in recognition of the greater benefit of coordinated weed control measures. In the HCC area, the Applicant assists in these efforts by providing equipment, labor, materials, botanical expertise and study data, and public advertising to support the work of the CWMAs. Much of the Applicant's emphasis is on providing infrequently needed but critical resources not otherwise available to the usually lightly funded CWMAs, resources including off-road vehicles and boat access to normally inaccessible locations such as island preserves in the Snake River.

Similarly, in addition to fulfilling its legal obligations to prevent and suppress fires on the lands that it controls, the Applicant has traditionally contributed to the creation of rural fire departments in communities near its projects. The Applicant continues to contribute resources to firefighting organizations throughout its service territory.

H.18.1.1.4. Management and Contribution of Real Estate for Protection of Cultural Resources

The Applicant is an active participant in regional cultural and historical resource preservation efforts and initiatives and has proposed extensive measures to document and ensure preservation of archaeological resources affected by the HCC as part of the Applicant's proposed hydroelectric project mitigation (see section E.4.2.5.). In addition to the contributions proposed or required as project mitigation, the Applicant has also made voluntary real estate dedications for the preservation of cultural resources without assurance that these contributions would be credited as mitigation for hydroelectric project impacts. Two examples of these dedications are the Applicant's financial support for The Nature Conservancy's purchase of the historic farmstead on Ritter Island at Thousand Springs and the Applicant's intervention to ensure preservation of the Oregon Trail remnants in southeast Boise, Idaho, in collaboration with the State of Idaho, the City of Boise, the Idaho State Historical Society, and adjacent property owners.

The Applicant has also contributed to at least one archaeological excavation project independently of the license requirements by helping to sponsor the Camp Creek excavation downstream of Hells Canyon in cooperation with the U.S. Forest Service. Finally, the Applicant has traditionally made annual financial contributions to the state historical societies for public outreach and education programs and provided other support when practical. This other support includes use of the Applicant's meeting rooms, study data, and transportation equipment to assist others in archaeological investigations and outreach projects.

As a result of its efforts on behalf of preserving historical and cultural resources in its service territory, the Applicant is proud to have twice been awarded the Idaho State Historical Society's Orchid Award "for superlative achievement in preserving Idaho's heritage," once for preserving and restoring the original Swan Falls Powerhouse and once for intervening to preserve the Oregon Trail remnants in southeast Boise.

H.18.1.1.5. Brownlee Reservoir Operations to Prevent Sloughing

To help prevent sloughing along the edge of Brownlee Reservoir, the Applicant has voluntarily adopted operating restrictions to minimize the effects of reservoir drafts on these margins. Since initial construction of Brownlee Dam, both individual property owners and public agencies have developed vacation and recreation sites at various locations along the reservoir margins. In response to concerns regarding erosion at these sites, the Applicant has voluntarily adopted a policy of restricting Brownlee Reservoir drafts to a maximum rate of 3 feet per day to help prevent the sloughing and erosion, thereby contributing to preservation of both developed sites and other land adjacent to the reservoir.

H.18.1.2. Applicant Contributions to Water Quality Studies and Improvements

Agricultural and municipal development of southern Idaho has had enormous impacts on water quality in the Snake River. Construction of irrigation diversion dams on the Snake River was initiated early in the twentieth century. There are now several irrigation diversions and dams, including three large-volume federal flood-control and irrigation dams on the upper Snake River, three on the Boise River, one on the Payette River, and one on the Owyhee River, all tributary to the Snake River upstream of the HCC. Some years, the federal and irrigation company dams on the Snake River retain and divert nearly all the natural flow from the river upstream of Twin Falls through much of the summer and winter. Some of the irrigation water diverted from the Snake River and its tributaries returns via seepage and irrigation returns; however, the return flows are normally heavily contaminated due to agricultural use. In addition to the contamination caused by agricultural use, industrial and municipal discharges add substantially to contamination of the Snake River upstream of the HCC. Impoundment and use of the Snake River by the Applicant for hydroelectric generation further affects the water quality.

In light of the impact of the Applicant’s use of the river for hydroelectric generation, the Applicant supports multiple water quality improvement initiatives along the Snake River, both formally as mitigation related to FERC project licensing and federal regulations and informally as voluntary contributions to water quality improvement. The water quality mitigation measures proposed or implemented for FERC licensing and/or federal water pollution regulations are listed elsewhere in this application and in other FERC project license applications. Some of the Applicant’s informal water quality improvement contributions are discussed in the following sections.

H.18.1.2.1. Pilot Wetland Projects

Independently of license requirements and mitigation, the Applicant has contributed funds to assist with constructing experimental wetlands upstream at the Cedar Draw irrigation return project, at an irrigation return above the Thousand Springs Project, and in the Malheur River basin. Subsequently, and as part of a settlement with the Idaho Department of Environmental Quality, the Applicant contributed additional funds for enlarging the Cedar Draw wetlands.

H.18.1.2.2. Boise River Watershed Advisory Group

Along with many other participants, the Applicant helped sponsor development of a proposed watershed management plan for the Boise River. The Applicant continues to participate in developing this plan, as well as the draft *Snake River–Hells Canyon Total Maximum Daily Load* (*TMDL*) (IDEQ and ODEQ 2001).

H.18.1.2.3. Recreation Site Municipal Services

Although a fairly small contributor to the contamination of the Snake River, recreation along the river through the HCC generates several types of pollution. The Applicant attempts to minimize the amount of pollution reaching the waterway through several measures. The Applicant pays for temporary toilets and some trash pickup at undeveloped campsites from the headwaters of Brownlee Reservoir down to near Hells Canyon Dam during the camping season. The sanitary waste from the portable toilets is collected by contractors and disposed of at municipal treatment plants. At the Applicant's parks, on-site wastewater treatment systems prevent contaminants from reaching the waterway. The Applicant has also contributed to the construction of centralized fish-cleaning stations at boat ramps on Brownlee Reservoir and built a fish-cleaning station at Woodhead Park to prevent the discharge of fish waste to the waterway.

H.18.1.2.4. Snake River Water Quality Modeling

In accordance with requirements of the Clean Water Act, the states of Idaho and Oregon have cooperatively prepared and proposed TMDLs (regional emission limits for water pollution based on the capacity of the waterway to assimilate pollutants without impairing the waterway's designated beneficial uses) for the Snake River through Hells Canyon coincidentally with the Applicant's studies prepared for this license application. The Applicant participated in the preparation of appropriate TMDLs and load allocations by providing data collected through extensive water quality studies and modeling commissioned and wholly financed by the Applicant.

H.18.1.3. Applicant Contributions in Support of Fish Preservation and Recovery

Along with agricultural and municipal development of the region, construction of dams on the Columbia and Snake rivers and their tributaries, starting with the first middle Snake River dam completed in 1901 at Swan Falls, has had a dramatic impact on the native fish that historically inhabited and spawned in the rivers, lakes, and streams of Idaho and eastern Oregon. Prior to construction of the downstream federal dams, the construction of the HCC, as well as dams on the Owyhee, Payette, Boise, and Weiser rivers, prevented anadromous fish spawning upstream of Hells Canyon Dam to Swan Falls Dam and migration to spawning sites on the Owyhee, Payette, and Boise rivers. Subsequently, construction of the federal hydroelectric dams on the Snake River downstream of the confluence with the Salmon River substantially impaired the success of the historical anadromous fish spawning throughout the Salmon River drainage, covering most of central Idaho.

In addition to the measures required by the FERC project licenses and federal law, the Applicant has voluntarily taken steps to help mitigate for negative impacts of Snake River basin development on anadromous fish. These voluntary measures are discussed in the following sections.

