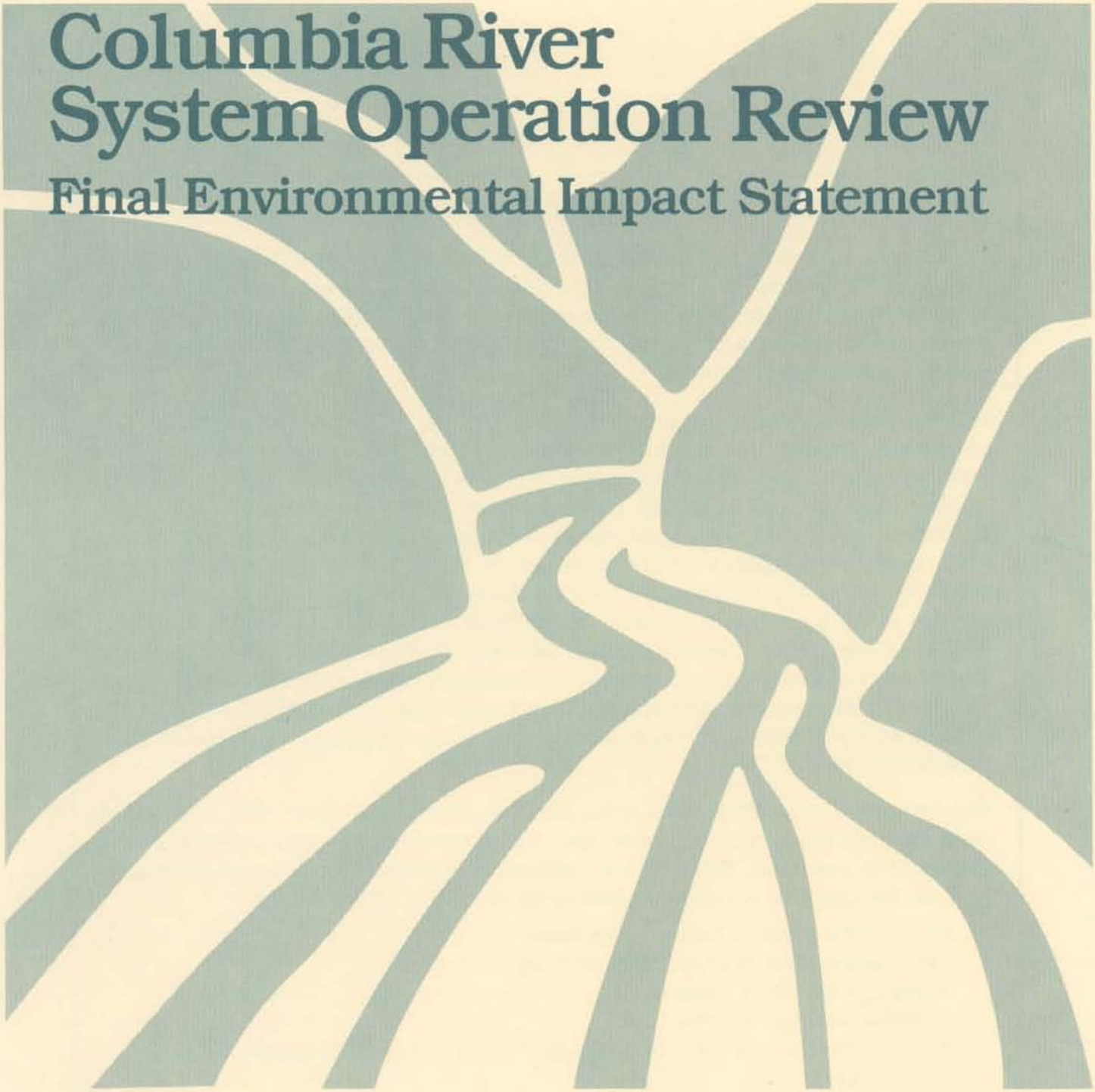
Columbia River System Operation Review

Final Environmental Impact Statement



Appendix N

Wildlife

BONNEVILLE POWER ADMINISTRATION

US Army Corps of Engineers
North Pacific Division

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DOE/EIS-0170

November 1995

PUBLIC INVOLVEMENT IN THE SOR PROCESS

The Bureau of Reclamation, Corps of Engineers, and Bonneville Power Administration wish to thank those who reviewed the Columbia River System Operation Review (SOR) Draft EIS and appendices for their comments. Your comments have provided valuable public, agency, and tribal input to the SOR NEPA process. Throughout the SOR, we have made a continuing effort to keep the public informed and involved.

Fourteen public scoping meetings were held in 1990. A series of public roundtables was conducted in November 1991 to provide an update on the status of SOR studies. The lead agencies went back to most of the 14 communities in 1992 with 10 initial system operating strategies developed from the screening process. From those meetings and other consultations, seven SOS alternatives (with options) were developed and subjected to full–scale analysis. The analysis results were presented in the Draft EIS released in July 1994. The lead agencies also developed alternatives for the other proposed SOR actions, including a Columbia River Regional Forum for assisting in the determination of future SOSs, Pacific Northwest Coordination Agreement alternatives for power coordination, and Canadian Entitlement Allocation Agreements alternatives. A series of nine public meetings was held in September and October 1994 to present the Draft EIS and appendices and solicit public input on the SOR. The lead agencies received 282 formal written comments. Your comments have been used to revise and shape the alternatives presented in the Final EIS.

Regular newsletters on the progress of the SOR have been issued. Since 1990, 20 issues of *Streamline* have been sent to individuals, agencies, organizations, and tribes in the region on a mailing list of over 5,000. Several special publications explaining various aspects of the study have also been prepared and mailed to those on the mailing list. Those include:

The Columbia River: A System Under Stress
The Columbia River System: The Inside Story
Screening Analysis: A Summary
Screening Analysis: Volumes 1 and 2
Power System Coordination: A Guide to the Pacific Northwest Coordination Agreement
Modeling the System: How Computers are Used in Columbia River Planning
Daily/Hourly Hydrosystem Operation: How the Columbia River System Responds to Short–Term Needs

Copies of these documents, the Final EIS, and other appendices can be obtained from any of the lead agencies, or from libraries in your area.

Your questions and comments on these documents should be addressed to:

SOR Interagency Team
P .O. Box 2988
Portland, OR 97208–2988

PREFACE: SETTING THE STAGE FOR THE SYSTEM OPERATION REVIEW

WHAT IS THE SOR AND WHY IS IT BEING CONDUCTED?

The Columbia River System is a vast and complex combination of Federal and non–Federal facilities used for many purposes including power production, irrigation, navigation, flood control, recreation, fish and wildlife habitat and municipal and industrial water supply. Each river use competes for the limited water resources in the Columbia River Basin.

To date, responsibility for managing these river uses has been shared by a number of Federal, state, and local agencies. Operation of the Federal Columbia River system is the responsibility of the Bureau of Reclamation (Reclamation), Corps of Engineers (Corps) and Bonneville Power Administration (BPA).

The System Operation Review (SOR) is a study and environmental compliance process being used by the three Federal agencies to analyze future operations of the system and river use issues. The goal of the SOR is to achieve a coordinated system operation strategy for the river that better meets the needs of all river users. The SOR began in early 1990, prior to the filing of petitions for endangered status for several salmon species under the Endangered Species Act.

The comprehensive review of Columbia River operations encompassed by the SOR was prompted by the need for Federal decisions to (1) develop a coordinated system operating strategy (SOS) for managing the multiple uses of the system into the 21st century; (2) provide interested parties with a continuing and increased long–term role in system planning (Columbia River Regional Forum); (3) renegotiate and renew the Pacific Northwest Coordination Agreement (PNCA), a contractual arrangement among the region's major hydroelectric–generating utilities and affected Federal agencies to provide for coordinated power generation on the Columbia River system; and (4) renew or develop new Canadian Entitlement Allocation Agreements (contracts that divide Canada's share of Columbia River Treaty downstream power benefits and obligations among three participating public utility districts and BPA). The review provides the environmental analysis required by the National Environmental Policy Act (NEPA).

This technical appendix addresses only the effects of alternative system operating strategies for managing the Columbia River system. The environmental impact statement (EIS) itself and some of the other appendices present analyses of the alternative approaches to the other three decisions considered as part of the SOR.

WHO IS CONDUCTING THE SOR?

The SOR is a joint project of Reclamation, the Corps, and BPA—the three agencies that share responsibility and legal authority for managing the Federal Columbia River System. The National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and National Park Service (NPS), as agencies with both jurisdiction and expertise with regard to some aspects of the SOR, are cooperating agencies. They contribute information, analysis, and recommendations where appropriate. The U.S. Forest Service (USFS) was also a cooperating agency, but asked to be removed from that role in 1994 after assessing its role and the press of other activities.

HOW IS THE SOR BEING CONDUCTED?

The system operating strategies analyzed in the SOR could have significant environmental impacts. The study team developed a three–stage process—scoping, screening, and full–scale analysis of the strategies—to address the many issues relevant to the SOR.

At the core of the analysis are 10 work groups. The work groups include members of the lead and cooperating agencies, state and local government agencies, representatives of Indian tribes, and

members of the public. Each of these work groups has a single river use (resource) to consider.

Early in the process during the screening phase, the 10 work groups were asked to develop an alternative for project and system operations that would provide the greatest benefit to their river use, and one or more alternatives that, while not ideal, would provide an acceptable environment for their river use. Some groups responded with alternatives that were evaluated in this early phase and, to some extent, influenced the alternatives evaluated in the Draft and Final EIS. Additional alternatives came from scoping for the SOR and from other institutional sources within the region. The screening analysis studied 90 system operation alternatives.

Other work groups were subsequently formed to provide projectwide analysis, such as economics, river operation simulation, and public involvement.

The three-phase analysis process is described briefly below.

- **Scoping/Pilot Study**—After holding public meetings in 14 cities around the region, and coordinating with local, state, and Federal agencies and Indian tribes, the lead agencies established the geographic and jurisdictional scope of the study and defined the issues that would drive the EIS. The geographic area for the study is the Columbia River Basin (Figure P-1). The jurisdictional scope of the SOR encompasses the 14 Federal projects on the Columbia and lower Snake Rivers that are operated by the Corps and Reclamation and coordinated for hydropower under the PNCA. BPA markets the power produced at these facilities. A pilot study examining three alternatives in four river resource areas was completed to test the decision analysis method proposed for use in the SOR.

- **Screening**—Work groups, involving regional experts and Federal agency staff, were created for 10 resource areas and several support functions. The work groups developed computer screening models and applied them to the 90 alternatives identified during screening. They compared the impacts to a baseline operating year—1992—and ranked each alternative according to its impact on their resource or river use. The lead agencies reviewed the results with the public in a series of regional meetings in September 1992.

- **Full-Scale Analysis**—Based on public comment received on the screening results, the study team sorted, categorized, and blended the alternatives into seven basic types of operating strategies. These alternative strategies, which have multiple options, were then subjected to detailed impact analysis. Twenty-one possible options were evaluated. Results and tradeoffs for each resource or river use were discussed in separate technical appendices and summarized in the Draft EIS. Public review and comment on the Draft EIS was conducted during the summer and fall of 1994. The lead agencies adjusted the alternatives based on the comments, eliminating a few options and substituting new options, and reevaluated them during the past 8 months. Results are summarized in the Final EIS.

Alternatives for the Pacific Northwest Coordination Agreement (PNCA), the Columbia River Regional Forum (Forum), and the Canadian Entitlement Allocation Agreements (CEAA) did not use the three-stage process described above. The environmental impacts from the PNCA and CEAA were not significant and there were no anticipated impacts from the Regional Forum. The procedures used to analyze alternatives for these actions are described in their respective technical appendices.

For detailed information on alternatives presented in the Draft EIS, refer to that document and its appendices.

WHAT SOS ALTERNATIVES ARE CONSIDERED IN THE FINAL EIS?

Seven alternative System Operating Strategies (SOS) were considered in the Draft EIS. Each of the seven SOSs contained several options bringing the total number of alternatives considered to 21. Based on review of the Draft EIS and corresponding adjustments, the agencies have identified 7 operating strategies that are evaluated in this Final EIS. Accounting for options, a total of 13 alternatives is now under consideration. Six of the alternatives remain unchanged from the specific options considered in the Draft EIS. One is a revision to a previously considered alternative, and the rest represent replacement or new alternatives. The basic categories of SOSs and the numbering convention remains the same as was used in the Draft EIS. However, because some of the alternatives have been dropped, the numbering of the final SOSs are not consecutive. There is one new SOS category, Settlement Discussion Alternatives, which is labeled SOS 9 and replaces the SOS 7 category. This category of alternatives arose as a consequence of litigation on the 1993 Biological Opinion and ESA Consultation for 1995.

The 13 system operating strategies for the Federal Columbia River system that are analyzed for the Final EIS are:

SOS 1a Pre Salmon Summit Operation represents operations as they existed from around 1983 through the 1990–91 operating year, prior to the ESA listing of three species of salmon as endangered or threatened.

SOS 1b Optimum Load–Following Operation represents operations as they existed prior to changes resulting from the Regional Act. It attempts to optimize the load–following capability of the system within certain constraints of reservoir operation.

SOS 2c Current Operation/No–Action Alternative represents an operation consistent with that specified in the Corps of Engineers' 1993 Supplemental EIS. It is similar to system operation that occurred in 1992 after three species of salmon were listed under ESA.

SOS 2d [New] 1994–98 Biological Opinion represents the 1994–98 Biological Opinion operation that includes up to 4 MAF flow augmentation on the Columbia, flow targets at McNary and Lower Granite, specific volume releases from Dworshak, Brownlee, and the Upper Snake, meeting sturgeon flows 3 out of 10 years, and operating lower Snake projects at MOP and John Day at MIP.

SOS 4c [Rev.] Stable Storage Operation with Modified Grand Coulee Flood Control attempts to achieve specific monthly elevation targets year round that improve the environmental conditions at storage projects for recreation, resident fish, and wildlife. Integrated Rules Curves (IRCs) at Libby and Hungry Horse are applied.

SOS 5b Natural River Operation draws down the four lower Snake River projects to near river bed levels for four and one–half months during the spring and summer salmon migration period, by assuming new low level outlets are constructed at each project.

SOS 5c [New] Permanent Natural River Operation operates the four lower Snake River projects to near river bed levels year round.

SOS 6b Fixed Drawdown Operation draws down the four lower Snake River projects to near spillway crest levels for four and one–half months during the spring and summer salmon migration period.

SOS 6d Lower Granite Drawdown Operation draws down Lower Granite project only to near spillway crest level for four and one–half months.

SOS 9a [New] Detailed Fishery Operating Plan includes flow targets at The Dalles based on the previous year's end–of–year storage content, specific volumes of releases for the Snake River, the drawdown of Lower Snake River projects to near spillway crest level for four and one–half months, specified spill percentages, and no fish transportation.

SOS 9b [New] Adaptive Management establishes flow targets at McNary and Lower Granite based on runoff forecasts, with specific volumes of releases to meet Lower Granite flow targets and specific spill percentages at run–of–river projects.

SOS 9c [New] Balanced Impacts Operation draws down the four lower Snake River projects near spillway crest levels for two and one–half months during the spring salmon migration period. Refill begins after July 15. This alternative also provides 1994–98 Biological Opinion flow augmentation, integrated rule curve operation at Libby and Hungry Horse, a reduced flow target at Lower Granite due to drawdown, winter drawup at Albeni Falls, and spill to achieve no higher than 120 percent daily average for total dissolved gas.

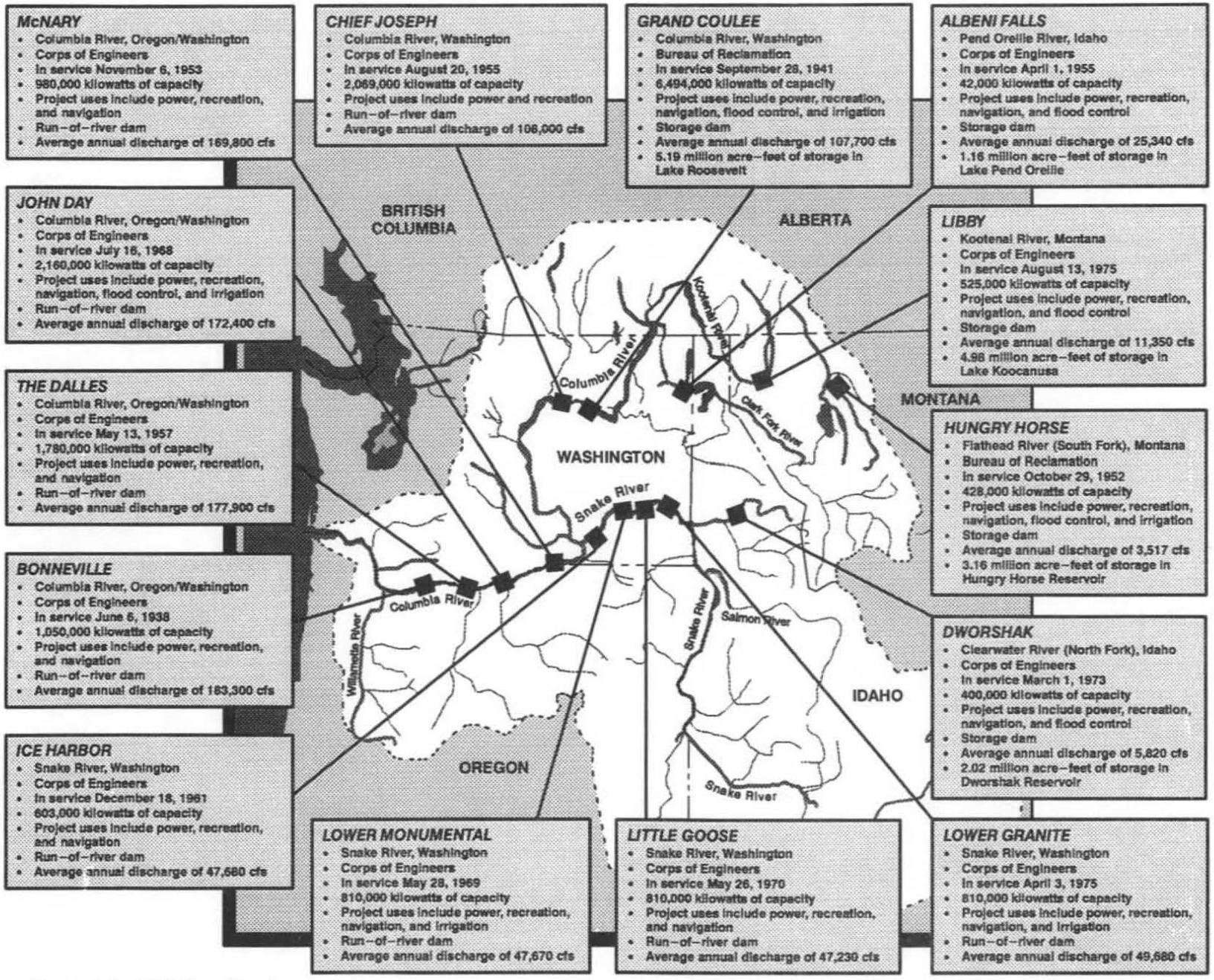
SOS PA Preferred Alternative represents the operation proposed by NMFS and USFWS in their Biological Opinions for 1995 and future years; this SOS operates the storage projects to meet flood control rule curves in the fall and winter in order to meet spring and summer flow targets for Lower Granite and McNary, and includes summer draft limits for the storage projects.

WHAT DO THE TECHNICAL APPENDICES COVER?

This technical appendix is 1 of 20 prepared for the SOR. They are:

A. River Operation Simulation
B. Air Quality
C. Anadromous Fish & Juvenile Fish Transportation
D. Cultural Resources
E. Flood Control
F. Irrigation/Municipal and Industrial Water Supply
G. Land Use and Development
H. Navigation
I. Power
J. Recreation
K. Resident Fish
L. Soils, Geology, and Groundwater
M. Water Quality
N. Wildlife
O. Economic and Social Impacts
P. Canadian Entitlement Allocation Agreements
Q. Columbia River Regional Forum
R. Pacific Northwest Coordination Agreement
S. U. S. Fish and Wildlife Service Coordination Act Report
T. Comments and Responses

Each appendix presents a detailed description of the work group's analysis of alternatives, from the scoping process through full–scale analysis. Several appendices address specific SOR functions (e.g., River Operation Simulation), rather than individual resources, or the institutional alternatives (e.g., PNCA) being considered within the SOR. The technical appendices provide the basis for developing and analyzing alternative system operating strategies in the EIS. The EIS presents an integrated review of the vast wealth of information contained in the appendices, with a focus on key issues and impacts. In addition, the three agencies have prepared a brief summary of the EIS to highlight issues critical to decision makers and the public.



1 million acre feet = 1.234 billion cubic meters
1 cubic foot per second = 0.028 cubic meters per second

Figure P–1. Projects in the System Operation Review.

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CHAPTER 1

SCOPE AND PROCESS

1.1 WORK GROUP FORMATION, AGENCY COORDINATION, AND PUBLIC INVOLVEMENT

The Wildlife Work Group (WWG) was formed in the summer of 1991, four months after the initial creation of technical work groups. Originally, wildlife and resident fish issues were handled by a single work group. However, as a result of comments received at public scoping meetings in August, 1991, and the realization that wildlife and resident fish have different concerns and priorities, the group was divided and a separate WWG was formed.

The WWG is composed of representatives from seven Federal agencies, three states, seven Tribes, public utilities, environmental groups, consulting firms, British Columbia Hydropower Authority (BC Hydro), Canadian Wildlife Service, and private individuals with regional and/or local wildlife expertise.

Throughout the SOR technical analysis, these groups and individuals have been divided into two categories: Tier 1 is composed of active participants and full working members; Tier 2 is composed of review–level participants who received all Work Group meeting notes and products. Members of the public who have expressed concern and given input but have not participated to the threshold of Tier 1 or Tier 2 are referred to as the 'general public.' Information is available to them on request.

Table 1–1 is the list of the Work Group Tier 1 and Tier 2 participants.

1.2 SUMMARY OF WILDLIFE PUBLIC ISSUES AND MANAGEMENT CONCERNS

Columbia River basin reservoir habitats of today are very different from the riverine habitats that existed before major dam development. Not surprisingly, current wildlife populations reflect this. Wildlife resources are significantly reduced from the historic levels that existed prior to hydroelectric development. The exceptions are those species that have typically adapted well to human activities, such as Canada geese, gulls, and mallards, or upland game species such as deer and elk that are closely managed due to their economic value.

While hydroelectric development is part of the reason for the declining wildlife resource, it is not the only reason. Increasing urban and rural growth have contributed to habitat conversion. Exotic plant and animal species introduced throughout the Columbia River basin over the past 50 years compete directly with native wildlife populations for decreasing habitat. Common examples of introduced species are cheat grass, Eurasian water milfoil, purple loosestrife, carp, house sparrows, and starlings. Once these introduced species become established, entire biospheres are permanently altered, leading to a significant loss of wildlife diversity.

The Columbia River System Operation Review presents an opportunity to address impacts to the wildlife resource that emerge from operation of the hydrosystem. During the formal scoping phase of SOR and informal discussions over the preceding four years, significant issues and management concerns have been identified by individuals and group representatives that eventually became the focus of the wildlife analysis. Local concerns centered on shorebird habitat on the lower Columbia River, cattle grazing impacts on the Snake River, big game impacts at Lake Roosevelt, non–game as well as game species impacts, and impacts to the wildlife refuges on the lower Columbia River.

Table 1–1. Wildlife Work Group Participants

Tier 1: Ken Brunner, COE
John Cannon, EBASCO
Geoff Dorsey, COE
Dick Giger, FWS, retired
Loren Kronemann, Nez Perce Tribe
Ron McKown, USBR
Don Treasure, USBR
Gary Bunn, COE
Carl Christianson, COE
Paul Fielder, Chelan Co. PUD
John Grettenberger, FWS
Rosy Mazaika
Bob Shank, BPA
Chris Thoms, BPA
Charlie Craig, BPA

Tier 2: Scott Ackerman, COE
Val Akana, Strategic Decisions Group
John Annear, FWS
Paul Ashley, Washington Dept. of Wildlife
Dale Becker, Confederated Salish and Kootenai Tribes
Joel Bich, Yakama Indian Nation
Bob Bradley, BC Hydro
Dan Casey, Kalispell, MT
Alan Christianson, USFS
Rich Clark, USBR
Mike Denny, Blue Mountain Audubon
Rick George, Confederated Tribes of the Umatilla Reservation
Dave Goeke, Columbia NWR
Tracy Hames, Yakama Indian Nation
Jerome Hansen, Idaho Dept. of Fish and Game
Steve Judd, Colville Confederated Tribe
Val Kitchen, The Wilderness Society
Bob Krein, Oregon Dept. Fish and Wildlife
Mike Kuttel, Washington Dept. of Wildlife
Rick Lamont, Audubon Society
Larry Lockard, FWS
Terry Luther, Confederated Tribes, Warm Springs Reservation
Diana MacDonald, PNUCC
Greg Mallette, Vancouver BC, Canada
Matt McCoy, Golden Eagle Audubon Society
Joseph L. McCrea, Spokane Tribal Wildlife Committee
Jack Melland, Oregon Dept. of Fish and Wildlife
Chris Merker, UCUT Fisheries and Wildlife Center
David Mevers, Idaho Power Company
Kathleen Moore, Canadian Wildlife Service
Lisa Norris, USFS
Harvey Nyherg, Cio Flathead National Forest, MT
Peter Paquet, NPPC
Julie Rogoski, BPA
Rich Shepard, Portland, OR
John Stevenson, PNUCC
Karen Taylor–Goodrich, NPS
Jim Torland, Oregon Dept. of Fish and Wildlife
Jeri Williams, FWS
Robin Witt, Western Area Power Administration

Not all input regarding wildlife concerns fell within the scope of the SOR process. Input such as phasing out all engineered restraints on the system (removing dams), extending endangered species protection to ecosystems, including the upper Snake River in the SOR, and halting mainstem irrigation diversions throughout the region were judged to be outside the scope.

For the SOR process, the WWG used different modeling and analytic techniques to evaluate strategies for operating the hydrosystem. The goal of the analysis was to assess impacts to wildlife from the strategies, both compared with present operations and compared with operations in the foreseeable future. Specifically, the WWG examined changes in the timing and magnitude of stream flows and reservoir elevations that would result from each strategy at the 14 Federal projects in the Columbia River system, as well as other projects and stream reaches affected by proposed changes. The concept underlying the analysis of streamflow and reservoir elevation is that these two results of hydrosystem operations largely determine the amount and quality of surrounding wildlife habitat. If hydrosystem operation negatively impacts habitat relative to the needs of its wildlife, the wildlife will decline.

A regional map of the Columbia River System provided in Figure 1–1.

1.3 SCREENING ANALYSIS

Following the Scoping process, 90 systemwide preliminary operating alternatives were submitted for the Screening Analysis by members of the public, by each of the technical work groups, and by various public and private groups. These preliminary alternatives represented a wide variety of operational possibilities ranging from current operations to those emphasizing single and multiple river uses.

The WWG developed two systemwide alternatives, entitled WLD – IDEAL, and WLD – REAL. Each alternative provided (in a slightly differing way) for stable reservoir elevations. The WWG next analyzed the 90 preliminary alternatives for their effect on wildlife resources in selected river reaches and hydroprojects, using quantitative and qualitative modeling techniques. (*See the Columbia River System Operation Review Screening Analysis, volume 1 & 2 for modeling techniques and results.*)

1.4 FULL–SCALE ANALYSIS

For Full–scale Analysis, the WWG revisited Screening Analysis methods and developed a matrix approach (*see Chapter Three, Study Methods*). The matrix evaluation was preferred because it has been effective in the past for identifying and comparing complex effects of proposed actions on wildlife habitats and populations. Early–on in the SOR process, the variability and lack of available data on a systemwide basis was identified as an issue affecting the wildlife analysis. Some parts of the system had considerable wildlife information, while others had little that was useful. For example, ample information might be available for Canada geese in one area, but little for shorebirds; or shorebird information might be available for a single reservoir, but not other project locations.

Compounding this problem, varying climatic zones, vegetative types, topography, and wildlife species greatly increased the complexity of the systemwide wildlife study.

A long–term benefit of the WWG's study methods has been the development of assessment techniques suitable for systemwide analysis that uniquely addresses public issues and management concerns identified in the scoping process.

1.4.1 Assumptions

Any analysis incorporates a number of basic assumptions. The methodological assumptions agreed to by the entire Work Group are noted in Chapter 3. Other assumptions by the Work Group about future activities in the region were necessary to estimate future conditions and impacts. Those assumptions concerning future trends include:

- The increasing growth in human population will continue;
- The Hanford Reach will remain undeveloped;

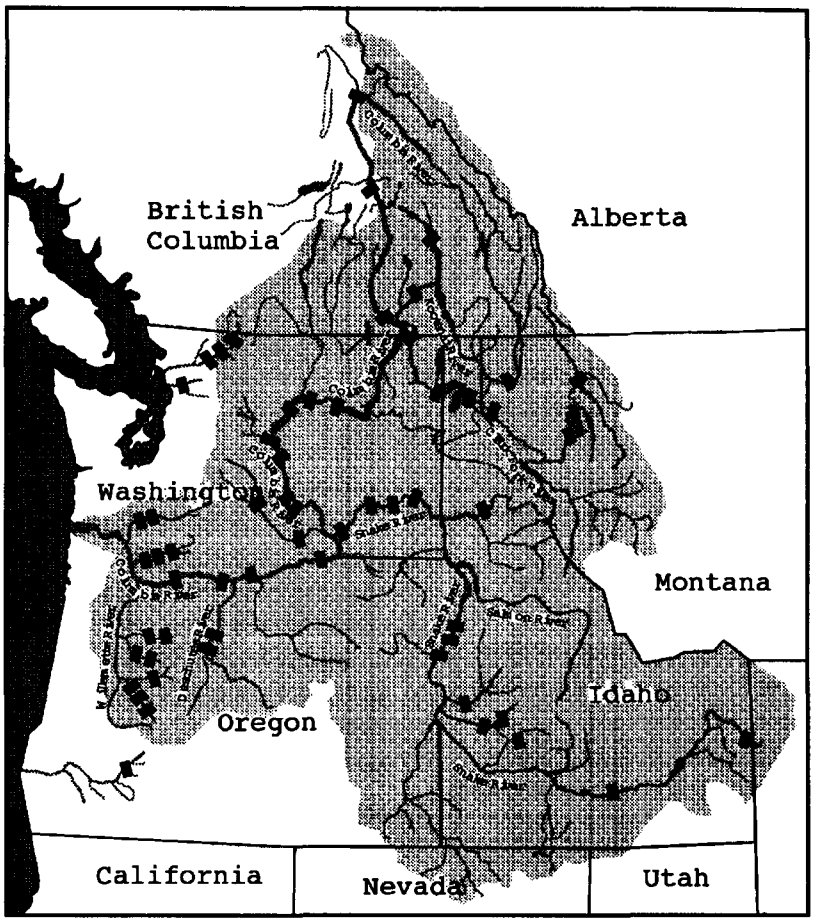

Figure 1–1. Columbia River Basin Major Dams

- No new dams will be added to the system;
- Normal weather patterns, based upon the existing 50 years of data, will continue;
- Existing Federal, state, and local laws/ordinances/ and regulations will remain in effect.

1.5 WILDLIFE RELATED LAWS AND REGULATIONS

Several Federal wildlife and other environmentally–related laws, as well as state, areawide, and local plans and programs, apply to the SOR. Federal laws specific to wildlife and associated shoreline habitat issues are shown in Table 1–2.

Table 1–2. Major Federal Acts Affecting the Wildlife Community

Endangered Species Act as amended	**16 USC 1531**	**1973**
Fish and Wildlife Coordination Act as amended	16 USC 661	1934
Fish and Wildlife Conservation Act	16 USC 2901	1980
Pacific Northwest Electric Power Planning and Conservation Act	16 USC 839	1980
Coastal Zone Management Act	16 USC 1451	1972
Marine Mammals Protection Act	16 USC 1361	1972
Clean Water Act as amended	33 USC 1251	1972
Wild and Scenic Rivers Act	16 USC 1271	1968
Compliance and other procedures are fully discussed in Technical Exhibit # B.		

CHAPTER 2

EXISTING AND AFFECTED ENVIRONMENT

2.1 OVERVIEW: WILDLIFE IN THE COLUMBIA BASIN TODAY

Wildlife resources vary widely over the Columbia River basin. Four different physiographic regions overlap the 14 coordinated hydroelectric projects and other areas which may be effected by the proposed actions of the System Operation Review (Bernard R.S. and Brown, K.F., 1978). Each of these physiographic regions have typical plant and animal communities that may be effected by proposed systemwide river operations in different ways. Several project reservoirs and/or stream reaches cross boundaries of the physiographic regions, including Lake Celilo behind the Dalles Dam, Franklin D. Roosevelt Lake behind Grand Coulee Dam, the Snake River through Hell's Canyon, and the Clearwater River in Idaho. The physiographic regions are the Northern Pacific Border Region, the Cascade Mountain Region, the Columbia Plateau Region, and the Northern Rocky Mountain Region.

The Northern Pacific Border Region includes the Columbia River segment below Bonneville Dam. This area of the Columbia River is typified by a spruce–hemlock–Douglas–fir upland forest. The area immediately adjacent to the river typically has riparian and wetland habitats containing cottonwoods, willows, cattails, and bulrushes. Some typical wildlife species include Canada geese, herons, gulls, sandpipers, warblers, bald eagle, osprey, beaver, deer, and increasing numbers of marine mammals such as harbor seals and sea lions.

The Cascade Mountain Region includes Bonneville Reservoir and the lower end of Lake Celilo. This region typically has a Douglas–fir/silver fir forest upland with some riparian and wetland habitat type developed adjacent to the reservoirs. The shorelines of the reservoirs in this region have been significantly affected by highway and railroad construction in the past and there is significant human activity (including residentially zoned and occupied areas). As a result, wetland and riparian wildlife habitats are limited. Typical wildlife of this region include Canada geese, ducks, herons, sandpipers, woodpeckers, eagles, osprey, and beaver.

The Columbia Plateau region contains the upper end of Lake Celilo, as well as other Federal projects including John Day, McNary, Chief Joseph, Grand Coulee (in part), Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams and reservoirs. Other facilities and reaches that occur within the Columbia Plateau physiographic region include: Brownlee and that downstream portion of the Snake River through Hell's Canyon to the upper end of the Lower Granite reservoir; the Public Utility District owned reservoirs on the mid–Columbia; and the Hanford Reach of the Columbia River. This region is dominated by a shrub–steppe environment, typified by fescue–wheatgrass, wheatgrass–bluegrass, sagebrush steppe, and wheatgrass–needlegrass shrub–steppe habitats in the uplands. Much of this upland habitat has been significantly altered by agricultural activity. Riparian and wetland communities are limited and in some cases are artificially developed and maintained as mitigation and licensing requirements for previous Federal and public utility actions. Typical wildlife include Canada geese, mallards, herons, terns, stilts, killdeer, swallows, warblers, bald and golden eagles, beavers, otter, mule deer, falcons, gopher snakes, and turtles.

Libby, Hungry Horse, Albeni Falls, and Dworshak projects are entirely within the Northern Rocky Mountains Region. The upper part of Franklin D. Roosevelt Lake, the Clearwater River, and part of the Snake River below Brownlee project are also in the physiographic region. As a region influenced by mountains, the various habitats are more diverse here than in the Columbia Plateau region. Primary

upland vegetation includes pine, fir, cedar, hemlock, wheatgrass, fescue, and needlegrass. Wetland and riparian areas are scattered but can be locally significant. Typical wildlife species include mergansers, sandpipers, waterfowl, osprey, bald eagles, beaver, otter, deer, elk, and bighorn sheep.

2.2 PROJECT BY PROJECT DISCUSSION

Each project and reach potentially impacted by proposed operational changes in the coordinated Columbia River system were examined individually. Local experts in wildlife management issues were contacted to assure the discussions were as accurate as possible. Beginning in the upstream areas of the Columbia River and working downstream to below Bonneville Dam, the existing wildlife resources are summarized by project and reach. In some cases, the resources are similar enough that several projects and/or reaches are combined in a single discussion.

The information presented on the following pages of this chapter was gathered from published and unpublished reports and discussions with local professional wildlife biologists, and unpublished information. The amount and quality of recent information available to the authors for each reach and reservoir varied and is reflected in this chapter.

In developing study methods, the Wildlife Work Group selected five habitats for impact analysis. These habitats were selected because they are sensitive to changes in reservoir elevations and operations, and because they effect a wide variety of wildlife. These habitats are:

Drawdown/Barren Zones: The drawdown/barren zone is a shoreline habitat devoid of vegetation. Lack of vegetation is generally associated with erosion and/or withdrawal of water due to reservoir operations. Increases in the drawdown/barren zone tend to negatively impact wildlife values, since the lack of vegetation and cover reduces availability of resources for most species. However, impacts can be duration–dependent. When the barren zone first makes its appearance, it acts as a barrier to wildlife migrating among quality habitats. The size of the barren zone is irrelevant at this stage, and a small barren zone is as effective a barrier as a larger barren zone. Should the barren zone persist, however, certain species may benefit, such as shorebirds, that would use the zone for feeding and nesting.

Riparian Zone: Riparian habitat is a special class of shoreline wetland habitat that is typified by development of woody shrubs and tree species. Riparian habitats are inundated part of the year, and species such as cottonwood that depend on regular groundwater and require scouring to establish new seedlings thrive in them. Riparian habitats contain an abundance and variety of wildlife. Some species such as mink spend entire life cycles in the riparian habitats, while other species complete critical life cycle activities in them such as nesting. Riparian habitats are dependent on available water, and therefore are sensitive to river operations which may increase or decrease stream flows.

Emergent Wetland Zone: Emergent wetland zones are classic wetlands. Marshy areas typified by cattails and bulrushes, these habitats are inundated with water most of the year, although they can tolerate some drying. Some species such as muskrats spend their entire life cycles in emergent wetlands, and could not exist elsewhere. Other species use emergent wetlands for incidental activities, such as white–tailed deer, which fawn in them. Wetlands typically depend on water depths and seasonal inundation patterns that are directly impacted by reservoir operations.

Submerged Aquatic Plant Zones: Submerged aquatic plant zones are areas of plants that spend their entire life cycle underwater. These submerged plants are a food source for several species of wildlife, including diving ducks. As with emergent wetlands, submerged aquatic plant beds depend on certain water depths and seasonal inundation patterns. Their existence is closely tied to river and reservoir operations.

Islands: Islands are bodies of land completely surrounded by water. Any individual island may contain one, several, or all of the habitats described above. As a result, they tend to support an abundance and variety of wildlife. Certain species, such as terns, exclusively use islands for nesting and

reproduction, while other species such as Canada geese use islands as preferred nesting sites. Islands are attractive to many species of wildlife because they provide security from mainland predators. Islands owe their existence to water elevations, and any changes in operations may directly effect their habitat profiles and their value to wildlife species.

The Wildlife Work Group also analyzed two categories that can only loosely be described as habitat zones for wildlife, although what takes place in the zones directly impacts wildlife values:

Primary Fish Productivity Zones are simply those areas within reservoirs and river reaches that produce fish populations. Many species of wildlife – bald eagles, osprey, bears, otter, etc. – feed on fish, and the work group evaluated how river operations may effect the capacity of these areas to produce food sources (known as 'prey base'). Should river operations significantly impact an area's capacity to produce fish, any variety of wildlife that feed primarily on fish are expected to decline.