H.18.1.3.1. Salmon Flow Augmentation

Historically, in accordance with a National Marine Fisheries Service biological opinion, the operators of the FCRPS have attempted to enhance the survival of juvenile salmon migrating downstream through the federal Snake River dams downstream of the HCC by arranging for increased flow in the lower Snake River from July through September. The Applicant assisted these efforts by scheduling increased flow through the HCC. Also, the Applicant drafted Brownlee Reservoir, typically starting in July, to further augment river flows below the HCC, again to help FCRPS operators moderate the biological impacts of the federal lower Snake River dams. These drafts to augment flows through the federal dams have typically been concluded by the end of August. To facilitate the Applicant’s cooperation with the flow augmentation program, the Applicant entered into annual agreements with the Bonneville Power Administration in the late 1980s, at the request of the Northwest Power Planning Council. Then in 1996, the Bonneville

Power Administration entered into a five-year agreement with the Applicant. The agreement reimbursed the Applicant through an energy exchange mechanism for any energy losses it incurred as a result of participation (Technical Report H.1-1). The agreement expired in April 2001. Although the Applicant has made attempts to develop a new agreement, it has not been renewed by the Bonneville Power Administration.

H.18.1.3.2. Fall Chinook Operations

As described elsewhere in this exhibit and in Exhibits B and E, the Applicant adopted new operating restrictions for the HCC in 1991 to improve the reproductive success and survival of fall chinook in the Snake River downstream of the HCC. The Applicant's fall chinook operations compel spawning salmon to build their redds downstream of Hells Canyon Dam at depths that the Applicant can keep submerged throughout the periods for embryonic development and fry emergence each spring. The Applicant drafts Brownlee Reservoir in the fall before the spawning period and then, subsequent to salmon spawning, maintains minimum flows (at or near the maximum flow released during the prior fall spawning period) below Hells Canyon Dam throughout the spring incubation period until fry emergence. Although the cost of these measures is substantial, they are considered to have been successful enough that the Applicant proposes to adopt these measures as permanent operating restrictions through the period of any new license.

H.18.1.3.3. Hatchery Contributions Unrelated to Project Licenses

As described in Technical Report E.3.1-4, the Applicant's fish trapping and hatchery programs have been able to produce many more fish and eggs than required by the original project license and subsequent settlement agreements. This production has made it possible for the Applicant, with the Idaho Department of Fish and Game, to contribute substantially to fish management, propagation, and sport programs, which are unrelated to the Applicant's projects, throughout Idaho and in Oregon and Washington. Eggs from the Applicant's hatcheries have been used for fish programs in the Clearwater, Lochsa, upper Salmon, Lemhi, and Grande Ronde river basins and have been contributed to state and federal hatcheries and tribal programs throughout Idaho and in Oregon and Washington. In accordance with Idaho Department of Fish and Game determinations, the Applicant has also trapped excess returning adults for redistribution and stocking for sportfishing by Idaho Department of Fish and Game. Also, the Applicant arranges for the distribution of adult salmon after spawning to charitable food organizations when feasible and safe.

H.18.1.3.4. Brownlee Reservoir Operations

As noted in Exhibit B and elsewhere in the license application, the Applicant attempts to prevent drafting Brownlee Reservoir after spring flood-control restrictions are lifted each year. Instead, the Applicant tries to fill Brownlee Reservoir by the end of June to minimize the impact of reservoir operations on resident fish spawning in the reservoir during this period. Brownlee Reservoir is drafted during the summer to meet power needs and in September to accommodate the fall chinook plan (section E.3.1.3.1.1.).

H.18.1.3.5. Brownlee Fisheries Planning and Studies with Oregon and Idaho

Brownlee Reservoir is one of the primary recreational fishing sites in the region. As a result, both the Idaho and Oregon fish and game agencies take considerable interest in the resident fishery and evaluate fisheries health and assess measures available to them and/or the Applicant to enhance and protect the game fish populations. Given the Applicant's similar, concurrent objectives, the Applicant and these agencies have collaborated on their HCC resident fish studies and fish management measures for the last 10 years to maximize the benefits and minimize the costs of these efforts.

H.18.1.3.6. Coordination with Downstream Nez Perce Salmon Project

In the mid-1990s, the Nez Perce Tribe initiated a project to help restore salmon runs in the Snake and Salmon rivers by acclimating hatchery-spawned salmon at Pittsburg Landing downstream of Hells Canyon Dam before releasing them. To avoid disrupting the Nez Perce Tribe's operations, the Applicant voluntarily attempts to maintain a minimum flow below Hells Canyon Dam of 11,000 cfs throughout the acclimation period. In the event that flow below Hells Canyon is reduced to below 11,000 cfs, the Applicant notifies the Nez Perce Tribe to ensure that they have the opportunity to adjust their flow-control devices.

H.18.1.3.7. Consumer Education

As described in section H.18.4.1., the Applicant helps to sponsor the annual Idaho Salmon and Steelhead Days school education program along with the Idaho Department of Fish and Game, Nez Perce Tribe, Bonneville Power Administration, U.S. Forest Service, Bureau of Reclamation, U.S. Fish and Wildlife Service, and many other volunteers. The Applicant also hosts public and school tours of its hatcheries and intermittently contributes financial support to groups working to promote protection and restoration of fish habitat and survival within the region.

H.18.1.4. Wildlife Contributions

Although many of the Applicant's recent contributions benefiting wildlife have been incidental to studies undertaken as part of the process for developing a new license application, the Applicant has actively participated in programs to benefit wildlife throughout its service territory for the past three decades. Some of these contributions are listed below, along with the incidental benefits that arose from relicensing studies.

H.18.1.4.1. Hells Canyon Bighorn Sheep Monitoring and Restoration

Although the existence of the HCC has probably had negligible impact on the the health of the bighorn sheep herds in the region, the Applicant has assisted with bighorn sheep monitoring and restoration in the area surrounding the project at the request of resource agencies. In the mid- and late 1990s, after disease caused a die-off of the herds within the project region, the Applicant contributed personnel, radio collars, and other resources to assist with the capture, import, and restocking of these bighorn herds. Since then, and incidentally to deer monitoring as part of the relicensing studies, the Applicant continues to collect data on bighorn sheep and immediately relays these data to the agencies managing bighorn sheep. The Applicant is also assisting with monitoring lamb mortality of bighorn sheep, an effort that has been conducted by Oregon resource agencies since about 2000.

H.18.1.4.2. Wildlife Data Collection and Distribution

As it was conducting studies for relicensing, the Applicant voluntarily contributed to regional natural resource data in four ways. First, in response to resource agency requests during prestudy consultation, the Applicant conducted studies regarding some high-profile species of concern, including the wolverine and mountain quail, that the Applicant believes are not significantly impacted by the existence or operation of the project.

Second, to conduct scientifically valid studies, the Applicant contributed to the development of wildlife survey tools that are now available to others throughout the region. The most conspicuous of the contributions to survey tool development has been the Applicant's financial support for the University of Idaho to create new protocols and procedures for mountain quail calling surveys.

Third, while collecting data for the license application, the Applicant also collected data for unrelated resource agency studies when practical. This parallel data collection, mainly during aerial wildlife surveys, provided the agencies with data that they may not have been able to afford to collect otherwise. In turn, these resource agencies also provided data that they had collected to the Applicant for the Applicant's relicensing studies. Additionally, in some cases, the Applicant contracted with resource agencies and others for wildlife data collection, making the data collected available to both the Applicant and the agency. For example, the Applicant contracted with Idaho State University for Hells Canyon reptile and amphibian studies, and so study results were available to both the Applicant and the Intermountain Reptile and Amphibian Database maintained by Idaho State University.

Fourth, the Applicant shared data from its studies with multiple resource agencies as these data were compiled and prior to study completion, assisting the agencies' short-term and long-term resource management and planning throughout the study period. For example, the Applicant provided data to the resource agencies prior to study completion regarding mule deer, wolverine, elk, mountain quail, sage grouse, sharp-tailed grouse, bull trout, and other species as requested. The Applicant intends to continue providing study data to the resource agencies and, in some cases, collecting data beyond initial study completion, for the benefit of regional wildlife and habitat management, and independently of FERC license requirements.

The Applicant also provided native plant information collected during relicensing studies to the resource agencies, including the Idaho Conservation Data Center and the Oregon Natural Heritage Program.

H.18.1.4.3. Raptor Protection Program

In the 1970s, the Applicant—together with neighboring Pacific Northwest utilities, private conservation groups, and federal agencies—sponsored groundbreaking studies to find methods to eliminate or minimize injury and death to raptors from contact with overhead powerlines. These studies led to the identification of standard methods, based on raptor behaviors, for constructing and retrofitting overhead powerlines to significantly reduce risks to raptors. The results of these studies have been published in natural resource, scientific, and industry journals, provided in educational video format, and presented at natural resource and industry conferences. In 1996, the study results were published in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC 1996), which has been adopted by electric utilities worldwide to guide the design of overhead powerlines to minimize electrocution risks to raptors.