Benthic Invertebrate Productivity Zones are those areas at the bottom (benthic zone) of reservoirs and river reaches that are producers of invertebrates. These invertebrates are valuable to wildlife as sources of food. Otters, for instance, feed on crayfish, and diving ducks feed on freshwater mussels.

Finally, the continuing effect of human activities on wildlife resources has been examined for each project/reach and alternative. Human effects range from incidental visits by recreationalists to the conversion of habitat through development of residential and/or industrial areas. All have critical effects on existing wildlife populations.

2.2.1 Lower Kootenai River

The Kootenai River is 485 miles long and approximately one–third of it lies in the United States. It originates in British Columbia and flows south though the Rocky Mountain Trench. The Kootenai River enters Montana near Eureka, and swings West at the confluence with the Fisher River. It then runs past Libby and Troy and enters Idaho, where it flows north into British Columbia once again and empties into Kootenay Lake, and eventually into the Columbia River. The area is characterized by high, rugged, forested northwest–trending mountain ranges separated by narrow linear valleys. The area downstream of Libby Dam is characterized by relatively flat terraces that lie at intervals between the riverbanks and steep mountain slopes. The meandering Kootenai River below Libby Dam has an average stream gradient of 0.1 percent, with the river dropping approximately five feet per mile. Elevations of the study area vary from 2,100 feet at the valley floor to over 5,000 feet on mountain ridges.

The Upper Columbia United Tribes, in particular the Kootenai Tribe of Idaho, have a strong interest in the resources of the Kootenai River, especially its bull trout, cutthroat trout, rainbow trout, whitefish, and burbot. The Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation also have a strong interest in this region's resources.

2.2.1.1 Physical Habitat

Barren Zone

Gravel bars and some portions of the shoreline are intermittently exposed during low flows and comprise a majority of barren area acreage.

Operation of Libby Dam has been blamed for increased shoreline erosion of the Kootenai River, particularly in the Idaho reach upstream of Bonners Ferry. Erosion is caused by varying flows through the winter months. An important mechanism of bank erosion is high flows resulting in ice forming high on the banks. As the flows drop, the ice falls, taking bank soils with it.

Upland Zone

The upland zone vegetation occurring in the Kootenai River basin between Libby and Bonners Ferry may be broadly separated into three types: south–facing slope, north–facing slope, and bottomland.

South–facing slopes are generally characterized by scattered, open stands of ponderosa pine, and a limited amount of Douglas–fir. Understory species are bitterbrush, western serviceberry, and chokecherry. Other shrubs occurring include creeping Oregon

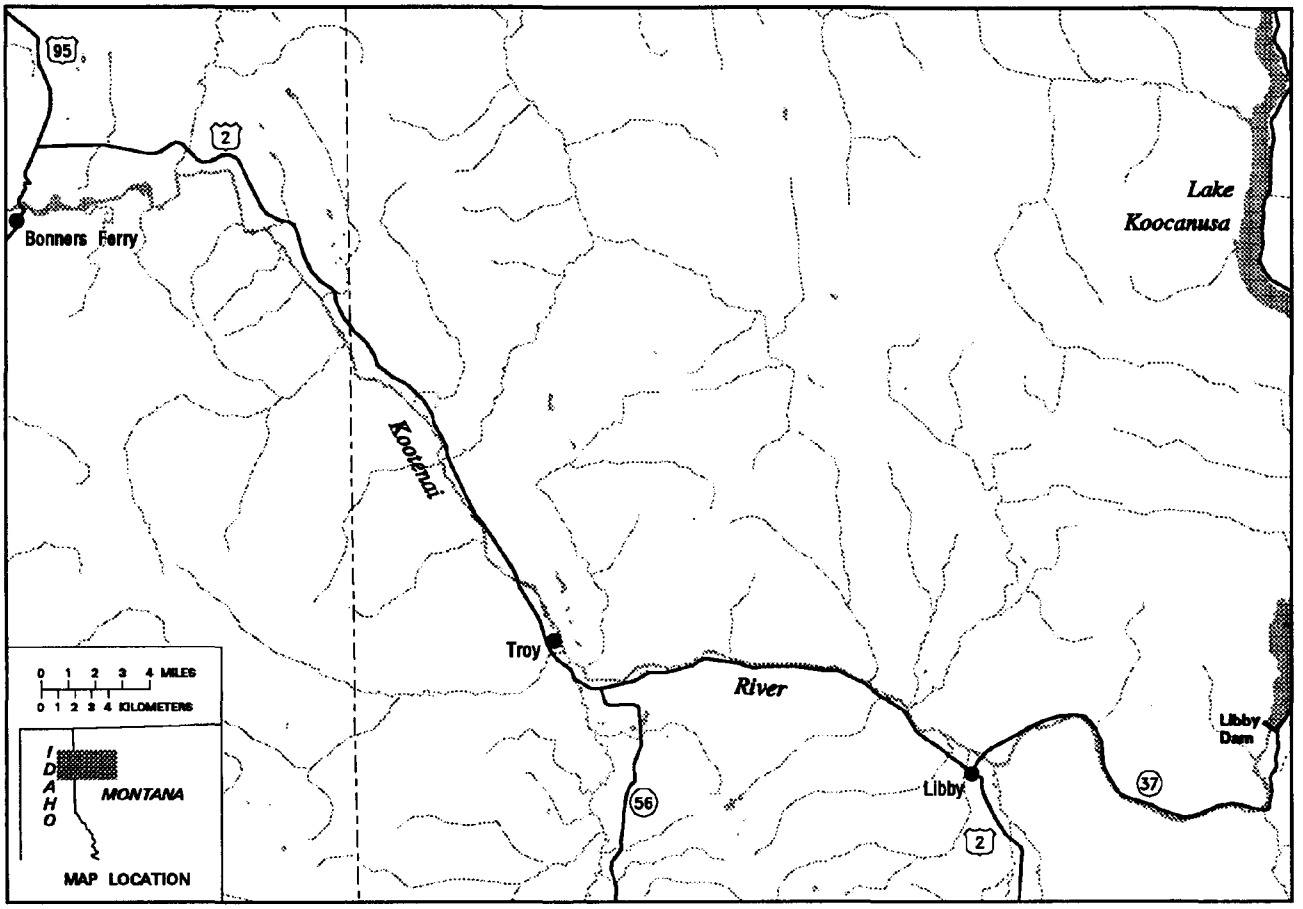

Figure 2–1. Lower Kootenai River

grape, and white spiraea. Major forbs found are yarrow, arrowleaf balsamroot, and dogbane. Dominant grasses include bluebunch wheatgrass, and rough fescue.

North–facing slopes south of the Kootenai River are usually densely timbered with mountain maple, Douglas–fir, western larch, and lodgepole pine. Understory shrubs consist of mock orange, ninebark, snowberry, and kinnikinnick. Forbs present include heartleaf arnica, Sego lily, as well as lupine and yarrow. The predominant grass is pine grass.

Meadows occur in several areas. Grasses include brome grasses, bluegrass, Junegrass, Idaho fescue, needlegrass, and bluebunch wheatgrass.

Riparian Zone

Riparian habitat is discontinuous along the river. Habitats (within the floodplain) can be divided into coniferous forests and deciduous forests. Coniferous forests consist of Douglas–fir, and western redcedar. Understory species include Oregon grape, Rocky Mountain juniper, and Canadian buffaloberry. Dominant deciduous overstory species include black cottonwood, alder and willow. Understory vegetation includes dogwood, gooseberry, chokecherry, ninebark, and serviceberry.

Total existing riparian area includes 1,775 acres from Libby Dam to the US border (Ebasco unpublished report).

Emergent Wetland Zone

Marsh areas support aquatic plants such as sedge, cattail, and pondweeds, though emergent wetlands are continuous and small in size. Total emergent acres: 1,574 (Ebasco, 1992).

Submerged Aquatic Plant Bed Zone

Filamentous algae and pond lily are common in the Kootenai River ecosystem, where flows are slack and water is shallow. Total acres: 553.

Island Habitat

Islands developed from the gravel bars on the Kootenai River are maintained in early successional stages through continued water level fluctuations. A variety of shrubs, forbs, and grasses do eventually colonize these areas and include willow, sweetclover, cocklebur and thistle. The bars and vegetated islands are vital habitat for numerous shorebirds, ducks, and geese. Total island acreage: 510.

Fish Productivity Zone

Introduced kokanee salmon entrained from Libby Dam provide food for eagles and osprey as well as some aquatic furbearers. Native whitefish also provide forage.

Benthic Invertebrate Productivity Zone

Benthic invertebrates in the Kootenai River are restricted in abundance by the fluctuating water levels that are the result of Libby Dam operations, as well as the generally cold water temperatures. Typical species include the larvae of mayflies and midges, and crayfish.

Human Effects

Three towns are situated along the lower Kootenai River: Libby, Troy, and Bonners Ferry. Highways 37 and 2 parallel the river for its entire length in this reach. Typical human uses include recreation (boating and fishing), and being repository to treated wastes.

2.2.1.2 Wildlife

Waterfowl

The Kootenai River Basin lies primarily within the Pacific Flyway. Mallards, harlequin ducks, pintail, American wigeon, teal, gadwall, goldeneye, American coot, common merganser, tundra swan, and Canada goose constitute the principal waterfowl species. The ten mile reach of the river below Libby Dam does not receive heavy use by waterfowl, although occasionally flocks of up to 30 waterfowl feed and rest on the slower moving backwater areas near the river islands. Harlequin ducks nest in smaller tributary streams, and possibly along the Kootenai River as well. Canada goose and duck nesting occurs on some of the river islands and among the grasses and/or dense vegetation growth associated with these habitats.

Colonial Nesting Birds

No colonial nesting birds are known to occur in this reach of the Kootenai River.

Shorebirds

Some shorebird species seasonally use the Kootenai River area for feeding and as a rest stop during southern migration. Species include the common snipe, spotted sandpiper, and lesser yellowlegs. Common snipe and spotted sandpiper may nest near the river.

Nongame Birds

The passerine bird life of the area is representative of northern coniferous forests including such species as the mountain chickadee, downy and pileated woodpeckers, common nighthawk, western tanager, cordilleran flycatcher, red–breasted nuthatch, common flicker, American robin, Swainson's thrush, northern flicker, house sparrow, red–eyed vireo, fox sparrow, pine siskin, dark–eyed junco, and Steller's jay. River habitats also supports the belted kingfisher, redwing blackbird, yellow warbler, and dipper.

Upland Game Birds

Upland game in Kootenai River basin include ruffed, blue and spruce grouse, ring–necked pheasants, and mourning doves. Chukar, sharp–tailed grouse and

Hungarian partridges also occur. Ruffed grouse are the most common species of grouse, occurring at lower elevations, while blue and spruce grouse prefer higher, more mountainous areas. Agricultural lands near Bonner's Ferry support moderate numbers of ring–necked pheasants and migrating mourning doves. The wild turkey can also be found along the river.

Raptors

Ospreys and bald eagles perch in tall bankside cottonwood and Douglas–fir trees along the riparian areas below the mouth of the Fisher River. Four pairs of bald eagles nest along the Fisher River, and six pairs nest along the Kootenai River in Montana. Migratory and wintering concentrations of bald eagles occur below Libby Dam. Great–horned owl, goshawk, red–tailed hawk, and short–eared owl are other common raptors that inhabit the area.

Aquatic Furbearers

Beaver, muskrat, mink, and river otter constitute the principal furbearers inhabiting the Kootenai River basin. Beaver colonies are found primarily along the Kootenai mainstem downstream of Bonners Ferry and along certain gradient tributaries. Diked agricultural lands near Bonners Ferry support the bulk of the muskrat populations. Small numbers of mink and river otters occur along main watercourses in the timbered areas of the basin.

Terrestrial Furbearers

Weasels, skunks, and raccoons are abundant in the area. Martens use heavily forested localities at higher elevations and wooded areas at lower elevations.

Big Game

Principal big game animals in Kootenai River basin are white–tailed deer, mule deer, elk, black bear, and moose. Less common species are grizzly bears, mountain goats, bighorn sheep, and woodland caribou. Grizzly bears inhabit the roadless backcountry of the extreme northeast and northwest corners of the basin. Black bears can be found from the Douglas–fir forests of the mountains to the wet meadow riparian areas by the river. White–tailed deer are abundant within the region with the largest concentration inhabiting the river basins and bottomlands.

Mule deer are less numerous and found at higher elevation in scattered herds. Elk herds are small, widely dispersed, and occur principally in the Moyie and Fisher rivers' drainages, and the Dunn Creek drainage. Elk also occur in the Boulder Creek and Alexander Creek drainages. Herds use the north and east facing slopes at higher elevations. Moose prefer the bottomlands along lakes and streams and early successional habitat.

Winter range is restricted to narrow areas along the Kootenai River and the lower reaches of lateral drainages on south and west facing slopes. Migrations to winter range generally occur during late October or early November. During normal winters, elk, and sometimes moose, are in direct competition with deer for food and cover on winter range. Common browse species used by big game include chokecherry, ceanothus, serviceberry, bitterbrush, mountain maple, red–osier dogwood, willow, aspen, and kinnikinnick. Mountain goat and Bighorn sheep inhabit rocky cliffs, benches and steep terrain in small bands. Bighorn sheep graze in meadows at lower elevations during winter.

Amphibians and Reptiles

Amphibians in this area include a few species of salamanders and frogs, and the western toad.

Reptiles include the painted turtle, garter snake, rubber boa, western skink, and the northern alligator lizard. Amphibians are closely tied to the river and its sloughs while reptiles can be found from upland coniferous forests to the mats of emergent plant bed in river sloughs.

Endangered, Threatened, and Sensitive Species

The USFWS has identified the following listed and candidate plant and wildlife species that may be found in the vicinity of the Kootenai River:

Idaho Portion of Kootenai River	
Grizzly bear, *Ursus arctos* Cabinet–Yaak Proposed Recovery Zone and Selkirk Proposed Recovery Habitat	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus* 6 nest territories along the river; common winter resident	threatened
Northern goshawk, *Accipiter gentilis*	candidate 2
Wolverine, *Gulo gulo luscus*	candidate 2
Black tern, *Chlindonias niger*	candidate 2
Triangular–lobed moonwart, *Botrychium ascendens*	candidate 2
Montana Portion of Kootenai River	
Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

Bald eagles are common along the river throughout the year. Grizzly bears, gray wolves, and peregrine falcons are uncommon and rarely sighted near the river. At least one historic peregrine falcon eyrie is known from the cliffs adjacent to the Kootenai River. Black terns are found in scattered localities in quiet pond/marsh associations in northern Idaho, but are generally not associated with the Kootenai River. Northern goshawks and wolverines are both generally poorly known from the region, but are not likely to be closely associated with the Kootenai River. The triangular–lobed moonwart occurs near Lake Pend Oreille, but its status near the Kootenai River is unknown. Water howellia was listed in 1994, and its abundance and population status in Montana and Idaho are not well known.

2.2.2 Libby Dam and Lake Koocanusa

Short–term Operational Limits	
Lake Elevation	
Full Pool	2,459 ft
Minimum Pool	2,287 ft
Discharge	
Minimum instantaneous	2,000 cfs
Minimum daily flow	3,000 cfs
Rate of change of tailwater elevations	
May 1 – September 30 (1ft/hr)	4 ft/24 hrs
October 1 – April 30 (1ft/hr)	6 ft/24 hrs

Libby Dam was completed in 1976 (a fifth turbine was installed in 1984), and is located on the Kootenai River in Montana at river mile 221.9. The dam is located in the Kootenai River Valley of northwest Montana within the Kootenai National Forest. The area is characterized by high, forested northwest–oriented mountain ranges separated by narrow linear valleys. Downstream of Rexford, Montana, Lake Koocanusa occupies a narrow gorge, averaging one mile in width, between steep, coniferous forest–covered mountains with flat benches at the mouths of tributary streams. Above Rexford, extending a few miles north of the Canadian border, the reservoir is approximately two miles wide and the character of the shoreline changes to generally sloping, rolling terrain with extensive flat areas at or below pool level.

The Upper Columbia United Tribes, in particular the Kootenai Tribe of Idaho, are concerned with operation of Libby Dam and its effects on fish resources in the Kootenai River downstream of the dam. The Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation also have a strong interest in the operation of Libby Dam.

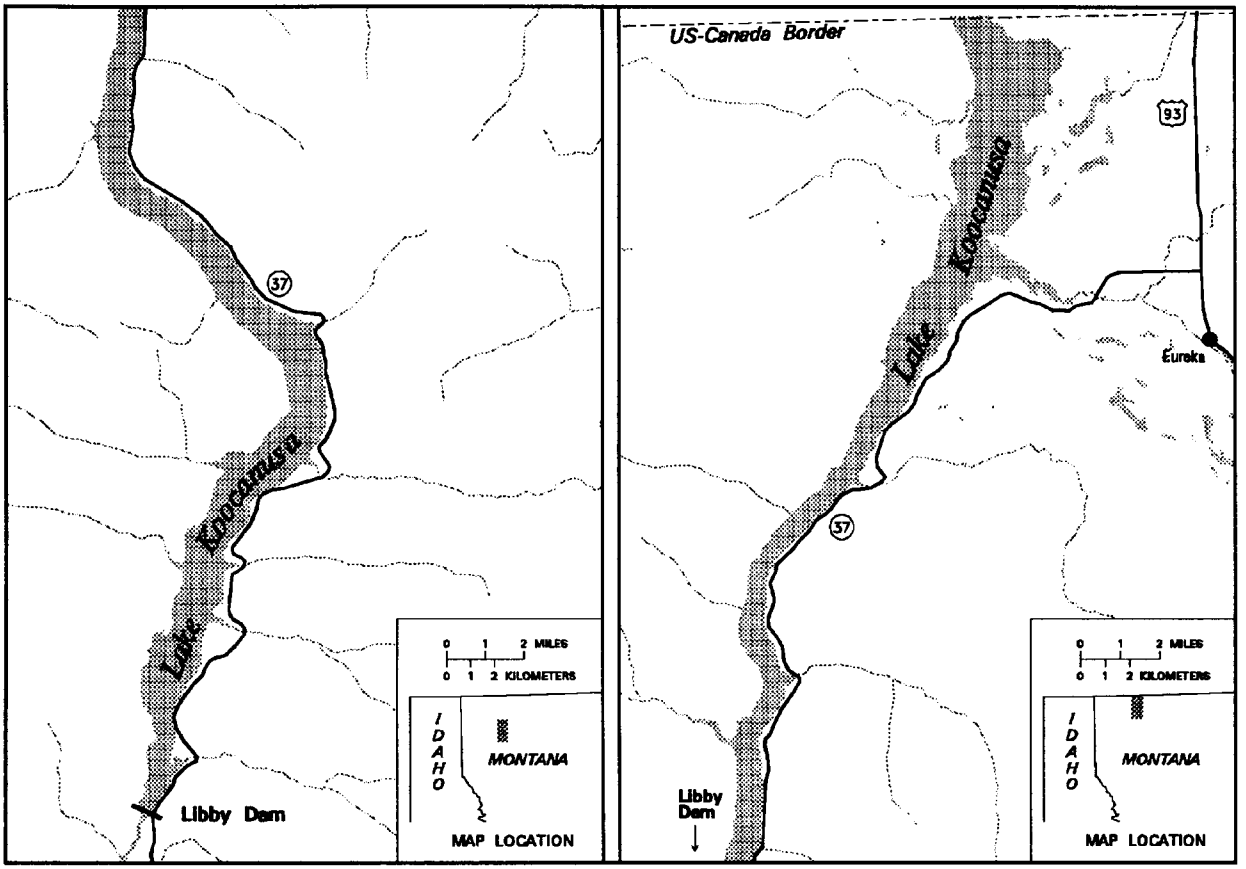

Figure 2–2. Libby Dam and Lake Koocanusa

2.2.2.1 Physical Habitat

Barren Zone

Bare sand and mud are exposed during the fall, winter, and spring drawdown, and during summers when the reservoir does not refill. Erosion can be a serious problem, particularly during winter wind storms when the substrate has dried out.

Upland Zone

Lake Koocanusa lies in a valley between two ranges that are north–south trending. Consequently, the forested slopes above the river are predominately east and west–facing slopes, with relatively few south– and north–facing slopes. The aspect of slopes at the Libby project area is an important factor in controlling vegetation colonizations in an area where the summers are hot and dry. Thus, south–facing slopes receive sun for a large portion of each day and consequently are the hottest and driest slopes. They are typified by a sparse growth of ponderosa pine and relatively few understory plants, including roses and ninebark. Ground cover is composed primarily of grasses and other herbaceous plants.

At the other extreme, north–facing slopes receive little to no direct sunlight, and tend to be cooler and steeper. These slopes do not become as dry, because they receive moisture from morning dew. Hence, vegetation is denser and more lush, usually showing a greater diversity of species. These slopes tend to be 85 percent Douglas–fir and 15 percent western larch, with a large number of understory plants including serviceberry and ocean spray.

The east– and west–facing slopes tend to show a gradation of community makeup encompassing a wide range of variability within the Douglas–fir/western larch/ponderosa pine association. The west–facing slopes however, tend to be slightly drier than the east–facing slopes and are somewhat more open in structure. Vegetation communities include species common to both north and south–facing slopes and usually have the greatest diversity of vegetation and animal species. Understory plants consist of ninebark, snowberry, kinnikinnick, Oregon grape, ocean spray, mock azalea and serviceberry.

Riparian Zone

Plant species in riparian areas include cottonwood, willow, red–osier dogwood, mountain alder, birch, serviceberry, and ninebark. Riparian areas are important not only for the variety of food and cover they provide for wildlife, but also for their ready availability of water. Riparian areas provide an especially rich variety of foods including buds, twigs, catkins, seeds, and fruit. The riparian areas also provide tree perches for ospreys and bald eagles. Canada geese and other waterfowl nest among the grasses and/or dense vegetation growth associated with these habitats. Riparian habitats are restricted to only 24 acres, mostly associated with tributary streams.

Emergent Wetland Zone

There is only one significant emergent wetland near Lake Koocanusa. Total acreage of emergent wetlands is approximately 24 acres.

Submerged Aquatic Plant Bed Zone

There are no aquatic plant beds in Lake Koocanusa.

Island Habitat

One hundred and twenty acres of islands in the reservoir contain Douglas–fir, western larch, and western redcedar in the overstory. The understory consists of Rocky Mountain juniper, common juniper, birch, ninebark, snowberry, and Oregon grape. This vegetation complex supports a limited range of wildlife species.

Fish Productivity Zone

Salmonids provide prey for bald eagles. Other species of fish are prey for the osprey.

Benthic Invertebrate Productivity Zone

The benthic life within the reservoir is severely restricted by the wide seasonal drawdowns that occur. Populations of insect larvae exist along with some limited numbers of crayfish.

Human Effects

Recreation is restricted to boating and fishing during the summer months.

2.2.2.2 Wildlife

Waterfowl

The Kootenai River basin lies primarily within the Pacific Flyway. Mallard, pintail, American wigeon, teal, gadwall, goldeneye, wood duck, western grebe, common merganser, and tundra swan are seasonal migrants. Nesting is rare along this reservoir, and is limited to mallards and common mergansers.

Colonial Nesting Birds

No colonial nesting birds are known to occur in Lake Koocanusa.

Shorebirds

Some shorebird species seasonally inhabit the dam area for feeding and as a rest stop during southern migration. Species include the common snipe, spotted sandpiper, and lesser yellowlegs. The common snipe and spotted sandpiper may nest in the vicinity of Lake Koocanusa.

Nongame Birds

The bird life of the area is representative of coniferous forests including such species as the mountain chickadee, woodpeckers, swallows, wrens, bluebirds, finches, chickadees, wrens, red–breasted nuthatch, common flicker, American robin, hermit thrush, red–eyed vireo, fox sparrow, pine siskin, and dark–eyed junco. Island wildlife includes common flickers, belted kingfishers, and several other species of small birds.

Upland Game Birds

Upland game birds which might be found within the project area include ruffed and blue grouse. Ruffed grouse are the most common species of grouse occurring at lower elevations, while blue grouse prefer higher, more mountainous areas. The kinnikinnick fruit seems to be preferred by blue grouse.

Raptors

Great–horned owls, goshawks, and red–tailed hawks inhabit the forests surrounding the reservoir.

Aquatic Furbearers

Mink, river otter, and muskrat constitute the principal furbearers found along the shore of Lake Koocanusa. However, numbers near the reservoir are limited due to the extensive barren area between the water in the reservoir and shoreline vegetation during most of the year (i.e., when the reservoir is less than full).

Terrestrial Furbearers

Common furbearers include raccoon, cottontail rabbits, porcupine, shrews, marten, bobcat, weasel, coyote, mountain lion and black bear. Island furbearers include red and flying squirrels.

Big Game

Higher elevations of the slopes are the preferred summer range of deer, sheep, and elk, while the lower bottomland elevations provide winter habitat for big game. The north–facing slopes are generally used for escape and bedding cover by big game, primarily because of the lack of sunlight to the forest floor (due to the denser overstory vegetation). In addition, these slopes in the project area tend to be relatively steep, which likely discourages use by big game predators to some degree. The availability of grass on south–facing slopes makes them important seasonal feeding areas for mule deer and elk. White–tailed and mule deer favor the snowberry for its shoots and foliage, but also eat the shoots and foliage of Oregon grape, Ponderosa pine, and Douglas–fir. White–tailed deer also show an additional preference for kinnikinnick fruit. Moose seek the bottomlands for the twigs and foliage of the red–osier dogwood, willows, alder, and birch.

A moderate number of mountain lions, and black and grizzly bear are found throughout this region.

Amphibians and Reptiles

Amphibians in this area include a few species of salamanders, frogs, and the western toad. Reptiles include the painted turtle, garter snake, rubber boa, western skink, and the northern alligator lizard.

Endangered, Threatened, and Sensitive Species

The USFWS has indicated the following listed species may be found in the vicinity of Lake Kookanusa:

Lake Kookanusa	
Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	threatened
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

Four pairs of bald eagles nest along the shores of Lake Koocanusa; 20 to 50 bald eagles may winter along the Kootenai River just below the dam. Grizzly bears, gray wolves, and peregrine falcons are uncommon near Lake Koocanusa and are rarely observed.

2.2.3 Hungry Horse Project

Short–term Operational Limits	
Lake Elevation	
Normal Full Pool	3,560 ft
Minimum Pool	3,336 ft
Discharge	
Minimum	400 cfs
Maximum (limit during flood control operations)	500 – 3,000 cfs

Hungry Horse Dam was completed by the Bureau of Reclamation in 1953 for flood control and hydropower generation on the Flathead River. The dam is located on the South Fork of the Flathead River five miles upstream of its confluence with the main stem of the Flathead River, seven miles southeast of Columbia Falls, and 11 miles south of the west entrance to Glacier National Park (BPA, 84). The Bureau attempts to maintain reservoir levels between 3,560 feet msl (full pool) and 3,475 feet, except under conditions of extreme runoff. In recent years, however, annual drawdown has ranged from 66 feet (1990) to 178 feet (1988), and has exceeded 85 feet in four out of six years. Between 1988 and 1993, the pool has refilled only twice.

Maximum power generation at full pool is achieved from Hungry Horse Dam at about 12,500 cfs. The Bureau typically releases about 10,000 cfs, and is required to maintain a minimum of 135 cfs in the South Fork and 3500 cfs in the main stem of the Flathead River to protect fish. In recent years, releases from the Dam have tended to range over a period of several days from a low near 135 cfs, to a high of about 10,000 cfs. The (ramping) rates at which releases are increased or decreased are modulated under agreement with Montana Department of Fish, Wildlife and Parks (Richard Clark, USBR, Hungry Horse Dam, personal correspondence). Because the channel capacity of the South Fork is approximately 20,000 cfs, the wide fluctuations in releases that occur over a several–day period tend to maintain at least the lower portion of the channel (that is, nearest the channel bottom) free of vegetation. Riparian vegetation growing along the channel's edges above the 20,000 cfs level is rarely inundated.

Existing Mitigation Program

The Montana Department of Fish, Wildlife and Parks (MDFWP) and US Forest Service are cooperatively implementing the Hungry Horse Habitat Enhancement Project and the Habitat Protection Project, which are designed to mitigate effects on wildlife habitat resulting from construction of Hungry Horse Dam. The two projects (as well as the Libby Habitat Enhancement Project) are funded by a trust account established as part of the Wildlife Mitigation Agreement for Libby and Hungry Horse Dams signed by the State of Montana and Bonneville Power Administration. The projects are described by Wood et al. (1995), from which the following was summarized.

The Hungry Horse Habitat Enhancement Project was designed "primarily to mitigate the loss of seral shrubfields used as elk winter range". Project activities include timber harvesting, slashing and burning on selected forest stands, and seeding with forage species. The project is a cooperative effort between MDFWP and Flathead National Forest. The areas selected are not influenced by water levels in Hungry Horse Reservoir.

The Habitat Protection Project was designed "primarily to protect riparian, wetland, palouse prairie [associated with Libby Dam], and mature/old growth forest habitats." Species expected to benefit include grizzly bear, waterfowl, terrestrial furbearers, numerous small mammals and birds associated with riparian and old growth habitats, mule deer, elk, white–tailed deer, aquatic furbearers, bald eagle and osprey. Goals include protection and/or enhancement of 4,564 acres of prime wetlands in the Flathead Valley, and protection of 8,590 acres of riparian habitat and travel corridors. The project is implemented by MDFWP in consultation with a Habitat Protection Committee comprising biologists from various agencies and conservation groups. Location of specific wetlands and riparian areas have not been finally identified, but some of the wetland areas will be dependent on Flathead River hydrology and would likely be influenced by Columbia River System operations.

Trust funds are also being used in a cooperative effort to mitigate the effects of the recent prolonged drawdown of Hungry Horse Reservoir. The three cooperating agencies are MDFWP, Flathead National Forest, and the US Bureau of Reclamation. The upper reaches of the Reservoir, in the vicinity of Spotted Bear, have been exposed year–long in seven of the last ten years, allowing eroded sediments and dust to degrade water quality. To miti-

gate the effects of prolonged drawdown, six objectives have been identified:

- improve water quality by decreasing wind and water erosion;
- promote insect nesting for fish prey;
- improve waterfowl habitat by vegetating low porosity swales and potholes;
- increase elk winter forage;
- improve aesthetics by decreasing bare soil;
- establish native vegetation to deter invasion by noxious weeds.

Initial efforts to meet these objectives have involved seeding approximately 50 acres of mud flats along the east and west shore of the upper reaches of the Reservoir. Seeding success and vegetation survival will be monitored in 1995. Additional efforts under consideration for 1995 include more seeding, transplanting of shrubs, and some form of weed control (letter from Carol Eckert, Flathead National Forest, to John Wachsmuth, MDFWP, dated March 6, 1995).

Relative to wildlife, significant physical features of this project include elevation above 4,000 ft, where there are several feet of snow every winter, and short growing seasons.

2.2.3.1 Physical Habitat

Barren Zone

Bare sand and mud are exposed during the fall, winter, and spring drawdown. Since 1988, Hungry Horse dam has failed to refill in the summer on several occasions (Reller and Collette, 93). Erosion can be a serious problem particularly during winter wind storms when the substrate has dried out and is susceptible to wind.

Upland Zone

The upland areas surrounding Hungry Horse Dam support many diverse habitats. Upland grasslands, meadows and floodplain terraces are dominated by bluebunch wheatgrass, rough fescue, Idaho fescue, and blue grass. Upland shrubland is dominated by the presence of several species including serviceberry, bitterbrush, Rocky Mountain maple, ceanothus, and snowberry (BPA, 84). Alpine forests dot the uppermost rims, along the side slopes and valley floors cool moist forests of Douglas–fir, larch, and ponderosa pine are interspersed with western hemlock and western redcedar. The understory is characterized by serviceberry, red–osier dogwood, and chokecherry.

Riparian Zone

The only riparian habitat (29 acres) is found along that portion of the South Fork just upstream of the reservoir. It consists of deciduous shrub and deciduous tree cover types. The deciduous shrub community consists of a shrub overstory with an understory composed of a variety of grasses, forbs and shrubs. Scattered deciduous or coniferous trees are occasionally found. Deciduous tree regions contain an overstory composed primarily of black cottonwood. A dense shrub and herbaceous understory is usually present. Scattered conifers are also found. The conifers are western hemlock, ponderosa pine, and western redcedar.

Emergent Wetland Zone

These are very limited around the reservoir. A total of 15 acres is found at the delta of the South Fork Flathead River.

Submerged Aquatic Plant Bed Zone

Communities of aquatic plants are similar to those found downstream at Flathead Lake. The species commonly found are elodea, knotweed, pondweed, parrotweed, duckweed, and milfoil. Aquatic plant beds cover 137 acres in the reservoir, nearly all of it at the delta of the South Fork Flathead River.

Island Habitat

Eleven coniferous islands remain in Hungry Horse Reservoir totaling 334 acres. The islands are surrounded by barren areas during drawdowns.

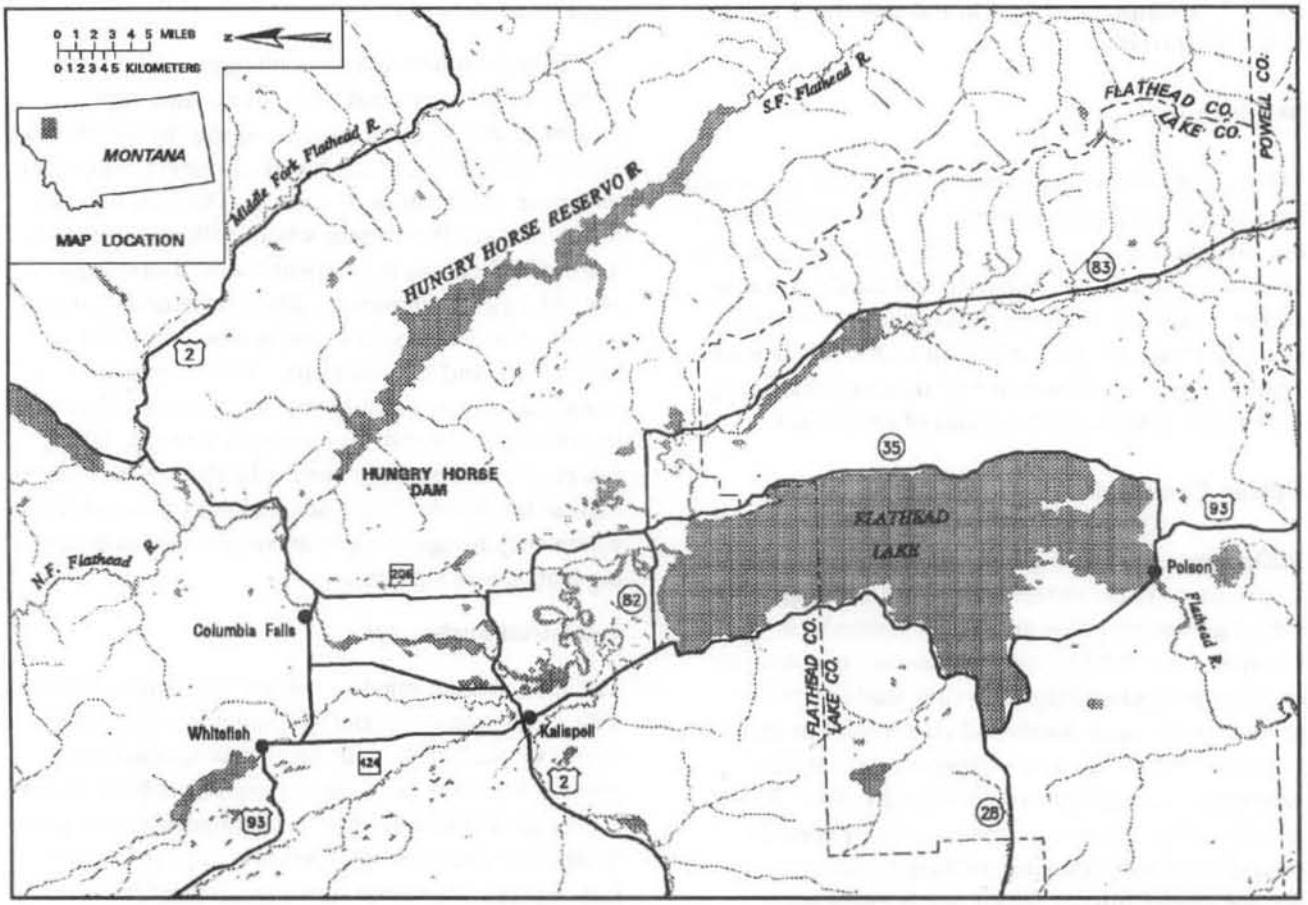

Figure 2–3. Hungry Horse Project, Flathead Lake, and Upper Flathead River

Fish Productivity Zone

The reservoir contains westslope cutthroat trout, bull trout, and kokanee. Bald eagles prey on these species, primarily on kokanee.

Benthic Invertebrate Productivity Zone

The benthic life within the reservoir is severely restricted by the wide seasonal drawdowns that occur. Populations of insect larva exist along with some limited numbers of crayfish.

Human Effects

Fishing, boating, and hunting are the principle recreation activities on and around the reservoir.

2.2.3.2 Wildlife

Waterfowl

Waterfowl seen at the project area include the Canada goose, mallard, wood duck, Barrow's goldeneye, common merganser, and a variety of other dabbling and diving duck species.

Colonial Nesting Birds

None.

Shorebirds

Some shorebird species seasonally inhabit the dam area for feeding and as a rest stop during southern migration. Species include the common snipe, spotted sandpiper, and lesser yellowlegs. The

spotted sandpiper may nest in the vicinity of Hungry Horse Reservoir.

Nongame Birds

The bird life of the area is representative of coniferous forests, including such species as the mountain chickadee, woodpeckers, swallows, wrens, blue birds, finches, chickadees, wrens, red–breasted nuthatch, common flicker, American robin, hermit thrush, red–eyed vireo, fox sparrow, pine siskin, and dark–eyed junco. Island wildlife includes common flickers, belted kingfishers, and several other species of small birds.

Upland Gamebirds

Ruffed grouse, spruce grouse, and blue grouse are all known to occur in the South Fork drainage. The ruffed grouse and blue grouse are common in the riparian areas, while spruce grouse are common in coniferous forests along the valley walls. Ruffed grouse prefer open hardwood stands with moderately dense herbaceous and sapling understory for courtship, nesting and broods (Landry, 80). Blue grouse typically breed in open stands of conifers interspersed with openings of herbaceous cover. Spruce grouse inhabit mixed coniferous forests, generally preferring subalpine spruce–fir and lodgepole pine. Spruce grouse also inhabit spruce–fir forests interspersed with fire induced serial stands of western larch and lodgepole pine.

Raptors

Great horned owls, goshawks, red–tailed hawks, ospreys, and bald eagles are represented near the reservoir. A single bald eagle nest is active on one island in the reservoir. Areas used for feeding and resting by eagles include portions of the river below the dam, and the upper end of the river valley above the reservoir.

At the time of the latest census, 18 osprey nest locations were known in the vicinity of Hungry Horse Reservoir (BPA, 1984). It is unknown how many active pairs used these nests during the 1993 breeding season.