H.18.1.4.4. Bald Eagle Surveys

Beginning in the 1980s, the Applicant has provided personnel and resources to assist with bald eagle surveys throughout Hells Canyon. Through the end of the 1980s and into the 1990s, the Applicant conducted biweekly surveys along Brownlee Reservoir in response to a need identified by the Oregon Cooperative Fish and Wildlife Unit. As part of this effort, the Applicant started doing the winter bald eagle survey for the entire reach of the river from the headwaters of Brownlee Reservoir down to the confluence with the Salmon River. Since that time, concurrently with nationwide counts by federal, state, and volunteer groups, the Applicant has done the entire annual winter bald eagle count in this reach of the river and submitted data to the Idaho and Oregon data managers for submission to the U.S. Fish and Wildlife Service.

H.18.1.4.5. Other Raptor Surveys

In the mid-1990s, as part of the relicensing studies, the Applicant began conducting surveys for other raptors, in addition to bald eagles, in the Hells Canyon region. Since that time, data collected by the Applicant, especially regarding peregrine falcon nest sites, have been provided to the U.S. Forest Service for its information needs. The Applicant has continued to monitor for nesting peregrine falcons each year concurrently with bald eagle nesting surveys.

H.18.1.4.6. Sage Grouse and Sharp-Tailed Grouse Surveys

As part of the impact assessment of the transmission lines associated with the project, the Applicant conducted a literature survey about the presence of the greater sage grouse and Columbian sharp-tailed grouse in the area of the Applicant's transmission lines. Because data found during the literature review were assessed to be obsolete, the Applicant, beginning in 2001 and in collaboration with regional resource agencies, undertook field surveys to update species data. As a result, the regional information available regarding these species has been significantly improved.

H.18.1.4.7. Deer Feeding

Intermittently since construction of the HCC, the Applicant has contributed to deer-feeding projects, at the request of the Oregon Department of Fish and Wildlife, to enhance survival during unusually severe winters. This effort contributed to the wildlife resource, independently of the Applicant's license and regulatory obligations. Although not a proposed mitigation measure, the Applicant will consider cooperating, upon request, with Idaho Department of Fish and Game and Oregon Department of Fish and Wildlife winter-feeding programs in Hells Canyon during years with extremely harsh winter conditions.

H.18.1.4.8. Hells Canyon Bird Guide

For the benefit of those who enjoy birding, the Applicant created a guide to birds found in the HCC in 1996, based on information collected by the Applicant as part of its bird studies and surveys for relicensing. This 11-page pamphlet provides a generalized map showing the HCC, with a brief description of the area, each of the hydroelectric projects, access, and recreation sites, as well as data regarding the location and season for each of the bird species found in the area. The Applicant's toll-free recreation report telephone number is also provided. This pamphlet is provided free of charge at the recreation and interpretive sites located in the HCC. Due to its popularity, it has been reprinted repeatedly since 1996.

H.18.2. Collaboration with Native American Organizations

The Applicant has legal obligations to consult with the Native American tribes and their representatives regarding the Applicant's use of Hells Canyon resources and the impact of the project on other natural and cultural resources. The Applicant makes complying fully with these legal requirements a high priority. In addition, the Applicant has also adopted other policies and participated in other projects that seek to ensure that, regardless of the legal obligations, the interests of the Native American tribes and organizations are considered in any of the Applicant's actions. These policies also ensure that these organizations are consulted before any actions are taken that could affect the interests of the tribes and organizations. Four examples of collaboration with Native American tribes are discussed in the following sections.

H.18.2.1. Nez Perce Settlement

The Nez Perce Tribe sued the Applicant in 1996 for infringing on tribal fishing rights by constructing and operating Snake River hydroelectric projects. The Applicant opposed the lawsuit; however, the Applicant also responded by concurrently initiating negotiations with the Nez Perce Tribe to reach an equitable settlement regarding this issue. Although the courts ultimately determined that the Applicant was not liable for violating tribal fishing rights and therefore did not need to provide compensation for such infringement, the Applicant nonetheless continued negotiations with the Nez Perce Tribe and ultimately concluded a settlement that the Applicant believes provides equitable compensation for the Applicant's impacts on tribal fishing rights. The Applicant believes that this settlement represents a substantial voluntary contribution to a harmonious and equitable relationship between the Applicant, the Native American community, and the public.

H.18.2.2. Public Outreach for Preservation of Cultural Resources

Prompted by a suggestion from a member of the Confederated Tribes of the Umatilla Indian Reservation during a collaborative work group meeting in 2000, the Applicant initiated and sponsored a project to enlist and encourage public support for protecting and preserving the cultural resources along the Snake River downstream of Hells Canyon Dam. With support from the other members of the collaborative work group, the Applicant convened a group of representatives from the six Snake River basin tribes to create a video presenting Native

American views regarding the importance of the cultural resources in Hells Canyon and along the Snake river and advising the public of the legal protections given to these resources. This 15-minute video, which includes commentary from members of most of the Snake River tribes, is being played and distributed at interpretive sites in the project area. Also, the video is regularly shown by the Applicant's community education representatives during presentations made to school classes and other groups throughout the Applicant's service territory. The Applicant hopes that this video, titled *A River Has Many Stories*, will be an effective means of encouraging recreationists using the resources surrounding the project and others throughout the Applicant's service territory to treat existing Native American cultural resources with respect in accordance with tribal desires and applicable federal and state laws and regulations.

H.18.2.3. Support for Regional Cultural Resources Preservation

As described in section H.18.1.1.4., the Applicant routinely supports the protection and preservation of cultural resources, whether Native American, Euro-American, or Asian-American, throughout its service territory, independently of its legal and license obligations. Contributions made by the Applicant to help protect the region's historical and cultural resources include dedications of labor and equipment use and administrative and financial support to the regional historical and cultural resource protection groups, as well as occasional support for specific investigations regarding the regional resources and prehistoric/historic cultures and societies.

H.18.2.4. Native American Grass-Roots Program

Independent of the Applicant's ongoing collaboration with the six Snake River basin tribes, several cooperative Native American grass-roots and oral history projects have been undertaken. These projects are designed to bolster tribal vitality and economic independence. Four of these projects have already been completed or are underway. These four projects include the video titled *A River Has Many Stories*, described in section H.18.2.1., that encourages cultural resources protection; resource handbooks on Native American plant uses; a documentary video about Sacajawea that is being promoted by the Shoshone-Bannock Tribe; and conversion of Native American video and audio oral histories into print. The Applicant plans to continue providing support for these projects, as well as several others that have recently been proposed. The following paragraphs summarize the Applicant's grass-roots programs for 2000 to 2003.

Shoshone-Bannock Tribe—One project began in December 2001 entailed assisting in the production of a documentary video about Sacajawea. The documentary aired on the Public Broadcasting System in March 2003. The Applicant contributed to a second project in 2002 by providing printing resources for the *Indian Summer VIII* field report. *Indian Summer VIII* is a tribal youth field school focused on fish and habitat restoration. This project was completed in early 2003.

Shoshone-Paiute Tribes—The Applicant is currently developing a project for audio transcription of more than 10 oral history interviews, which will be professionally dubbed in both Shoshone and Paiute languages. This project is still underway.

Burns Paiute Tribe—A project that has been ongoing since April 2001 includes developing a plant resource handbook for public and tribal use. Two versions of the handbook are expected to be completed in 2003.

Confederated Tribes of the Warm Springs of Oregon—A project that has been ongoing since October 2001 includes transcribing 200 oral history cassettes into written format. This project is still underway.

Confederated Tribes of the Umatilla Indian Reservation—Development of a project began in May 2002. The project includes producing a DVD to be used in the context of the tribes' Archaeological Resource Protection Act for training law enforcement officers and cultural resource professionals. The project is planned for completion in 2003.