Aquatic Furbearers

The most common aquatic furbearers of the area include beaver, muskrat, river otter, and mink. Beaver prefer riparian habitats along the South Fork and its tributaries, which has traditionally supported moderate populations of beaver. Optimal habitats for beaver are those areas where willow or poplars are available along permanent water courses (generally the larger tributaries). Muskrat probably use aquatic and streamside habitats along both the South Fork and its tributaries. Otters appear to be numerous along the river and use both the river and its tributaries. Backwater sloughs, streams, lakes, reservoirs, and beaver dens could also be important habitat for otters. Mink occur along the South Fork where they forage in riparian vegetation, overhanging banks, and log jams.

Terrestrial Furbearers

The pine marten inhabits mature coniferous timber with small openings. Bottomland and lower valley slopes of old growth with fire–caused openings, provide the most preferred of marten habitat. Lynx prefer the dense seral stands of lodgepole pine due to the high densities of showshoe hare, their preferred prey. Snowshoe hares reach their highest densities in these seral forests (Adams, 59). Other furbearers include weasel, skunk, and raccoon.

Big Game

Black bears are present along the riparian areas and lower benches. The large cottonwood trees located along the bottoms provide preferred type of denning sites (Jonkel and Cowan, 71). The riparian zones provide abundant lush vegetative forage during the spring, and an abundant late summer and fall food supply of berries and mast. Grizzly bears also reside in the project area. Grizzly bears select low level riparian areas after spring emergence because of the available succulent forage. In some areas big game carrion is an important source of spring food. During the summer period grizzly bears move up to higher elevations as the snow recedes. The fall period is spent in preparation for denning and the bears are forced back down to the lowland habitats for available food. The mountain lion is known to occur in a

variety of upland and bottomland areas (especially white–tailed deer habitat) where they feed on deer and elk. The bottomland and open shrubland slopes offer important winter range for prey species.

During the winter, elk require habitats that provide food, escape cover and thermal cover. Elk prefer habitats that support mountain maple, serviceberry, willow, chokecherry, dogwood, and ceanothus. Elk of the project area are not limited in the availability of summer range. A scattered population of mule deer exists around the project area. The deer are widely distributed in the summer with use in all the drainages. During the winter, the deer tend to concentrate on the open shrublands along south– and west–facing slopes where abundant forage is located. The white–tail deer population uses a wide variety of habitats throughout spring, summer, and fall. Winter ranges are in the south and west facing slopes along the east side of the drainage. Fires during the early portion of this century created extensive shrublands and conifer regeneration which, when combined with adjacent thermal cover, provide excellent winter range (BPA, 84). The further succession of thick lodgepole pine stands has caused a slight decline in white–tail deer numbers.

Reptiles and Amphibians

Amphibians typically associated with habitats found along the upper end of Hungry Horse Reservoir and South Fork of the Flathead River include spotted frog, tree frog, long–toed salamander and tiger salamander. Reptiles are generally scarce.

Endangered, Threatened, and Sensitive Species

The USFWS has identified five listed species that may be found in the vicinity of Hungry Horse Project (letter from R. Peterson, USFWS, to D. Treasure, USBR, dated March 29, 1995)

Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

No candidate species were included except for two fish species, which will be addressed in the Resident Fish and Anadromous Fish technical appendix (letter from R. Peterson, USFWS, to D. Treasure, USBR, dated March 29, 1995).

Grizzly bears roam the higher elevations around Hungry Horse Project. A single pair of bald eagles nests on an island (Clayton in Hungry Horse Reservoir). Gray wolves and peregrine falcons are seldom observed in the area. Water howellia has been reported from the Swan Valley, but not from anywhere along the Flathead River. It grows in "vernal glacial pothole ponds and former river oxbows" (USFS, 1994). Although some potential habitat occurs along the South Fork of the Flathead River below Hungry Horse Dam, the probability of water howellia occurring in the Flathead drainage is considered very low (M. Mantas, Forest Botanist, Flathead National Forest, personal communication, June 7, 1995).

2.2.4 Flathead Lake and Upper Flathead River

The Flathead Basin is located in a broad valley of northwestern Montana, between two ranges of the Rocky Mountains. The Flathead River is formed by three main tributaries originating along the west slope of the continental divide. These tributaries join before flowing into Flathead Lake.

Kerr Dam maintains lake elevations between 2,983 and 2,993 feet msl, and releases water at rates ranging from 1500 to 50,000 cfs (Matthews et al., 1986). At full pool (2,893 feet msl), Flathead Lake surface area is nearly 51,000 ha (126,000 ac), making it the largest natural freshwater lake in the western United States. Upland developments along the mostly rocky shoreline areas are dominated by mixed stands of ponderosa pine, Douglas–fir, western larch, and quaking aspen. Agricultural lands encompass 12,779 acres of the Flathead River basin above the lake. The shallow bays of the lake support limited emergent marshes.

2.2.4.1 Physical Habitat

Barren Zone

About one square kilometer of mudflats are exposed during winter drawdowns.

Upland Zone

Upland vegetation is dominated by extensive forests of Douglas–fir and ponderosa pine.

Riparian Zone

Coniferous forests and rangeland dominate much of the riparian areas (Mackey et al, 1984). The undeveloped portions of shoreline consists primarily of Douglas–fir, quaking aspen and paper birch. Scattered pockets of riparian shrub communities dominated by red–osier dogwood, Douglas hawthorn, and sandbar willow are found along much of the shoreline above the lake.

Emergent Wetland Zone

Communities of Cattail, flowering rush, and hardstem bulrush can be found in areas associated with the shallow mud–bottomed bays of the lake.

Submerged Aquatic Plant Bed Zone

Ponds and sloughs around Flathead Lake contain aquatic plants species such as elodea, knotweed, pondweed, parrotweed, duckweed, and milfoil.

Island Habitat

Islands in the upper Flathead basin below Hungry Horse are represented mainly by gravel bars. As the river gradient decreases, sloughs and numerous forested islands become typical.

Twenty–one islands covering 140ha occur in Flathead Lake. Vegetation typically consists of 33 percent ponderosa pine, Rocky mountain juniper, black cottonwood, and aspen. Shrub cover dominated by sandbar willow, red–osier dogwood, and chokecherry occupied 29.8 percent of the island area. The remaining area is dominated by herbaceous cover, including reed canarygrass, Columbia River mugwort, and compressed bluegrass (Mackey, D.L. 1984).

Fish Productivity Zone

A number of species inhabit Flathead Lake and the Flathead River. Trout (rainbow, westslope cutthroat, and bull), kokanee, suckers, and others all occur.

Benthic Invertebrate Productivity Zone

The benthic life of the Flathead River and of Flathead Lake include aquatic insect larvae. Crayfish and freshwater molluscs also occur.

Human Effects

Flathead Lake is used by boaters and fishermen, and there are numerous summer cabins located along the shoreline. The towns of Bigfork and Kalispell are located upstream of the lake and near the Flathead River. The area is known for the cherry orchards that occur around Flathead Lake.

2.2.4.2 Wildlife

Waterfowl

Mallard, pintail, teal, American wigeon, mergansers, and other waterfowl use the rivers, sloughs, and marshlands for nesting and rearing areas. Canada geese use Flathead Lake and its islands as important nesting and rearing areas.

During migration many species use the open water of the river and associated sloughs. Island, backwater sloughs, and gravel bars are used by Canada geese for nesting, brooding and loafing sites. Riparian and mixed forest, islands, bottomland meadows, and riparian shrubland in the project area offer suitable nesting habitat for a variety of duck species. Cavity nesting species use cottonwood and conifer trees in bottomland forest types. The mallard was the most common breeding waterfowl species using bottomland meadows, riparian shrublands, and beaver pond areas prior to the project, but is far less numerous now. The harlequin duck is known to nest along swift streams and rivers in northwestern Montana including the Flathead River.

Colonial Nesting Birds

Great blue heron commonly nest in the flat valley just above Flathead Lake.

Shorebirds

Many species of shorebirds use Flathead Lake and River as an important stopping point along their migration routes. Among them are the semipalmated

plover, long–billed curlew, solitary sandpiper, greater yellowlegs, long–billed dowitcher, northern phalarope, and sanderling.

Nongame Birds

The gray jay, cliff swallow, poorwill, rufous hummingbird, pileated woodpecker, dipper, western meadowlark, and northern oriole are a few of the many non–game birds that can be found in the Flathead region. Species such as the white–winged crossbill, northern shrike, and the common redpoll use the region during the winter.

Upland Game Birds

Wild turkey, ring–necked pheasant, and ruffed grouse are the principal game birds of the basin.

Raptors

Nesting species of raptors in the area are the turkey vulture, golden and bald eagle, and great–horned owl. The American peregrine falcon, and prairie falcon are also present along the river. Snags at Flathead Lake are used extensively for perching by osprey and bald eagle. During the winter, rough–legged hawks and pelicans are relatively common. Snowy owls appear during irruption years.

Aquatic Furbearers

Muskrat, river otter, beaver, and mink use habitats along the upper Flathead River and along the north shore of Flathead Lake. Muskrats prefer slough and pond habitats and avoid the braided river section. Muskrat use of the 93.1ha of marsh is restricted to periods of full pool (Bissell G N, 1987). Eighty–two beaver colonies were located and studied by Bissell. Eighty–five percent of the beavers were found to reside in braided, slough, and tributary habitats. River otter are found in slough, pond and river habitats. The otters feed primarily on two species of fish: the yellow perch is eaten in backwater sloughs, and the mountain whitefish is caught in the Flathead River. Mink prefer to use the food resources and bank cover of the main stem and braided aquatic habitats of the river.

Terrestrial Furbearers

Lynx, bobcat, and marten may be found within the upper Flathead River environment.

Big Game

The intermixture of forest, grassland, cropland and water in the Flathead River and valley provide excellent cover and forage for white–tailed deer; the main large animal of the valley. The white–tailed deer use a wide variety of habitats throughout the year. Elk and moose are also present in stable but smaller populations.

Black bears are present along the riparian areas and lower benches. The large cottonwood trees located along the bottoms provide preferred denning sites. The riparian zones provide abundant lush vegetative forage during the spring, and an abundant late summer and fall food supply of berries and mast. The mountain lion is known to occur in a variety of upland and bottomland areas, where they feed on deer and elk.

Reptiles and Amphibians

Spotted frogs and other amphibians occur in the Flathead basin. Resident reptiles include western painted turtles, garter snakes and northern alligator lizards.

Endangered, Threatened, and Sensitive Species

The USFWS has identified five listed species that may be found in the vicinity of Hungry Horse Project (letter from R. Peterson, USFWS, to D. Treasure, USBR, dated March 29, 1995).

Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Water howellia, *Howellia aquatilis*	threatened

Riparian and lakeshore habitat are important to bald eagles year–round. Migrant eagles near Glacier National Part feed along stream reaches characterized by numerous shallow riffles, gravel bars, and deep pools. Preferred streamside perching snags of

large western larch and western redcedar are available. Gravel bars and large boulders in the riverbed are also used for feeding and resting (BPA, 84) 1,000 bald eagles may pass through the region each fall.

2.2.5 Albeni Falls

Short–term Operational Limits	
Lake Elevation (at Hope)	
Normal Full	2,062.5 ft
Normal Minimum	2,051.0 ft
Maximum daily lake elevation change	
Above Elevation 2,058 ft	0.4 ft
Below Elevation 2,058 ft	0.5 ft
Discharge	
Minimum instantaneous	4,000 cfs
Minimum daily flow	4,000 cfs
Maximum rate of change	
Normal 60–minute limit	5,000 cfs/hr
Maximum 60–minute increase or reduction	1.0 ft/hr
Maximum daily increase	10,000 cfs/ 24 hrs
Maximum daily reduction below 50,000 cfs	10,000 cfs/ 24 hrs
Minimum daily reduction – 50,000 to 75,000 cfs	2.0 ft/ 24 hrs
Minimum daily reduction above 75,000 cfs	1.0 ft/ 24 hrs
Special requirements	
Lake level is maintained at or near the observed November 20 elevation through December 31 to protect Kokanee spawning areas and prevent dewatering of nests	

Albeni Falls Dam was built across the Pend Oreille River in Idaho at river mile 86.9. The dam was completed in 1955.

The Clark Fork–Pend Oreille River Basin is a mountainous area dominated by conifer forests, situated mainly in western Montana but also in portions of northern Idaho, northeastern Washington, and two small areas in British Columbia, Canada. The basin comprises a total area of 25,960 square miles, of which 24,200 square miles are upstream of the Albeni Falls Dam site.

Lake Pend Oreille is a natural lake. Though construction of Albeni Falls Dam did not raise the level of the lake over natural elevations, operation of the dam have dramatically changed the natural environment of the lake. Prior to project operation, natural spring floods (usually May and June) brought the lake up to its highest elevations (often up to 2,070 ft); and then quickly (usually within two weeks) the lake levels would return to 'normal' levels – about 6 to 20 feet lower than the maximum. The average annual range in water levels for the 10–year period 1938 to 1947, inclusive, was nine feet, and the extreme annual fluctuation for the 33–year period 1914–47 was 21.4 feet. The maximum known water–surface elevation of Pend Oreille Lake, 2,076.08 ft, occurred in June 1894, and the minimum lake level, 2,046.47 ft, was recorded in February 1936 – a difference in elevation of 29.6 feet between the absolute maximum and absolute minimum lake levels of record.

In addition, at two locations (the deltas of the Pack River and the Clark Fork River), the topographic relief was quite flat and slightly higher than the summer lake levels. At the two delta areas the effect of the flat relief was the development of two vast wetland areas, consisting primarily of emergent marshes and forested swamps. Operation of the dam resulted in the lake levels remaining at maximum elevations throughout the summer, drowning the wetlands and resulting in the loss over time of in excess of 3,000 acres of wetlands and forested delta islands.

The Upper Columbia United Tribes, in particular the Kalispel Indian Tribe, and the Kootenai Tribe of Idaho, have more than passing interest in operations that affect Lake Pend Oreille and the Pend Oreille River, which are a part of their ceded lands. The tribes maintain their livelihoods near the lake and along the river, hunting and fishing the resources found there. The Salish and Kootenai Tribes of the Flathead Reservation also maintain active involvement with Corps activities in the vicinity.

about one–fourth of the basin area is devoted to farming.

Riparian Zone

More moist conditions exist along the area surrounding the lake. Reflecting this, the composition of the surrounding forest shows areas with significant inclusions of deciduous trees. Common deciduous trees in these forests include paper birch, aspen, willow, black cottonwood, and red alder. Shrubs include various willows and red–osier dogwood. There are 1,341 acres of riparian habitat lining the shore of the lake.

Emergent Wetland Zone

The wetland communities that characterize approximately 69 percent of the 4,215–acre project land base provide valuable wildlife food, cover, and nest sites. Roughly 3,780 acres of the project lands are licensed for wildlife management to the Idaho Department of Fish and Game (IDFG). They consist primarily of wet meadows, shallow marsh, deep marsh, and submerged aquatic beds. Wetlands include wet meadows of sedge and rush, shallow marsh of cattail and reed canary grass, and deep marsh of water lily.

Submerged Aquatic Plant Bed Zone

Submerged aquatic beds cover roughly 8,000 acres in Lake Pend Oreille. The beds are dominated by Chara and stonewort (Nitella), and also include pondweed and arrowhead.

Island Habitat

Islands in the deeper parts of Lake Pend Oreille are all composed of rock, which, over geologic time, have become forested primarily by coniferous trees. They are characterized by having steep slopes rising abruptly out of the water. The forests are all rather small, generally less than a few acres with the exception of Warren Island, which is close to 80 acres in size. These support bald eagle and osprey nests, and are used by bald eagles in winter months for perching. By contrast, the delta areas (Clark Fork, Pack River, Priest River, et al) have relatively large, low–lying islands composed mainly of river sediments, and dominated by broad–leaved deciduous trees (for list of species see riparian vegetation, this section). These trees are used by nesting bald eagles, ospreys and great blue herons, as well as many other species of songbirds and raptors. In addition, these islands are rapidly being eroded by the high summer lake levels, due to seasonal fluctuations, and to wind and wave action along the island shorelines. Approximately 1,000 acres of islands occur in Lake Pend Oreille, including the Clark Fork delta.

Fish Productivity Zone

Kokanee salmon and whitefish provide the principal prey for bald eagles. Bullhead, perch, squawfish, suckers, peamouth chubs, shiners, and salmonids, including kokanee, provide prey for ospreys.

Benthic Invertebrate Productivity Zone

The benthic life of Lake Pend Oreille includes aquatic insect larvae. Crayfish and freshwater molluscs also occur.

Human Effects

Following project construction, many homes were built along the shoreline as a result of the lake levels being predictably high during the summer. Therefore, the lake is readily accessible from waterfront property. The high summer lake levels also prompted a recreation boom in the area, and in the past forty years human disturbance has increased drastically. Fifty–nine percent of the lake's shoreline is privately owned. The primary recreation activities on the lake are fishing and boating.

2.2.5.2 Wildlife

Waterfowl

Lake Pend Oreille supports large flocks of migratory and resident waterfowl. Twenty–three species of waterfowl, including Canada goose, tundra swan, mallard, pintail, redhead, three species of teal, American wigeon, and wood duck, are prominent. Lake Pend Oreille is a major spring and fall stop for migratory waterfowl of the Pacific Flyway. The fall and winter waterfowl surveys conducted by IDFG indicate numbers of duck and Canada geese peak

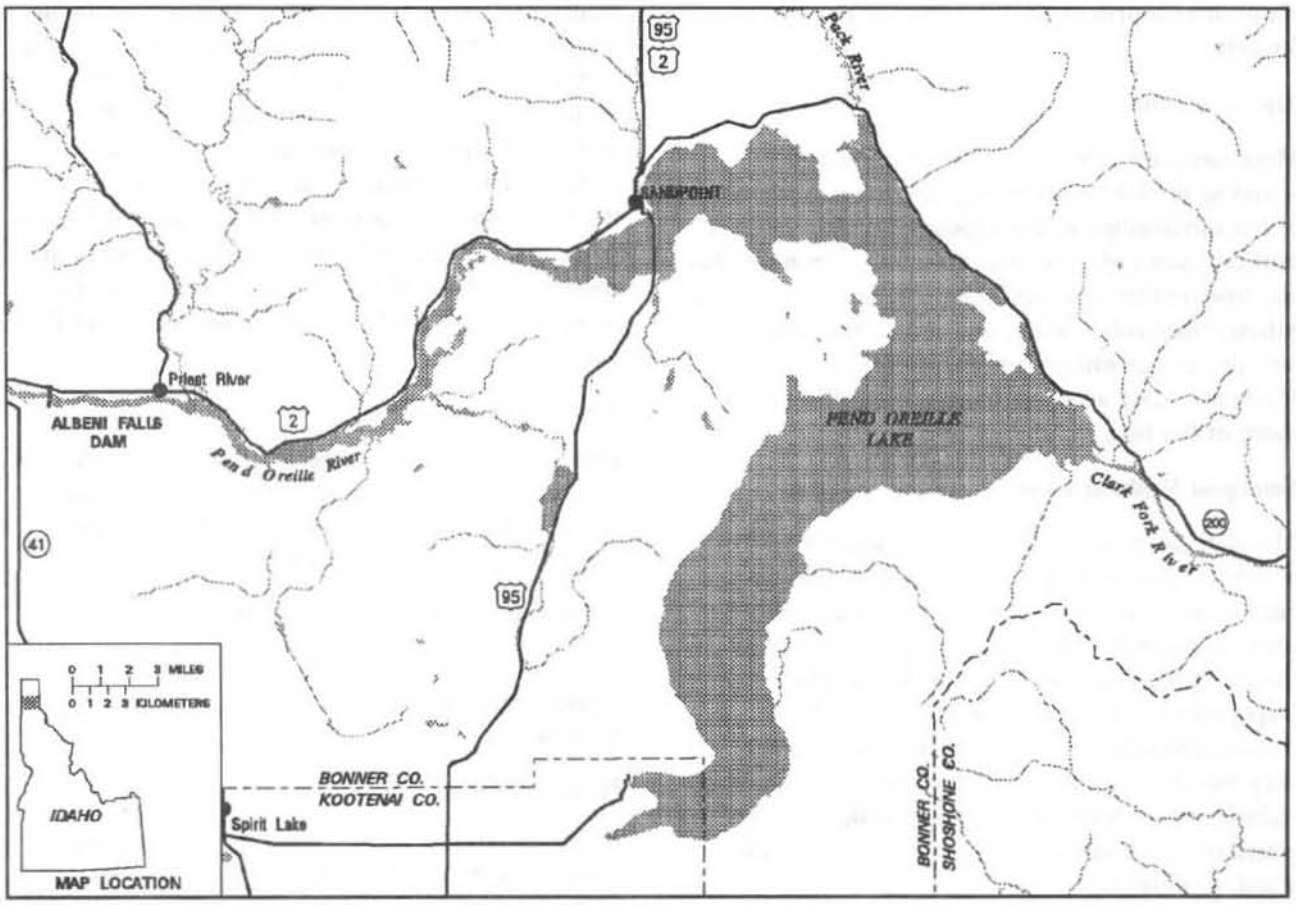

Figure 2–4. Albeni Falls

2.2.5.1 Physical Habitat

Barren Zone

Two major areas, the Pack River delta and the Clark Fork River delta, are barren during the winter drawdown period. In addition, much of the shoreline in the northern portion of the lake is exposed and barren during the drawdown. Soils of the Clark Fork delta are sandy. The remainder of the barren areas of the lake are primarily fine–textured.

Approximately 6,000 acres of wetlands have been lost to erosion since the project's construction. Wave and wind erosion have had dramatic effects, particularly in areas where shoreline vegetation has been lost. Seasonal fluctuations may be the greatest cause of erosion, resulting in sloughing of banks that become waterlogged in summer, then collapse under their own weight as the reservoir drops in elevation. Current drawdown rates have been reduced to lessen the effect.

Upland Zone

Approximately 80 percent of the basin area is covered by coniferous forests. At higher elevations (above 3,600 ft), mature forests are dominated by Douglas–fir, western redcedar, western hemlock, subalpine fir, grand fir, and western white pine. At lower elevations, ponderosa pine, lodgepole pine, and western larch dominate. Most of the forest in the study area is second growth. There is an old growth stand of western redcedar in the Albeni Cove recreation area in the 150 to 250–year age range. Most of the forested area is grazed by livestock, and

each year in November at an estimated 24,000 ducks and 2,200 geese. Concentrations of redhead ducks, which use (principally) Oden Bay through early winter, have numbered as many as 17,000 birds, estimated by IDFG to be almost 98 percent of the statewide count and approximately 20 percent of the total Pacific Flyway redhead population. The concentrations at Oden Bay are believed to be due to extensive stands of Chara and Nitella (benthic algae), on which they feed.

While most waterfowl species are migrants or winter residents only, several species of ducks (including mallard, American wigeon, and three species of teal), and the Canada goose nest on and around the lake. Permanent and summer resident waterfowl nest in marshes and adjacent riparian or upland habitats. Emergent vegetation, submerged vegetation, and shoreline habitats are also important for rearing activities and for food resources. The shallow water and abundant food supply make the principal areas at Morton Slough, Pack River, Oden Bay, Hoodoo Creek, Clark Fork River, Ellisport Bay, Sandpoint Bay, and the Pend Oreille River between the Highway 95 long bridge and Dover Peninsula particularly attractive for resting and feeding by both resident and migratory waterfowl.

Colonial Nesting Birds

Great blue herons are a resident species. A heronry of from 20 to 25 nests is located in a large riparian cottonwood grove in the Clark Fork Delta.

Several species of gulls have been reported in the area, but most are noted as migrants or uncommon summer residents.

Shorebirds

The largest shorebird populations occur during migration, with the greatest concentrations occurring in spring when the shoreline mudflats are most extensive and northward migrating shore birds pass through. Nesting species include killdeer and spotted sandpiper.

Upland Game Birds

Upland game birds generally prefer upland habitats for food, cover, and nesting, but may be found in riparian cover as well. Lake Pend Oreille upland game birds include ruffed grouse, mourning dove, and Merriam's turkey. Blue grouse are abundant at higher elevations.

Nongame Birds

Nesting species in riparian habitats and delta islands include downy woodpecker, warbling vireo, yellow warbler, common yellowthroat, thrushes, swallows, bobolink, and numerous others. Red–winged blackbirds, long–billed marsh wrens, American bitterns, and sora rails are the most common breeding passerine species in marsh areas. The mix of species in coniferous forests differs. Common species include red–breasted nuthatch, solitary vireo, yellow–rumped warbler, golden–crowned kinglet, western tanager, and many others. Wintering passerine species are less abundant and include ravens and dippers.

Raptors

Raptors using the area along the lake include numerous species of owls, hawks, osprey, and bald eagles. Owls and hawks nest in riparian trees and open woodlands, and hunt small birds and mammals in forested areas and open grasslands. Riparian cottonwood areas and nearby evergreen forests are important nesting habitats for the osprey, whereas shallow water habitats are of particular importance as foraging areas. The osprey is an area resident from mid–March through October.

Aquatic Furbearers

Aquatic mammals including beaver, river otter, muskrat, and mink can be found in project lands. The river otter is uncommon, and beaver, muskrat, and mink are not abundant. Beaver activity is higher in slough and river areas than in the lake. Muskrat are found primarily at the Pack River Delta. Mink den in riparian habitats and along tributary drainages, but forage chiefly in marsh areas.

Terrestrial Furbearers

The most common terrestrial furbearers are coyote, bobcat, raccoon and weasel.

Big Game

Large mammals in the vicinity include elk, moose, mule and white–tailed deer, mountain goat, and black bear. White–tailed deer spend both summer and winter seasons in deciduous and riparian habitats near the lake. Mountain goats winter in small numbers on the hills and bluffs bordering the lake near Bay View at the extreme southern end of the lake. A sparse population of grizzly bear and mountain lion is also present in the Lake Pend Oreille region.

Amphibians and Reptiles

The variety of aquatic, riparian and upland habitats supports many amphibians such as Pacific tree frog, bullfrog, leopard frog, Pacific giant salamander, tiger salamander, tailed frog, and long toed salamander. Populations of painted turtles, western skink and alligator lizard, rubber boa, gopher and garter snakes are present in numbers notably less than in warmer areas of the United States.

Endangered, Threatened, and Sensitive Species

The USFWS has provided three separate lists of listed and candidate species that may be found in the vicinity of Lake Pend Oreille (Albeni Falls project area):

Clark Fork Corridor	
Grizzly bear, *Ursus arctos*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Gray wolf, *Canis lupus*	endangered
Wolverine, *Gulo gulo luscus*	candidate 2
Harlequin duck, *Histrionicus histrionicus*	candidate 2
Northern goshawk, *Accipiter gentilis*	candidate 2
Lake Pend Oreille Corridor	
Grizzly bear, *Ursus arctos*	threatened
Gray wolf, *Canis lupus*	endangered
Peregrine falcon, *Falco peregrinus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Northern goshawk, *Accipiter gentilis*	candidate 2
Harlequin duck, *Histrionicus histrionicus*	candidate 2
Pend Oreille Corridor	
Gray wolf, *Canis lupus*	endangered
Bald eagle, *Haliaeetus leucocephalus*	threatened
Wolverine, *Gulo gulo luscus*	candidate 2
Lynx, *Lynx lynx*	candidate 2

Grizzly bears are rare near Lake Pend Oreille, which is also not within a recovery zone for grizzly bears. Gray wolves have been identified within six miles of the lake. Northern goshawks nest in the dense forests just south of Lake Pend Oreille. Wolverines and lynx are found at higher elevations in the same vicinity as the goshawk. Harlequin ducks nest along tributary streams of lake Pend Oreille.

There are eight bald eagle nests around Lake Pend Oreille. They also winter in large numbers around the lake from October through March. Numbers of wintering bald eagles are shown in the table below. The high count was 286 on January 8, 1987. For the past three years, attempts have been made to reintroduce peregrine falcons, which formerly nested in the vicinity of Lake Pend Oreille.

Mean number of bald eagles observed on Pend Oreille Lake during the mid–winter inventory, 1971 – 1994

Time Period	Adults	Immatures	Total
1971 – 1975	38	3	41
1976 – 1980	58	7	65
1981 – 1985	74	9	83
1986 – 1990	165	31	196
1991 – 1993	84	14	98
1994	91	4	95

2.2.6 Grand Coulee Dam

Short–term Operational Limits	
Lake Elevation	
Normal Full Pool	1,290 ft
Normal Minimum Pool	1,208 ft
Maximum daily drawdown	1.5 ft
Maximum 6–hour drawdown	1.5 ft
Discharge	
Above tailwater elevation 957 ft	3.0 ft/hr
Below tailwater elevation 957 ft	2.0 ft/hr

Grand Coulee Dam formed Franklin D. Roosevelt Reservoir, a 151–mile long lake with 660 miles of shoreline and a surface area of more than 82,000 acres at full pool (elevation 1,290 feet) (USBR, 1977;1984). The reservoir inundated the Columbia River mainstem and lower reaches of the Sanpoil River (nine miles), Spokane River (32 miles), Colville River (two miles), Kettle River (11 miles), and about 20–30 miles of other tributary streams, (USBR, 1976). Approximately 70,000 acres of wildlife habitat was inundated by construction of the project.

Existing (post–project) wildlife and habitat have not been studied extensively, thus data are limited. Payne, et al. (1976) provides the most detailed quantitative information on wildlife species, habitat types, and distribution, as well as discussion of effects of water regulation. Creveling and Renfrow (1986) present detailed estimates of habitat and species losses caused by project construction, but not of existing resources.

Roosevelt Lake is noteworthy for its history of landslide activity along many miles of reservoir shoreline (Jones and Peterson, undated; USBR,1984). The annual cycle of soil saturation, followed by extensive drawdown and lesser short–term fluctuations, has led to continued erosion and slumping of the soil mantle on steeper slopes prevalent in this major river canyon. The steep, unstable shoreline substantially limits habitat development and use by wildlife (Creveling and Renfrow, 1986).

2.2.6.1 Physical Habitat

Barren Zone

Acreage of exposed, unvegetated soil present at different drawdown levels can be calculated from an elevation/acreage model for the project. Under average water conditions, maximum seasonal drawdowns under the no action alternative result in exposure of approximately 23,200 acres of reservoir substrate.

The average inshore slope below full pool is approximately 8°, but varies substantially from site to site and decreases in an upstream direction. Near the dam areas as steep as 45° are found, while in upper reaches of the reservoir and in tributaries there are slopes of less than 5°.

During spring, the Roosevelt Lake water level is drawn down from 50 to 82 feet below full pool to store spring runoff and maximize power production, as well as to prevent flooding. Reservoir elevations may also fluctuate one or more feet daily depending on water withdrawals for power and irrigation needs (Creveling and Renfrow, 1986). Project operation essentially determines the degree of establishment and maintenance of wildlife and wildlife habitat on the reservoir shoreline.

Upland Zone

The extensive Roosevelt Lake environment overlaps two very different ecological and physiographic zones (Creveling and Renfrow, 1986). The southern reaches of the reservoir are in the Columbia Basin (Franklin and Dyrness, 1973) and are characterized by shrub–steppe vegetation. Northern reaches, which extend to the Canadian border, lie within the Okanogan Highlands and are characterized by forest vegetation. The area and vegetation are further described in USBR (1976), Rogers (1941), and Creveling and Renfrow (1986).

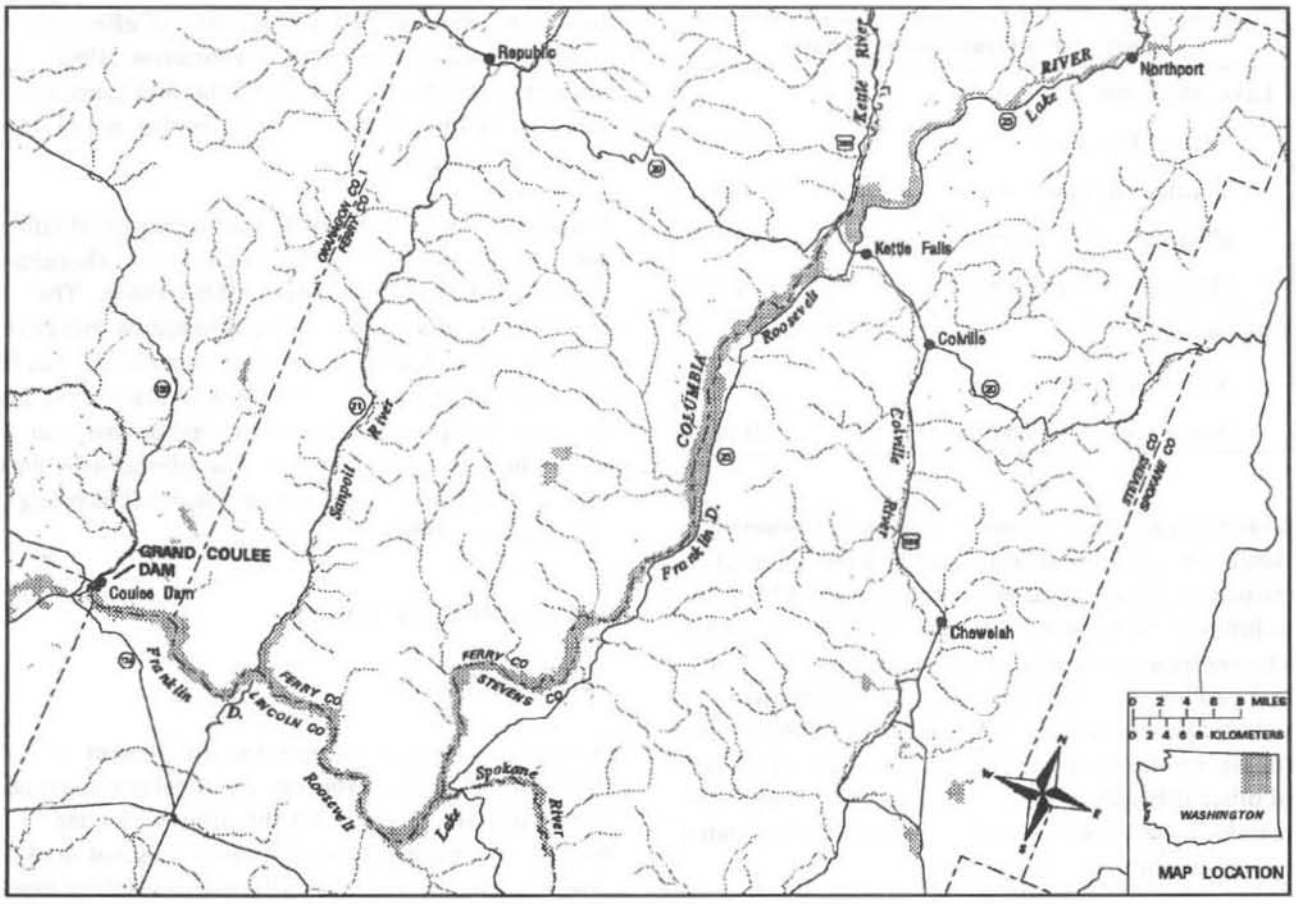

Figure 2–5. Grand Coulee Dam

The lower (southern) reach of Roosevelt Lake from the dam (RM 596) to RM 634 is shrub–steppe and runs east–west, generally with bitterbrush communities on north–facing slopes and sagebrush communities on south–facing slopes. Rabbitbrush is common in much of this area. Between RM 634 and 675, the reservoir runs north–south and ponderosa pine and bitterbrush are characteristic, with serviceberry on dry sites and redstem ceanothus in moist areas and on north–facing slopes. From RM 675 to 706, the vegetation can be characterized as open stands of ponderosa pine/pinegrass habitat, with Douglas–fir and ponderosa pine occurring on north–facing slopes. Bitterbrush occurs in the lower part of this reach, but not in the upriver portion. Canyon slopes are heavily vegetated with redstem and evergreen ceanothus and serviceberry. Rogers (1941) describes the upper reach (RM 706–745) forest as largely second growth ponderosa pine, Douglas–fir and western larch, with a grass shrub understory. Sumac is abundant in some sites. Nearer the Canadian border, there is a mixed forest of paper birch, aspen, lodgepole pine, and Douglas–fir.

Riparian Zone

Roosevelt Lake lacks extensive riparian habitat (Payne, et al., 1976). With few exceptions the pre–impoundment riparian vegetation at Grand Coulee, especially large–branched deciduous trees of high wildlife value, has not been re–established on the shoreline of the reservoir (Creveling and Renfrow, 1986). Payne, et al. (1976) reported that riparian habitat occupies less than 10 miles (1.5 percent) of the reservoir shoreline. Of an estimated total of only 25 acres of riparian habitat, virtually all was located in the northern (upper) portion of the reservoir.

Dry climate, spring reservoir drawdown, wave action, steep shoreline slopes and related erosion and landslide activity are principal factors preventing riparian re–establishment (Payne, et al., 1976; Creveling and Renfrow, 1986). Reservoir shoreline vegetation is perched well above the water level during the spring drawdown and the early portion of the growing season. As a consequence, despite a more moist climate in the northern reaches, riparian areas are typically associated with small streams and spring areas where the source of water is from precipitation, snow melt, or ground water discharge rather than reservoir. These areas are also typically more gently–sloping and protected from erosion forces, and are characterized by silt accumulation. According to Payne, et al. (1976), opportunities to establish further riparian zones at Lake Roosevelt appear limited.

The primary cottonwood riparian stands occurring in the northern portion of the reservoir are composed of an understory of birch, alder, red–osier dogwood, alder buckthorn, and lesser shrubs such as thimbleberry, poison ivy and rose (Payne, et al., 1976).

It is not known whether riparian establishment has increased this habitat since the survey in the mid–70's. Riparian development hinges on successful germination and establishment, which in turn are controlled mostly by soil conditions and moisture. The great scarcity of riparian habitat along Roosevelt lake is an indication of the lack of suitable sites and the detrimental effects of the water regime and soil conditions. Based on these problems and projections from the literature and current knowledge, riparian stands are probably in relatively stable condition at present, with no evidence of expansion.

Emergent Wetland Zone

Emergent wetlands are also limited in extent at Lake Roosevelt. They are restricted by the steep shorelines, seasonal drawdowns, and shorter–term fluctuations that also influence other habitat types. The National Wetlands Inventory (NWI) has classified approximately 230 acres as vegetated wetlands. These occur along the reservoir shoreline primarily in embayments, the mouths of small streams, and in the confluences of larger tributary streams. Areas containing significant wetland types include the mouths of the Colville River and Kettle River and nearby upper reservoir shallows. Most other wetlands are small and scattered in isolated areas such as Mill Creek (Spokane River arm), Big Sheep Creek, Fifteenmile Creek, Onion Creek, Spring Creek, and other sites. According to USACE (1992) the reservoir wetlands are dominated by *Calamagrostis* species.

Approximately 24 acres of Palustrine forested and 16 acres of Palustrine scrub–shrub wetlands are also delineated on NWI maps. These wetland classifications probably overlap somewhat with riparian areas identified by Payne, et al., (1976).

Roosevelt Lake wetlands are believed to be in a fairly static condition under the present water regime, since the project has been operating for about 50 years. Some continued growth of trees and other vegetation likely occurs where these have established.

Submergent Aquatic Plant Beds

According to Ball, et al. (1981) fluctuating reservoir levels in Lake Roosevelt essentially prevent growth of submergent vegetation. The steeply–sloping nearshore areas in much of the reservoir are another obvious limiting factor. Although some submergent plant beds are known to establish during extended high water elevations, these are very limited according to local experts. NWI maps of the reservoir do not include any identified aquatic bed delineations.

Approximately 46 acres of shallow water area is classified under NWI as Lacustrine (system), Littoral (subclass), unconsolidated bottom or shore. These are the types of sites where submergent plants such as water–weed (Elodea sp.) may develop to varying degrees.

Island Habitat

Only 28 islands are identified in Lake Roosevelt, compared to a pre–project river reach total of 114 (Creveling and Renfrow, 1986). These remaining islands total approximately 130 acres (Payne, et al.,1976). Much of the island acreage is classified under NWI as uplands. These areas are commonly the tops of hills or ridges that were isolated by water in the reservoir. According to Payne, et al. (1976) the islands support no riparian vegetation.

Islands were historically important in this area, receiving use by aquatic mammals, shorebirds, waterfowl, and other species. They were particularly important as secure nesting sites for Canada geese and as deer fawning areas. Islands are still important in the reservoir, but their value and use by wildlife is limited by the annual spring drawdown. Vegetation development is inhibited, the barren drawdown zone restricts wildlife use, and some islands become more accessible to predators. There evidently is little Canada goose nesting on remaining islands.

Fish Productivity Zone

A number of fish species inhabit Lake Roosevelt. Trout, kokanee, suckers, walleye, and others all occur.

Benthic Invertebrate Productivity Zone

The benthic life of the reservoir is severely restricted by the wide seasonal drawdowns that occur. The scarcity of emergent wetland vegetation adjacent to the reservoir restricts the production of microscopic crustaceans, such as Copepods and Ostracods that are in important food source for fish fry and hatchling amphibians. Populations of insect larvae occur along with some limited numbers of crayfish.

Human Effects

Although shoreline development is minimal at Lake Roosevelt, recreation is a major activity and boating, camping, picnicking, fishing, and related activities are seasonally intensive. These activities can disturb wildlife and reduce wildlife potential, especially because most campgrounds and picnic areas have been developed on nearshore islands, creek mouths, embayments, and flat benches that contain much of the best remaining habitat. There have recently been concerns raised about the level of contaminants entering Lake Roosevelt from the Canadian part of the Columbia River drainage. Data are not available concerning the effects of contaminants (heavy metals and dioxins) on fish, other aquatic forms or terrestrial wildlife in and around Roosevelt Lake.

Wildlife

About 350 species of wildlife are found in the vicinity of Roosevelt Lake (Creveling and Renfrow, 1986). Many of these use the riparian, wetland, and island habitats along the reservoir shoreline for part or all of their life requisites.

The overall wildlife values of Roosevelt Lake are limited because of the Lake's storage function and substantial seasonal drawdowns which adversely

affect shoreline habitat development and use. Important habitats generally are confined to tributary stream reaches, embayments and backwaters, and islands. Conditions are much less favorable on the main pool where steep, eroding banks are prevalent. Islands are important in part because only 28 remain from a pre–dam count of 114. In general, riparian and wetland habitats exist only as small, scarce units scattered throughout the reservoir.

The following wildlife resource areas are of note, starting from the dam and working upstream.

- On the State (south) side of the lower reservoir up to the Spokane River, several areas are identified. The Keller area includes bald and golden eagle nest sites, and osprey nesting occurs from Sterling Valley to Hawk Creek butte. Riparian stands exist at Welch Creek near Jones Bay, and at Hawk Creek. Bald eagle perching sites and waterfowl hunting are also present at Hawk Creek. The Lincoln area is notable for upland species that include Lewis' woodpecker and the introduced species, California bighorn sheep, and Merriam's turkey. There is significant raptor habitat in the vicinity of Whitestone Rock and Meeker Mountain.
- On the Colville Indian reservation side of the lower reservoir, as in some other reaches, lower elevation sites are important as deer winter range and portions as elk winter range. Between the dam and Sanpoil River there is significant use by geese in the fall and winter as a resting area. Significant waterfowl use of areas in this vicinity include the mouths of the Sanpoil River and Redford Creek. Between the Sanpoil River and reservation line further north, there are reported to be four bald eagle nest sites and four communal roost areas. Barnaby Island and Barnaby Creek areas near the reservation line are noted for shallows that provide habitat for waterfowl. This general area provides for some duck and goose nesting and grazing. Other shoreline species such as beaver, muskrat, and some otter use occurs in and near the mouths of tributary streams.
- The Spokane River arm is a notable wildlife resource area. It serves as an occasional resting area for as many as several thousand Canada geese in the fall. A wetland area has been documented at Mill Creek, and Moccasin Cove near Squaw Creek that contains riparian habitat. Osprey nest sites occur on the lower river, and the Spokane Tribe has documented bald eagle communal roosting on their side of the river. Roosting sites for Thompson's big–eared bat are reported for this area. Porcupine Bay is a popular human use area.
- Upstream on the Columbia, an area just south of the Gifford Ferry near Inchelium is notable for shallows supporting a high waterfowl concentration. Osprey nests occur in this vicinity on both the state and reservation sides of the pool. The greatest concentration of eagles is said to occur between Kettle Falls and Hunters, and more particularly from Hunters to Gifford.
- The Colville River mouth near Kettle Falls is of significance as a wildlife and public use area. Colville flats (lower river) contains a wetland area, and the area supports significant osprey use. There is also a heron rookery farther upstream on the Colville.
- Across the reservoir, the Sherman Creek mouth exhibits wildlife values including use by great blue herons. The Washington Department of Wildlife Sherman Creek Habitat Management Area borders on the reservoir in this reach, but it is an upland management area.
- Marcus Island and the Evans Spit are potentially important areas for wildlife which are reduced in value by the presence of parks and campgrounds. As embayment areas protected somewhat from rough water conditions, they provide values such as waterfowl (duck) production. Wetland habitat occurs surrounding Evans Spit.
- The lower Kettle River between Barstow and the confluence near Kamloops is generally recognized as an important site for a variety of wildlife species. Its backwater areas and

bayous contain riparian stands and shallows with emergent wetland vegetation. It has waterfowl production values and is a bird concentration area. Osprey nest sites are present in this reach, and furbearers and other wildlife species also use the area.

Waterfowl

While waterfowl use of Roosevelt Lake is noteworthy, the reservoir is not generally considered by local biologists to be a major waterfowl resource management area. Production is substantially limited by the scarcity of islands, wetland habitat, and shoreline usable for waterfowl activities, as well as by the severe spring drawdowns. The most significant use appears to be in open water areas as a resting or wintering area for migrants, however density of wintering ducks is also considered low because of cold winter conditions and lack of adequate food supplies (USACE,1992).

Characteristic waterfowl species or groups identified for Grand Coulee are Canada goose, mallard, and diving ducks such as scaup. Nesting and feeding habitat for geese and mallards is said to be very limited (Creveling and Renfrow; 1986; Payne, et al., 1976). Riparian habitat used for duck nesting is in very short supply as are wetlands and other feeding areas. Islands, which are of particular importance as secure nest sites for geese, support little nesting because of their limited occurrence and the drawdown problems of land bridging and barren mudflat formation which lead to predation and restricted use. Shallower areas in upper reaches and tributaries support some seasonally flooded emergent wetlands that are potential nesting and grazing areas. However, drawdowns are particularly damaging to these areas since islands are more easily bridged and the more gently–sloping shoreline is separated from the vegetation by large expanses of barren soil. In other parts of the reservoir, steep and eroding banks are commonplace and are a barrier to shoreline use by geese with goslings or duck broods. Waterfowl use of the reservoir is mostly as a temporary stopover during migration periods.

Although riparian and wetland habitat has established slowly at Lake Roosevelt, the reservoir has been in place and under a similar operating regime long enough that these habitats have probably reached a certain degree of equilibrium. There is no information suggesting significant trends in waterfowl use.

Colonial Nesting Birds

Great Blue heron and bank swallow are representative colonial nesting birds at Grand Coulee. Reservoir creation eliminated most of the large riparian deciduous trees (such as cottonwoods), and they have not been replaced to any significant degree over the years (Creveling and Renfrow, 1986). These trees provided important nest sites for colonial waterbirds such as herons. Nevertheless, herons use a wide range of habitat types and are a familiar resident at Roosevelt Lake.

Bank swallows may have benefited from the creation of the reservoir and the increased insect foraging area over water. They may also derive benefit from shoreline erosion that creates vertical banks in some areas which are then colonized. Continuing erosion, may cause periodic slumping of the same vertical banks used for nesting.

Populations of these colonial species are also believed to be relatively stable in numbers, since the reservoir has been in place for many decades and habitats are not undergoing any significant year–to–year change.

Shorebirds

Shorebird use of Roosevelt Lake is limited and related mostly to the water level during spring and fall migration. Numbers of species may use the lake and surrounding barren zone at that time. Species likely to nest include killdeer and spotted sandpiper.

Nongame Birds

The downy woodpecker, red–winged blackbird, and yellow warbler are considered representative of nongame bird species at Roosevelt Lake. They primarily use riparian and emergent wetland habitats potentially impacted by changes in operational water regimes. Their nesting and feeding activities in relation to trees, shrubs, emergent aquatic vegeta-

tion, and other factors are important in determining their survival and density at the reservoir.

Upland Game Birds

Game birds such as chukar, Hungarian partridge, mourning dove, ring–necked pheasant, and California quail eat a variety of seeds, agricultural grasses (wheat, oats, corn) and insects. The pheasant and quail are found most commonly near agricultural lands and generally do not venture far into shrub–steppe areas. Upland game birds such as sharp–tailed grouse, ring–necked pheasant, and California quail may also harvest the catkins of willows, alders, and birches, and also eat the new buds. The upper (northern) end of Lake Roosevelt can also support some numbers of grouse such as blue, ruffed, and/or spruce.

Raptors

Bald eagles are an important reservoir area resource, with a recent wintering population estimate of about 250 birds, and as many as ten nests in the Roosevelt Lake area. Reservoir use appears to be increasing based on winter surveys and prior reports of little or no nesting. Although the bald eagle is well–known at the reservoir, other raptors such as golden eagle and prairie falcon commonly use cliff sites in the area. There is relatively low use of the shoreline by osprey for nesting.

Bald eagles and some other raptors are dependent on fish populations in the reservoir for food, and operational changes in the water regime could influence fish abundance and availability. Foraging success by raptors is potentially affected by system operation.

Snags and large–branched trees are important perching, nesting and roosting sites for raptors, especially the bald eagle. Operational changes could affect tree survival. The presence of large evergreens near the reservoir offsets the need for large riparian trees. However, shoreline conifers have been subject to cutting, snag removal, and landslide–induced loss. Riparian and other land–water interface habitats are important generally, however, as raptors use them regularly in their foraging activities.

Aquatic Furbearers

The beaver and otter are representative of the aquatic furbearers at Lake Roosevelt. This wildlife group must be able to travel between the water body and terrestrial vegetation, and thus can be significantly affected by reservoir operation. The shoreline interface is a critical component of aquatic furbearer habitat suitability. Islands are also of importance when present.

At present, most shoreline at Roosevelt Lake is of little value to aquatic furbearers because of its steepness and instability (erosion), and lack of vegetation. Additionally, drawdown of the reservoir in more gently–sloping areas creates large, barren mudflats which separate water and vegetated shoreline, increasing the animals' energy expenditure and vulnerability to predation, or even preventing use of an area. Otter can also be affected by loss of aquatic invertebrates such as crayfish, a primary food source.

Terrestrial Furbearers

Representative species of furbearers include the porcupine, least chipmunk, yellow pine chipmunk, striped skunk, bushy–tailed woodrat, deer mouse, sagebrush voles, cottontail rabbits, yellow–bellied marmots, bobcats, badgers, coyotes, cougar, and several species of mice, and bats. Most of these are resident in the conifers. Furbearers found in the shrub–steppe habitats of the project area (bobcat, badger, coyote) are predators, feeding primarily on rodents, as well as bird eggs and carrion. Rabbits and marmots eat grasses and herbaceous plants, and in winter may eat bark and twigs of woody plants as well. Marmots are restricted to rocky areas where they can find refuge among the many tunnels in the rocks. Small mammals such as the sagebrush vole and least chipmunk feed primarily on green vegetation.

Big Game

Prior to the construction of Grand Coulee Dam, lower elevation areas of the Columbia River corridor were critical winter range habitat for big game. Low elevation areas around the reservoir are important for deer wintering areas, and in some areas, for elk winter range. Riparian or shoreline areas containing deciduous or evergreen trees are used by big game

for feeding, fawning, summer and winter thermal cover, and as corridors.

Big game species are not as dependent as other wildlife species on habitats bordering the reservoir, but may still be significantly affected by habitat losses or changes in human use and disturbance patterns caused by reservoir operation. For these reasons, deer and elk foraging and wintering are considerations when reservoir operations change.

Amphibians and Reptiles

The spotted frog and long–toed salamander were selected to represent potential effects of reservoir operation modification on amphibians at Roosevelt Lake because these species have both an aquatic larval stage and a terrestrial adult stage. Very small seasonal ponds and pools can be used by long–toed salamanders and small permanent ponds can be used by spotted frog during breeding season. Increased drawdowns or fluctuations can remove these sources of water that provide oviposition and larval development sites for these and other amphibian species. Other species include western skink and Pacific chorus frog.

Endangered, Threatened, and Sensitive Species

State and Federally listed species of plants and animals that potentially occur in wetland and riparian habitats at Roosevelt Lake include the following (USACE, 1992):

Plants	
Giant helleborine	state sensitive
Nuttall's pussy toes	state sensitive
Palouse milk vetch	state sensitive
Least bladdery milk vetch	state sensitive
Columbia crazy weed	state sensitive
Pygmy–weed	state sensitive
Insects	
Immaculate green hairstreak	state monitor
Birds	
Great blue heron	state monitor
Golden eagle	state candidate
Bald eagle	Federal threatened
Osprey	state monitor
Peregrine falcon *Falco peregrinus anatum*	Federal endangered
Mammals	
Long–eared myotis	state monitor
Gray wolf	Federal endangered

2.2.7 Chief Joseph Dam

Short–term Operational Limits	
Lake Elevation	
Full Pool	956 ft
Minimum Pool	930 ft
Summer operating range	950–956 ft
Discharge	
Minimum instantaneous	No limit
Minimum daily flow	35,000 cfs
Maximum rate of change	No limit
Special Requirements	
Based on providing 36,000 cfs at Priest Rapids Dam, Chief Joseph outflow may be less if the 36,000 cfs at Priest Rapids is provided by tributary flow or from storage at another project.	

Chief Joseph Dam is on the Columbia River at river mile 545.1.; the reservoir is 51 miles long, ending at Grand Coulee Dam. The original structure was completed in 1961; an additional ten feet were added to the dam and reservoir in 1981.

Chief Joseph Dam and Rufus Woods Lake lie in a steep–sided canyon of the Columbia River valley which ranges in width from two to four miles. The north side of the valley rises sharply to the Okanogan Highlands, 1,000 feet or more above the Columbia River. The south side of the valley rises in a series of terraces and benches climbing to the Columbia Plateau surface. The majority of the shoreline is treeless with a dry land shrub–steppe cover and numerous canyons and deep draws supporting isolated stands of pine and deciduous trees and shrubs. Rangeland and irrigated orchards on upland benches and sixteen project wildlife mitigation sites along the lakeshore provide islands of greenery. Scenic areas include the badland–like area at RM 588, a resistant silt cliff at RM 574, and windcut sandy formations from RM 564 to RM 568.

2.2.7.1 Physical Habitat

Barren Zone

Barren areas are few along Rufus Woods Lake, due to only one to two foot daily fluctuations. Those barren areas that exist are on the steep slopes that are also the area of chronic erosion.

Erosion/Landslide Potential. Landslides and erosion are common on the steep canyon walls which are partially filled with thick deposits of fine–grain sediments. Glacial lake and old landslide deposits tend to slough more easily than other materials, but well–drained sands and gravels tend to be quite stable, even if of considerable height. Several major prehistoric and historic landslides have occurred in the project area. The post–glacial Bridgeport Slide occurred upstream of the project. It is presently administered by the Corps and is allocated for project operations to discourage public access to the area and allow for slide monitoring. Slides along the upstream portion of Rufus Woods Lake became active during the middle and late 1940's. They slowed after 1953, due to lesser tailwater fluctuations, probably as a result of the raised lake levels at Grand Coulee Dam. In 1970, construction for the third powerplant at Grand Coulee precipitated additional sliding and measures to control those slides are under study by the Bureau of Reclamation. Furthermore, impoundment of Rufus Woods Lake has caused slides near Bridgeport State Park and upstream of China Creek (RM 575) on the south bank. Reservoir operation and upland irrigation have resulted in a lesser degree of sloughing along the reservoir periphery. Riprapping to stabilize the slide area is currently being tested.

Upland Zone

Shrub–steppe. The major upland communities are the Big Sagebrush/Wheatgrass and Threetip Sagebrush/Fescue. These two communities are discussed together because their structural characteristics are very similar. Both the big sagebrush/wheatgrass community and the threetip sagebrush/fescue community are characteristic of the arid steppe province of the Columbia Basin. These two communities are distributed in response to total and seasonal distribution of precipitation, the threetip sagebrush/fescue community being established in somewhat moister areas. Franklin and Dyrness (1973) indicate that the north bank of the Columbia River supports the threetip sage/fescue community eastward from the Omak Trench into the Okanogan Highlands. These communities support several plant species important to wildlife. The cheatgrass, bitterbrush, serviceberry, black hawthorn, and snow eriogonum provide cover and food for both game and non–game species. Orchards are accelerating their expansion into Okanogan County, and hundreds of acres now line the shoreline of Rufus Woods Lake, displacing shrub–steppe habitat.

Coniferous Forest Habitat. Conifers are scarce along the majority of the shoreline of Rufus Woods Lake. Especially along the lower (downstream) half of the reservoir, trees are widely–spaced individuals instead of grouped in clusters. In a few areas, ponderosa pines grow in loose stands located on relatively steep hillsides suffused with seeps. On north–facing slopes, the pines become more densely packed and are mixed with Douglas–firs. The understory plants consist of some of the same species that grow in the riparian communities.

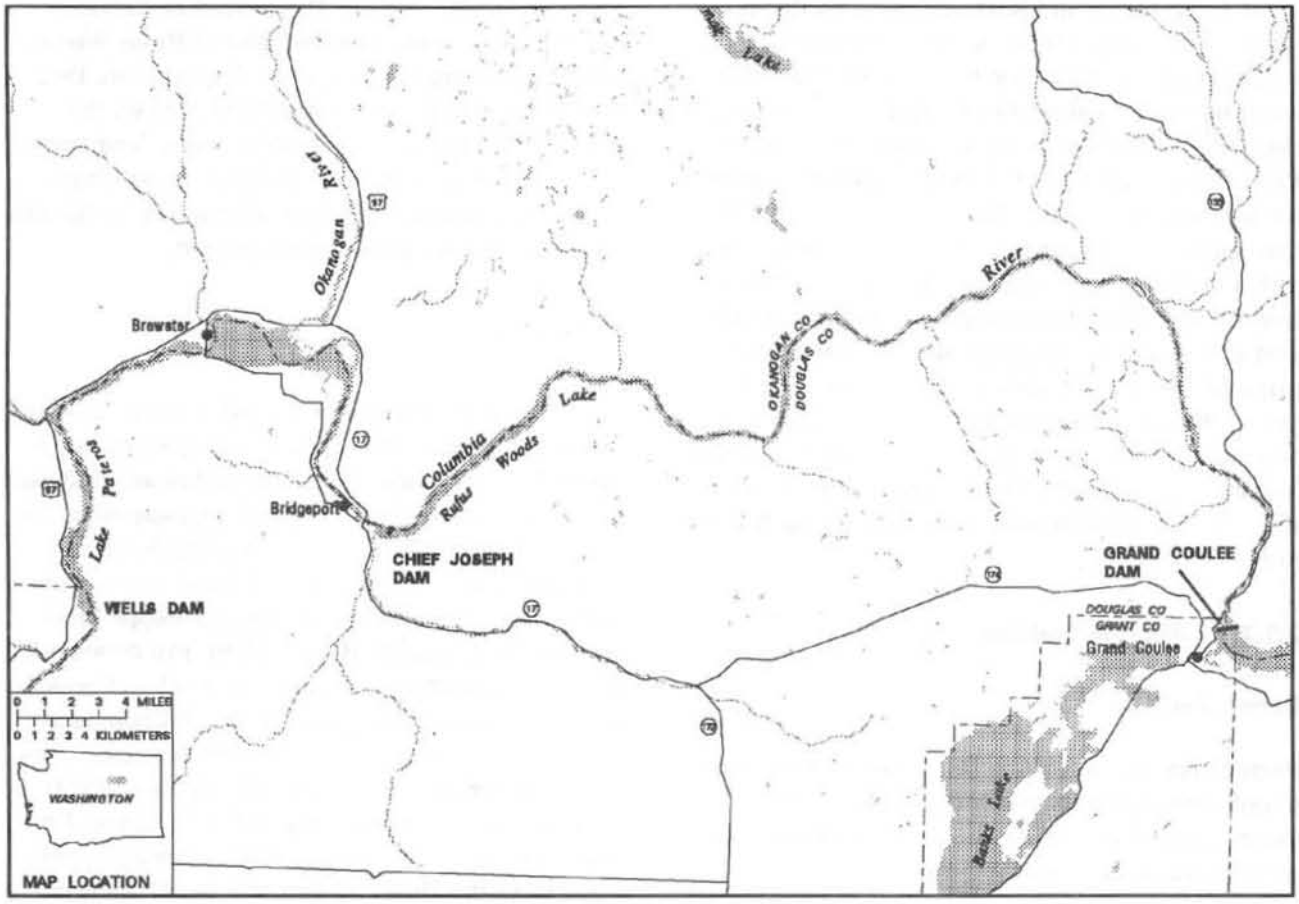

Figure 2–6. Chief Joesph Dam

Riparian Zone

Small streams running down the slopes into Rufus Woods Lake provide the best riparian habitats in the project area. The vegetation of these draws generally consists of serviceberry, squaw currant, golden currant, black hawthorn, mountain alder, Wood's rose, Bebb willow, and red–osier dogwood. Mock orange, mallow ninebark, oceanspray, chokecherry, smooth sumac, and quaking aspen are less common. Many of the same animals that use shrub–steppe communities also take advantage of the thermal and visual cover provided by the riparian vegetation, as well as the abundant and diverse food source.

Prior to construction of the additional power units and the 10–foot rise in reservoir elevation in February 1981, little riparian vegetation developed along the reservoir. The reasons for this are not clear, though it now appears that one reason may have been that the topography along the shoreline was too steep to allow plants to establish themselves. This is substantiated by the new shoreline which is generally of a much lower gradient than that of the original pool, and already has at least as much riparian vegetation as the original pool had after 22 years. Another reason for the sparse riparian vegetation may be that daily fluctuations of the reservoir prior to 1981 were usually 6 ft; since 1981 they are usually about one to two feet. Nevertheless, nowhere along the pool is the riparian vegetation on the shore established to the point where it represents a viable community. However, at the rate these plants are establishing, it should not be more than five years before small

communities of riparian vegetation of sufficient size and structure to support wildlife are established at several points along the lake.

Emergent Wetland Zone

Wetlands are scarce in the project area. At least two marshy areas have begun to develop since the pool raise: one at mitigation site 7 (RM 558) and one at mitigation site 3 (RM 549.5). These are areas of very shallow gradient at the high pool elevation. A small marsh/swamp/stream also exists on mitigation site 18 (RM 584.8), which is recovering from recent overgrazing by livestock. This wetland system is extremely valuable to many species of wildlife for the food, cover, and water it provides. Passerine birds find this type of habitat to be an oasis in the vastness of shrub–steppe and wheatlands that dominate the region.

Submerged Aquatic Plant Bed Zone

Aquatic vegetation in Rufus Woods Lake is not particularly abundant because the rocky shoreline, steep slopes in many areas, and the water level fluctuations effectively limit available habitat. A narrow band of aquatic vegetation is present along much of the shoreline of the reservoir. Five species of submerged aquatic vegetation have been observed in the lake, including elodea, Eurasian watermilfoil, sago pondweed, curly leaf pondweed, and watercress (though watercress is arguably not a true submerged aquatic). Excepting watercress, which has been observed only at mitigation site 16 (RM 575.2), these species have been observed the entire length of the lake, from RM 591 downstream. The most abundant aquatic plant in the lake is elodea, and Eurasian watermilfoil is more abundant than sago pondweed and curly leaf pondweed.

Island Habitat

There are several islands in Rufus Woods Lake. Two of them are man–made by the Corps as mitigation to replace goose nest sites lost to the pool raise. Most of the islands are small, and are often used by geese for nesting. Buckley Bar, near RM 587, is about 40 acres in size, and is wooded with small juniper trees, and used by Canada geese and other birds for nesting, and by mule deer for fawning.

Snags

The lake was not cleared at the time of the pool raise since so few trees were subject to inundation. The trees that died and became snags are important enough to constitute a habitat in themselves. Snags are a valuable source of food for many insectivorous birds and small mammals. They are used by many cavity–nesting birds and mammals, and are excellent perches for raptors.

Fish Productivity Zone

A number of fish species inhabit Rufus Wood Lake. Trout, kokanee, suckers, walleye, and others all occur.

Benthic Invertebrate Productivity Zone

The benthic life in the reservoir is severely restricted by the wide seasonal drawdowns that occur. Populations of insect larva exist along with some limited numbers of crayfish.

Human Effects

The principal human disturbance along the reservoir is from orchards and consequent erection of deer fences. This results not only in habitat losses but also restricts movements of deer and many other mammals. Cattle grazing also severely damages range condition and lowers carrying capacity for native animals. Hunting is a popular recreational activity in the vicinity of Rufus Woods Lake, although waterfowl hunting is restricted to the area between RM 582.5 and RM 590, as the rest of the reservoir is designated a waterfowl preserve by the WDFW.

2.2.7.2 Wildlife

Most resident species have declined from historic numbers due to their dependence, at least part of the year, on shoreline habitats that were lost when the reservoir was originally created. Because of the presence of food and the warming effect of these shoreline areas, the habitats have been extremely important during critically harsh winters. Following construction of the dam, grain acreage increased due

to the better accessibility of irrigation. The increase in grain acreage fortuitously benefited certain species of upland game birds and big game animals, though resulting in a loss of shrub–steppe habitat. In 1980, the Corps established six areas of riparian habitat totaling over 100 acres as mitigation for riparian habitat lost to a 10–foot increase in reservoir elevation. Orchards and overgrazing by livestock continue to lessen habitat quality in many areas.

Waterfowl

About 18,000 waterfowl of 33 species use the lake annually, primarily during fall and winter. Most of this number is comprised of mallards, Canada geese, and American coots. Canada goose is the only waterfowl species that nest in appreciable numbers – about 75 nests have been out each of the past two years. Brooding pastures are not abundant, but seem to be adequate for brood rearing. Mallards are common nesters, though riparian and emergent habitats are sparse. Wintering coots are an important source of prey for bald eagles along the reservoir. Lesser scaups are the second most common wintering waterfowl (after Canada goose) on the reservoir.

Colonial Nesting Birds

Great blue herons once had a nesting colony on the reservoir, but it was abandoned shortly before the 10–foot pool raise was initiated. No colonial nesting birds use Rufus Wood Lake to any significant extent. Gulls and herons may be seen occasionally but are not resident. No nesting activities have been recorded since 1981.

Shorebirds

Spotted sandpipers and killdeer commonly nest along the gravelly shoreline of Rufus Woods Lake. Potholes and wetlands in the vicinity of the project attract shorebirds, loons, grebes, and even white pelicans. As a result, many of these species have also been observed on Rufus Woods Lake, albeit only occasionally. The 10–foot pool raise inundated an excellent mudflat at the mouth of the Nespelem River which often had hundreds of shorebirds, occasionally including uncommon species such as solitary and Baird's sandpipers. However, with the disappearance of this mudflat, migrant shorebirds are seldom observed along the reservoir now.

Nongame Birds

The Columbia River is a migratory route for birds, which often follow the river's shoreline. Although shrub–steppe by itself supports relatively few species, the mix of riparian, tree/shrub, and wetland habitats are magnets to migrant songbirds. In one complex marsh/shrub–swamp, approximately three acres in size, on a cool August day, the author counted 39 species of birds in roughly two hours (this wetland is on one of the mitigation sites). The list from this one day included such species as sora rail, cedar waxwing, Nashville warbler, Wilson's warbler, MacGillivray's warbler, solitary vireo, warbling vireo, northern oriole, lazuli bunting, and western tanager. Red–winged blackbirds are found wherever there is an emergent marsh, no matter how small. Characteristic birds of ponderosa pine woodlands include downy and hairy woodpeckers, western wood pewee, mountain chickadee, red–breasted nuthatch, house wren, golden–crowned kinglet, solitary vireo, Townsend's warbler, western tanager, black–headed grosbeak, Cassin's finch, dark–eyed junco, and song sparrow.

Upland Game Birds

Game birds such as chukar, Hungarian partridge, mourning dove, ring–necked pheasant, and California quail eat a variety of seeds, agricultural grasses (wheat, oats, corn) and insects. The pheasant and quail are found most commonly near agricultural lands and generally do not venture far into shrub–steppe areas. Upland game birds such as sharp–tailed grouse, ring–necked pheasant, and California quail may also harvest the catkins of willows, alders, and birches, and also eat the new buds.

Raptors

Raptors using the area along the lake include two species of eagle, twelve species of hawks and falcons, and six species of owls. Of these, both species of eagle, four of hawks and falcons, and five of owls nest along the reservoir. The five most common nesting raptors are American kestrels, great horned

owls, red–tailed hawks, golden eagles, and long–eared owls. One nest each of bald eagle and osprey have been active the past two years. Most of the raptors are also present during the winter, although in lesser numbers. A few, such as the rough–legged hawk, are present during the winter months only.

Aquatic Furbearers

A few beaver and mink are found in the project area, nearly always in association with riparian communities. Likewise, the smaller mammals and furbearers such as mink and river otter find thermal cover and a wide variety of food in coniferous areas of the reservoir.

Terrestrial Furbearers

Representative species of furbearers include the porcupine, least chipmunk, yellow pine chipmunk, striped skunk, bushy–tailed woodrat, deer mouse, sagebrush voles, cottontail rabbits, yellow–bellied marmots, bobcats, badgers, coyotes, cougar, and several species of mice, and bats. Most of these are resident in the conifers. Furbearers found in the shrub–steppe habitats of the project area (bobcat, badger, coyote) are predators, feeding primarily on rodents, as well as bird eggs and carrion. Rabbits and marmots eat grasses and herbaceous plants, and in winter may eat bark and twigs of woody plants as well. Marmots are restricted to rocky areas where they can find refuge among the many tunnels in the rocks. Small mammals such as the sagebrush vole and least chipmunk feed primarily on green vegetation.

Big Game

The shrub–steppe habitat supports both resident and wintering mule deer. 1982 winter census counted 702 mule deer in the vicinity of Rufus Woods Lake. No other animal populations in these upland habitats have been estimated or extensively studied. However, food habits of some species are relatively well known. In early spring mule deer graze on the young shoots of cheatgrass, generally the first plant to 'green–up' in the spring. Later on, and generally throughout the summer, the deer prefer to feed on the young shoots of bitterbrush and to a lesser extent on the various sages and riparian shrubs such as serviceberry and black hawthorn. It appears from a recent study that, during the winter, mule deer may depend on snow eriogonum as a major source of food. Mule deer also make use of well–protected areas of shrub–steppe to give birth to their fawns, especially behind large rocks. Buckley Bar is important for fawning as well, as the junipers provide needed shade and visual cover. Wildlife in the coniferous areas also include cougar and black bear, and the black bear are often observed throughout the shrub–steppe habitats.

Amphibians and Reptiles

Amphibians attracted to the complex marsh/shrub–swamp habitats present in the project vicinity include tree frogs and spotted frogs. Great Basin spade–foot toads are also present. Reptiles are limited to four species of snakes, including rattlesnakes and gopher snakes.

Endangered, Threatened, and Sensitive Species

The USFWS has provided the following list of listed and candidate species that may be found in the vicinity of Rufus Woods Lake (Chief Joseph project area):

Rufus Woods Lake	
Bald eagle *Haliaeetus leucocephalus*	threatened
Peregrine falcon, *Falco peregrinus*	endangered
Harlequin duck, *Histrionicus histrionicus*	candidate 2
Black tern, *Chlidonias niger*	candidate 2
Columbian sharp–tailed grouse, *Tympanuchus phasianellus*	candidate 2
Western sage grouse, *Centrocercus urophasianus*	candidate 2
Ferruginous hawk, *Buteo regalis*	candidate 2
Northern goshawk, *Accipiter gentilis*	candidate 2
Western burrowing owl, *Athene cunicularis hypuges*	candidate 2
Olive–sided flycatcher, *Contopus borealis*	candidate 2

Loggerhead shrike, *Lanius ludovicianus*	candidate 2
Pale Townsend's big–eared bat, *Plecotus townsendii townsendii*	candidate 2
Small–footed myotis, *Myotis ciliolaburm*	candidate 2
Yuma myotis, *M. yumanensis*	candidate 2
Washington ground squirrel, *Spermophilus washingtoni*	candidate 2
Northern sagebrush lizard, *Sceloporus graciosus graciosus*	candidate 2
Spotted frog, *Rana pretiosa*	candidate 2
California floater, *Anodonta californiensis*	candidate 2
Columbia pebblesnail, *Fluminicola columbianus*	candidate 2

The peregrine falcon is an endangered species that has been seen on rare occasion flying overhead, but they do not appear to nest or winter in the area. The bald eagle, a threatened species, winters regularly along Rufus Woods Lake (October through April). Approximately 35 bald eagles are observed each winter using the snags along the reservoir. The eagles feed primarily on chukar, American coots, waterfowl, fish, and carrion. There are three successful bald eagle nests along the shoreline of Rufus Woods Lake. Part of the wildlife mitigation program is specifically aimed at bald eagles. This includes retaining snags for as long as possible, and the erection of 25 raptor poles for perching, five of which are equipped with artificial nesting platforms.

Of the candidate species, only the sharp–tailed grouse and loggerhead shrike have been observed near the project in recent years. Sage grouse were common early in this century, but may have been extirpated from the project area. Western burrowing owls nest near the project, but generally are well removed from the reservoir. Sagebrush lizards and the three species of bats may occur in the vicinity of the project, though inventories for these species have not been conducted. Sightings of black tern, harlequin duck, northern goshawk, olive–sided flycatcher, Washington ground squirrel, spotted frog, California floater, and Columbia pebblesnail are very rare in the project vicinity, as habitat for these species is wanting near the reservoir.

2.2.8 Mid–Columbia River Projects

2.2.8.1 Wells Reservoir

NOTE: *Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.*

Wells Dam is located on the Columbia River at RM 515.5. The dam is licensed by FERC and owned and operated by the Public Utility District No. 1 of Douglas County. The reservoir behind the dam extends for about 29 miles to the tailwater of Chief Joseph Dam. The reservoir also extends up the Okanogan Valley. The Colville Indian Reservation is borders the north shore of the upstream portion of the reservoir.

Precipitation averages about 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83°F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

Most of Wells Reservoir (Lake Pateros) is in a broad valley. The reservoir is very wide, but shallow, with many shoals, mud banks, and low islands. The upstream four–mile portion is narrow.

2.2.8.1.1 Physical Habitat

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs along the margins of the reservoir. Riparian grass/forb, riparian shrub, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Cottonwoods trees and stands of cattail and bulrush are the predominant components of the riparian plant community. Grassland and shrub–steppe are found along the upland margins of the shoreline. Much of the developed upland area adjacent to the reservoir supports fruit orchards and residences associated with the town of Bridgeport, Brewster, and Pateros. Highway and railroad right–of–ways

border portions of the shoreline. The Washington Department of Wildlife manages portions of the shoreline to provide wildlife habitat as part of a wildlife mitigation plan.

2.2.8.1.2 Wildlife

Waterfowl

The reservoir is used as a wintering area for ducks and geese. Wells Reservoir has typically supported many wintering diving ducks and coots. Ducks nest on islands and backwater areas along the reservoir. Canada geese nest on islands along the reservoir and in goose nesting structures maintained by the Washington Department of Wildlife. Shoreline orchards, residential lawns, and wildlife management areas offer abundant brooding and grazing areas.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. The wildlife management areas typically support higher populations of upland game birds than do other non–managed portions of the Columbia River. The numbers of nesting doves are often highest near orchards. A wide variety of non–game birds occur along the reservoir, containing representatives of the wide variety of habitat types in the area.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, nesting ospreys, kestrels, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir. River otters occur in the area also, but their numbers are relatively low compared to other furbearers. Beaver are abundant.

Big Game

Mule deer inhabit range adjacent to the reservoir. Highways and a railroad border a large portion of the reservoir shoreline. Because of the abundance of orchards and residential use along the shoreline, improvement of deer populations along the reservoir is not encouraged. Relatively few big game animals use the Wells Reservoir shoreline.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only Federally–listed T&E species along the reservoir. Bald eagles have also nested on a hillside overlooking the reservoir. As many as 50 bald eagles have been seen using two communal night roosts on hillsides overlooking the reservoir. The eagles usually arrive in the area in October, are most abundant in January and February, and most leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl is the main item in the diet of bald eagles wintering in the area. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. Shoreline cottonwoods are the most used perch sites.

2.2.8.2 Rocky Reach Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Rocky Reach Dam is located on the Columbia River at RM 474. The dam is licensed by FERC and owned and operated by the Public Utility District No. 1 of Chelan County. The dam was placed in service in 1961. The reservoir behind the dam extends for about 42 miles.