Joint Tribal Video—As described in section H.18.2.2., this project began in September 2000, was completed in June 2002, and included several collaborators: the Applicant; Hare in the Gate Productions; and several tribes, including the Shoshone-Bannock Tribe, Shoshone-Paiute Tribes, Burns Paiute Tribe, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs of Oregon, and Nez Perce Tribe. During this project, an educational video illustrating the cultural significance of the Hells Canyon area was created.

H.18.3. Support for Recreation Use

Construction of the HCC has created recreation opportunities for the public that would not otherwise be available, including reservoirs that support year-round recreational fishing and boating. In addition to recreation benefits occurring incidentally to project development, the Applicant has clear obligations, as a condition of the project license, to provide for optimum public recreational development, access, and use at the project, including access to the project waters and associated lands. As reflected both in this new license application and by the existing recreational facilities provided by the Applicant in the HCC, the Applicant has committed itself not only to fully complying with the license requirements, but also to ensuring that the spirit of the license requirement is met. To illustrate this commitment, the Applicant's contributions to encourage and accommodate beneficial public use of the project resources are summarized in the following sections.

H.18.3.1. Provision of Recreation and Access Sites

Exhibit E.5. provides a list of the existing recreation and access facilities within and adjacent to the project. Most of the sites developed by the Applicant were offered or agreed to by the Applicant as a condition of the existing license. However, as part of its commitment to provide optimum public recreation development and use, the Applicant has significantly improved and expanded the sites that it originally developed and, in some cases, entirely reconstructed them to ensure that the recreational benefits are optimized and the sites remain attractive to the public.

Woodhead Park, on Brownlee Reservoir, was originally constructed by the Applicant between 1959 and 1961 as part of the Brownlee Project. It was expanded in 1969, 1972, 1977, and nearly doubled in size and reconstructed at a cost of approximately $7.5 million between 1990 and 1995. The public boat ramp at Woodhead Park was again extended in 1995 at an approximate cost of $80,000. Copperfield Park at the Oxbow Project was converted from a construction camp to a public campground on completion of the Oxbow Project in about 1965. The park was entirely reconstructed at a cost of approximately $2 million between 1989 and 1990. Subsequently, a new boat ramp and landscaped parking area on Hells Canyon Reservoir to support reservoir access from Copperfield Park was constructed in 1993 and 1994 at a cost of approximately $100,000. In 1995, a new RV dump station was permitted and constructed at Hells Canyon Park on Hells Canyon Reservoir at an approximate cost of $120,000. In addition, throughout the period of the license, the Applicant has routinely improved and upgraded the amenities at its other recreation sites, including McCormick Park on Oxbow Reservoir just downstream of Brownlee Dam, the Oxbow and Carters Landing boat launches on Oxbow Reservoir, Hells Canyon Park, and various undeveloped sites along the reservoirs and within the project boundary.

Similarly, the Applicant also voluntarily provides public parks, including picnic areas and stream channel access points, at the Applicant's Niagara Springs and Rapid River fish hatcheries, for public benefit. In addition, the Applicant provides free trash collection and portable toilets seasonally at undeveloped sites along the reservoirs to minimize the detrimental environmental impacts of the public use of these sites and optimize the public recreational-use experience.

H.18.3.2. Contributions in Support of Recreation and Access Sites by Others

As noted in section E.5.1., many of the recreation and access sites provided by others within and adjacent to the HCC are on lands contributed by the Applicant or were constructed and/or are operated with financial or other support from the Applicant. These sites include Oregon's Farewell Bend State Park at the upper end of Brownlee Reservoir, Baker County's Hewitt and Holcomb parks on the Powder River arm of Brownlee Reservoir, and the U.S. Forest Service's primitive Big Bar campground on Hells Canyon Reservoir, all of which are on lands donated by the Applicant. The Applicant contributed funds to help develop Farewell Bend State Park and Hewitt Park, to improve the Bureau of Land Management's Steck Park and Spring Recreation Area, and to help the U.S. Forest Service improve the Deep Creek Trail and Hells Canyon Creek Recreation Site below Hells Canyon Dam and Big Bar upstream of Hells Canyon Dam.

H.18.3.3. Public Recreation Outreach and Information

As part of its efforts to enhance public use of recreation resources associated with the HCC, the Applicant created and supports several programs to advertise the recreation opportunities available in the project area and provide information to the public. For example, the Applicant publishes and distributes brochures describing the recreation available in the area and inviting public use. The Applicant has been publishing these brochures, with updates as the parks were improved, for nearly 40 years. The latest systemwide parks brochure published by the Applicant was the 1999 issue of *Fun Country*, which briefly describes the recreational opportunities available at all of the Applicant's power sites, from the Jim Bridger coal-fired plant in Wyoming to the north end of the HCC. The latest recreation site directory specific to Hells Canyon was published in 2001. Supplementary brochures, with information regarding various regional recreation resources and the Applicant's facilities, have been published intermittently since original licensing. For example, the Hells Canyon Reservoir trail map, also published in 2001, was based on mapping and data collection done for license application preparation.

In the mid-1990s, the Applicant set up a toll-free telephone number with a menu that provides current information to callers on parks, recreation, water levels, boating access, and river flows. The telephone number is widely advertised in the Applicant's recreation brochures, in bill inserts, in newspaper ads, and via regular news outlets and state and county recreation departments. Also, since 1996, the Applicant has provided extensive recreation information on its Internet website at http://www.idahopower.com.

For some years, the Applicant has had a project underway to automatically collect streamflow data from streamflow gaging sites throughout the Applicant's hydroelectric system and transmit these data to the Applicant's operating offices in Boise to help operation of the Applicant's hydroelectric generating system. This information is transmitted via the Applicant's regional electronic energy management system. In 2001, the Applicant started making data from this system available to the public via the Applicant's website so that visitors assessing the recreational opportunities can also access real-time data regarding streamflows along the Snake River.

As noted in section E.5.1., the Applicant also maintains information kiosks and signs throughout the Hells Canyon area. Among other things, these kiosks and signs provide information to travelers about the location and characteristics of the recreational resources in the area. The Applicant's employees in the area also regularly assist visitors as needed. Full- and part-time employees are specifically assigned to the Applicant's parks, and camp hosts are recruited to stay at the Woodhead, McCormick, Copperfield, and Hells Canyon parks throughout the camping season. Since 1999, the Applicant has also provided one full-time employee from May through September at the U.S. Forest Service's Hells Canyon Creek Recreation Site and Hells Canyon Visitors Center below Hells Canyon Dam to help whitewater boaters and other visitors.

The Applicant also routinely uses bill inserts; news media; and federal, state, and county recreation departments and information booths to advertise the recreation opportunities in the Hells Canyon area.

H.18.3.4. Public Safety Resources

As part of operating the HCC, the Applicant maintains roads, communications systems, an airport, and helicopter landing sites within the HCC, all of which facilitate emergency medical evacuations, if needed, for public recreationists as well as for Applicant employees. Also, in the event of an accident involving the public in the HCC, the Applicant's employees normally provide emergency communication, transportation, and on occasion, medical assistance. The Applicant also attempts to ensure that any public hazards associated with the Applicant's facilities are eliminated, either by eliminating the hazards, preventing public access where necessary, or providing adequate warning devices, such as buoys and booms in the reservoirs and plant tailraces.

Since 1993, the Applicant has also worked with the Adams County sheriff's office to support having a deputy on site in the HCC throughout the camping season. The Applicant provides housing and any other assistance as needed to support this service, primarily for the safety and welfare of the public.

H.18.4. Community Involvement

Throughout its history, the Applicant and the Applicant's employees have been active in the communities they serve, contributing their time and money to hundreds of public campaigns and programs. Each year, the Applicant and its employees contribute more than $700,000 and many thousands of hours of volunteer efforts to over 200 different community and charitable organizations throughout the Applicant’s service territory. These contributions typically include over $80,000 each year to regional schools and educational programs and over $400,000 for charitable purposes. Some of the charitable purposes to which the Applicant and its employees contribute each year are senior citizens and special-needs citizens programs; disease prevention and research organizations; volunteer fire and emergency response departments; youth programs; shelter, medical care, and meals programs for the indigent, homeless, elderly, and residents of small and agricultural communities throughout Idaho and Oregon; organized charitable organizations such as United Way; and some individuals and families in southern Idaho and eastern Oregon communities who have encountered extraordinary hardships. In addition, the Applicant and its employees voluntarily contribute several thousands of dollars each year to civic and community organizations, resource preservation initiatives, and cultural and arts programs throughout the Applicant’s service territory. These contributions are supplemented by the Applicant’s donations of already fully depreciated property to local organizations and governments, property such as vehicles and equipment contributed to local and county volunteer fire and emergency response departments and excess buildings and real estate.

Specifically related to the HCC, the Applicant and its employee contributions include financial and labor contributions to volunteer fire and ambulance departments in Cambridge, Council, and Indian Valley, Idaho, and in Halfway, Richland, Ontario, Eagle Valley, and Pine Valley, Oregon; to senior centers in Council and Weiser, Idaho; and to women’s and children’s shelters in multiple communities from Boise to Ontario. In addition to these financial and labor contributions, the Applicant has recently contributed buildings and real estate to the Huntington School District in Huntington, Oregon; to a women’s shelter in Ontario; and to the City of Vale, Oregon. In addition, the Applicant continues to provide financial, professional, and administrative support and labor to multiple resource agencies and organizations supporting wildlife preservation and enhancement, cultural resource protection, fire prevention, weed control, and public recreation and access in the Hells Canyon area.

H.18.4.1. Consumer Education

Since 1983, the Applicant has offered educational programs to schools and other groups on topics such as electrical safety, efficient energy use, the environment, electricity generation, and general information about the Applicant. Currently, five full-time community education representatives and four full-time community relations representatives provide this support across the Applicant's service territory. A group of the Applicant's employees with specific expertise regarding the power industry also acts as a voluntary speakers bureau available to organizations seeking information of a general or specific nature regarding the power industry. Community education representatives speak primarily to elementary school groups; however, adult groups often call on these representatives for presentations. In 2000 and 2001, the five community education representatives gave 2,115 presentations that reached over 48,000 people. In 2002, the community education representatives gave 1,176 presentations to approximately 35,000 people. The four community relations representatives coordinate system maintenance, improvements, and expansions with local governments and other interested groups and arrange for technical support and data for these groups. In addition to the public outreach effort, the Applicant has historically hosted power plant and hatchery tours. Although tours at most of the plants have been temporarily curtailed for a variety of factors, the Applicant anticipates resuming this service in future.

Besides directly providing education and information services, the Applicant also supports programs and initiatives developed by others. One of the most notable programs occurs annually for Boise-area fourth-graders: Salmon and Steelhead Days. Part of the Idaho education curriculum, this three-day event about natural resources is sponsored by the Idaho Department of Fish and Game, the Nez Perce Tribe, the Applicant, Bonneville Power Administration, the U.S. Forest Service, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, local citizen volunteers, and others. During each of the last few years, 7,000 or more students attended this program. The Applicant provides personnel, funds, and educational materials for this program.

A second popular educational program supported in part by the Applicant is Water Awareness Week, developed by the Boise School District and the Idaho Department of Water Resources, with assistance from the Applicant, regional irrigation canal companies, and several other Idaho agencies and businesses. Curriculum objectives are to identify the potential hazards of water recreation and emphasize the importance of taking precautions around the region's water resources. The Applicant developed a video presentation, brochures, and posters, all of which continue to be used for program presentations. Originally aimed at sixth-grade students in public and private schools within the Boise School District, the program is now offered statewide by the Idaho Department of Water Resources because of positive reception. The Applicant continues to provide nominal financial support to help sustain the program.

H.19. Expense Impact from Transfer of License

As noted in section H.2. and section H.3., accurately estimating the continuing ownership and/or operating and mitigation costs for the existing project if the project license were transferred from the existing licensee is impossible. Such an estimate would require an inappropriate amount of speculation to the extent that it would be largely meaningless. Accordingly, accurately estimating the reduction in ownership and operating costs if the project license were transferred from the existing licensee is also impossible. As noted in section H.2. and section H.3., because this cost component cannot be reasonably accurately estimated, it was omitted from the estimates provided and was instead commented on in the text.

H.20. Annual Fees

Table H-3 lists the annual fees paid under Part I of the Federal Power Act for the use of any federal land included in the project boundary.

Literature Cited

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Table H-1 Estimated average monthly loads and generation[a] (in average MW) for the first year after license expiration beginning August 1, 2005, with and without the Hells Canyon Complex

Month	Expected Load, aMW	Generation with the HCC	Surplus or (Deficit) with the HCC	Generation without the HCC	Surplus or (Deficit) without the HCC
August 2005	2,098	2,098	0	1,634	(464)
September 2005	1,793	2,066	273	1,494	(299)
October 2005	1,622	1,793	171	1,208	(414)
November 2005	1,703	1,703	0	1,120	(583)
December 2005	1,914	1,914	0	1,228	(686)
January 2006	1,927	2,157	230	1,355	(572)
February 2006	1,811	2,435	624	1,633	(178)
March 2006	1,675	1,940	265	1,133	(542)
April 2006	1,661	2,335	674	1,548	(113)
May 2006	1,818	2,185	367	1,404	(414)
June 2006	2,113	2,237	124	1,455	(658)
July 2006	2,333	2,332	(1)	1,765	(568)
Daily Average:	1,873	2,097	224	1,413	(460)

a. Generation includes existing and planned long-term power purchase and CSPP contracts.

Table H-2 Lost generation due to unscheduled outages at the Hells Canyon Complex, by year, plant, and date, January 1, 1997–December 31, 2001

Unit	Description	Date	Time	Duration (hours)	Approx. Lost Generation (MWh)
1997					
BL-2	PCB TRIP, VOLTAGE REG POWER LOSS	5/5/97	00:10	0.75	65
BL-2	PCB TRIP, VOLTAGE REG POWER LOSS	5/13/97	11:48	0.17	15
BL-5	COOLING WATER OUTAGE	6/4/97	23:15	0.58	115
HC-1	24V POWER SUPPLY REGULATOR FUSE	1/27/97	19:56	1.97	285
HC-1	86N RELAY TRIP DUE TO 480V PANEL SHORT	11/11/97	15:15	3.00	310
HC-2	THRUST BEARING TEMPERATURE ALARM	1/10/97	00:54	14.10	2010
HC-2	PCB TRIP ON MIS-SET	2/11/97	11:40	0.10	14
HC-2	REPLACE FAILED GOVERNOR PSD SOLENOID	2/21/97	21:43	2.17	310
HC-2	#2 PCB FAN CONTACTOR FAILURE	3/12/97	12:26	2.07	295
HC-2	LOW OIL PRESSURE TRIP	6/11/97	10:20	0.08	15
OX-3	GOVERNOR PSD SOLENOID FAILURE	10/18/97	11:36	1.65	90
1998					
BL-2	SWITCHYARD BUS DIFFERENTIAL TRIP	10/7/98	13:08	30.62	1100
BL-4	UNIT 4 TRIP ON PANEL ALARM	5/29/98	14:57	0.10	10
BL-5	UNIT 5 GOVERNOR LOW OIL PRES ALARM	10/8/98	15:52	8.72	1550
HC-3	TRANS LINE OVERCURRENT OUTAGE DUE TO OXBOW-LOLO LINE OUTAGE	7/6/98	15:20	1.38	80

Table H-2 Lost generation due to unscheduled outages at the Hells Canyon Complex, by year, plant, and date, January 1, 1997–December 31, 2001