Precipitation averages about 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83° F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

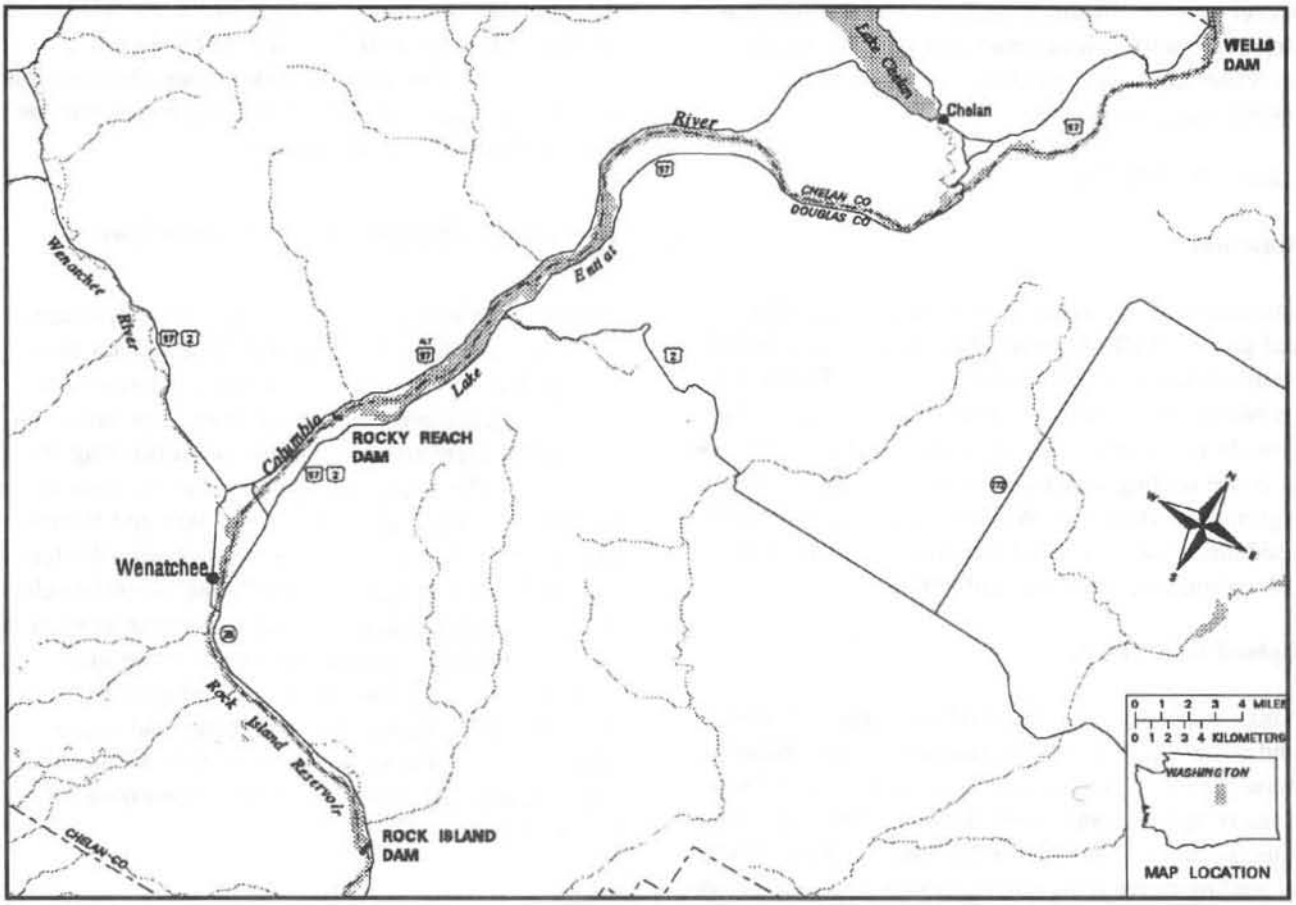

Figure 2–7. Wells, Rocky Reach and Rock Island Reservoirs

2.2.8.2.1 Physical Habitat

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs intermittently along the margins of the reservoir. Riparian grass/forb, riparian shrub, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Cottonwoods trees are the predominant component of the riparian plant community. Grassland and shrub–steppe are found along the upland margins of the shoreline. Exposed rock of both fluvial and glacial origin is often mixed into the landscape. Much of the developed upland area adjacent to the reservoir supports fruit orchards and residences. Much of the shoreline is riprap along the highway and railroad right–of–ways. Ebasco Environmental (1991) completed a HEP analysis that extensively described the shoreline vegetation. These soils form extensive terraces and some small bars composed of soils ranging from clay to gravel and cobbles. Turtle Rock Island, consisting of approximately 175 acres, is located in the lower portion of the reservoir. Several other smaller, near shore islands and rocks are scattered along the reservoir.

2.2.8.2.2 Wildlife

Waterfowl

The reservoir is used as a wintering area for up to 17,000 ducks and geese. Few ducks, mostly mallards, nest along the reservoir. Goose nesting has doubled in the last 10 years from about 32 nests/year in the early 1980s to 78 nests in 1992. About 25 goose

nesting structures, maintained by Chelan PUD, have aided in this nesting increase. Prior to the nesting structures, nest destruction by predators often exceeded 50 percent. Shoreline parks, residential lawns, and orchards offer abundant brooding and grazing areas.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. The numbers of nesting doves are often highest near orchards. A wide variety of non–game birds occur along the reservoir, containing representatives of the wide variety of habitat types in the area.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, ospreys, kestrels, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir. River otters occur in the area, but their numbers are relatively low and their occurrence is sporadic. Beaver are abundant, and are a present and continuing threat to many shoreline cottonwood groves used by perching bald eagles.

Big Game

Mule deer and bighorn sheep are big game animals that inhabit range adjacent to the reservoir. Big game winter range adjacent to the west shore of the downstream half of the reservoir was purchased by Chelan PUD as partial wildlife mitigation for the original project. That range was turned over to the Washington Department of Wildlife for management. A deer fence, State Highway 97, and a railroad separate the winter range from the reservoir shoreline area, so the project area is not an important part of the habitat base of the big game herds. Relatively few big game animals use the Rocky Reach Reservoir shoreline.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only Federally–listed T&E species along the reservoir. Between 1975 and 1992, the maximum number of bald eagles seen along the reservoir was 37. A common mid–winter bald eagle survey count during January or February is about 25 to 30 bald eagles. They usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl is the main item in the diet of bald eagles wintering in the area. Winter–killed, road–killed, railroad–killed big game and livestock also supplement the eagles' diet. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. Shoreline cottonwoods are the most used perch sites.

2.2.8.3 Rock Island Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Rock Island Dam is located on the Columbia River at RM 453.5. The dam is licensed by FERC and owned and operated by the Public Utility District No. 1 of Chelan County. The dam was built in 1933. The reservoir behind the dam extends for about 20.5 miles.

Precipitation averages about 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83°F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

2.2.8.3.1 Physical Habitat

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs intermittently along the margins of the reservoir. Riparian grass/forb, riparian shrub, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Cottonwood trees are the predomi-

nant component of the riparian plant community. Grassland and shrub–steppe are found along the upland margins of the shoreline. Exposed rock of both fluvial and glacial origin is often mixed into the landscape. Much of the developed upland area adjacent to the reservoir supports fruit orchards. The residential and industrial development associated with the cities of Wenatchee and East Wenatchee also extend along the shores.

2.2.8.3.2 Wildlife

Waterfowl

The reservoir is used as a wintering area for 2,000 to 5,000 ducks and geese. Few ducks, mostly mallards and mergansers, nest naturally along the reservoir. As many as 25 wood duck nests have been attempted in a year along the reservoir, the result of a Chelan PUD wood duck nest box program. Goose nesting has been tripled in the last 15 years from 42 nests/year in the mid–1970s to 140 nests in 1992. Chelan PUD maintains about 25 goose nesting structures along the reservoir which have aided in this nesting increase. Shoreline parks, residential lawns, and orchards offer abundant brooding and grazing areas.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. Their abundance and distribution is affected by human activities. The numbers of nesting doves are high in some orchards. Quail are especially abundant within the city limits because of abundant conifers for roosting and a very active bird feeding program by local residents. A wide variety of non–game birds occur along the reservoir, containing representatives of the wide variety of habitat types in the area.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, nesting ospreys, kestrels, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir, especially in backwater areas. River otter occur in the area, but their numbers are relatively low and their occurrence is sporadic. Beaver are abundant and are a present and a continuing threat to many shoreline cottonwood groves used by perching bald eagles.

Big Game

Mule deer are the only big game animals that use the reservoir shoreline. Due to the abundance of orchards and residential and industrial use along the shoreline, improvement of deer populations along the reservoir is not encouraged.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only Federally–listed T&E species along the reservoir. Between 1975 and 1992, the maximum number of bald eagles seen along the reservoir was 12. A common mid–winter bald eagle survey count is four eagles. They usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl are the main item in the diet of bald eagles wintering in the area. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. Shoreline cottonwoods and cliffs are the most used perch sites. No known communal night roosts occur along the reservoir.

2.2.8.4 Wanapum Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Wanapum Dam is located on the Columbia River at RM 415.5. The dam is licensed by FERC and owned and operated by the Public Utility District No. 2 of Grant Co. The reservoir behind the dam extends for about 38 miles upstream to Rock Island Dam. Large portions of the reservoir are bordered by the Washington Department of Wildlife's Colockum and Quincy Wildlife Management Areas. The Crescent Bar recreation area is located on the east shore of the reservoir.

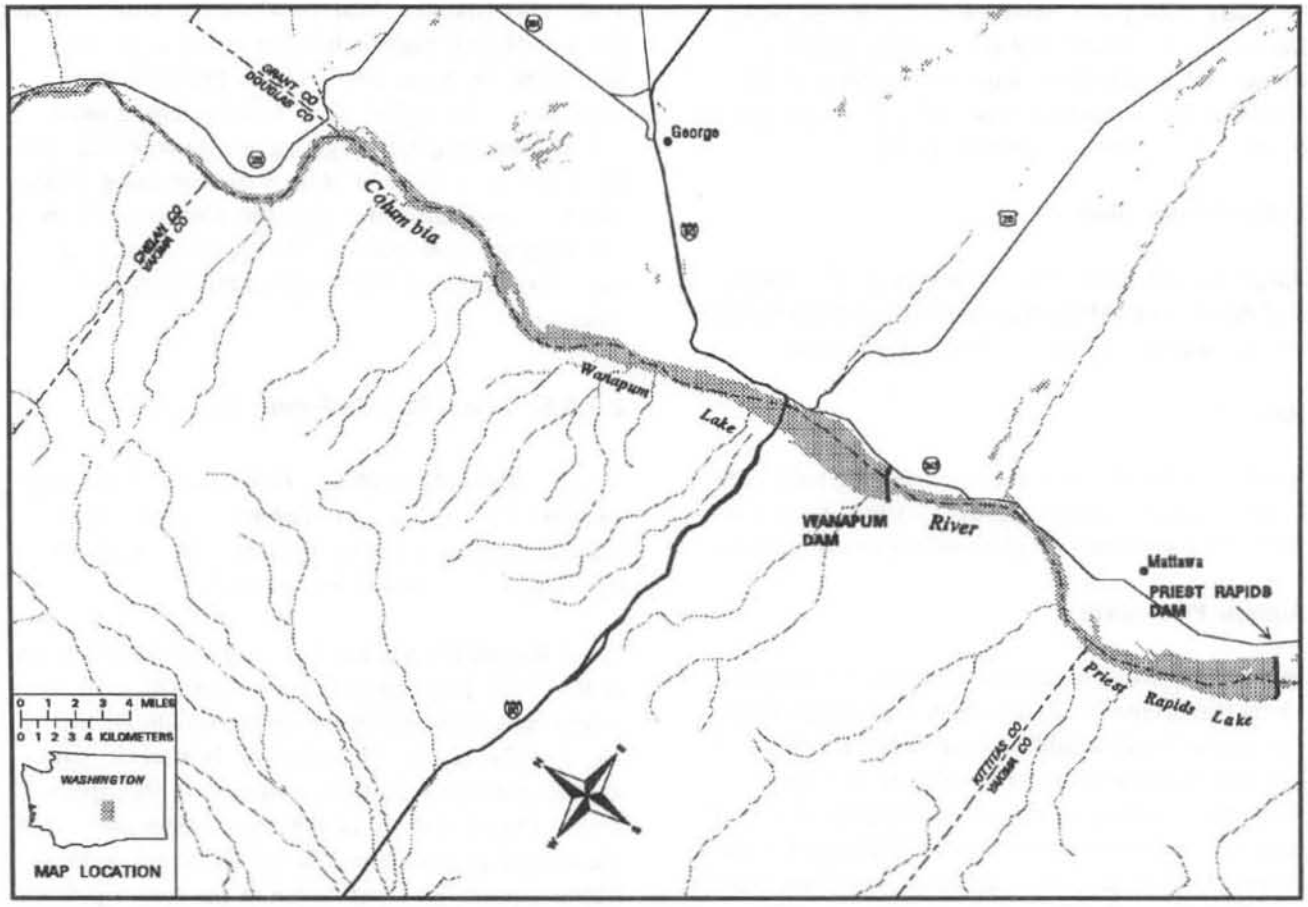

Figure 2–8. Wanapum and Priest Rapids Reservoirs

Annual precipitation averages less than 8.5 inches. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83°F. Winter temperatures can drop below 0°F, with average daily minimums of 25°F.

2.2.8.4.1 Physical Habitat

Basalt cliffs reaching 400 feet are common. The downstream portion of the reservoir is broad with shallows near the shore. The middle portion is bordered by tall basalt cliffs on both shores with several small bays formed by the reservoir flooding creeks entering the river from the west. The upstream portion of the reservoir is narrow with several rock and gravel bar islands, and the cliffs give way to portions of more open shorelines.

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Intermittent strips of riparian vegetation occur along the margins of the reservoir and in backwater areas. Riparian grass/forb, riparian shrub, and cottonwood trees comprise the vegetation within this typically narrow zone. Shrub–steppe habitat comprised of sagebrush, rabbitbrush, and bluebunch wheatgrass is found along the upland portions of the shoreline.

2.2.8.4.2 Wildlife

Waterfowl

In the mid–1970s, the reservoir was used as a wintering area for as many as 100,000 ducks and geese, although that number is much lower now. Few ducks, mostly mallards, nest along the reservoir.

As many as 64 goose nests have been found along the reservoir. Geese nest on available shoreline islands and cliff ledges. Sunland Estates and the Crescent Bar recreation area and golf course provide grazing and brooding areas for geese.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. A wide variety of non–game birds occur along the reservoir.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, ospreys, kestrels, hawks, and owls. The area may also be used by prairie falcons.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon are common along the reservoir. River otters may occur along the reservoir but would be expected to be rare because of the absence of suitable tributaries. Beavers are relatively abundant along the reservoir, and are a present and continuing threat to the few shoreline trees along this reservoir, especially cottonwoods.

Big Game

Mule deer and Rocky Mountain elk are big game animals that inhabit range adjacent to the reservoir, especially the Colockum wildlife management area on the west shore. Quilomene Bar and West Bar are important elk and deer wintering areas along the west shore of the reservoir.

Endangered, Threatened, and Sensitive Species

Wintering bald eagles are the only listed T&E species along the reservoir. Between 1975 and 1992, a maximum of 25 bald eagles were counted along the reservoir. They usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Waterfowl are the main item in the diet of bald eagles wintering in the area. Winter–killed big game and livestock probably also supplement the eagles' diet. Fish are not as available to wintering bald eagles along the mid–Columbia River as they are in other eagle wintering areas. The tall basalt cliffs and shoreline cottonwoods are the most used perch sites. No known communal night roost used by bald eagles occur along the reservoir.

2.2.8.5 Priest Rapids Reservoir

NOTE: Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids are non–Federal Projects where impacts are expected to be minimal. As a result, the information presented is less detailed.

Priest Rapids Dam is located on the Columbia River at RM 397. The dam is licensed by FERC and owned and operated by the Public Utility District No. 2 of Grant Co. The reservoir behind the dam extends for about 19 miles upstream to Wanapum Dam. The west shore of the downstream portion of the shoreline is bordered by the US Army, Yakima Firing Center. The east shore of the center portion of the reservoir is bordered by the Washington Department of Wildlife Priest Rapids Wildlife Recreation Area.

The area is very dry with little annual precipitation. Annual temperatures vary markedly. Summer temperatures can exceed 100°F with average daily maximums of about 83° F. Winter temperatures can drop below 0° F, with average daily minimums of 25° F. The reservoir is subject to high winds, varying from zero to 80 m.p.h. in the fall with an average of five to 25 m.p.h.

2.2.8.5.1 Physical Habitat

The geology of the reach is typified by extensive basalt flows and extensive river terraces. Several gravel bar islands occur in the upstream portion of the reservoir and a large island (Cabin Island) lies just upstream of Priest Rapids Dam.

Vegetation reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Intermittent strips of riparian vegetation occur intermittently along the margins of the reservoir and in backwater areas. Riparian grass/forb, riparian shrub, and cottonwood trees comprise the vegetation within this typically narrow zone. Shrub–steppe habitat comprised of sagebrush, rabbitbrush, and bluebunch wheatgrass is found along the upland portions of the shoreline.

2.2.8.5.2 Wildlife

Waterfowl

Ducks and geese use the reservoir as a wintering area. Duck nesting along the reservoir is relatively low. Mallard is the most common species of duck nesting along the reservoir. Recent goose nesting surveys have located about 165 nests annually along the reservoir. Most of these nests (about 125) were found on Cabin Island, just upstream of Priest Rapids Dam. Most of the remainder of the nests (about 25) were found on Railroad Bridge Island at RM 412.5. The Priest Rapids wildlife management area provides most of the grazing and brooding area for geese along the reservoir.

Upland Game Birds

Ring–necked pheasants, California quail, chukar, and doves occur along the reservoir. Habitat for pheasants and quail is restricted to the immediate shoreline and the Priest Rapids wildlife recreation area. A wide variety of non–game birds occur along the reservoir.

Raptors

Raptors using the area include wintering bald eagles, resident golden eagles, hawks, and owls.

Aquatic Furbearers

Beaver, muskrats, mink, and raccoon probably occur along the reservoir in relatively low numbers. Aquatic furbearer habitat is scarce along the reservoir, except for the mouth of Crab Creek, which lies along the east shore of the reservoir.

Big Game

Mule deer inhabit range adjacent to the reservoir, but occur in limited numbers. The shores of Priest Rapids Reservoir are not an important wintering area for deer.

Endangered, Threatened, and Sensitive Species

Bald eagles are the only Federally–listed T&E species along the reservoir. No bald eagles nest along the reservoir and relatively few bald eagles winter along the reservoir. A high count of ten bald eagles was recorded during ten winters of surveys from 1975 to 1984. The eagles usually arrive in the area in October, are most abundant in January and February, and leave by the following April. Wintering bald eagles in eastern Washington are relatively transitory, moving about during the winter as local food availability changes. Most of the bald eagles that use Priest Rapids Reservoir probably move back and forth between the reservoir and the Hanford Reach, where food is more available. Waterfowl are the main item in the diet of bald eagles wintering in the area. Winter–killed big game and livestock probably also supplement the eagles' diet. Fish are not as available to wintering bald eagles along Priest Rapids Reservoir as they are in other eagle wintering areas. Shoreline cottonwoods, and especially cottonwoods on Cabin Island, are the perch sites most used by bald eagles along this reservoir. No known communal night roost used by bald eagles occur along the reservoir. Low availability of shoreline perches and available prey items probably limit bald eagle numbers along this reservoir.

2.2.9 Hanford Reach

The unimpounded area of the Hanford Reach of the Columbia River has experienced less alteration than any other reach. Unlike other stretches of the river, peak flows associated with winter rains or spring run–off still influence upland, riparian, and riverine vegetation along the approximately 50–mile reach.

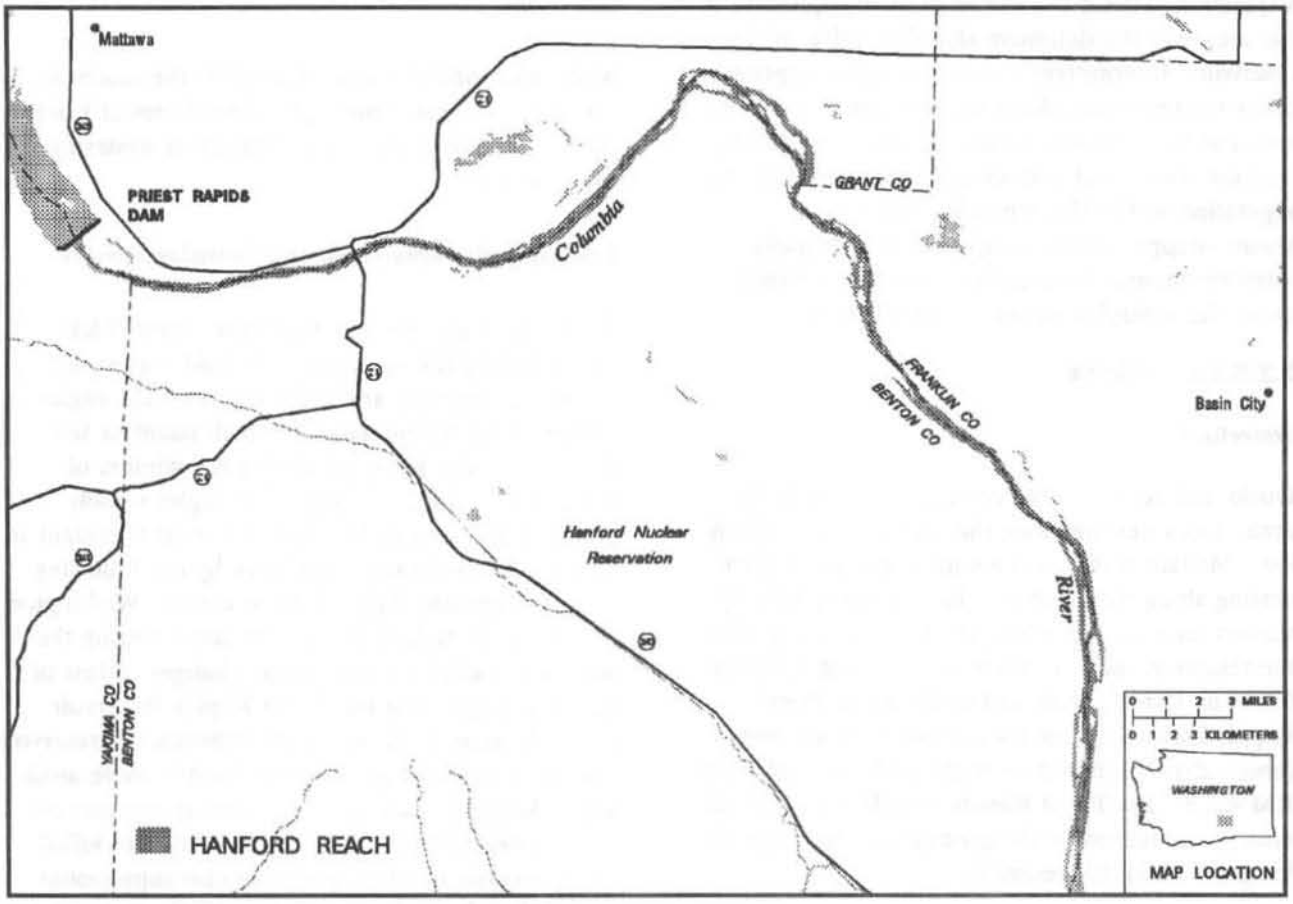

Figure 2–9. Hanford Reach

Riverine habitat includes the sloughs, backwaters, shorelines, islands, and palustrine forests that are associated with the river floodplain and are covered by water for the majority of the year. Artificial habitats include the ponds and ditches that drain irrigation water on the northern and eastern shores of the river. Riparian habitat includes the shoreline–river interface where species that are tolerant of fluctuating surface water elevations persist. Upland shrub–steppe habitat along the Hanford Reach is dominated by the sagebrush/cheatgrass/Sandberg's bluegrass vegetation community. Unique areas include bluff, dune, island, cultivated (non–native), and spring stream habitats.

Sands and silt loams are the predominant soils on the Hanford site. Sands and loamy sands tend to cover low elevation areas central to the site, while silt–loams occur at higher elevations in the south, west, and north portions of the Hanford Site (Natl. Park Serv. 1992).

2.2.9.1 Physical Habitat

Barren Zone

Under current operations, a barren zone is not present along the Hanford Reach.

Upland Zone

Some of the last vestiges of sagebrush–steppe habitat occur along the Hanford Reach within the area surrounding the Hanford facilities. The area is botanically characterized as shrub–steppe, however, cheat grass is the dominant species occurring

throughout the eight major plant communities. The shrub–steppe habitat community is dominated by big sagebrush, antelope bitterbrush, grey rabbitbrush, and spiny hopsage. Remnant natives include bluebunch wheatgrass, Sandberg's bluegrass, needle–and–thread grass, Indian ricegrass, and prairie junegrass (Rickard and Poole 1989). The distribution and dominance of endemic species have been altered by human activities, which has resulted in the predominance of alien species, especially cheatgrass and tumble mustard. Although current river operations along the Hanford Reach have minimal affects on upland vegetation, competition from exotic species has precluded the proliferation of native vegetation within the shrub–steppe habitat (Rickard and Poole 1989).

Riparian Zone

Riverine and riparian habitat provides nesting, foraging, thermal, and travel cover for many wildlife species (Books 1984). Riverine vegetation includes willow, mulberry, Siberian elm, sedge, reed canarygrass, and bulbous bluegrass.

Shoreline riparian communities are seasonally important for a variety of species. Willows trap food for waterfowl (i.e., Canada geese) and shorebirds (i.e., killdeer, spotted sandpiper) and provide nesting habitat for passerines (i.e., mourning doves). Terrestrial and aquatic insects are abundant in emergent grasses and provide forage for fish, waterfowl, and shorebirds. Beaver and mule deer, and rely on shoreline habitat for foraging.

Emergent Wetland Zone

Emergent vegetation occurs within the riverine area (e.g., that area below mean high water) of the Hanford Reach that also includes riffles, gravel bars, oxbow ponds, backwater sloughs and the cobble shorelines that typified the Columbia River prior to inundation by dam development. These and emergent habitats that occur infrequently along the Hanford Reach, have acquired ecological significance due to the net loss of wetland habitat elsewhere within the region. The majority of emergent species include reed canarygrass, common witchgrass, and large barnyard grass.

The release of water used in industrial processes at the Hanford facilities created several artificial ponds that did not exist prior to industrial development. The ponds are ephemeral but have contributed to the establishment of cattail, reed canarygrass, willow, cottonwood, and Russian olive.

Submerged Aquatic Plant Bed Zone

The Columbia River and artificial ponds and ditches created as a result of Department of Energy facility operation comprise the aquatic habitat of the Hanford Reach. Diatoms represent 90 percent of the algae in the Hanford Reach. Species composition of plankton that persists within the reach is influenced by communities in upstream reservoirs (e.g., Priest Rapids). Although populations are largely transient, the peak concentration of phytoplankton develops in April and May (Cushing 1967).

Because currents within the main channel are generally strong, macrophytes that include *Lemna*, *Potamogeton*, *Elodea*, and *Myriophyllum* are generally limited. Rushes and sedges occur along the shorelines of several sloughs along the Reach at White Bluffs, below the 100–H area, downstream of 100–F, and the Hanford Slough (Cushing 1990).

Island Habitat

Approximately 18 islands, accounting for 39.9 miles of island shoreline (USACE 1976), occur within the main channel of the Hanford Reach. These islands range in size from one to five miles in length and afford a ratio of island shoreline to rivermiles of 0.77 to 1.0. Islands provide resting, nesting, and escape habitat for waterfowl, shorebirds, and small mammals. Shoreline riparian vegetation that characterizes the islands includes willow (*Salix* spp.), poplar, Russian olive, and mulberry. Species occurring within the island interior include buckwheat, lupine, mugwort, thickspike wheatgrass, giant wildrye, yarrow, and cheatgrass (Warren 1980). During 1993, purple loosestrife *(Lythrum salicaria),* a noxious plant species, was removed from the east side of Island 18 (USFWS, pers. comm.)

Fish Productivity Zone

Anadromous fish common within the Hanford Reach include chinook, coho, and sockeye salmon, and steelhead trout. Currently, approximately 2.5 million salmon and steelhead return to the Columbia River to spawn and rear, and include individuals of both species that spawn in the Hanford Reach. Activity of spring and summer chinook, coho, and sockeye salmon is limited to up– and downstream migration within the reach.

Approximately 60 percent of the fall chinook salmon passing the McNary Dam return to spawn in the Hanford Reach. The primary spawning areas include Vernita Bar, Locke Island, and White Bluffs. Although measures of steelhead spawning have not been recorded for the reach, the area is used for spawning and holding by adult fish.

Resident fish in the Hanford Reach include white sturgeon, mountain whitefish, and smallmouth bass which comprise a majority of the existing sport fishery. White sturgeon, which occur in isolated assemblages, spawn within vestigial habitat of the Hanford Reach. Smallmouth bass were introduced into the Yakima River and subsequently spread to the Columbia. Smallmouth bass contribute the sport fishery within the Hanford Reach. Mountain whitefish occur throughout the reach during the entire year and likely are afforded spawning habitat throughout the entire length of the Reach.

Mountain sucker, sandroller, paiute sculpin, and reticulate sculpin are state Species of Special Concern that also occur within the reach.

Benthic Invertebrate Productivity Zone

Benthic invertebrate productivity along Hanford Reach should not be affected significantly for any of the alternatives.

Unique Habitat

Bluffs. The White Bluffs on the north river bank and Umtanum Ridge on the south bank below Priest Rapids Dam provide nesting habitat for prairie falcons, cliff swallows, bank swallows, and rough–winged swallows. Canada geese also use the bluffs for nesting.

Dunes. The terrain of the Hanford Dunes rises and falls between 10 and 16 feet above ground, creating sandy habitats 2.5 to several hundred acres in size (Department of Army 1990). The dunes are vegetated by bitterbrush, scurfpea and thickspike wheatgrass. This community is ecologically important because of its unique vegetation which stabilizes the rivershore.

Orchards/Groves. Prior to 1943, the Hanford town site was inhabited by settlers who planted now remnant groves of black locust, Lombardy poplar, white poplar, Siberian elm, and white mulberry. Because many of these non–native specie are aggressive colonizers, they have become established within the riparian zone along the river and maintain a non–native vegetative component on the site. These trees that occur along the shoreline provide nesting habitat for great blue herons and roosting habitat for bald eagles.

Spring Streams. Rattlesnake and Snively springs are highly diverse biologic communities (Cushing and Wolf 1984). Watercress, which persists until flash floods decimate populations in the winter and early spring, is abundant. Other vegetation includes bulrush, spike rush, and cattail. These springs provide water for terrestrial vertebrates within the arid portion of the Hanford site (Cushing 1990).

Human Effects

The Hanford Reach, has received relatively minor disturbance since the 1940's when the Department of Energy acquired lands for the location of its facilities. Today only 6 percent of the landbase is used for Department of Energy operation facilities (Cushing 1990). Included in this area is 11 km^2 adjacent to the south shore of the Hanford Reach that accommodates the retired production reactors and the N reactor. The reach receives minimal disturbance from facility operation.

In 1977 the entire Hanford site was designated as a National Environmental Research Park (Cushing 1990). This is of significance in an region where the predominant adjoining land use is irrigated agricul-

ture, where tillage and grazing has converted a majority of former sagebrush–steppe to cultivated fields or pasture.

2.2.9.2 Wildlife

The Hanford Reach was ranked as the second most important area for fish and wildlife in the state, identifying the area as a regionally significant resource (USFWS 1992).

Waterfowl

Wintering waterfowl represent a primary resource of the Hanford Reach. Currently, 23 species use the reach for resting and feeding, although overall use has declined throughout the recent past (Fitzner 1991). Declines could be attributed to changes in management of downstream areas or changes in crop production in fields adjoining the reach. These factors, or intermittent occurrence of suitable foraging habitat (e.g., sloughs and backwater areas) may be responsible for the uneven distribution of waterfowl throughout the reach.

The Hanford Reach is off–limits to waterfowl hunting, from the powerline crossing upstream to the Vernita Bridge. This designation affords a refuge that accommodates resting and feeding activity of waterfowl. The primary nesting species along the reach are the mallard and Canada goose. However, gadwall, teal, and common merganser also take advantage of nesting habitat afforded along the river shorelines.

The Hanford Reach is a primary production site for Canada geese. Historic declines in nest numbers reflect the steady decrease in nest site availability. During 1980, 90 percent of goose nests were located on ten islands (Deward 1981). Site suitability for nest location is based on habitat as well as potential for nest success or failure. Previously, coyotes have been implicated in reducing nest success of Canada geese by predation on eggs and nestlings.

Colonial Nesting and Shorebirds

Colonial nesting species, including Forster's tern, California gull, ring–billed gull, and great blue heron, have established significant breeding populations within the Hanford Reach. Black–crowned night herons, and white pelicans, a state endangered species, are a desired species for management by the WDFW. During 1993, a night heron colony became established and was productive on Island 18 within the reach (USFWS, pers. comm.). Although white pelican numbers are increasing along the reach, currently no nesting has been recorded. The long–term management objective is to establish pelican nesting habitat along the reach. During 1993, spotted sandpipers nested on Island 14 within the reach.

Nongame Birds

Songbirds occur along the Hanford Reach, and nest within willow, cottonwood, and mulberry trees and shrubs along the shoreline. Common species include the western kingbird, horned lark, cliff swallow, barn swallow, black–billed magpie, common raven, American robin, European starling, yellow–rumped warbler, white crowned sparrow, dark–eyed junco, western meadowlark, red–winged blackbird, house finch, and house sparrow (WHC 1992).

Upland Game Birds

While several species are present in the area, including California quail and sharp–tailed grouse, none are expected to be effected by any of the alternatives.

Raptors

Raptor species occurring along the Hanford Reach are identified within designations for threatened, endangered, or sensitive (TES) species; or as species of special concern and are discussed below within the context of TES species.

Aquatic Furbearers

Furbearers occurring within backwater sloughs along the Hanford Reach include beaver, muskrat, and mink. Beaver distribution is generally limited by

fluctuations in water level, that affects forage supply and individuals susceptibility to predation.

Terrestrial Furbearers

Raccoons, skunks, long–tailed weasels, short–tailed weasels, and bobcat occur in the area.

Big Game

Mule deer, the most common big game species in the area, use the Hanford Reach to forage, rest, and fawn (Natl. Park Serv. 1992), relying primarily on riparian habitat and islands for fawning (Tabor et al. 1980). Fawn mortality has been attributed to coyote predation (Steiger et al. 1980) that limits overall population production. Occasionally, white–tailed deer are observed within the reach (Fickeisen 1980). The Hanford Site serves as a refuge for big game. Deer cannot be hunted on the site, and hunting is only permitted on the Wahluke State Wildlife Recreation Area in Franklin County.

Elk were first observed on the Hanford Site in 1972. The origin of the herd is suspected to be in the Cascade Mountains from where elk migrated to the Rattlesnake Hills. Recent surveys (1992) indicate that the population is increasing, and that approximately 170 Rocky Mountain elk are established on the Arid Lands Ecology Reserve (B. Tiller, Pers. comm.). Elk cannot be hunted on the site, and hunting is only permitted on the Wahluke State Wildlife Recreation Area or private lands adjoining the ALE.

Predatory Species

Coyotes are the most common predator occurring along the Hanford Reach. Primary prey of coyotes include small mammals, mule deer fawns, and goslings. Coyotes have been implicated in reducing nest success of waterfowl and contributing to mortality of deer fawns within the reach.

Amphibians and Reptiles

Reptiles and amphibians are distributed between characteristically very dry or moist sites on the Hanford Site. The Great Basin spadefoot toad, western painted turtles, and western terrestrial garter snakes are distributed near water. Pacific rattlesnakes, gopher snakes, short–horned lizards side–blocked lizards, and western skinks occur on drier sites.

The side–blotched lizard is the most abundant reptile that occurs on the Hanford Reach. Short–horned and sagebrush lizards are also common. The gopher snake, western yellow–bellied racer, and the Pacific rattlesnake are the most common snakes on the Hanford Site. In shallow water areas, tree frog and spotted frog occur in association with areas of aquatic vegetation. In more sparsely vegetated areas, long–toed salamanders would be expected to occur.

Endangered, Threatened, and Sensitive Species

Because of the protection afforded to vegetation and wildlife by the designation of the Hanford site as a NERP and the restrictions on hunting on site, unique biological resources are able to persist. A listing of Federal endangered, threatened, sensitive, and candidate species follows.

Plants	
Howelia aquatilis	Federal threatened
Golden Indian paintbrush	proposed threatened
Birds	
Bald eagle	Federal threatened
Western burrowing owl	Federal candidate–2; state candidate
Little willow flycatcher	Federal candidate–2
Olive–sided flycatcher	state candidate
Mammals	
Long eared myotis	Federal candidate–2
Fringed myotis	Federal candidate–2

Long–legged myotis	Federal candidate–2; state candidate
Washington ground squirrel	Federal candidate–2; state candidate
Yuma myotis	Federal candidate–2; state candidate
Pale Townsend's big–eared bat	state candidate
Small footed myotis	state candidate
Amphibians and Reptiles	
Tailed frog	Federal candidate–2
Northern sagebrush lizard	Federal candidate–2; state candidate
Spotted frog	Federal candidate–1
Fish	
Green sturgeon	Federal candidate–2
River lamprey	Federal candidate–2; state candidate
Westslope cutthroat trout	state candidate
Bull trout	Federal candidate–1
Pacific lamprey	Federal candidate–2; state candidate

A discussion of state sensitive species and species of special concern that occur on the Hanford Site are presented below. These species occur or have been recorded for the Hanford Site and are regarded as unique resources.

Fish. Washington State Species of Special Concern, that occur in the Hanford Reach include mountain sucker, sandroller, paiute sculpin, and reticulate sculpin.

Although its distribution is limited, the sandroller is endemic to the Columbia River system and has been found within the Hanford Reach (Dauble 1991).

Birds. The Hanford Reach provides habitat for bald eagles which are classified as a Federal threatened species. A wintering population of approximately 50 birds occurs along the Hanford Reach from the Umatilla National Wildlife Refuge to the Vernita Bridge. Bald eagles that occur along the Hanford Reach are reliant on waterfowl and spawned–out salmon carcasses for forage, and on groves of trees for roosting. Bald eagles generally initiate nesting along the Hanford Reach in April, but in the past have abandoned their nest sites. Currently, no nesting is reported for the reach.

The occurrence of peregrine falcons has not been reported for the Hanford Reach since 1987. The Aleutian Canada goose, sandhill crane, and black tern are reported for the Hanford Site. However, activity is limited to resting or foraging during migration and does not include nesting (WDFW, Pers. comm.).

In addition to bald eagles and ferruginous hawks, presence or absence of Swainson's hawk, long–billed curlew, western sage grouse, white pelican, loggerhead shrike, and great blue heron is recorded regularly for the Hanford Reach.

Swainson's hawks nest in trees along the Hanford Reach. Approximately 28 pairs nest within the area of the Saddle Mountain National Wildlife Refuge and the Wahluke Wildlife Recreation Area (Radke and Fitzner 1991).

The ferruginous hawk is presently listed as a state threatened species and is a candidate for Federal listing as threatened or endangered. Ferruginous hawks have declined in the recent past due to a reduced prey base and increased human disturbance in former nesting habitat. Approximately, one–sixth of the ferruginous hawks in the state of Washington occur along the Hanford Reach. Currently, there are 12 active nests on the site that occur in association with high voltage transmission towers.

The long billed curlew nests in isolated areas throughout the Hanford Site, Wahluke Slope, and on the Saddle Mountain National Wildlife Refuge. Approximately 300 birds occur throughout these areas (Allen 1980). The preferred habitat of long-billed curlews is grass covered uplands or islands that provide nesting, foraging, and loafing habitat for curlew. This species has been down-listed to a category three species, and is no longer being considered for listing as a threatened or endangered species.

Although white pelicans do not nest on the Hanford Site, breeding habitat is present along the reach. Future resource management objectives include establishing a breeding colony on the Hanford site.

Loggerhead shrikes, which are considered a candidate species for Federal and state listing rely on shrub-steppe habitat for nesting and foraging. The species tend to roost and nest in dense sagebrush and the Hanford Reach affords high quality habitat for shrike (Dobler 1992).

Mammals. The pygmy rabbit is a state threatened species and is a Federal candidate species. The species is endemic to the western states, and its historic range includes an isolated portion of the Columbia Plateau. Pygmy rabbits requires dense (50 percent cover) sagebrush and rabbitbrush (USFWS 1979).

Invertebrates. One aquatic mollusc that occurs in the Hanford Reach is a Federal candidate species. Reproductive populations of the Columbia pebblesnail occur throughout the reach and serve as food for goldeneye and mountain whitefish.

Amphibians and Reptiles. The spotted frog occurs in shallow waters of ponds and wet meadows or streams. The species occurs commonly with bull frogs, which are likely predators of this native species. Although reported for the site, individual observations or known locations have not been documented.

Plants. The persistantsepal yellowcress is a Federal candidate species and is considered endangered by the state. Persistentsepal yellowcress occurs along unimpounded stretches of the Columbia River from Vernita Bridge to RM 345 and below the Bonneville Dam near Beacon Rock State Park.