Unit	Description	Date	Time	Duration (hours)	Approx. Lost Generation (MWh)
OX-1	PCB TRIP ON SYSTEM DISTURBANCE	5/12/98	7:01	0.10	5
OX-4	PCB TRIP ON SYSTEM DISTURBANCE	5/12/98	6:58	0.12	6
1999					
BL-1	UNIT 1 BROKEN WICKET PIN, GEN BRG OVERTEMP	5/7/99	21:33	2.83	170
BL-4	UNIT 4 SINGLE STATOR COIL INSULATION FAILURE	2/27/99	14:23	118.75	13200
BL-5	UNIT 5 GEN GUIDE BEARING COOLING WATER LOW FLOW	5/25/99	3:47	6.60	1150
BL-5	UNIT 5 GOVERNOR LOW OIL PRESSURE	6/13/99	12:00	5.58	1120
2000					
HC-1	T231 XFMR FAN BANK FUSE FAILURE	4/3/00	19:35	1.05	150
HC-2	OVERSPEED RELAY OUTAGE	1/27/00	23:07	1.20	220
HC-2	VOLTAGE REGULATOR OUTAGE	2/8/00	10:34	0.43	60
HC-2	LOSS OF FIELD OUTAGE	3/17/00	10:43	1.47	150
HC-2	THRUST BRG LOW OIL ALARM	12/12/00	5:16	5.9	50
HC-3	86N ON HEAD GATE OUTAGE	5/2/00	8:09	1.32	50
HC-3	GOVERNOR LOW OIL ALARM	9/3/00	1:44	2.00	20
HC-3	GOVERNOR LOW OIL ALARM	10/25/00	19:50	2.00	20
HC-1, HC-2, & HC-3	LIGHTNING STRIKE NEAR HC-WALLA WALLA LINE AND HCPR	5/16/00	19:59	8	1250

Table H-2 Lost generation due to unscheduled outages at the Hells Canyon Complex, by year, plant, and date, January 1, 1997–December 31, 2001

Unit	Description	Date	Time	Duration (hours)	Approx. Lost Generation (MWh)
2001					
HC-3	LOCAL SERVICE DIFFERENTIAL TRIP	1/16/01	2:12	8.43	40
HC-3	204A LINE BREAKER TRIP	10/17/01	11:49	0.63	90
2002					
HC-2	TRIP ON VOLAGE REGULATOR SETPOINT	1/31/02	13:16	16.85	5
HC-3	FREQUENCY TRIP ON SOLENOID FAILURE	7/1/02	20:55	35.43	7

Table H-3 Annual fees paid for federal land use at the Hells Canyon Complex

Year	Land Charges	Notes	Statement Date
2002	$ 371,075.03		—
2001	$ 362,380.92		12/21/00
2000	$ 355,307.84		1/24/00
1999	$ 350,734.55		9/30/99
1998	$ 348,526.66		3/9/98
1997	$ 341,161.67		1/13/97
1996	$ 334,088.59		11/27/95
1995	$ 328,252.78		11/28/94
1994	$ 323,320.98		10/29/93
1993	$ 314,532.93		10/30/92
1992	$ 306,316.49		11/22/91
1991	$ 294,524.79		11/30/90
1990	$ 345,855.72	1	11/22/89
1989	$ 333,731.62	1	11/21/88
1988	$ 315,360.46	1	11/30/87
1987	$ 187,216.95	1	—[a]

a. The 1987 land charges were paid in 1988 ($62,405.65), 1989 ($62,405.64), and 1990 ($62,405.66).

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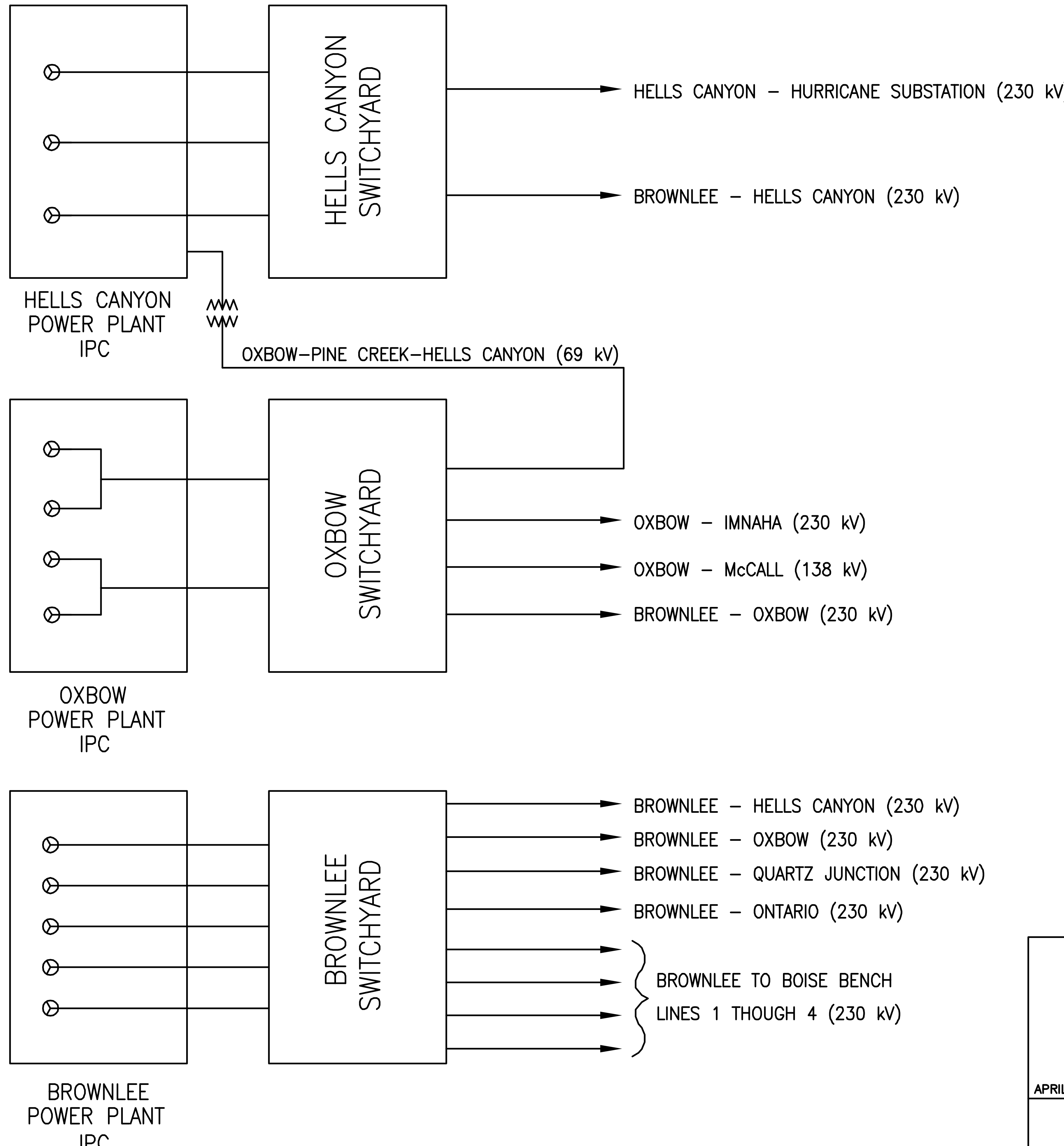

F.E.R.C. PROJECT 1971 – IDAHO

HELLS CANYON COMPLEX

Figure H–1

TRANSMISSION SINGLE–LINE DIAGRAM

IDAHO POWER COMPANY
BOISE, IDAHO

APRIL 2003

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Hells Canyon Complex
FERC No. 1971
License Application