Columbia milkvetch is a Federal candidate species and is considered threatened by the state (WNHP 1990). Milkvetch occurs in an area near Wanapum Dam south to Vernita Bridge. The species occurs in the west (south) side of the Columbia.

Hoover's desert parsley is a Federal candidate species and is listed as threatened by the state of Washington. Its distribution is limited to basalt outcrops of Umtanum Ridge near Priest Rapids.

State sensitive species that occur along the Hanford Reach include dense sedge, shining flatsedge, bristly cryptantha, gray cryptantha, Piper's daisy, dwarf desert primrose, southern mudwort, and false pimpernel (WNHP 1990).

2.2.10 Brownlee Reservoir

Short-term Operational Limits	
Lake Elevation	
Freeboard	2,090 ft
Maximum pool	2,080 ft
Normal full pool	2,077 ft
Minimum pool	1,976 ft
Discharge	
Minimum	No limits
Tailwater	No limits

Brownlee Reservoir is a non-Federal hydroelectric facility located near Weiser, Idaho on the Snake River (RM 247). The dam is one of three hydroelectric facilities often referred to as the Hells Canyon Complex. The other two dams making up the 'Complex' include Oxbow (RM 273) and Hells Canyon (RM 247) dams.

Brownlee Reservoir, completed in 1958, is owned and operated by Idaho Power Company. The primary purpose of the dam is power generation. However, flood control and recreation are other important project functions.

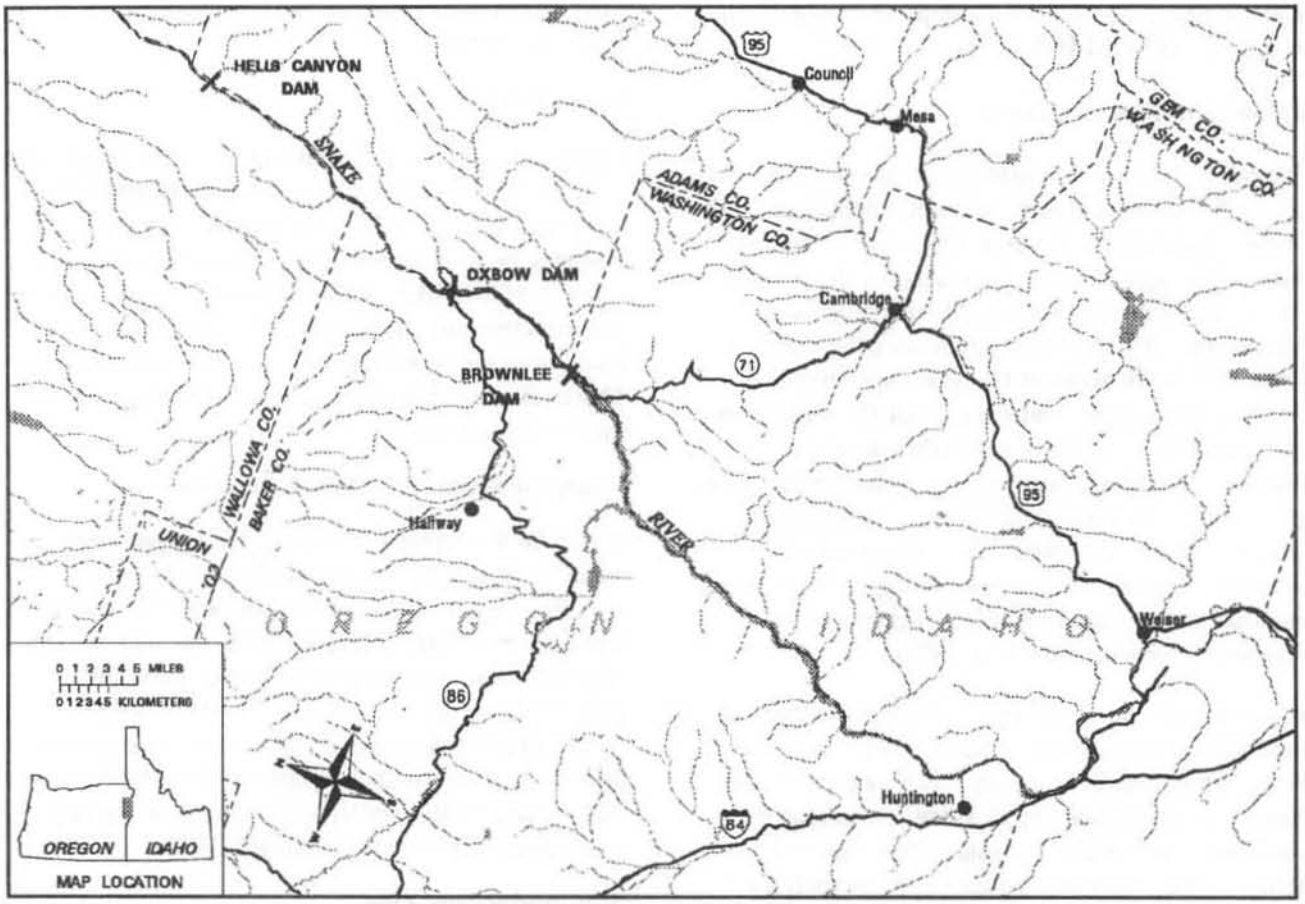

Figure 2–10. Brownlee, Oxbow, and Hells Canyon Dam Reservoirs

Full pool elevation at Brownlee is 2,077 msl. However, some FERC license requirements such as downstream flow releases, power generation, ramping, and flood control constraints may require the reservoir be drawn down during certain times of the year. For example, the FERC license requires Idaho Power to draw the reservoir down to 2,034 by March 1 of each year (subjected to forecast run–offs).

This area is typically hot and dry in the summer, with mild winters. Winter conditions tend to be milder than those of adjacent uplands. Precipitation falls most heavily in the late fall–winter and spring periods (Asherin and Claar, 1976).

2.2.10.1 Physical Habitat

Barren Zone

As is common in other reservoirs in mountainous terrain, numerous landslides are scattered around the perimeter of Brownlee Reservoir and several extend into the reservoir. Unstable slopes are possible candidates for rapid drawdown slope failures. Some of the more recent landslides may have resulted from rapid lowering of water levels. Such failures generally occur in saturated material which is not free–draining.

Because Brownlee is used for storage, barren soil along shorelines is exposed when the reservoir is drawn down. At reservoir level 2,067 ft, mud flats

begin to occur. At 2,064 ft, stumps and snags begin to appear. (CH2M Hill, 1984).

Upland and Riparian Zones

Brownlee Reservoir is enclosed by rolling grass–covered hills, giving a smooth textured appearance with scattered pockets of riparian vegetation. From the dam to the upper end of the reservoir, the predominant vegetation type is big sagebrush/bluebunch wheatgrass. Big sagebrush dominates the shrub layer, with small areas of Douglas hackberry and antelope bitterbrush scattered about the main body of the reservoir. Antelope bitterbrush is usually found around steep, rocky slopes. Bluebunch wheatgrass is the dominant understory. Cheatgrass, an annual invader, has replaced the wheatgrass in overgrazed areas. This vegetation type covers the majority of the shoreline in this segment of the reservoir (Asherin and Claar, 1976).

At the upper end of the reservoir, shrub/willow type vegetation occurs between the high and low water lines, and is flooded annually. This vegetation type consist of several species of willow which may include peachloaf willow, coyote willow, and red willow. The understory composition varies from dense grasses, mainly cheatgrass, to sparse forbs. A limited distribution of cattail and cottonwood vegetation types occurs around shallow bays in the upper reservoir.

Vegetation in the many small side canyons along the reservoir varies considerably from one to another, depending on the slope and the amount of time water is present. Narrow, steep canyons, usually have a dense tree and shrub association with a poorly developed herbaceous layer. Wider, gentle canyons have an equal mix of trees, shrubs, and herbaceous cover.

Many tributaries of the reservoir have vegetation associations that cannot be typed, as no one species is dominant. Several different tree species may occur, including white alder, black cottonwood, box elder, and water birch as well as the many exotics of apple, plum, apricot, walnut, and grape. A well–developed shrub layer is common, with the herbaceous layer usually comprised of grass species (McKern, 1976).

Island Habitat

Creeping wildrye is the dominant vegetative species on the 405 acres of islands at the upper end of the reservoir. Barren soils or shrub/willow type vegetation may be found between the high and low water zones (CH2M HILL, 1984). Upper reservoir islands may become part of the main shoreline through land–bridging if the reservoir is drawn down too far. This could have major impacts for island nesters such as Canada geese.

Emergent/Submergent Vegetation Zone

Brownlee Reservoir is known to have significant water quality problems, particularly in the summer months. High water temperatures and high nutrient input (from upstream irrigation returns and sewage sources) cause algal blooms and encourage the growth of emergents (112 acres) and submerged rooted plants (38 acres) along the shoreline and in bays created by tributary inflows. Decomposition of this organic matter contributes to nutrient cycling and oxygen depletion (Goodnight, 1971).

Fish Productivity Zone

Following the completion of the three dam complex (Hells Canyon, Oxbow, and Brownlee) and the elimination of attempts to pass migrating salmon through the system, two general types of fisheries were developed: warm–water and cold–water fisheries. These reservoirs favor the growth of warm–water fish species, but support cold–water fish as well. Smallmouth bass and channel catfish seem to dominate the warm–water fishery, while rainbow trout dominate the cold water fishery.

Benthic Invertebrate Productivity Zone

References on this topic were not found. Preliminary indications show the proposed strategies are unlikely to change the existing benthic environment.

Human Effects

Except for a few small communities, residences are widely scattered. According to a Baker County

survey, there are 34 summer residences along the reservoir from Huntington downstream to the dam on the Oregon side. At the upper end of the reservoir is the City of Weiser, Idaho. Recreation use is probably the greatest human effect on this area. Brownlee has the greatest number (5) of developed recreation sites of the three dam complex. The developed sites are located on the upper and lower end of the reservoir. The middle segment is accessible only on the Oregon side via an undeveloped dirt road (CH2M Hill, 1984).

2.2.10.2 Wildlife

Waterfowl

Asherin and Claar (1976) reported that at least 30 species of waterfowl use the Snake River between Asotin, WA and Weiser, ID during some time of the year. Of these, six species are known or suspected to be nesting in the area. These include Canada goose, mallard, pintail, American wigeon, green-winged teal, and common merganser. They also reported finding 191 Canada goose nests located on islands in the Brownlee pool during 1975. Aerial surveys of the Snake River from Walter's Ferry to Farewell Bend documented an increase from 289 nests in 1973 to 900 in 1981. This area includes the upper end of Brownlee pool where major nesting islands are located. These islands make up 20 to 25 percent of the total goose nesting of this stretch of the upper Snake River.

Colonial Nesting and Shorebirds

The most common colonial nesting/shorebirds found in the project area are the great blue heron, killdeer, spotted sandpiper, American avocet, and ring billed and California Gulls. No breeding colonies of gulls or terns were found in the area when Asherin and Claar completed their survey in 1975. However, ring billed, California, and herring gulls, and Caspian, common, and Forster's terns were sighted in the project area during the nesting season.

Nongame Birds

Approximately 76 species of passerines are found in and around the project. Some of the more common species include red-winged blackbird, house finch, American goldfinch, and song sparrow. Species of the goatsucker, swift, hummingbird, kingfisher, and woodpecker families are also found around the project. Many of these species are totally dependent on riparian vegetation for food, cover, and nesting. Others, such as the kingbirds, use riparian areas along with surrounding habitat types as well.

Upland Game Birds

Upland game birds occupying the reservoir area include chukar, California quail, ring-necked pheasant, gray partridge, ruffed grouse, and mourning dove. Of these, chukar and mourning dove are the most widely distributed. Chukars use a variety of habitats on a daily and seasonal basis, seeking out shady loafing areas during the hottest parts of the summer and depending on tree/shrub riparian habitats in the fall where water is available. Mourning doves are common during all seasons but winter. They occupy all brush/shrub/tree habitats as well as agricultural fields.

Raptors

McKern (1976) noted that Sharp-shinned and Cooper's hawks are commonly found in riparian zones where the small birds they prey on are plentiful. Red-tailed, Swainson's, rough-legged, and ferruginous hawks, while using riparian zones for roosting and perching, generally scour upland fields, meadows, and brush fields for rodents. The marsh hawk uses riparian marshes and meadows as well as uplands in foraging. Osprey and bald eagles, dependent on the reservoir for fish, perch and roost in riparian trees, and coniferous forest at higher elevations.

Prairie falcons use cliff ledges for nesting, and like the golden eagle and peregrine falcon, seek food along ridges and slopes above the river. The American kestrel, a tree cavity nester, is more dependent on the riparian zone than the larger cliff nesters.

The following excerpt from McKern (1976) describes the occurrence and habitats of owls found around the reservoir. "Barn, screech, great-horned, long-eared, short-eared, and saw-whet owls relied heavily on riparian trees and shrubs for perching and roosting. Screech and long-eared owls nest in trees

or tree cavities, while barn and great–horned owls often nest in cliff cavities. Short–eared owls are ground nesters. Burrowing owls were observed primarily in upland types. Pygmy owls were seen only where coniferous forest extended down to Brownlee Reservoir."

Aquatic Furbearers

Aquatic furbearers found in the area include the river otter, mink, and muskrat. Most mink and muskrat activity has been noted in the upper Brownlee pool. River otter sightings have been noted in the lower end of the reservoir near the dam.

Terrestrial Furbearers

Five terrestrial furbearers were found in the Brownlee Project study area. They include the coyote, striped skunk, raccoon, red fox, and badger. The coyote, striped skunk, and raccoon are the most widely distributed of the terrestrial furbearers, ranging over many distinct vegetation types. Badger and red fox were observed only on the upper end of the reservoir. Badger were found in areas where sagebrush was in close association with riparian habitat and red fox were observed around intensive agricultural activities.

Big Game

Mule deer are by far the most numerous of the big game species, followed in numbers by elk and white–tailed deer. Mule deer and elk tend to use the lower, open elevations of the project in winter and higher elevations the rest of the year. White–tailed deer, whose numbers are much smaller, tend to stay near permanent cover such as that provided by riparian vegetation along tributary streams rather than elevation.

Grover (1983) reported deer and elk numbers had been increasing in game management units for about the last 15 years. This was especially true of elk which, in Oregon at least, were increasing at the expense of mule deer due to competition for forage. In 1993 Oregon Department of Fish and Wildlife reported deer numbers were on the decline. Predation is felt to be the suspected cause of this decline (pers. comm. Jack Melland, 1993).

Black bear occur throughout the area and cougar have been reported to use the lower end of the reservoir. They are probably present along the reservoir in the highest numbers during the winter, when deer move to the lower elevations. They have also been reported using Douglas hackberry and riparian vegetation along tributary streams.

Amphibians and Reptiles

A literature search for amphibians and reptile information was incomplete for this river segment. However, the western toad (Bufo boreas) is a species that is believed to occur in this area. Documented breeding sites contain warm shallow edges of lakes. Toads appear to be declining in North America, especially in the west. Very little is known of life histories, habitat requirements or presence/absence. Another amphibian, the spotted frog (Rana pretiosa) is also suspected to occur. They are associated with warm, shallow water, the same habitats that are preferred by the introduced bullfrog which is commonly thought of as being an efficient predator of the native spotted frog. Very little field data are available for this species. Preliminary analysis indicates that the proposed strategies should not change their existing habitat.

Endangered, Threatened, and Sensitive Species

The bald eagle and the peregrine falcon are the only threatened or endangered species expected to occur on the Brownlee Project. The endangered peregrine falcon formerly nested in Hells Canyon and has been sighted in the Hells Canyon Dam area, where suitable nesting cliffs exist. However, no nesting is known to occur in the canyon at present. Efforts to augment the peregrine population through captive propagation continue.

Bald eagles are listed as endangered in Idaho and threatened in Washington and Oregon. The Brownlee/Oxbow/Hells Canyon Complex is an important wintering area for bald and golden eagles. Asherin and Claar (1976) found that wintering bald eagle use peaks in February. Isaacs (1991) reported 52 eagles counted in Oregon along

Brownlee during the 1991 Midwinter Bald Eagle Survey. Bald eagles usually leave the area by late April.

Table 2–1 on page 2–56 below was produced by the USFWS and provides additional ESA information for the Brownlee Reservoir area.

2.2.11 Oxbow and Hells Canyon Dam Reservoirs

Short–term Operational Limits	
Oxbow Dam and Lake	
Lake Elevation	
Normal full pool	1,805 ft
Minimum pool	1,795 ft
Active capacity	11,000 AF
Discharge	
Minimum	No limit
Tailwater	No limit
Hells Canyon Dam and Lake	
Lake Elevation	
Freeboard	1,695 ft
Maximum	1,693 ft
Normal full pool	1,688 ft
Minimum pool	1,678 ft
Discharge	
Minimum	5,000 cfs
Tailwater	3

Oxbow and Hells Canyon Reservoirs are hydroelectric facilities located along the Snake River near Halfway, Oregon. The dams are part of three hydroelectric facilities often referred to as the Hells Canyon Complex. The other dam making up the Complex is Brownlee.

Oxbow and Hells Canyon dams, completed in 1961 and 1964 respectively, are owned and operated by Idaho Power Company. The primary purpose of the dams is power generation. However, flood control and recreation are other project functions. Other uses of the projects and surrounding area include water budget releases to assist in anadromous fish runs, livestock and wildlife forage production, ranching, farming, and some dispersed residential development (Asherin and Claar, 1976).

Oxbow is located at Snake River RM 271, approximately 12 miles downstream of Brownlee and 22 miles northeast of Halfway, Oregon. The storage created by Oxbow Dam, which extends to the tailwater of Brownlee, is quite limited. As such, the generation at Oxbow is determined by current or expected generation levels at Brownlee. Hells Canyon Dam is located downstream of Oxbow (about 24 miles) at Snake River RM 247.6. It too has very limited storage, so the power plant is operated in conjunction with the other two plants. Brownlee serves as the principal storage system, while Oxbow and Hells Canyon function with shorter retention periods.

This area is typically hot and dry in the summer with mild winters. Winter conditions tend to be milder than those of adjacent uplands. Precipitation falls most heavily in the late fall–winter and spring periods (Asherin and Claar, 1976).

2.2.11.1 Physical Habitat

Barren Zone

Ten percent of the shoreline of Oxbow and over 40 percent of Hells Canyon Reservoir is roadfill material due to the close proximity of the road that runs the entire length of these two reservoirs. Hells Canyon and Oxbow undergo very little fluctuation. They are narrower, which probably reduces the amount of waves created by wind, and they have rocky shorelines. Shoreline erosion in these two reservoirs is negligible when compared to Brownlee Reservoir (Asherin and Claar, 1976).

Table 2–1. Federally Listed and Proposed Endangered and Threatened Species and Candidate Species: Snake River from Brownlee Dam to the Oregon/Washington Border (1–7–93–SP–383)

LISTED SPECIES			
Birds			
Peregrine falcon	*Falco peregrinus*	D	LE
Bald eagle	*Haliaetus leucocephalus*	D	LT
Fish			
Chinook salmon	*Oncorhynchus tshawytscha*	D	LT
Spring/summer/fall runs in the Snake River. (Petitioned June 7, 1990; proposed June 27, 1991 in SGFR 29542–29544; listed April 22, 1991 in 57 FR 14G53)			
Snake River sockeye salmon	*Oncorhynchus nerka*	D	LE
Salmon River Tributary to the Snake River, Idaho. (Petitioned Aprinl 2, 1990; proposed April 5, 1991 in 56 FR 14055; listed November 20, 1991 in 56 FR 5b619)			
Plants			
MacFarlanes' four o'clock	*Mirabilis macfarlanoi*	D	LE
PROPOSED SPECIES			
None			
CANDIDATE SPECIES			
Mammals			
North American lynx	*Felis lynx canadensis*	S	C2
California wolverine	*Gulo gulo luteus*	S	C2
Pacific fisher	*Martes pennanti pacifica*	S	C2
Pacific western big–eared bat	*Plecotus townsendii townsendii*	D	C2
Long–eared myotis (bat)	*Myotis evotis*	S	C2
Long–legged myotis (bat)	*Myotis volans*	S	C2
Yuma myotis (bat)	*Myotis yumanensis*	S	C2
Pale Townsend's big–eared bat	*Plecotus townsendii townsendii*	S	C2
Washington ground squirrel	*Spermophilus washingtoni*	D	C2
Birds			
Northern goshawk	*Accipiter gontilia*	S	C2
Ferruginous hawk	*Suteo regalis*	S	C2
Western burrowing owl	*Athene cunicularia hypugea*	D	C2
Plants			
Hazel's prickly–phlox	*Leptodactylon pungens ssp hazeliae*		C2
Amphibians and Reptiles			
Tailed frog	*Ascaphus truel*	S	C2
Spotted frog	*Rana pretiosa*	S	C1
Fish			
Bull trout	*Salvelinus confluentus*	S	C1

E – Endangered
T – Threatened
S – Suspected
D – Documented
C2 – Information indicated listing as T or E may be appropriate, but is inconclusive presently.

Upland and Riparian Zones

The predominant vegetation types along Oxbow Reservoir are antelope bitterbrush and Douglas hackberry. The antelope bitterbrush vegetation type forms an open shrub layer dominated by bitterbrush with smooth sumac and blue elderberry. Cheatgrass dominates the herbaceous layer, with other herbaceous species occurring in the area being common components. The Douglas hackberry vegetation type occurs primarily on the upper end of Oxbow Reservoir where the current pool level does not reach the old natural river high water mark. Narrow bands of this type line the riverbanks above the highwater mark. Blue elder is an important constituent of the overstory, which is dominated by hackberry. The understory is a grassland type community. Minor amounts of Ponderosa pine/bluebunch wheatgrass, blue elder, cheatgrass grassland, and shrub willow vegetation types occur throughout the area around the reservoir, depending on site specific conditions.

From Oxbow Dam to Hells Canyon Dam, the predominant vegetation type is bluebunch wheatgrass/ sandberg bluegrass. Much of Oxbow's shoreline is rightful and talus slopes. White sweetclover dominates on these previously disturbed areas. Foxtail barley, cheatgrass, yarrow, alfalfa, and curley dock are also common on these sites.

Emergent/Submergent Aquatic Plant Bed Zone

Emergent vegetation is limited by the steep topography in the area and the fluctuating water levels. High water temperatures and poor water quality at Brownlee Reservoir causes algal blooms and encourages the growth of emergent and submerged rooted plants along the shoreline and in bays created by tributary inflows (Goodnight, 1971). To what degree Oxbow and Hells Canyon reservoirs experience the problems of Brownlee is unknown. However, it is visually apparent that Oxbow and, to a certain degree, Hells Canyon, have lower levels of primary productivity. Water retention in these two reservoirs is much less than Brownlee, which means nutrients will be less available and more dilute, and thermal stratification may not occur (Asherin and Claar, 1976).

Island Habitat

Total island acreage is minimal for Oxbow Reservoir at .5 acres. Hells Canyon Reservoir has almost 28 acres, most of which is bluebunch wheatgrass–sanberg bluegrass type vegetation (Asherin and Claar, 1976).

Fish Productivity Zone

Following the completion of the three dam complex (Hells Canyon, Oxbow, and Brownlee) and the elimination of attempts to pass migrating salmon through, two general types of fisheries were developed: warm–water and cold–water fisheries. These reservoirs favor the growth of warm–water fish species, but support cold–water fish as well. Smallmouth bass and channel catfish seem to dominate the warm–water fishery, while rainbow trout dominate the cold water fishery.

Benthic Invertebrate Productivity Zone

Appropriate references were unavailable, although preliminary analysis indicates the proposed strategies are unlikely to change the existing benthic environment. Benthic life in Oxbow and Hells Canyon dams is restricted by annual drawdowns. Insect larvae and crayfish are present along with other species.

Human Effects

Except for a few small communities, residences are widely scattered. Growth of this area is slow and tourism/recreation seems to be the economic mainstay. Water–related recreation makes up the bulk of human activity on these reservoirs. Hells Canyon, Copperfield, and McCormack Parks are the developed sites. Several roadside pull–offs exist for day use and dispersed camping opportunities.

2.2.11.2 Wildlife

Waterfowl

Asherin and Claar (1976) reported that at least 30 species of waterfowl use the Snake River between Asotin, WA and Weiser, ID during some time of the year. Of these, six species are known or suspected to be nesting in the area. These include Canada

goose, mallard, pintail, American wigeon, green-winged teal, and common merganser. Surveys of the Hells Canyon and Oxbow reservoirs identified common mergansers brooding on these projects. A wintering waterfowl survey conducted in January of the same area showed grebes, mallards, goldeneyes, and mergansers using the reservoirs. Mergansers and goldeneyes were the most common.

Colonial Nesting and Shorebirds

The most common colonial nesting/shorebirds found in the project area are the great blue heron, killdeer, spotted sandpiper, American avocet, and ring billed and California Gulls. No breeding colonies of gulls or terns were found in the area when Asherin and Claar completed their survey in 1975. However, ring billed, California, and herring gulls, and Caspian, common, and Forster's terns were sighted in the project area during the nesting season.

Nongame Birds

Approximately 76 species of passerines are found in and around the project. Some of the more common species include red–winged blackbird, house finch, American goldfinch, and song sparrow. Species of the goatsucker, swift, hummingbird, kingfisher, and woodpecker families are also found around the project. Many of these species are totally dependent on riparian vegetation for food, cover, and nesting. Others, such as the kingbirds, use riparian areas along with surrounding habitat types as well.

Upland Game Birds

Upland game birds occupying all or parts of the reservoirs include chukar, California quail, ring–necked pheasant, gray partridge, ruffed grouse, and mourning dove. Of these, chukar and mourning dove are the most widely distributed. Chukars use a variety of habitats on a daily and seasonal basis, seeking out shady loafing areas during the hottest parts of the summer and depending on tree/shrub riparian habitats in the fall where water is available. Mourning doves are common during all seasons except winter. They occupy all brush/shrub/tree habitats as well as agricultural fields.

Raptors

McKern (1976) noted that Sharp–shinned and Cooper's hawks are commonly found in riparian zones where the small birds they prey on are plentiful. Red–tailed and Swainson's hawks, while using riparian zones for roosting and perching, generally scour upland fields, meadows, and brush fields for rodents. The marsh hawk uses riparian marshes and meadows as well as uplands in foraging. Osprey and bald eagles, dependent on the reservoir for fish, perch and roost in riparian trees. Prairie falcons use cliff ledges for nesting, and like the golden eagle and peregrine falcon, seek food along ridges and slopes above the river. The great–horned owl relies heavily on riparian trees and shrubs for perching and roosting, and on cliffs for nesting. The American kestrel, a tree cavity nester, is more dependent on the riparian zone than the larger cliff nesters.

Aquatic Furbearers

Aquatic furbearers found in the area include the river otter, beaver, and muskrat. Most river otter sightings were in close proximity of Oxbow Reservoir and most likely accounted for one family group.

Terrestrial Furbearers

At least three terrestrial furbearers were identified by Asherin and Claar (1976) to inhabit areas adjacent to the reservoirs. They include the coyote, striped skunk, and the raccoon. The badger, spotted skunk, and the bobcat also occur according to ODFW, but sightings were never made in any of their 1975 and 1976 surveys.

Big Game

Mule deer are by far the most numerous of the ungulates, followed in numbers by elk. White–tailed deer and bighorn sheep are also found, although their numbers are much smaller. Mule deer tend to use the lower, open elevations of the projects in winter and higher elevations the rest of the year (Grover, 1983). Elk winter in this segment usually at higher elevations and prefer the open bluebunch wheatgrass slopes and benches bordered by stands of ponderosa pine. Bighorn sheep were transplanted/released near Hells Canyon Dam in 1971 by Oregon Game Com-

mission (now ODFW). Some of these animals were observed on the Idaho side of the canyon since the transplant which meant they were swimming the river, crossing Hells Canyon Dam on the road, or both (Asherin and Claar, 1976). These sheep eventually disappeared by the 1980s and a second transplant was performed by the State of Oregon (pers. comm Jack Melland, 1993).

Black bear use was noted in the Douglas hackberry and riparian tributary vegetation types. Black bear are infrequently observed in early spring on the open bunchgrass slopes and in the ponderosa pine stands and in the late summer and fall when berry crops are abundant (Asherin and Claar, 1976). Cougar have been sighted in the area, but numbers are small. They are probably present along the reservoirs in the highest numbers when deer move to the lower elevations (CH2M Hill, 1984).

Amphibians and Reptiles

A literature search for amphibians and reptile information was incomplete for this river segment. However, the western toad (Bufo boreas) is a species that is believed to occur in this area. Documented breeding sites contain warm shallow edges of lakes. Toads appear to be declining in North America, especially in the west. Very little is known of life histories, habitat requirements or presence/absence. Another amphibian, the spotted frog (Rana pretiosa) is also suspected to occur. They are associated with warm, shallow water, the same habitats that are preferred by the introduced bullfrog which is commonly thought of as being an efficient predator of the native spotted frog. Very little field data are available for this species. Preliminary analysis indicates that the proposed strategies should not change their existing habitat.

Endangered, Threatened, and Sensitive Species

The bald eagle and the peregrine falcon are the only Federally–listed species expected to occur on the projects. The endangered peregrine falcon formerly nested in Hells Canyon and has been sighted in the Hells Canyon Dam area, where suitable nesting cliffs exist. Efforts to reintroduce the peregrine to this area continue. Since 1987, a cooperative effort between the Peregrine Fund and the states of Oregon and Idaho have released 62 young birds into this area. Although sightings have been limited, mating behavior was recorded in the 1992 breeding season (pers. comm. Phil Mattson, 1993).

Bald eagles are listed as endangered in Idaho and threatened in Washington and Oregon. The Brownlee/Oxbow/Hells Canyon Complex is an important wintering area for bald and golden eagles. Asherin and Claar (1976) found that wintering bald eagle use usually peaks in February. Isaacs (1991) conducted a midwinter bald eagle survey in 1991 along the Oregon side of Hells Canyon and Oxbow reservoirs. Eleven eagles were counted on Hells Canyon and eight were counted along Oxbow's. Bald eagles usually leave the area by late April but there have been summer sightings on Hells Canyon Reservoir. These birds may be summering and nesting in the high country adjacent to Hells Canyon Reservoir (Asherin and Claar, 1976).

Table 2–1, produced by the USFWS, provides additional ESA information for the Hells Canyon Complex area.

2.2.12 Hells Canyon, Snake River

Hells Canyon, or that portion of the Snake River below Hells Canyon Dam, was established as a Wild and Scenic River in 1975 by PL94–199. The river forms the northern portion of the boundary between the states of Oregon and Idaho. It runs north approximately 100 river miles from Hells Canyon Dam to the small Washington town of Asotin where this free flowing stretch of the Snake turns into the upper end of Lower Granite Reservoir. The upper 32 miles, or that portion between Hells Canyon Dam and Pittsburg Landing is designated as Wild River. The thirty six miles downstream of Pittsburg Landing is designated as Scenic River (US Army Corps of Engineers Navigation Charts, 1990).

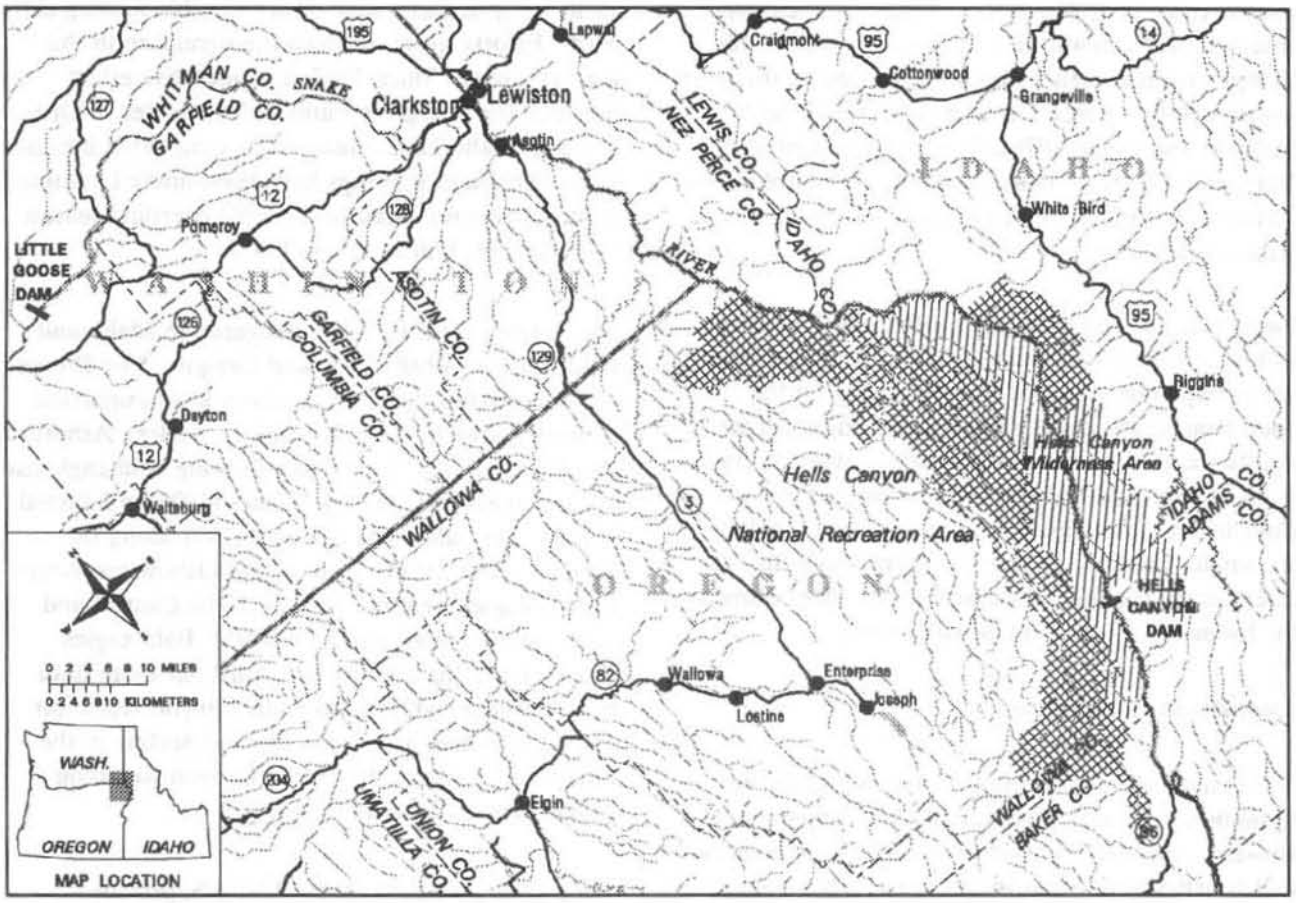

Figure 2–11. Hells Canyon, Snake River

Known as the deepest gorge in North America, this stretch of the Snake River averages about 10 miles from rim to rim and is over 5,000 feet deep in some places. Flows from Hell's Canyon Dam range from 5,000 to 30,000 cfs from the powerhouse. Additional flows are often provided via spill (pers. comm. Dan Sparks, Idaho Power, 1993). Numerous tributaries add additional flow as they enter the Snake River downstream of the dam.

Most of this portion of the Snake River is undeveloped and unroaded. There are two public access roads on the Oregon side and two on the Idaho side. Residences are widely scattered and usually depend on farming or ranching as an economic mainstay. Federal lands make up the majority of this area, and it is heavily used by recreationists.

This area is typically hot and dry in the summer with mild winters. Winter conditions tend to be milder than those of adjacent uplands. Precipitation falls most heavily in the late fall–winter and spring periods (Asherin and Claar, 1976).

2.2.12.1 Physical Habitat

Barren Zone

Layers of rock created by the Columbia River basalt flows have formed steep canyon walls. Several small sandy beaches add variety to the miles of rocky shorelines. These sand bars are decreasing in size and numbers as a result of erosion by the spring runoff, power peaking by the upstream dams, water budget releases, and power boating. In addition, the three upstream reservoirs are trapping sediments

and therefore not allowing new sand bars to form (Asherin and Claar, 1976).

Upland and Riparian Zones

The predominant shoreline vegetation type from Hells Canyon Dam to the mouth of the Salmon River is Douglas hackberry (McKern, 1976). Blue elderberry is found upstream near the Hells Canyon dam but is not found further downstream. Douglas hackberry types may range from an open savanna community to a closed thicket along the shoreline. The open, savanna type may have a serviceberry and mockorange understory, with cheat grass, sand dropseed, or bluebunch wheatgrass in the herbaceous layer (depending on moisture, topography, and grazing). The dense shoreline communities often contain mulberry and Pacific willow in the overstory, and a diverse herbaceous layer of starry cerastium, western scouringrush, American licorice, sunflower, hoarhound cocklebur, poison oak, sand dropseed, red threeawn, giant wildrye, and cheatgrass. These communities often represent an earlier successional stage, rather than open savannas, because of poorer soil development.

The Louisiana sagebrush vegetation type forms a minor component of the total shoreline. This type occurs below the high water line on cobblestone bars, reaching maximum development late in the year. Hairy goldenaster, willow, storkskill, sand dropseed, and red threeawn are the most common components of the type in addition to the dominant Louisiana sagebrush. In some areas, no shrub layer exist and the herbaceous layer is more diverse.

Ponderosa pine/Douglas hackberry vegetation type is another minor component of the shoreline miles. Bluebunch wheatgrass/sandberg bluegrass occurs frequently from Pittsburg Landing to the confluence of the Salmon–Snake Rivers. Minor patches of serviceberry–dominated shrub thickets occur downstream of Pittsburg Landing. Serviceberry usually occurs as scattered individuals in other shrub communities (CH2M Hill, 1984).

The only plant species Federally–listed for this area is McFarlane's four–o'clock. It is restricted to the Snake River canyon and its major tributaries (USFS, 1979).

Emergent Wetland Zone

Measurable quantities of emergent wetland habitat do not occur along this area of the Snake River.

Submerged Aquatic Plant Bed Zone

Aquatic vegetation has very limited distribution because of fluctuating water levels (McKern, 1976).

Island Habitat

Island habitat is minimal and is limited to the lower stretch between Pittsburg Landing and Asotin, WA. There is little difference between the vegetation found on these islands and that found above the high water mark along the adjacent shorelines.

Fish Productivity Zone

The Snake River in Hells Canyon supports populations of fish species that have regional, national, and even international importance. Of particular significance are the Snake River spring, summer, and fall chinook, which are Federally–listed as 'threatened,' and sockeye salmon which are Federally–listed as 'endangered' under the Endangered Species Act. The area supports both a warm water and cold water fishery for recreationists. Important fish species found in these two popular fisheries include steelhead, rainbow trout, white sturgeon, channel catfish, and smallmouth bass.

Benthic Invertebrate Productivity Zone

Benthic invertebrates should not be affected by any of the proposed alternatives.

Human Effects

Recreation in Hells Canyon is the primary human use potentially effecting the system. The Snake River corridor within the Hells Canyon National Recreation Area is designated as a Wild and Scenic River, which attracts increasing numbers of people on an annual basis.

2.2.12.2 Wildlife

Waterfowl

Canada geese, mallards, pintails, gadwalls, American wigeons, northern shovelers, green–winged teal,

blue–winged teal, cinnamon teal, wood ducks, redheads, canvasbacks, common and Barrow's goldeneye, ruddy ducks, common mergansers, and American coots are suspected to occur in Hells Canyon. Although Canada goose, mallard and common merganser broods were the only broods observed, pintails, American wigeon, and blue and green winged teal are suspected to nest in the canyon.

Canada goose nesting activity in Hells Canyon is widely scattered and erratic from year to year. Upper canyon nesting is usually always found to be on cliffs. This is mainly due to the lack of islands on the upper end of Hells Canyon and the numerous available cliffs in this stretch. The lower canyon does provide island nesting habitat, and geese take advantage of the islands available (Asherin and Claar, 1976).

Colonial Nesting and Shorebirds

The most common colonial nesting/shorebirds found in the project area consist of the great blue heron, killdeer, spotted sandpiper, American avocet, and ring billed and California Gulls. No breeding colonies of gulls or terns were found in the area when Asherin and Claar completed their survey in 1975. However, ring billed, California, and herring gulls, and Caspian, common, and Forster's terns were sighted in the project area during the nesting season.

Nongame Birds

Approximately 76 species of passerines are found in and around the project. Some of the more common species include red–winged blackbird, house finch, American goldfinch, and song sparrow. Species of the goatsucker, swift, hummingbird, kingfisher, and woodpecker families are also found around the project. Many of these species are totally dependent on riparian vegetation for food, cover, and nesting. Others, such as the kingbirds, use riparian areas along with surrounding habitat types as well.

Upland Game Birds

Chukar partridge is one of the most sought after small game birds in Hells Canyon. Abundance of cheatgrass brome, steep rocky brushfields, and Douglas hackberry contribute to excellent chukar and gray partridge (also called 'Huns') habitat. These habitats also contribute to the well being of both the California and mountain quail (USFS Hells Canyon NRA, Final EIS, 1979). Mourning doves are also common except during winter months when most migrate south for the winter months. Ring–necked pheasant and ruffed grouse are also found, though populations are generally smaller (McKern, 1976).

Raptors

The following birds of prey are known to occur in this free flowing stretch of the Snake River: Goshawk, Cooper's hawk, sharp–shinned hawk, northern harrier, rough–legged hawk, red–tailed hawk, Swainson's hawk, osprey, golden eagle, bald eagle, prairie falcon, American kestrel, long–eared owl, screech owl, and great–horned owl. A nesting survey completed by Asherin and Claar in 1974 and 1975 identified the American Kestrel as the most common nester in this group with 37 occupied territories. Eight occupied nesting territories of red–tailed hawk were also found as well as three golden eagle eyries, one prairie falcon eyrie and one suspected marsh hawk nesting territory. This data represents minimum numbers at best (Asherin and Claar, 1976). The peregrine falcon, a Federally–listed endangered species, has been known to nest in this area. Since 1987 the Peregrine Fund, the states of Idaho and Oregon, and the US Forest Service have cooperated in a successful release of 62 young peregrines in the canyon. Although observations have been limited, mating behavior was recorded during the 1992 breeding season (pers. comm. Phil Mattson, 1993).

Aquatic Furbearers

Aquatic furbearers consist of beaver and river otter. Neither are very common.

Terrestrial Furbearers

Five terrestrial furbearers were identified by Asherin and Claar (1976) to inhabit Hells Canyon. They include the bobcat, coyote, striped skunk, raccoon, and long–tailed weasel. Badger and spotted skunk are suspected to occur, but sightings were never

made in any of their surveys. Coyotes and raccoons seemed to be the most common.

Big Game

Mule deer are by far the most numerous of the big game species in Hells Canyon, followed by Rocky Mountain elk and white–tailed deer. Hells Canyon is a primary wintering area for these species. They will normally move up in elevation in the spring as green–up occurs. White tailed deer may be the exception. They seem to be found mostly north of Granite Creek and are more closely associated with riparian areas than are mule deer and elk. They do not tend to winter on the open, lower slopes, but rather stay near permanent cover types provided by riparian vegetation along tributary streams.

Bighorn sheep and mountain goats are also found in the Hells Canyon reach of the Snake River. These populations are the result of reintroduction efforts in Oregon, Idaho, and Washington. Sheep and goats often occupy the rock cliffs and bluebunch wheatgrass/sandberg wheatgrass vegetation types located above the river.

Black bear use was noted in the Douglas hackberry and riparian tributary vegetation types. Black bear are infrequently observed in early spring on the open bunchgrass slopes and in the ponderosa pine stands and in the late summer and fall when berry crops are abundant (Asherin and Claar, 1976). Cougar have been sighted in the area but numbers are small. They are probably present along the reservoirs in the highest numbers when deer move to the lower elevations (CH2M Hill, 1984).

Amphibians and Reptiles

A literature search for amphibians and reptile information was incomplete for this river segment. However, the western toad *(Bufo boreas)* is a species that is believed to occur in this area. Documented breeding sites contain warm shallow edges of lakes. Toads appear to be declining in North America, especially in the west. Very little is known of life histories, habitat requirements or presence/absence. Another amphibian, the spotted frog *(Rana pretiosa)* is also suspected to occur. They are associated with warm, shallow water, the same habitats that are preferred by the introduced bullfrog which is commonly thought of as being an efficient predator of the native spotted frog. Very little field data are available for this species. Preliminary analysis indicates that the proposed strategies should not change their existing habitat.

Endangered, Threatened, and Sensitive Species

Bald eagles, which are Federally–listed as threatened, winter along the Snake River. They may be observed roosting or feeding from October through May. Probable food items include fish, waterfowl, and carrion. Bald eagle numbers were estimated for this area in 1991 to be 76 birds (Isaacs, 1991).

The peregrine falcon is also a Federally–listed species. It is listed as endangered and was most likely no longer a resident of Hells Canyon at one point (USFS Hells Canyon NRA, Comp. Mgt. Plan, 1979). Efforts began in 1987 to reintroduce the peregrine into the area. More information is in the 'Raptors' discussion above.

Table 2–1, produced by the USFWS, provides additional ESA information for the Hells Canyon area.

2.2.13 Dworshak Project

Short–term Operational Limits	
Lake Elevation	
Full Pool	1,600 ft
Minimum Pool	1,445 ft
Discharge	
Minimum	1,000 cfs
Maximum weekly average (Oct. 1–Nov. 15	inflow + 1,300 cfs
Rate of change (Peck Gauge)	
Hourly	1 ft
24–hour (Oct.1–Nov. 15)	40 percent of previous weekly avg. outflow
Downstream flood control limit Clearwater River at Spalding	
Bank full	85,000 cfs
Flood stage	105,000 cfs
Lewiston levee capacity	150,000 cfs

The Dworshak Project is located on the north fork of the Clearwater River near Orofino, Idaho. The Nez Perce Tribe has particular interest in this project, as it is within their reservation. Also, the project controls a significant portion of the flows of the Clearwater River.

2.2.13.1 Physical Habitat

Barren Zone

Dworshak Project is a storage reservoir capable of a 155– foot drawdown. Rate and amount of drawdown and refill vary annually depending on environmental conditions. Typically the reservoir is managed to be full in July and drawn down during fall and winter reaching its lowest level by April. This operation pattern has caused Dworshak to exhibit typical characteristics for a storage reservoir: barren rocky slopes below high pool, devoid of soil and vegetation. Any significant erosion and landslide activity has already occurred from this repeated operation. Recent operations have included provision of additional flows for downstream fish passage, contributing to faster drawdown rates. However, this and future modifications of the like would not be expected to have any type of impact on existing conditions.

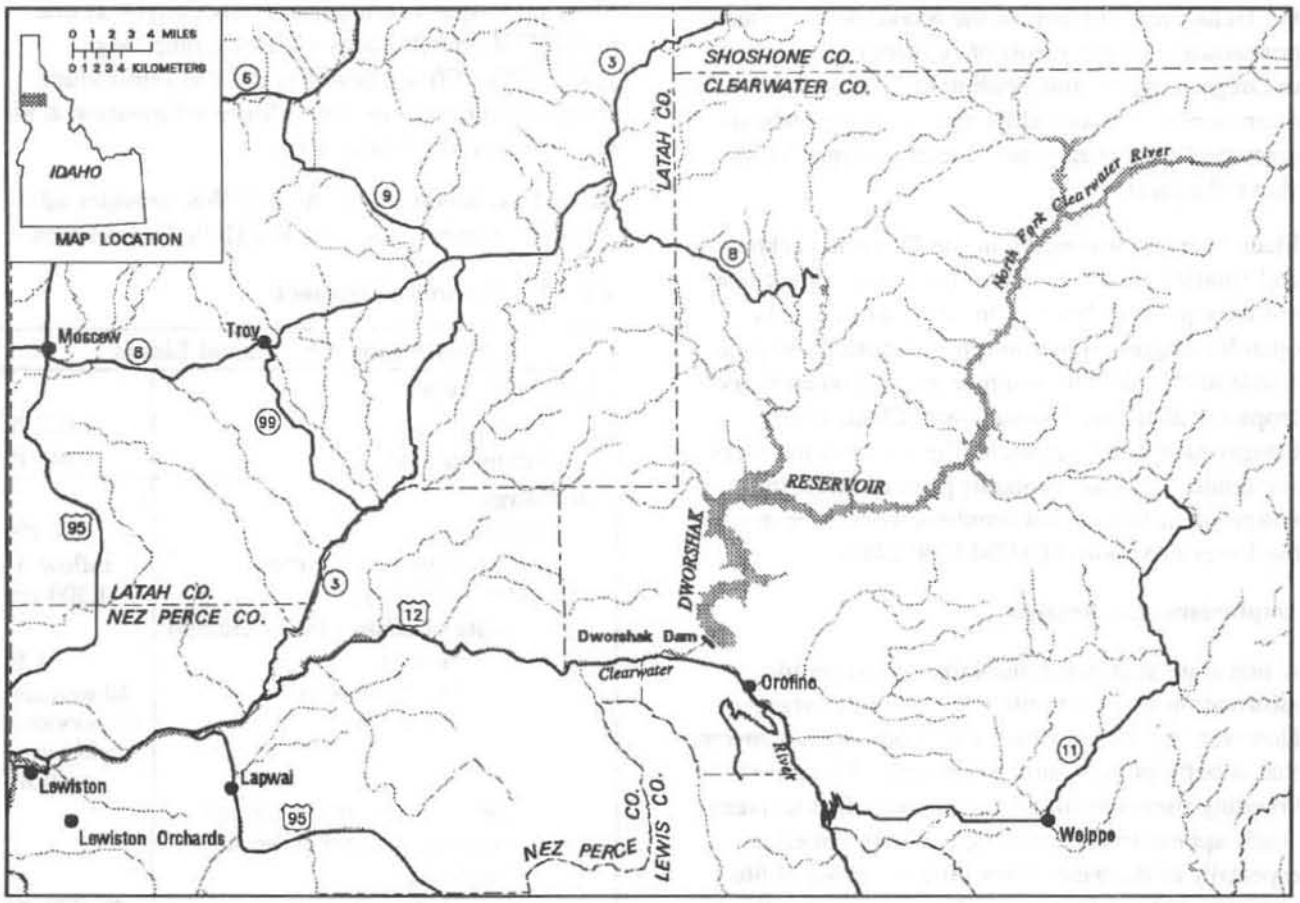

Figure 2–12. Dworshak Project and Lower Clearwater River

Upland Zone

The lands surrounding the reservoir are dominated by an open coniferous habitat type dominated by Douglas–fir and ponderosa pine associations along the lower end, transitioning to dense stands of Douglas–fir and cedar/hemlock toward the stream end of the pool. Generally, the more dense cover types characterize the north facing slopes while the south facing slopes contain open ponderosa pine stands, brush fields and meadows. Dominant shrubs include mallow ninebark, creambrush oceanspray, mockorange, common snowberry, serviceberry and thimbleberry. Grasses include bluebunch wheatgrass, cheatgrass brome, Kentucky bluegrass, orchardgrass and timothy. Maidenhair fern is a dominant and aggressive colonizer that occurs throughout the area, typically invading areas that have been disturbed sites.

According to cover mapping completed by an interagency team for a habitat loss assessment conducted on Dworshak, the following acreages of upland habitat types were determined: grass/forb (1,879); deciduous shrubland (6,882); evergreen forest open (570), dense (19,546), old growth (1,878); urban and developed (76); barren land (20). Approximately 3,795 acres have been clearcut and burned by the Corps of Engineers to create brushfields for wintering elk. Providing this browse for elk has been conducted under agreement with the Idaho Department of Fish and Game.

These habitat types have no dependence on the amount of water contained within the reservoir. Therefore, regardless of future operations, any changes in these habitats will be due to natural environmental influences, succession, and mitigation or timber management.

Riparian Zone

Very little riparian vegetation exists under current conditions. Deciduous scrub–shrub habitat that existed pre–project (104 acres) was inundated on completion of the project. Some deciduous forest is present (41 acres) associated with tributaries and springs. This habitat is dominated by red alder. Some relatively flat shelves, mostly associated with tributary deltas, support a 'green–up' of herbaceous vegetation in the spring. Riparian vegetation would not be expected to be affected by any type of drawdown regime.

Emergent Wetland Zone

Virtually no mappable emergent wetlands have existed, either pre–project or currently. This habitat type would not be expected to develop under future drawdown operations.

Submerged Aquatic Plant Bed Zone

No submergent aquatic plants of significance exist, nor would they be expected to develop under future drawdown operations.

Island Habitat

No islands exist or become exposed within the normal drawdown zone.

Fish Productivity Zone

The reservoir is presently populated with 18 species of fish, three of which were introduced into the drainage. Smallmouth bass were introduced, and kokanee have been heavily stocked since 1972. In 1979, some catches of northern pike were reported. Reservoir stocking of catchable and fingerling rainbow trout and kokanee is done on an annual basis. Cutthroat trout, steelhead, and smallmouth bass have been periodically released. The program for fishery mitigation includes stocking the reservoir annually with 100,000 pounds of fish. Future existing drawdown operations are not expected to impact the existing fishery.

Benthic Invertebrate Productivity Zone

Any benthic populations would be associated with tributaries and therefore not expected to be impacted by future drawdown operations.

Human Effects

Dworshak project and reservoir receives summer boating, fishing, and camping activity. Scattered campgrounds throughout the project are used in summer by recreationists and in the fall by hunters. Density of recreationists to water and land acreage

is relatively low. Future existing operations oriented toward achieving full pool during the summer recreation period would not change this use. Some additional use may be experienced in the future if this area experiences a general increase in human population. Fall use by hunters would remain unaffected.

2.2.13.2 Wildlife

Waterfowl

Some nesting wood duck, mallard and common merganser occurs on the reservoir in association with the tributaries at the upper end of the reservoir. The reservoir is used as a stop–over mainly during spring migration.

Colonial Nesting Birds

Great blue heron can be observed along the reservoir, occurring primarily in association with the tributaries and upper reservoir area.

Shorebirds

The following have been observed along the reservoir: common snipe, marbled godwit, solitary sandpiper, American avocet and killdeer. Killdeer is probably the only species that potentially nests on the project. Most shorebird use is confined to the tributaries and upper end of the reservoir.

Nongame Birds

Downy woodpeckers and black–capped chickadees nest and feed in the riparian forested areas. These and other species are dependent on creation of snags to provide suitable nest sites.

Raptors

Wintering Bald Eagle. These birds are know to winter along the reservoir, their highest concentration occurring immediately downstream of the dam. From 12 to 25 have been counted in the past. Raptors feed primarily on fish and also use ducks and carrion when available.

Osprey. These birds are common nesters along the reservoir. They feed exclusively on kokanee, trout and other available fish species.

Aquatic Furbearers

River otter and related species are confined to the upper reservoir and tributaries.

Terrestrial Furbearers

Due to the forested and more heavily vegetated nature of this project area, and given these species are not riparian–dependent, impacts due to future drawdown operations are probably nonexistent.

Big Game

Rocky mountain elk. Over 1000 elk have been observed wintering on project lands. Mitigation actions have been taken to assure sufficient browse is available to sustain them. While not dependent on the reservoir or riparian areas, the reservoir creates a hazard due to formation of ice. Depending on environmental conditions, it is not unusual to observe animals having broken through the ice and drowned.

White–tailed deer. Significant numbers of white–tailed deer also winter along the reservoir. Ice poses a hazard to these ungulates as well. Coyotes have been known to chase deer onto the ice facilitating their predation.

Amphibians and Reptiles

Several amphibian and reptile species occur in the area in association with shallow water areas, pools, shallow lake edges, or upstream tributaries. Bull frog, tree frog, and spotted frog occur in association with submerged aquatic vegetation or seasonal emergent wetlands and ponds. Long–toed salamander and western toad occur in seasonal wetlands or scrub–shrub wetlands. At higher elevations, tailed frogs occur in riffles and pools of tributary streams. The Coeur d' Alene salamander is a state species of special concern and occurs in the upper reaches of the Dworshak reservoir (S. Stephens, ICDC, pers. comm.).

Benthic Invertebrates

Due to the magnitude of drawdown, the reservoir is likely devoid of benthic fauna. However, some benthics are associated with the tributary areas and uppermost portion of the reservoir. Their occurrence would not change under future drawdown operations.

Endangered, Threatened, and Sensitive Species

Plants	
Broad–fruited mariposa	federal candidate 1
Jessica's aster	federal candidate 2
Birds	
Bald eagle	federal endangered
Mammals	
Gray wolf	federal endangered
Amphibians and Reptiles	
Coeur d' Alene salamander	Idaho state species of concern
Western toad	Idaho state species of concern
Spotted frog	Idaho state species of concern
Fish	
Chinook salmon	federal endangered
Bull trout	federal candidate 1

2.2.14 Lower Clearwater River

The Lower Clearwater River extends from the junction of the north and main forks of the Clearwater River to its junction with the Snake River at Lewiston, Idaho. The Nez Perce Tribe have a major interest in this reach of the river as it flows through their reservation and is a resource for the tribe.

2.2.14.1 Physical Habitat

Barren Zone

Water level fluctuations along the lower Clearwater River are regulated by outflow from Dworshak Dam. Peak flows occur in May with the spring freshet. Although this was also the case prior to operation of Dworshak Dam, the magnitude of the freshet was greater, causing bank and island scouring. These same islands are more stable today as is the riparian growth along the banks.

Average seasonal stage height fluctuation is about seven feet as measured at the Spalding gauge. Lowest flows are observed in August when Dworshak is still maintained for recreation. While the difference between highest and lowest flows is less today, an increase in daily fluctuations during releases from Dworshak have been observed. The water temperature regime has also been affected as cooler water than would normally be experienced is released from the lower depths of the reservoir upstream.

Upland Zone

The river is bounded by a road on one side and a railroad on the other. In many places there is only rock riprap between these transportation corridors and the river. Most of the upland vegetation consists of grasslands dominated by cheatgrass brome and perhaps some native bunchgrasses in places such as bluebunch wheatgrass. Ponderosa pine commonly occurs in association with the grassland.

Riparian Zone

Approximately 37 percent of the river bank is occupied by coyote willow (859 acres). Mixed deciduous shrub (26 acres) and deciduous forested wetland (97 acres) typical of that described for the lower Snake River also occur. These latter types were not nearly as predominant prior to construction of Dworshak Dam when high flood flows and ice scouring maintained vegetation in early successional stages.

Emergent Wetland Zone

Some emergents occur in small backwater pockets and narrow bands too small to be mappable.

Submerged Aquatic Plant Bed Zone

Little if any of this plant type is associated with a free–flowing river.

Island Habitat

Numerous islands totaling 243 acres are present. These islands are more stable since operation of Dworshak Dam. Many support deciduous forested

wetland (11 acres total). They are used by waterfowl, deer, furbearers, raptors, songbirds and any other wildlife that can reach them.

Fish Productivity Zone

Changes in relative abundance of game and rough fish have been observed since the operation of Dworshak Dam. Gordon, et. al. (1970) predicted the demise of the resident smallmouth bass population based on the decline in summer water temperature induced by regulated hydroelectric flows released from Dworshak Dam. Petit (1976) reported that by 1975 the sizable smallmouth bass population in the Clearwater River was reduced to a remnant of the pre–impoundment (1969) population. Further surveys of the river revealed a greater number of rough fish, much greater than the number of smallmouth bass and trout (Fleck et.al., 1978).

Benthic Invertebrate Productivity Zone

The composition and ecology of the benthic community is in question. The increased velocities and the sharp temperature and flow fluctuations resulting from operation of Dworshak Dam might affect the resident insect populations with subsequent adverse effects on resident fish (Fleck et.al., 1978). A study by MacPhee and Brusven (1973) indicated that hydroelectric peaking–induced flow fluctuations could change community structure to a less stable community marked by fewer species, changes in dominance, relationships among species, and changes in the available energy for higher trophic levels. However Brusven et. al. (1975), reported no major shifts in community structure during the pre– and post–impoundment period at several sites on the Clearwater River and below the confluence of the North Fork of the Clearwater River.

Human Effects

Aside from the occurrence of the road and railroad, there are several dwellings and homesteads scattered along the river. Some prominent beach areas are heavily used by recreationists, and fishing and boating are common along its entire length.

2.2.14.2 Wildlife

Waterfowl

Canada Goose

(1) Nesting: The number of nesting geese on downstream islands of the lower Clearwater has tripled since 1981. As many as 82 nesting structures have been erected in recent years to protect geese from high flows and predation. Approximately 50 percent of the structures are used. In addition, an average of 25 ground nesters have been successful.

(2) Brooding: Most brooding likely occurs within the lower reach under reservoir influence on a combination of managed and naturally vegetated sites. The Corps maintains and irrigates two pastures in this and other agricultural areas.

(3) Wintering: Some geese may winter along the reservoir–influenced portion of the river, but the vast majority of goose wintering occurs on Lower Granite Reservoir below Clarkston.

Common Merganser

(1) Nesting: A minimal amount of nesting occurs on the islands.

(2) Wintering: Prior to operation of Dworshak, much of this stretch froze in winter. However, this reach now remains ice free and harbors hundreds of wintering ducks.

Colonial Nesting Birds

Great Blue Heron

(1) Nesting: There are no known rookeries along this reach.

(2) Foraging: Great blue herons frequent the shallow water shorelines. It is not understood how or if changes in temperature and flow regimes have altered the potential forage base if any, but adequate forage is still available.

Shorebirds

Spotted Sandpiper

(1) Nesting: Some nesting may occur along limited beach areas and islands.

(2) Foraging: The seven foot annual fluctuation provides many suitable foraging sites for sandpipers along the shoreline.

Nongame birds

Downy Woodpecker

(1) Nesting: Some nesting cavity sites are available in snags amongst clumps of mature cottonwood and willow stands along this reach. Regeneration of this habitat type is limited though, due to attenuation of periodic flood flows. There are 86 acres of this habitat type along the river, and 11 acres on islands within the river.

(2) Feeding: Feeding for this and other gleanor species occurs in this habitat type that provides the highest habitat diversity within this arid ecotype. Most of the species found in this region are dependent on this habitat type for at least a part, if not all, of their life cycle.

Yellow Warbler. This species nests and feeds in the riparian shrub component, primarily associated with the scrub–shrub willow association. This habitat type occurs in small pockets along the river, many too small to be mapped but still having significant food and cover value for many species of wildlife. Approximately 725 acres of scrub–shrub are known to occur along the shorelines and another 134 acres along the periphery of the islands.

Raptors

Wintering bald eagle. Bald eagles winter along the entire reach feeding on fish, waterfowl, and carrion. They tend to concentrate just below the Dworshak Dam site, feeding largely on kokanee that pass through the turbines. Good perch sites are furnished by mature trees, and releases from Dworshak keep the lower Clearwater ice–free throughout the winter.

Aquatic Furbearers

Beaver. Beaver are known to occur throughout the reach, as are mink, muskrat and river otter. No lodges have been constructed in this environment with bank denning being exclusively used. Den sites usually occur in association with well developed riparian habitat. Beaver feed on abundant scrub–shrub willow and the bark of saplings.

River Otter. Otters occur in association with dense riparian, boulder and flood detritus/logjam cover types. Otter feed in the associated shallow water areas and den in previously excavated sites near the water, or within boulder piles, rock outcrops or dense logjam–type litter.

Terrestrial Furbearers

Raccoon. Raccoon are intimately tied to riparian habitat, especially for denning, which includes use of snags, rotted logs, and dense debris. The vast majority of prey items are obtained along the interface of shallow water shorelines and riparian vegetation.

Big Game

Deer. White–tailed deer are more prevalent in this area than mule deer. Most occurrence and use, however, occurs in the side canyons. Asherin and Orme (1978) found very minimal evidence of deer occurrence in either the riparian corridor or on the islands. They suspected this was due to the abundance of water in the side canyons, and the very minimal security cover afforded by narrow bands of riparian vegetation in the riparian corridor.

Amphibians and Reptiles

The Western toad is one of the most abundant amphibians encountered by Asherin and Orme (1978). As is the case with most amphibians, they are closely associated with permanent ponds, usually within forested wetland vegetation adjacent to the river. Long-toed salamanders also occur in these habitats. Bull frog, tree frog, and spotted frog occur in association with submerged aquatic vegetation of seasonal emergent wetlands and ponds. At higher elevations, tailed frogs may occur in pool or riffle habitats. The Western garter snake and ring neck snake (S. Stephens, ICDC, pers. comm.) are reptile species noted to occur in riparian habitats or permanent ponds associated with the river (Asherin and Orme 1978).

Endangered, Threatened, and Sensitive Species

Plants	
Broad-fruited mariposa	federal candidate 1
Jessica's aster	federal candidate 2
Birds	
Bald eagle	federal endangered
Mammals	
Gray wolf	federal endangered
Amphibians and Reptiles	
Ring neck snake	Idaho state species of concern
Western toad	Idaho state species of concern
Spotted frog	Idaho state species of concern
Fish	
Chinook salmon	federal endangered
Bull trout	federal candidate 1

2.2.15 Lower Snake River Projects

Short-term Operational Limits	
Lower Granite Dam and Lake	
Lake Elevation	
Full Pool	738 ft
Minimum Pool	733 ft
Discharge	
Minimum	
December-February	None
March-November	11,500 cfs
Maximum rate of change per hour	70,000 cfs
Little Goose Dam and Lake Bryant	
Lake Elevation	
Full Pool	638 ft
Minimum Pool	633 ft
Discharge	
Minimum	
December-February	None
March-November	11,500 cfs
Maximum rate of change per hour	70,000 cfs
Lower Monumental Dam and Lake Herbert G. West	
Lake Elevation	
Full Pool	540 ft
Minimum Pool	537 ft
Discharge	
Minimum	
December-February	None
March-November	11,500 cfs
Maximum rate of change per hour	70,000 cfs
Ice Harbor Dam and Lake Sacajawea	
Lake Elevation	
Full Pool	440 ft
Minimum Pool	437 ft
Discharge	
Minimum	
December-February	None
March-July	9,500 cfs
August-November	7,500 cfs
Maximum rate of change per hour	20,000 cfs

2.2.15.1 Physical Habitat

Barren Zone

Lower Granite and Little Goose dams operate within a five–foot range; Ice Harbor and Lower Monumental operate within a three–foot range. This has created a small band (primarily within the upper two feet of the operating range) that is periodically and irregularly inundated. The vast majority of this river stretch exhibits relatively steep topography with very few expanses of mudflats. There are only three areas of significant mudflat development at the mouths of tributaries: the Palouse River (RM 59.5), Tucannon River (RM 62) and Deadman Slough (RM 83). One other major tributary, the Clearwater River (RM 140), contributes a significant sediment load, however flows are high in this area and deposition is far enough downstream as to not form mudflats. Erosion, landslides and bank sloughing are accentuated by wind and wave action, and to a certain extent by towboat wakes. Although this is a continual dynamic action, it has been on–going for approximately 20 years and has therefore reached relative stability. Erosion and sloughing occurs, primarily along lower lying benches, and deposition of silts continues at the mouths of the tributaries.

A recent change in operations has included operation of the four reservoirs to within one foot of minimum operating pool (MOP) from April through October. Affects to the physical aspects of the drawdown zone are minimal. Advantages to vegetation are discussed below.

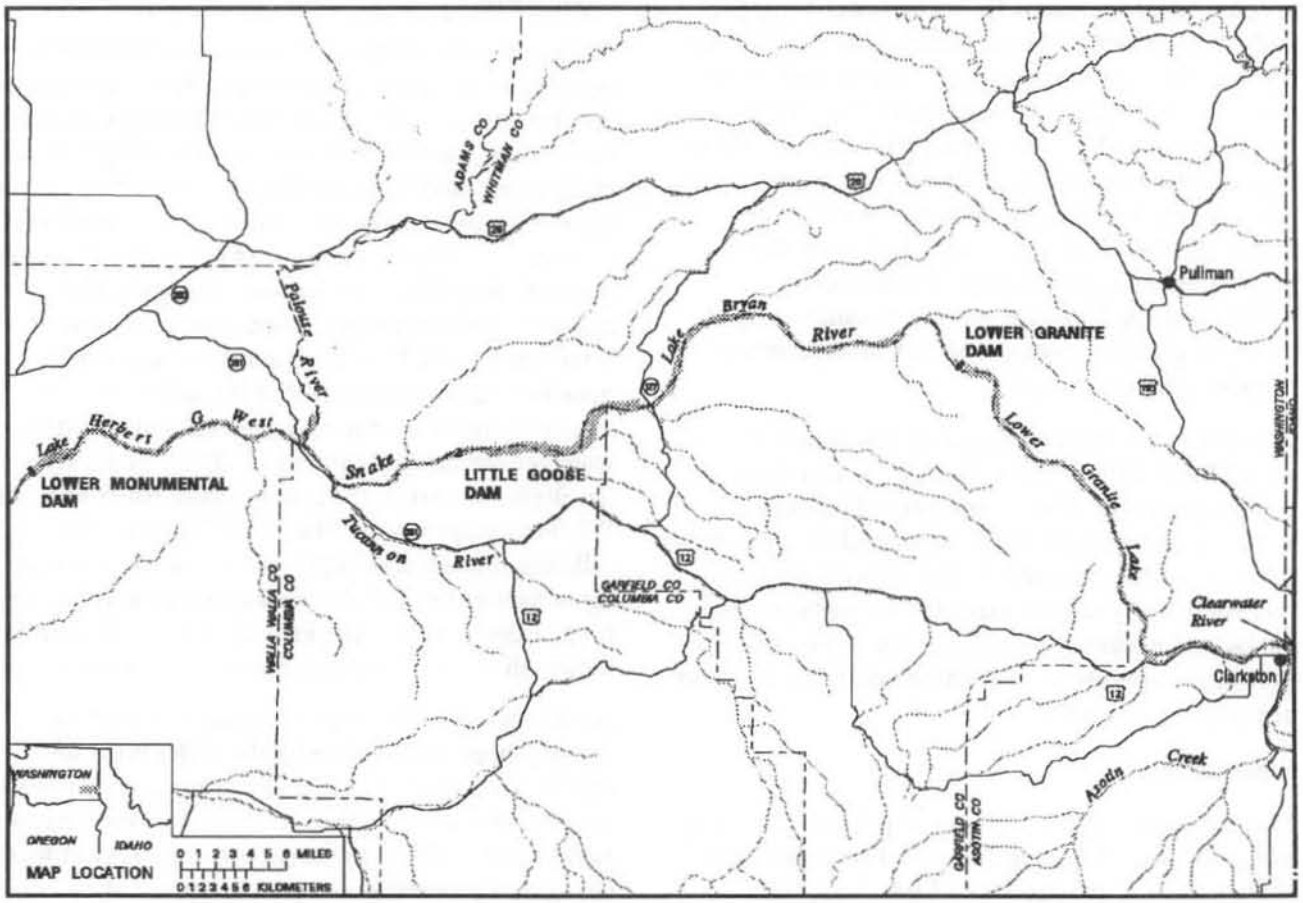

Figure 2–13. Lower Snake River Projects

A 34–foot drawdown of Lower Granite Reservoir, and 13–foot drawdown of Little Goose Reservoir were conducted in March 1992 to test physical impacts and feasibility in attempts to improve flows for juvenile outmigrating salmonids. As expected, significant sloughing of previously submerged sediments and banks was observed. It is almost certain that additional tests of this nature will be undertaken on the same two reservoirs and very possibly on all four lower Snake River reservoirs. Additional significant sloughing and erosion can be expected.

Upland Zone

The upland areas surrounding the projects are typical of the semi–arid Intermountain ecotype which is dominated here by rabbitbrush, cheatgrass and remnant bunchgrasses and forbs. Topographic relief increases from the lower to upper end of this reach reflecting increasing proportions of rock cliff and talus slopes. This upland community is the dominant vegetation type throughout the reach. Fencing of project lands has eliminated cattle grazing on this plant community thus encouraging re– establishment of some of the native plants. There are 13,497 acres of this vegetation type within project boundaries. Approximately 7,436 acres were inundated by the projects. (Above acreages do not include intermingled cliff and talus).

Continued historic operation of the projects would have little if any influence on this vegetation community. If the expected additional testing of drawdowns leads to annual drawdowns throughout the majority of the growing season, this community can be expected to replace some bands and pockets of riparian vegetation that is presently dependent on existing reservoir levels to provide subirrigation.

Riparian Zone

The extent and type of riparian vegetation occurring along this reach is totally dependent on water availability. Prior to construction of the dams, there were approximately 5,201 acres of riparian vegetation. This type included forb areas composed of species such as teasel, curly dock, and water hemlock; shrubland represented by hawthorn, chokecherry, currant and blackberry; scrub–shrub dominated by coyote and other willows; and forested areas dominated by black cottonwood and white alder. Much of this vegetation was found in discontinuous stringers along the main river at the bottom of the canyon. However, much of this habitat type also occurred in the side canyons associated with seeps and springs. Along with an increase in topographic relief from the downstream to the upstream end, there exists a corresponding gradient in precipitation that ranges from approximately nine to 15 inches. Increased precipitation in the upstream reaches affords a higher occurrence of riparian vegetation in the side draws and shallow pockets across the canyon slopes not found further downstream. This change in vegetation frequency becomes evident around RM 85.

Today, approximately 2,123 acres of similar habitat types occur in varying proportions. Species composition has also changed somewhat reflecting intrusion of invader species such as Canada thistle, false indigo, black locust, and Russian olive. The following percent losses have been estimated: Forb – 42 percent; shrub – 29 percent; scrub–shrub – 84 percent; forest – 82 percent. In addition to riparian vegetation that remained relatively undisturbed above the newly established water line, 1,050 acres are supported or have been artificially recreated through the use of irrigation on 10 habitat management units (HMU's) scattered throughout this reach. These areas were developed as part of the Lower Snake River Fish and Wildlife Compensation Plan (LSRFWCP). The following percentages represent the contribution of these habitat types to the total currently existing on all project lands: forb – 69 percent; shrub – 25 percent; scrub–shrub – 33 percent; forest – 28 percent.

An additional 3,434 acres of adjacent lands have recently been acquired under the LSRFWCP and will be developed and managed to support additional riparian vegetation. Under historic operation practices, some additional riparian vegetation, or at least changes in proportion of riparian types, can be expected through natural succession or to additional sediment deposition. The recent operation of the

reservoirs near MOP has shown significant benefits for riparian vegetation, particularly scrub–shrub which has naturally invaded the exposed band of rich sediment and can endure inundation from November through March. Continuance of this operational strategy would reflect additional development of this habitat type. Introduction of additional drawdowns, particularly any of significant length (e.g., April through June) could be devastating to existing riparian vegetation. Removal of water that presently infiltrates the root zone along the existing shoreline would likely cause that vegetation to desiccate and die and likely be replaced by upland vegetation types above high pool. In addition, modifications would have to be made to existing water intakes for irrigation systems presently supporting riparian–type vegetation on the HMU's.

Emergent Wetland Zone

Amount and occurrence of wetland vegetation has increased since project construction. From mapping that was performed in 1989 using 1/2 acre minimum mapping units (from which all acreages were derived for this reach), 44 acres of wetland vegetation now exist. Numerous small pockets of wetland vegetation less than 1/2 acre in size exist in small impoundments behind roads and railroads and small embayments. Vegetation is dominated by cattail with some rushes and sedges.

Little if any change in amount of wetland vegetation would be expected under historic operating conditions. With future operation at MOP during the growing season, a slight increase may be observed, or perhaps just a shift in location of existing wetland areas to slightly closer to MOP elevation with development of more riparian–type vegetation landward. Future operations implementing extended drawdowns would likely exhibit similar effects to those incurred on riparian–types. Long periods of desiccation during the growing season would eliminate this habitat type.

Submerged Aquatic Plant Bed Zone

Extent of this vegetation type has never been quantified for this reach but is assumed to be limited, correlated with the amount of shallow water present. Future operation at MOP could potentially influence an increase in this type since a more stable pool would be more conducive to these plants' survival. Future operations based on drawdowns would likely eliminate all of this vegetation type.

Island Habitat

Prior to project construction, there were over 50 islands of greater than 5 acres in size scattered throughout the 140 mile stretch of river. This component has been reduced to two islands of significant size (48 and 123 acres), the latter having become a recreation area connected to the mainland by a causeway. About 20 additional islands, some as small as 0.1 acre are also present. At least four have been created from dredged material disposal.

All of these islands maintain their integrity under existing operating conditions, i.e. no land–bridging occurs, even at MOP. However, if future operations incorporate drawdowns, most or all of these islands will exhibit land bridging, depending on the magnitude of the drawdown.

Fish Productivity Zone

Reference the Corps' 1992 Options Analysis EIS for a good discussion of resident fish productivity.

With continuance of historic operating conditions, resident fish productivity should remain unaffected. Continued operations at MOP could possibly enhance spawning conditions for some species. Future operations incorporating drawdowns could have devastating effects on many or most of these same species depending on timing, duration and magnitude.

Benthic Invertebrate Productivity Zone

Benthic diversity in the lower Snake projects is relatively low, and is dominated by chironomids and oligochaetes. The density of other taxa such as amphipods (*Corophium sp.*) and nematodes is low. Total biomass is highly influenced by oligochaetes and ranges from 2 g/m^2 to 20 g/m^2 in Lower Granite reservoir (Bennett et al. 1990).

Mollusc diversity has been greatly reduced by the impoundment of the Snake River, and molluscs

populations are presently dominated by the introduced Asian clam (*Corbicula fluminea*). In Lower Granite reservoir, *Gonidea angulata* is the most frequently observed large bivalve. Two species of floaters, (*Anodonta kennerlyi)* and (*A. californiensis)*, Federal candidates for listing as threatened and endangered species, are present. All molluscs in Lower Granite reservoir were severely impacted by the 1992 drawdown (Frest and Johannes 1992).

Densities of crayfish in the lower Snake reservoirs have not been quantified, except for limited evaluations in Lower Granite reservoir. Bennett et al. (1983) found the highest densities of crayfish at upstream sites in Lower Granite reservoir, with numbers being greater in the main channels compared to benches. Mortality during the 1992 drawdown would also indicate that large numbers of crayfish are associated with riprapped shorelines.

Benthic invertebrate densities in the drawdown zone would likely be reduced with the drawdown alternatives, as benthic organisms do not tolerate prolonged desiccation. Recolonization after refill would occur to some extent, dependent on duration and depth of dewatering, and would likely be greater in the upper pools where benthic drift from free–flowing stretches of the Snake River enters the lower Snake River projects. Recolonization by chironomids is likely to be most rapid because of their short life cycle and mobility of the adults.