Definitions

DEFINITIONS

accretion	the addition of land through natural processes
aerobic	life processes that occur only in the presence of molecular oxygen
aggradation	geologic process during which materials are carried downstream and deposited, causing the bottom of the river or water body to rise in elevation
Agriculture	land-use cover type designating an area that is used principally for producing agricultural crops
allele	form of a gene; any of tow or more alternative forms of a gene occupying the same chromosomal locus
allopatric	occuring in seperate, nonoverlapping geographic area
alluvium	sediment deposited by flowing water
anadromous	fish that migrate from saltwater to freshwater to spawn
anaerobic	life processes that occur in the absence of molecular oxygen
ancillary services	benefits of the power system, including load shaping, load following, voltage control, and generating reserves
anoxia	the failure of oxygen to gain access to, or be utilized by, the body tissues
avulsion	the removal of land through natural processes
Barrenland	land-use cover type designating an undisturbed (by direct human influence) upland area with a total vegetation cover of 5% or less
bedload (bed load)	sediment that moves on or near and frequently in contact with a streambed by rolling, sliding, and sometimes bouncing with the flow
benthic	of, pertaining to, or living on the bottom or at the greatest depths of a large body of water
branchial	of or pertaining to gills
candidate species	a species for which enough information about vulnerability and threats is on hand to justify listing under the Endangered Species Act
catch per unit of effort	the number of fish caught per the effort in time or distance, for example number of fish per mile of shoreline
centrarchid	sunfish and bass species
char	any trout of the genus *Salvelinus*
Cliff/Talus Slope	natural-feature cover type designating an area of nearly vertical rock or bare soil face, or slopes of unconsolidated rock material, with a total vegetation cover of 5% or less
cline	a gradual change in character or feature across the distributional range of a species or population, usually correlated with an environmental or geographic transition
clinograde	oxygen profile in which the hypolimnion has less dissolved oxygen than the epilimnion
colluvium	loose deposit of rock debris at the base of a cliff or slope, accumulated mainly by gravity
combined-cycle gas turbine	a combustion turbine equipped with a heat recovery system that uses the residual hot exhaust gas to create steam then used to drive a secondary steam turbine

deflation	sweeping erosive action of wind over the ground
degradation	geologic process during which materials are carried away, causing the bottom of the river or water body to be lower in elevation
dependable capacity	the peak capacity available for a one-hour period under critical water or reservoir elevation conditions
derating	the reduction of the rating of a device, such as a generating unit, to improve reliability or to permit operation at high temperatures
Desertic Herbland	vegetation cover type designating an upland community with 1 to 25% total vegetation cover and nonwoody plants (including lichens and mosses) forming the dominant vegetation stratum; includes sparsely vegetated habitats in nondesert areas
Desertic Shrubland	vegetation cover type designating for an upland community with 1 to 25% total vegetation cover and shrubs (and trees shorter than 5 m) forming the dominant vegetation stratum; includes sparsely vegetated habitats in nondesert areas
diurnal	occurring or active during the daytime
ecological succession	the sequence of communities and their composition that develops in a particular region over time, from initial stages of colonization to climax
ecosystem function	processing of energy and nutrients by communities
edaphic	of or relating to soil
Emergent Herbaceous Wetland	vegetation cover type designating for a wetland community dominated by erect and rooted herbaceous plants that grow in water and are present for most of the growing season in most years; usually dominated by perennial plants; total vegetation cover is at least 30%, while woody vegetation is less than 30%
endangered species	listed under the Endangered Species Act, a species in imminent danger of extinction through all or a portion of its range
epilimnion	uppermost layer of water in a lake that has a uniform temperature and a less dense but oxygen-rich layer of water
escapement	number of fish that survive natural and human-caused mortality to spawn
eutrophic	rich in nutrients
evapotranspiration	movement of moisture from the earth to the atmosphere as water vapor by the evaporation of surface water and the transpiration of water from plants
Evolutionarily Significant Unit	a population or group of populations that is considered distinct for purposes of conservation under the Endangered Species Act
Falconiformes	an order of birds containing the diurnal birds of prey, including falcons, hawks, vultures, and eagles
felsic	light colored minerals
fluvial	inhabiting a river or stream
Forbland	vegetation cover type designating an upland community with a total vegetation cover of at least 25% and dominated by nonwoody plants (including lichens and mosses), of which forbs (native or introduced) are dominant; includes many weedy fields, old fields, and other types in early successional stages
forebay	that part of a reservoir immediately upstream of and adjacent to the penstock intakes
Forested Upland	vegetation cover type designating an upland community dominated by trees (taller than 5 m) and having a tree canopy cover of at least 25%

Forested Wetland	vegetation cover type designating a riparian community dominated by woody wetland vegetation 6 m (20 ft) tall and taller, with a total vegetation cover of at least 30%
generating reserves	operation of the powerhouse below the immediately available peak generating capacity to ensure than an “operating cushion” is available to respond to unscheduled changes in system load and/or system disturbances
geologic unit	a stratum or body of strata recognized as a unit for description, mapping, or correlation; rocks may be classified stratigraphically on the basis of lithology, fossil content, age, or properties in categories for which formal nomenclature is lacking
geomorphic	form or shape of the landscape
geomorphology	processes that create landforms and their material composition
glide	a shallow stream reach without surface turbulence that has a maximum depth that is 5% or less of the average stream width and that has a water velocity less than 20 cm per second.
Grazing Land/Pasture	land-use cover type designating an area used principally for pasture or grazing of domestic livestock
ground-truth	verify through field work
haplotype	a combination of alleles of closely linked loci that are found in a single chromosome and tend to be inherited together
herpetofauna	amphibians or reptiles of a particular region or period
herptile	amphibian or reptile
Holocene	epoch of the Quaternary Period or geologic time, also known as Postglacial
hydrology	movement of water
hydrophyte	a plant that grows in water or saturated soils
hypolimnion	lower layer or region in a stratified lake that is poorly oxygenated and illuminated
hyporheic zone	group of underground habitats through the sediment deposit area of the channel and floodplain
hypoxia	condition characterized by a low level of dissolved oxygen in a water body
Industrial	land-use cover type designating an area used principally for larger businesses and corporations such as office complexes, manufacturing plants, and warehouses
isothermal	water at a constant temperature
iteroparous	fish that are capable of repeat spawning
Lagomorph	plant-eating mammals having furred feet and two pairs of upper incisors and belonging to the order Lagomorpha, which includes rabbits, hares, and pikas
Lentic	natural-feature cover type designating standing open-water habitat
lithic	pertaining to stone artifacts
lithology	physical character of a rock or deposit that is defined by rock type or distribution of particle size
littoral	shallow shore areas where light can penetrate to the bottom
load	the demand for electricity by customers in the Idaho Power Company service territory, or the power output of a generator

load curve	a graph that plots the power demand of an electric power system versus time
load following	operation of units necessary to respond to unscheduled real-time changes in system load
load shaping	operation of units necessary to follow regional demand for electricity (also called “load”)
load-following	operation of a power plant that manipulates generation levels to meet changing daily customer demands for electricity
loci	physical place occupied by a gene on a molecule of DNA
loess	a buff-to-gray, fine-grained, calcareous silt or clay thought to be a deposit of wind-blown dust
Lotic	natural-feature cover type designating moving open-water habitat such as rivers and streams
macroinvertebrate	a small animal lacking a backbone and internal skeleton, such as an insect, mollusc, or worm; during aquatic surveys, these organisms must be at least 2 mm to be retained on coarse sieves
mafic	dark colored minerals
mainstem	a river segment into which tributaries flow
mass wasting	processes by which large masses of earth are moved by gravity, either quickly or slowly
median water year	a year of average, or normal, water flow
mesic	characterized by a moderate amount of water
metabolite	a product of intermediary metabolism
metalimnion	area between the epilimnion and hypolimnion that exhibits a marked temperature gradient equal to or exceeding 1 °C per meter
Mid-Snake projects	Upper Salmon Falls, Bliss, and Lower Salmon Falls hydroelectric projects
mineralogy	minerals that makeup a rock or deposit
morphology	physical attributes of a water body
net head	the difference in water surface elevation between the forebay and tailrace minus friction losses
net investment	historical costs minus the accumulated depreciation; also referred to as net book value
ocean annulus fish	fish that spend most of their first year in salt water
oligotrophic	lacking in nutrients
osmoregulate	maintain an optimal and constant level of osmotic activity of the fluid in and around cells
Pacific Flyway	a north–south waterfowl migration corridor situated along the Pacific Coast (a flyway is a political unit that groups together states with common borders and similar waterfowl problems)
passerine	of or relating to birds of the order Passeriformes, which includes perching birds and songbirds including warblers, tanagers, and thrushes; a bird of this order
PCBs	any of a family of highly toxic and possibly carcinogenic compounds that have been banned in the United States because of concern over water contamination
peaking turbine	combustion turbine that is economic to operate only during peak load periods

pelagic	organisms at or near the surface of water away from the shore
penstock	a pipe or conduit that carries water from a reservoir to a turbine in a hydroelectric plant
phylogeny	evolutionary or ancestral history or organisms
planform	the outline of an object viewed from above
plant factor	the ratio of actual generation at a power plant to the amount of energy it could produce if operated continuously at its rated output
Pleistocene	epoch of the Quaternary Period of geologic time, also known as the Ice Age
potamodromous	fish that migrate, spawn, and feed entirely in freshwater
prosobranch snails	the largest subclass of Gastropoda mollusks
pyroclastics	rock composed of fragmented volcanic products
radial gate	a spillway gate whose face, a section of a cylinder, rotates about a horizontal axis on the downstream end of the gate, which can be closed under its own weight (also known as a Tainter gate)
raptor	a bird of prey such as a hawk or eagle
ruderal	growing in waste spaces, along roadsides, or in rubbish
sagebrush obligates	birds that are specifically tied to sagebrush habitat for their life requirements (food, cover, and reproduction)
SCADA system	an automated electronic data collection and transmission system
Scrub-Shrub Wetland	vegetation cover type designating a riparian community dominated by woody wetland vegetation (less than 6 m tall) and having a woody vegetation cover of at least 30% and a total vegetation cover of at least 30%
seral	the developmental stage of ecological succession from initial stage to the climax for communities occupying an area
Shore & Bottomland Wetland	vegetation cover type designating a riparian area that may have bare sand, gravel, or rocky areas; vegetation, if present, has a total cover less than 30% and is dominated by rooted plants that grow in water much of the year
Shrub Savanna	vegetation cover type designating an upland community having a canopy cover of shrubs (including trees shorter than 5 m) between 5 and 25% and a total vegetation cover of at least 25% (area between shrubs is typically dominated by grasses or other herbaceous vegetation)
Shrubland	vegetation cover type designating an upland vegetation community dominated by shrubs (including trees shorter than 5 m) and having a shrub canopy cover of at least 25% and a total vegetation cover greater than 25%
single-cycle gas turbine	A combustion turbine that burns natural gas, creating a hot exhaust gas that expands through a turbine to turn an electric power generator
single-line diagram	A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit, including major devices used (for example, generator, transformer, and circuit breaker)
species density	the number of individuals of a particular species per unit area
species distribution	geographical area where a species can be found
species diversity	a measure of the variety of species in a community that takes into account the relative abundance of each species

species richness	the number of species in a community or region
stage	elevation of a water surface above or below an established reference point
stream annulus fish	fish that spend their first year in fresh water
tailrace	a channel for carrying water away from a hydroelectric power plant after it passes through a turbine
talus slope	bare soil faces or slopes of unconsolidated rock material, usually with a total vegetation cover of 5% or less
thalweg	stream path that follows the deepest part of the channel
thermocline	a metalimnion that exhibits a marked temperature gradient equal to or exceeding 1 °C per meter
threatened species	listed under the Endangered Species Act, a species likely to become endangered in the foreseeable future
topography	the position of a surface's natural and artificial features
Tree Savanna	vegetation cover type designating an upland community with a canopy cover of trees (taller than 5 m) between 5 and 25% and having a total vegetation cover of at least 25% (area between trees is typically dominated by grasses or other herbaceous vegetation)
trophic	involving the feeding habits or food relationships of different organisms in a food chain; any of the feeding levels through which nutrients pass through an ecosystem
turbidity	a measure of the extent to which light passing through water is reduced by suspended materials
voltage control	operation of units necessary to maintain a constant voltage throughout the regional power system
water quality	term used to describe biological, chemical, and physical characterisitic of an aquatic environment, usually in relation to the uses of water
weighted usable area (WUA)	the surface area (in square feet or square meters) of a stream, weighted by its suitability to an aquatic organism.
year class	the age group to which a fish belongs

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Abbreviations & Acronyms

ABBREVIATIONS & ACRONYMS

μg	micrograms
°C	degrees Celsius
°F	degrees Fahrenheit
ACEC	Area of Critical Concern
ACOE	U.S. Army Corps of Engineers
ADA	Americans with Disabilities Act
AGC	automatic generator control
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
ARWG	Aquatic Resources Work Group
ATV	all-terrain vehicle
BIA	Bureau of Indian Affairs
BLM	USDI, Bureau of Land Management
BMPs	best management practices
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
Btu	British thermal unit
C	candidate species under the Endangered Species Act
cf.	compare with
CFR	Code of Federal Regulation
cfs	cubic feet per second
cm	centimeter(s)
CPUE	catch per unit of effort
CRMP	Cultural Resources Management Plan
CRWG	Cultural Resources Work Group
CSI	College of Southern Idaho
CSPP	Cogeneration and Small Power Producer
CWMA	Cooperative Weed Management Areas
DFC	desired future conditions
DLA	draft license application
DO	dissolved oxygen
DPS	distinct population segments
EAP	Emergency Action Plan

ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EWG	Economics Work Group
FCP	*Formal Consultation Package for Relicensing: Hells Canyon Complex*
FCRPS	Federal Columbia River Power System
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
ff.	following few pages
FL	fork length
FLA	final license application
FPC	Federal Power Commission
ft	feet
g	gram(s)
GIS	geographic information system
GLO	General Land Office
gpm	gallon(s) per minute
GPS	global positioning system
GWh	gigawatt hour(s)
Ha	hectare(s)
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HART	Hydroelectric Application Review Team
HCC	Hells Canyon Complex
HCNRA	Hells Canyon National Recreation Area
HCRA	Hells Canyon Recreation Area
hp	horsepower
HPMP	historic properties management plan
HSC	habitat suitability criteria
HSI	Habitat Suitability Index
HWUA	hourly weighted usable area
I-84	Interstate 84
IDA	Idaho Department of Agriculture
IDCDC	Idaho Conservation Data Center (formerly IDNHP, Idaho Natural Heritage Program)
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDPR	Idaho Department of Parks and Recreation
IDWR	Idaho Department of Water Resources

IMACS	Intermountain Antiquities Computer System
INPS	Idaho Native Plant Society
IPC	Idaho Power Company
IPUC	Idaho State Public Utilities Commission
IRP	Integrated Resource Plan
IRU	Idaho Rivers United
IWF	Idaho Wildlife Federation
IWRB	Idaho Water Resource Board
km	kilometer(s)
kV	kilovolt(s)
kVA	kilovolt ampere(s)
kW	kilowatt(s)
kWh	kilowatt-hours
L	liter(s)
LE	listed endangered under the Endangered Species Act
LT	listed threatened under the Endangered Species Act
m	meter(s)
m^2	square meter(s)
MACRS	modified accelerated cost recovery system
MAF	million acre-feet
mg	milligram(s)
mg/L	milligrams/liter
mi	mile(s)
mm	millimeter(s)
MOU	memorandum of understanding
msl	mean sea level
MVAR	megavolts amps reactive
MW	megawatt(s)
MWh	megawatt hour(s)
NSTAC	Hells Canyon Native Salmonid Technical Advisory Committee
NEEA	Northwest Energy Efficiency Alliance
NESC	National Electric Safety Council
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council

NTU	nephelometric turbidity unit
NWAA	Northwest Archaeological Associates
NWPPVA	Northwest Professional Passenger Vessel Association
NWRFC	Northwest River Forecast Center
O&M	operations and maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
PAO	Portland Area Office
PCB	polychlorinated biphenyl; a family of highly toxic compounds that have been banned in the United States
PIT	passive integrated transponder
PM&E	protection, mitigation, and enhancement
PSD	proportional stock density
PUC	Public Utilities Commission
PVA	population viability analysis
RAMP	Recreation Adaptive Management Plan
RARWG	Recreation and Aesthetics Resources Work Group
RM	river mile
ROW	right(s)-of-way
RPA	reasonable and prudent alternative
rpm	revolutions per minute
RV	recreational vehicle
RWG	Resources Work Group
SCADA	supervisory control and data acquisition
SAIC	Science Applications International Corporation
SE	standard error
SHPO	State Historic Preservation Office
SMA	special management area
SMS	Scenery Management System
SRBPNCA	Snake River Birds of Prey National Conservation Area
ssp.	subspecies
STD	standard deviation
STE	survival to emergence
T&E	threatened and endangered
TL	total length
TMDL	total maximum daily load
TNC	The Nature Conservancy
TRWG	Terrestrial Resources Work Group

U.S. 30	U.S. Highway 30
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	USDA, Forest Service
VRM	Visual Resource Management
WUA	weighted usable area

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