Elimination of the mollusc fauna would be expected within the drawdown zone. Certain species that are already rare, such as the floaters, would probably be eliminated. The Asian clam, which is presently abundant and is an important white sturgeon food item, is likely to be substantially reduced (Bennett 1991).

Crayfish numbers would be greatly reduced by the drawdown alternatives. Based on observations during the 1992 drawdown, crayfish are very susceptible to stranding mortality because they seek refuge in nearby cover such as riprap, rather than following the receding water line.

Human Effects

Human activity and use of the reservoirs, primarily associated with recreation, i.e. boating, has increased relative to recreational use prior to creation of the reservoirs. This use is likely to increase under existing operations given general trends in increased 'leisure time' and observed and expected influx of retirees into the general area. Future operations incorporating MOP would likely seriously impact this recreational use.

Shoreline activity has increased locally, associated with dams and recreation areas, marinas and ports. Farming and grazing activities have almost been eliminated except for scattered cattle watering corridors, where cattle have direct access to the river. The fenced project lands created a buffer zone between the shoreline and all existing agricultural activities. The amount of this activity would remain unchanged under future conditions with perhaps some increase in 'curiosity seekers' under future drawdown operations. Drawdowns would also make islands accessible to people on foot.

2.2.15.2 Wildlife

Waterfowl

Canada Goose

(1) Nesting: Geese nest in the cliffs bordering the reservoirs along this reach with production corresponding to the occurrence and frequency of this habitat type which increases upriver. This component would be relatively unaffected by alternative strategies. New York Island, the sole remaining island of significance, produces an average of 64 successful nests annually. The other smaller islands that produce any successful nests average 0.3 – 2.4 annually. The Corps also maintains 75 goose nesting tubs located in various shallow water areas in association with HMU's. Use of these tubs by geese has increased over the years with the greatest use observed at the upper end of this reach. Highest use for all four reservoirs for which data is available was 15 successful nests in 1987.

(2) Brooding: An abundance of brooding pastures, both natural and artificially managed on HMU's, are present along this reach. This would not be expected to change under continued existing operating conditions. Continued operation at MOP could possibly provide some benefit in availability of sprouting herbaceous growth immediately adjacent to the water's edge. However, much of this zone is being invaded by woody species, creating conditions conducive to predation. Such growth could also hinder access and cause increased predation associated with existing landward pastures.

(3) Wintering: Most goose wintering occurs at the lower end of this reach, associated with the availability of irrigated agricultural lands providing a food source. The reservoirs are used primarily for roosting.

Mallard

(1) Nesting: Very little mallard nesting has been observed along the lower Snake River, most likely due to very limited occurrence of suitable dense nesting cover.

(2) Brooding: What little brooding that may occur is associated with the shallow backwaters and embayments.

(3) Wintering: Significant numbers of mallards winter on the reservoirs. As with geese, their primary use is roosting.

Colonial Nesting Birds

Great Blue Heron

(1) Nesting: There are no known rookeries along the lower Snake River.

(2) Foraging: Great blue herons are frequently observed along this reach. They forage along shallow shorelines, backwaters and embayments.

Shorebirds

Spotted Sandpiper. Shorebird occurrence along this reach is limited due most likely to limited availability of mudflats. The area is most likely used as a stop-over during migration. Although future operations incorporating drawdown would increase availability of mudflats, the expected durations would most likely eliminate desirable prey items.

Nongame Birds

Downy Woodpecker

(1) Nesting: Availability of nesting cavities associated with snags and decaying riparian hardwoods is an extremely limited habitat component along this reach. This is a necessary requirement for several species of neo-tropical cavity nesting birds. Present-day mitigation activities focus on replacement of this component which was prevalent along the original free-flowing river and associated canyon bottoms that have since been inundated. This is a difficult habitat type to replace for a variety of reasons, primarily due to lack of suitable areas to attempt re-establishment, and competing uses by other animals such as deer and beaver in earlier life stages of the tree.

(2) Feeding: Feeding for this and other gleanor species takes place in the same habitat type. This riparian forest habitat provides the highest habitat diversity within any single type found in this region and therefore provides necessary habitat components and life requisites for an abundance of species. Due to inundation from dams as well as poor grazing practices and increased frequency of fire in adjoining lands, this habitat type has become severely limited in extent.

Red-winged Blackbird

(1) Nesting: This species is totally dependent on cattail for nesting. This very common species can be found occupying almost all wetland areas supporting cattail throughout the reach. Continued operations similar to historic would not affect this habitat. Incorporation of MOP annually could possibly increase this habitat type slightly. Incorporation of annual

drawdown would likely eliminate this habitat type.

(2) Feeding: Although not necessarily dependent on wetlands for feeding, this species is rarely found in the absence of cattail.

Yellow Warbler

(1) Nesting/Feeding: This species exclusively occupies scrub–shrub habitat provided by shrub–type willow growth. Many small pockets of this habitat type occur along backwaters, embayments and tributary deltas. This habitat type provides food and cover for a variety of other animals as well.

Raptors

Wintering Bald Eagle

(1) Foraging: A few bald eagles winter along the lower Snake River, feeding primarily on waterfowl and, to a lesser extent, on upland game, salmonid carcasses and other wildlife carcasses.

Aquatic Furbearers

Beaver

(1) Denning: Beaver are quite common along the lower Snake River. Lodges are rare, with most denning occurring in banks and in association with at least sapling size trees.

(2) Feeding: Beaver are dependent on woody riparian growth as a food source.

Otter

(1) Denning: Requirements for this species are not as stringent as for beaver. Otter use dens previously excavated by other species, although always in close proximity to water.

(2) Feeding: Otters depend on prey found in shallow water and are also dependent on relatively dense bank cover that can be supplied by vegetation, woody debris and/or rocks. Heavy riparian vegetation cover provides the best environment for both the cover and feeding requirements of this species.

Terrestrial Furbearers

Raccoon. Raccoon foraging and denning requirements are largely dependent on prey items found in riparian–type habitats and associated shallow water.

Big Game

Deer

(1) Fawning: The primary species along this reach is mule deer. Whitetail deer are found along Lower Granite reservoir (the uppermost project) in association with dense shrub and tree cover. Although some island fawning may occur, mule deer are not dependent on islands for this. Primary use of the Snake River Canyon is for wintering with deer moving up and down the canyon draws and into the rolling wheatfields above on a daily basis. The HMU's, vegetated draws and other pockets of riparian vegetation provide good conditions for fawning. Impacts to these habitats would force deer to find suitable areas further from the projects and could possibly reduce overall populations because of this. Other suitable areas would already likely be used by other deer.

(2) Foraging: Although deer are found year–round on the projects and particularly on the HMU's, the primary dependency on the area would be for provision of winter browse.

Amphibians and Reptiles

Amphibian occurrence and use along the lower Snake River is limited. This could be due to a lack of suitable breeding habitat and/or lack of colonizing species post–inundation and low populations in the region in general.

As is the case with most amphibians, long–toed salamander, tiger salamander, Woodhouse's toad, a state monitor species, and Western toad are closely associated with permanent ponds, usually within forested wetland vegetation adjacent to rivers. Tree frog and spotted frog occur in association with

submerged aquatic vegetation of seasonal emergent wetlands and ponds.

Reptile occurrence and use is limited although some snake species are dependent on a well–developed riparian zone for availability of prey, cover and over–wintering requirements.

Endangered, Threatened, and Sensitive Species

Plants	
McFarlane's four–o'clock	Federal threatened
Northwest raspberry	Federal candidate 2
Jessica's aster	Federal candidate 2
Broad–fruited mariposa	Federal candidate 1
Snake River goldenweed	Federal candidate 2
Palouse goldenweed	Federal candidate 2
Cusick's lupine	Federal candidate 2
Spalding's silene	Federal candidate 2
Hazel's prickly phlox	Federal candidate 2
Bartonberry	Federal candidate 2
Insects	
Columbia River Tiger beetle	Federal candidate 2
Shepard's parnassian	Federal candidate 2
Birds	
Bald eagle	Federal endangered
Peregrine falcon	Federal endangered
Northern goshawk	Federal candidate 2
Western burrowing owl	Federal candidate 2
Harlequin duck	Federal candidate 2
Loggerhead shrike	Federal candidate 2
Western sage grouse	Federal candidate 2
Black tern	Federal candidate 2
Ferruginous hawk	Federal candidate 2; Washington State threatened
Olive sided flycatcher	Federal candidate 2
Mammals	
Gray wolf	Federal endangered
Preeble's shrew	Federal candidate 2
Long–eared myotis	Federal candidate 2
Long–legged myotis	Federal candidate 2
Yuma myotis	Federal candidate 2
Small–footed myotis	Federal candidate 2
Pale Townsend's big eared bat	Federal candidate 2
Washington ground squirrel	Federal candidate 2
Amphibians and Reptiles	
Tailed frog	Federal candidate 2
Spotted frog	Federal candidate 2; Washington State candidate
Northern sagebrush lizard	Federal candidate 2
Molluscs	
Columbia pebble snail	Federal candidate 2
California floater	Federal candidate 2
Fish	
Chinook salmon	Federal endangered
Sockeye salmon	Federal endangered
Bull trout	Federal candidate 1
Pacific lamprey	Federal candidate 2
Westslope cutthroat trout	Federal candidate 2
Interior redband trout	Federal candidate 2

2.2.16 McNary Project

Short–term Operational Limits	
McNary Dam and Lake Wallula	
Lake Elevation	
Normal Full Pool	340 ft
Minimum Pool	335 ft
Discharge	
Minimum	
December–February	12,500 cfs
March–November	50,000 cfs
Maximum change per hour	150,000 cfs

2.2.16.1 Physical Habitat

Barren Zone

The McNary reservoir typically operates within a five foot range. Much of the lower half of the reservoir is bordered by steep topography and rip rap protecting a road on the east side and railroad on the west side. The shorelines bordering the upper half of the reservoir are relatively flat, especially on the east side between the mouths of the Snake and Walla Walla Rivers. This provides for the creation of extensive mudflats when the pool is operated at or near its minimum. Erosion and landslide potential is minimal throughout the reservoir, however significant influx of sediment is contributed via the Walla Walla River which has formed an extensive delta at its mouth. Continual formation of this delta would be expected in the future. Little to no change would be expected regarding the extent of mudflats.

A recent change in operations has restricted water levels to within one–foot of MOP from April through October. This could have a minor effect on the shape and location of delta formation at the mouth of the Walla Walla River. While this operation would maximize the amount of mudflats exposed, it would concurrently promote desiccation.

Upland Zone

Upland areas surrounding the project are typical of shrub–steppe in the area. Gray and green rabbitbrush have replaced big sagebrush for the most part. Limited associations of sagebrush and bitterbrush can still be found within project boundaries, mostly on flat benches. Cheatgrass has replaced most of the native bunch grasses. There are presently 8,672 acres of upland habitat within the project. There would be very little if any affect on this plant community regardless of future operations.

Riparian Zone

Riparian vegetation is found in association with the reservoir shoreline, backwaters, sloughs and along tributaries. This vegetation is dependent on subirrigated conditions and represents three communities; forest or hardwood, shrub, and herb or forb. The habitat provided by this vegetation is very limited in extent and provides critical cover and food for the majority of wildlife species found in the area for at least part of the year.

The forest type is dominated by black cottonwood. The most extensive stand of cottonwood on the project is located at the mouth of the Walla Walla River. Willow is commonly found in association with cottonwood. The Yakima River delta, another major tributary, is composed mostly of Russian olive. Other common tree species include white alder, red alder, hackberry, and black locust. There are 1,255 acres of this habitat type on the project.

The shrub component is comprised of a scrub–shrub community of willow and an exotic, false indigo, usually found adjacent to the high water line along protected backwater areas. A more mesic shrub community is typified by species such as black hawthorn, chokecherry, golden currant and red–osier dogwood. Wood's rose and smooth sumac can withstand somewhat drier conditions. There are 365 acres of riparian shrub within the project.

The riparian herbaceous vegetation type is found chiefly on sandbars, mudflats and other riparian substrates as well as areas adjacent to the reservoir supporting subirrigated conditions. It is a very

limited habitat type occupying only 14 acres. Representative species include mustards, docks, pigweeds, composites, thistles, and Russian thistle. Grasses include foxtail, squirreltail and reed canarygrass.

Recent operation at MOP has encouraged development of scrub–shrub. This habitat type would be expected to mature under future similar operation. Other riparian types would be expected to remain relatively unaffected.

Emergent Wetland Zone

Approximately 354 acres of emergent wetlands occur, the majority located just below the mouth of the Snake River and in McNary Refuge which occupies McCormack Slough. Typical wetland taxa for the region are present including cattail, bulrush and sedge.

Continued operation at MOP could encourage expansion or minor displacement of this habitat type, i.e. replacement by scrub– shrub and development closer to the "new" water line. MOP operation would also increase the ratio of vegetation to water in the wetland ponds of McNary Refuge.

Submerged Aquatic Plant Bed Zone

This vegetation type has not been quantified. The most extensive beds likely occur in ponds within the refuge. Future operations at MOP could negatively impact these beds but could possibly be offset by establishment of beds in a more stable environment within the reservoir proper.

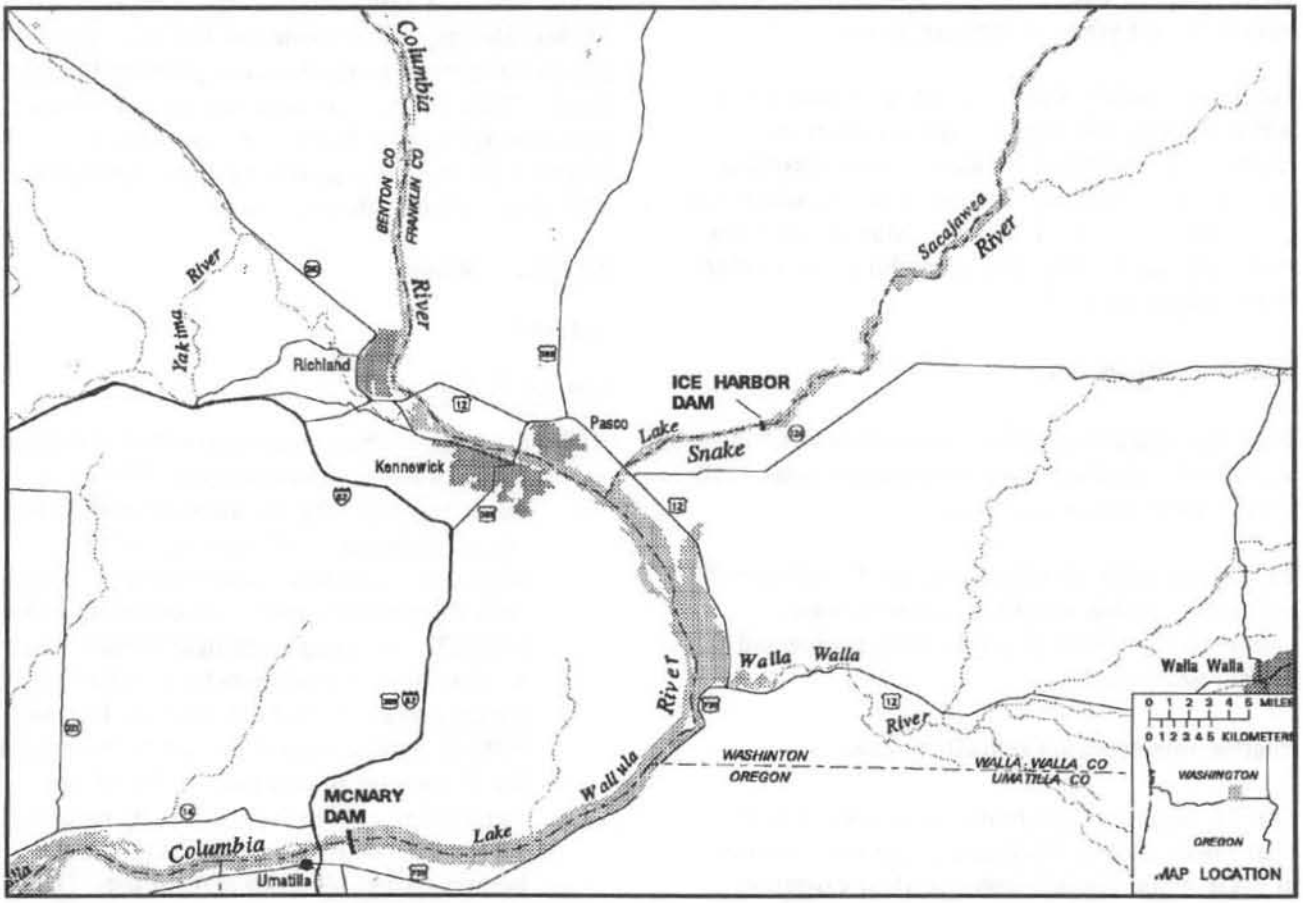

Figure 2–14. McNary and Ice Harbor Projects

Island Habitat

Dozens of islands were inundated by the project and replaced by relatively few new ones. The inundated islands were probably similar to those existing in the Hanford Reach and the Strawberry Islands located below Ice Harbor Dam. The 20 "new" islands are a result of partially submerged sand hills and bluffs. Other islands have been constructed using dredged material. Boise Cascade built a dredge island in 1985 composed of silt and cobble. Three islands were created from shot–rock dredged material below the mouth of the Snake River between 1978 and 82. Two of these islands were reshaped in January, 1992 to lower their profiles, and dredged silt from local port access sites were deposited on top of the original material and vegetated with grasses. The islands support the entire range of habitats found on the project from bare sand and gravel to riparian forest.

Future operations, whether at MOP or fluctuating within the normal range, should not affect the integrity of the islands nor cause a land–bridging concern. Past "normal" operation has included "soft constraints" between 1 March – May 15 operating within the upper three feet to inhibit goose nesting below maximum pool.

Fish Productivity Zone

Reference the Corps' 1992 Options Analysis EIS for a good discussion of physical parameters associated with resident fish productivity.

Future operations incorporating MOP could possibly enhance spawning conditions for some species. Otherwise, resident fish productivity is expected to remain unaffected.

Benthic Invertebrate Productivity Zone

Certain benthic invertebrates have been able to exist under existing operations. Future operations at MOP could possibly enhance their existence. Many wildlife and fish species rely on benthics as prey items.

Human Effects

The upper end of the Columbia River portion of the project flows through the Tri–Cities of Richland, Pasco and Kennewick, Washington. This populous, urbanized area supports many parks, beaches, boat launches and marinas. Most of the shorelines through this reach are rip rapped levees. Other similar recreation facilities are located toward the lower end of the project near Umatilla, Oregon. Hunting, fishing, water skiing and other boating– related activities are probably the most common sources of disturbance to wildlife. The more productive nesting islands are posted in an attempt to minimize human use during the nesting season. There are 3 port facilities scattered along the reservoir.

Human recreation and use will likely increase in the future following nationwide trends. The Hanford Nuclear Reservation is located at the uppermost end of the project along the free– flowing Hanford Reach. This facility is a major employer and has gone through several boom and bust periods. Employment has been increasing there associated with environmental cleanup efforts.

2.2.16.2 Wildlife

Waterfowl

Canada Goose

(1) Nesting: McNary pool supports a large population of nesting Canada geese. The 25 islands, together with the McNary Wildlife Refuge produced up to 675 goslings in 1991. Most goose nesting occurs on seven islands, with the greatest numbers of successful goose nests (73) occurring on Badger Island. Total number of successful nests for all island nesting averages 130. In 1974, the U.S. Fish and Wildlife Service erected 30 nesting baskets on the Strawberry Islands (part of the refuge complex) to eliminate predation by raccoons that had become established there. These baskets receive about 20 percent use. The refuge maintains 19 goose nesting platforms. Some ground nesting has also been observed

within the refuge but is very susceptible to both avian and ground predators.

Under continued existing operations, including operating at MOP, goose nesting would not be expected to be impacted. Operation at MOP would actually maximize the island acreage available for potential nesting.

(2) Brooding: Adequate habitat for brooding pastures is thought to exist along McNary Reservoir. Almost all of this habitat is naturally occurring. This condition would not change under continued existing operations. Future operations at MOP could provide additional herbaceous forage within the drawdown. Development of woody vegetation within this zone however, could create cover conducive to predators.

(3) Wintering: Number of wintering Canada geese on McNary Refuge have been known to peak at about 50,000 with as many as 20,000 additional geese utilizing other areas of the reservoir. These birds use abundant corn and wheat fields provided on the refuge and surrounding agricultural lands. Annual use is highly dependent on weather conditions. The U.S. Fish and Wildlife Service conducts aerial censuses of a large portion of the Columbia Basin on a monthly basis during November–January. Future use of this area is not expected to change under existing operating conditions.

Mallard

(1) Nesting: Little data is available on mallard nesting. In 1990, 104 mallard pairs were counted on McNary Refuge. Other pairs observed in 1990 included: gadwall (62), shoveler (203), wigeon (58), cinnamon/blue–wing teal (86), green–wing teal (58), and pintail (36). Nine boxes were added to goose structures for mallard use as well as 12 plastic nesting tubs in 1990. Some additional nesting likely occurs on the more heavily vegetated islands within the reservoir.

(2) Brooding: A few mallard broods are usually observed on McNary Refuge but high predation rates are assumed due to the abundance of skunk, magpie and feral cats. Teal, pintail and wood duck broods have also been observed. Very limited brooding may also occur associated with the islands or along shallow backwaters along the reservoir. An attractive brooding area consisting of a complex of backwater ponds and wetlands occurs immediately below the mouth of the Snake River.

(3) Wintering: Roughly 80,000 mallards used grain fields on the refuge in 1990. Approximately 172,000 were observed throughout the reservoir in December, 1993. As with Canada goose, these numbers vary dramatically from year to year depending on weather and other factors. Future use is not expected to change under existing operations.

Diving Ducks

(1) Nesting: Actual nesting data is not available but the following pair counts were observed on McNary Refuge in 1990: Redhead (76); Canvasback (6); Lesser Scaup (68); Ruddy (104); Ring–neck (45); Bufflehead (6); and common goldeneye (2). Future existing operations would not likely have any effect on potentially nesting divers.

(2) Brooding: No diving duck broods were mentioned as being observed on the refuge in 1990. If any brooding of diving ducks occurs within McNary Reservoir, it would not be expected to be effected by future existing operations.

(3) Wintering: Between 1,000–2,000 divers have been counted during December and January from aerial censuses over McNary Reservoir. These include redhead, canvasback, greater and lesser scaup, ringneck, common and Barrow's goldeneye, bufflehead, hooded and common merganser, and ruddy duck. Future existing operations would not be expected to have any effect on this usage by diving ducks.

Colonial Nesting Birds

Great Blue Heron

(1) Nesting: A substantial rookery is located on Foundation Island. This rookery also contains black–crowned night herons.

(2) Foraging: Herons are commonly observed foraging along shallow shorelines, backwaters and embayments. Their use of these areas would not be impacted by future existing operations.

Forsters Tern

(1) Nesting: Forsters (as well as Caspian) terns have been known to nest on the artificially–created Crescent Island. Vegetation development, combined with competition from California gulls is limiting this opportunity. Future operations incorporating MOP could possibly create favorable conditions for this species.

Shorebirds

Black–necked stilt. Little is known about the occurrence of nesting along McNary Reservoir. Data obtained from the Blue Mountain Chapter of the Audobon Society lists the following species that have been observed at the Walla Walla River Delta: American coot, black– bellied plover, lesser golden plover, snowy plover, semipalmated plover, killdeer, black–necked stilt, American avocet, greater and lesser yellowlegs, spotted sandpiper, whimbrel, long–billed curlew, marbled godwit, sanderling, semipalmated sandpiper, western sandpiper, least sandpiper, Baird's sandpiper, pectoral sandpiper, dunlin, stilt sandpiper, short–billed dowitcher, long– billed dowithcer, common snipe, Wilson's phalarope, and red– necked phalarope. A Virginia rail call was heard on the McNary Refuge in 1990 but never observed. Other water birds observed include pied–billed, red–necked and western grebe, white pelican (about 100 in 1990) and double–crested cormorant.

Nongame birds

Downy Woodpecker

(1) Nesting: Suitable habitat in the form of mature cottonwoods is present near the mouth of the Walla Walla River and pockets along the shoreline up to and above the mouth of the Snake River. There is also some suitable habitat along this same stretch along the western shoreline up to the mouth of the Yakima River although most "forested" areas along this shoreline are dominated by Russian olive. Regeneration of cottonwood is a concern since it normally requires a situation characterized by periodic flooding. Future existing operations are not expected to affect this habitat type. Future operations at MOP could possibly create conditions for some limited development of cottonwood.

(2) Feeding: Feeding is conducted within the same habitat type however, the areas dominated by Russian olive may be more heavily used for this activity.

Red–winged blackbird. All nesting and most feeding occurs within wetlands dominated by cattail. Small pockets of cattail occur throughout the backwaters along the reservoir. Continued existing operations would not affect this habitat type. Future operations at MOP could possibly encourage development of cattail.

Yellow Warbler. This species exclusively occupies scrub–shrub habitat provided by shrub–type willow growth. Many pockets of this habitat type occur along backwaters, embayments and tributary deltas. Continued existing operations should have no impact on this habitat type. Continued operation at MOP would encourage additional development of this habitat within the drawdown zone.

Raptors

Wintering Bald Eagles. A few bald eagles winter along McNary Reservoir feeding primarily on waterfowl and to a lesser extent on upland game, salmonid carcasses and other wildlife. Future existing operations are not anticipated to impact prey species nor mature trees which offer perch and roost sites.

Aquatic Furbearers

Beaver. Beaver are found in association with the riparian forested and scrub–shrub areas containing a high proportion of young trees and suitable banks for denning. Future existing operations are not expected to impact woody riparian habitat however regeneration of forested areas must take place. Future operations at MOP could potentially benefit this habitat type.

River Otter

(1) Denning: Otter use dens excavated by other species in close proximity to water. They have been known to use rip rap of suitable size for this purpose as well. Future existing operations are not likely to impact the occurrence of suitable den sites.

(2) Feeding: Otters depend on prey found in shallow water habitats and are also dependent on relatively dense bank cover provided by vegetation, woody debris and large rocks. Future existing operations are not expected to impact this requirement and future MOP operations could encourage development of additional cover.

Terrestrial Furbearers

Raccoon. Raccoon foraging and denning requirements are largely dependent on prey items found in riparian–type habitats and associated shallow water. Future operations are not expected to negatively impact these habitats.

Big Game

Deer

(1) Fawning: Mule deer occur throughout the project area. Islands are used to some extent for fawning. Otherwise, fawning is associated with heavy cover associated with riparian vegetation. Future operations are not expected to impact riparian vegetation.

(2) Foraging: Mule deer are only partially dependent on project lands and riparian areas for food, that dependence increasing during winter for sources of browse. Future existing operations are not expected to negatively impact riparian vegetation.

Amphibians and Reptiles

Amphibian occurrence and use of habitats along the reservoir are very low, probably due to existing fluctuations. Although recent operations at MOP have helped stabilize water levels, it has not yet allowed suitable wetland–type vegetation to establish immediately adjacent to the water line.

Riparian areas along the reservoir are used to some extent by garter and gopher snakes. These areas provide sources of prey, cover, and over–wintering habitat.

2.2.17 John Day, the Dalles, and Bonneville Dams

Short–term Operational Limits	
John Day Dam and Lake Umatilla	
Lake Elevation	
Full Pool	268 ft
Minimum Pool	257 ft
Discharge	
Minimum	
December–February	12,500 cfs
March––November	50,000 cfs
Maximum change per hour	200,000 cfs
Special Requirements: Normal minimum elevation in spring is 262 feet for protection of geese during nesting period March 1 – May 15.	
Reservoir is to be operated between elevation 264–265 once every three days during the goose nesting period, March 1 – May 15.	
Reservoir is to be operated between elevation 262.5–264 during juvenile fish outmigration period from May 1 – August 31 unless higher levels are required for irrigation withdrawals.	

The Dalles Dam and Lake Celilo	
Lake Elevation	
Full Pool	160 ft
Minimum Pool	155 ft
Discharge	
Minimum	
December–February	12,500 cfs
March–November	50,000 cfs
Maximum rate of change per hour	150,000 cfs
Bonneville Dam and Lake	
Lake Elevation	
Full Pool	77.0 ft
Minimum Pool	70.0 ft
Normal forebay operating range	71.5 – 76.5 ft
Maximum 24–hr fluctuation at Stevenson gauge	4.0 ft
Tailwater Elevation	
Rate of change	
Summer (April 1–September 30 (60–min limit	1.5 ft
Normal – 24 hr limit	4.0 ft
Maximum – 24 hr limit (no more than 10 times per season)	5.0 ft
Winter (October 1 – March 31) 60–min limit	3.0 ft
Normal – 24 hr	7.0 ft
Maximum – 24 hr limit (no more than 18 times per season)	10.0 ft
Discharge	
Minimum instantaneous	80,000 cfs
Minimum daily average	100,000 cfs
Special requirements: Normal operating range will not be exceeded more than 18 days per year.	
When average 7–day inflow is below 125,000 cfs, the minimum instantaneous outflow limit is 70,000 cfs and the minimum daily average discharge limit is 80 percent of the 7–day average inflow.	

Bonneville (RM 145), The Dalles (RM 216), and John Day (RM 292) dams are the most downstream of the Federal projects on the Columbia River. All three projects are operated by the USACE. These projects are run–of–river, with John Day Dam having flood storage capability. Significant wildlife habitat is prevalent in the area around John Day Dam.

2.2.17.1 Physical Habitat

Barren Zone and Shallow Water Zone

Shallow water habitat occurs along the shoreline of the Columbia River and around islands within the various pools. Typically the substrate for Bonneville, The Dalles, and John Day pools is comprised of rock, gravel, sand, and silt with rocky shorelines predominating in many locations. Gravel shorelines are prevalent in the upper John Day pool. Sand and silt deposits are most evident in backwaters, inlets, and embayments or at the mouths of rivers. A substantial delta formed from silts exists at the mouth of the Klickitat River in Bonneville pool. Sand/silt deposits are also evident just downstream of the Deschutes River mouth. The occurrence of wetland plants has been noted for the Klickitat River delta where elevational increase from sediment deposition has been sufficient for wetland plants to become established. Greater coverage of wetland plants is anticipated with additional elevation increase from sediment settling.

Shallow water areas can be very productive of submergent, emergent and aquatic vegetation in addition to benthic invertebrate populations. However, this productivity is somewhat tempered in Bonneville, The Dalles, and John Day pools by fluctuating pool levels. Still, aquatic plant beds are evident in some locations; their areal extent and species composition have not been formally documented, however. Neither has areas of importance for benthic invertebrates nor detailed work on their density and species composition been determined. There are indications of large beds of *Corbicula manilensis*, based on shorelines with dense layers of shells on the beach and observations of diving duck concentrations.

Bonneville pool normal operation range is from 71.5 to 76.5 ft msl. although typically fluctuations occur within the upper three feet of this range. Aquatic plant beds are present in the pool and are expected to be most prevalent below 73.5 msl. Location, extent and nature of these aquatic plant beds is unknown.

The normal operational range for The Dalles pool is 155.0 to 160.0 ft msl with the forebay normally fluctuating 1 to 3 feet. Thus, much of the shallow water habitat (el. 155.0–160.0) is periodically exposed. Development of aquatic plant beds would be most likely around elevation 155 ft. msl or slightly lower.

John Day pool is normally operated between elevations 262 and 265 ft msl. Location, extent, and nature of aquatic plant beds is unknown, although the relatively gentle topography and extensive shallow areas suggest their presence would be more substantial than in either The Dalles or Bonneville pools. The presence of suitable substrate within these shallow water areas for aquatic plants has not been established and would also significantly influence their presence, density, and possibly species composition.

Upland Zone

Upland areas abutting Bonneville, The Dalles and John Day pools exhibit a considerable variation in plant communities from west to east. This is attributable to a graduation from a mild, wet marine west coast climate to a dry, cold winter–hot summer continental climate. Pool levels typically only influence a very narrow region immediately abutting the reservoirs. This zone of influence includes riparian habitat but does not extend into the upland habitats. Thus, the upland zone is not considered an area subject to impacts from implementation of various operational strategies.

Riparian Zone

Riparian habitats determined by the USFWS (BPA 1990) are broken into three sub–categories: hardwood, shrub, and herb. Riparian hardwood is principally comprised of cottonwood trees, although red alder, Russian olive, large willows and a few other tree species might also be present. Riparian shrub habitat is comprised of willows, young hardwoods, false indigo, and other shrubby species. Riparian herb communities are chiefly herbaceous, low–growing forb–grass communities occupying sand, mud, or gravel bars. Herbaceous plants are generally weeds such as mustards, docks, pigweed, and Russian thistle. Grasses are also common. This category also includes seeding willows, cottonwoods, and other trees and shrubs.

Riparian plant communities are dependent on subirrigation for water and are typically in immediate juxtaposition to a stream. This is particularly true in The Dalles and John Day pools where very dry conditions and dryland plant communities occur at slight elevations above full pool.

Approximately 1,089 acres of riparian shrub and riparian hardwood occur adjacent to Bonneville pool or on islands within its bounds. Black cottonwood is the principal tree species in riparian hardwood stands along Bonneville pool. Large willows, red alder, western redcedar, and Douglas–fir are other species present (BPA 1990).

Riparian plant communities comprise only 377 acres adjacent to The Dalles pool. The reduction in acreage is a result of the arid environment, shorter pool, and the immediate juxtaposition of highways and railroads to the river. Riparian shrub habitat comprises 299 acres of the total. Riparian shrub communities occur primarily along inlets and embayments or on sandbars (BPA 1990). False indigo, an introduced shrub, is the most abundant shrub species (BPA 1990).

John Day pool supports an estimated 571 ac of riparian habitat based on 1994 aerial photo interpretation. Photo interpretation was not conducted downstream of RM 257.8 because of generally unsuitable conditions for riparian habitat development. Black cottonwood is the dominant tree species, with willow, Russian olive, alder and hackberry representing other members of the riparian forest community. Willows and young riparian hardwood species comprise the riparian shrub community. Much of this habitat occurs within the Umatilla NWR and Irrigon Wildlife Management Area.

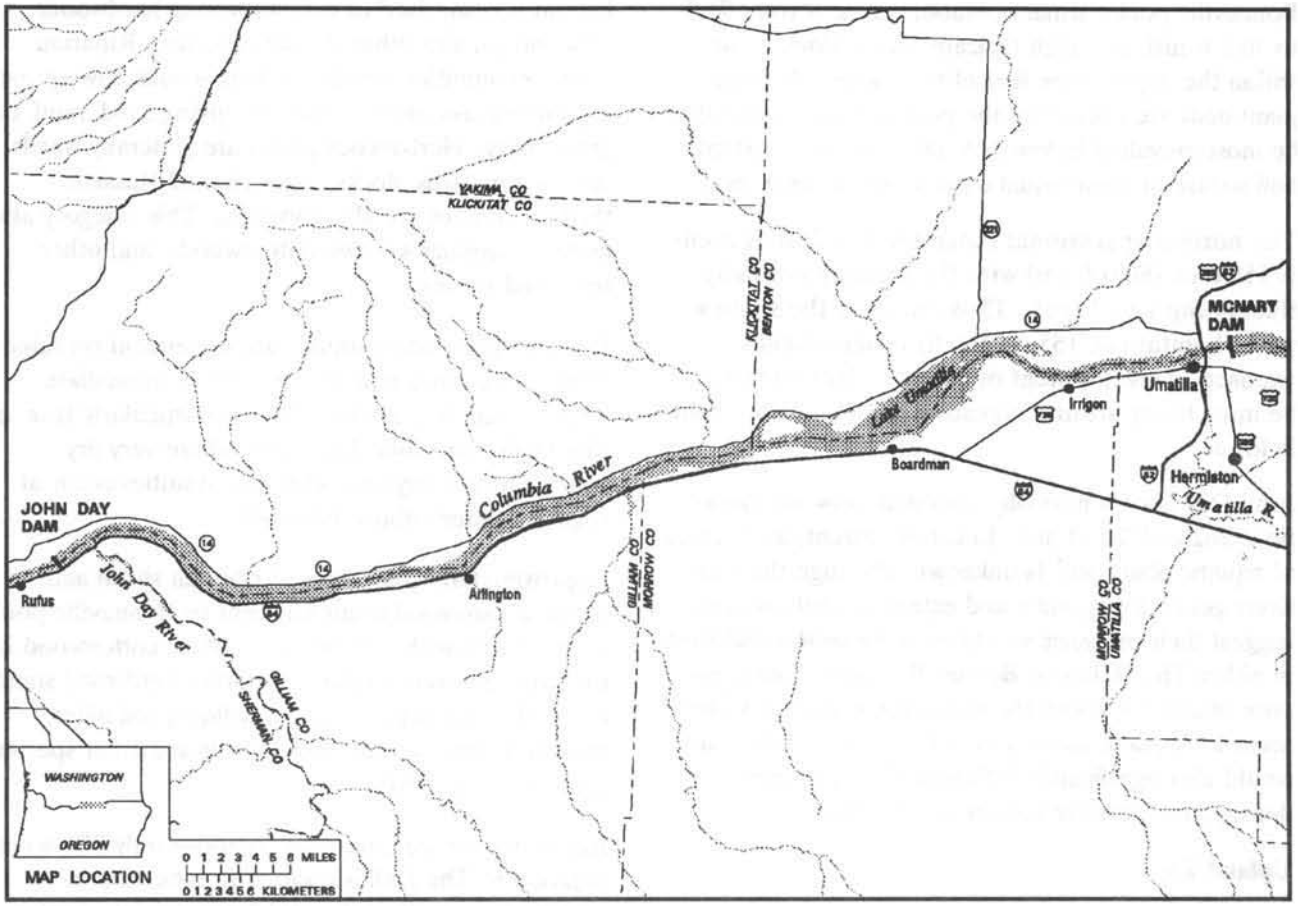

Figure 2–15. John Day Pool

Emergent Wetland Zone

Information on wetland habitat acreage associated with Bonneville and The Dalles, projects is derived from vegetative mapping efforts performed by Judith Glad, private consultant to the USFWS's for input into Bonneville Power Administration's (BPA) Wildlife Impact Assessments (1990) for these three projects. Mapping effort for Bonneville Project is based on 1975 aerial photography; 1979 photography is used for vegetation analysis on the other projects.

Very limited acreage (15 ac) of emergent wetlands is associated with Bonneville Project. The USFWS (BPA 1990) characterizes emergent wetlands as wet soil areas supporting rushes, sedges and/or cattails. Emergent wetlands generally occurs where drainage from adjoining slopes is interrupted by railroad or highway embankments or agricultural activities.

Emergent wetlands in The Dalles pool are also typically formed in this manner. Approximately 52 acres of emergent wetlands adjoin The Dalles pool, although not necessarily directly impacted by pool fluctuations.

An estimated 2,283 acres of emergent wetlands are associated with John Day pool according to 1994 aerial photo interpretation. Interpretation was only for lands upstream of RM 257.8 as rocky, steep slopes downstream result in minimal habitat presence. The USFWS (BPA 1990) note that emergent wetlands usually occupies sites where seepage from

upslope or subirrigation maintains wetland plant species. They note that emergent vegetation communities are more prevalent in Patterson and McCormack Slough Units in 1989 than indicated by interpretation of 1979 photography. They also note that numerous ponds appear to be undergoing natural succession from emergent wetlands to uplands.

Submergent plant communities are present in Paterson and McCormach Sloughs, Irrigon Wildlife Management Area and other slackwater areas.

Embayments

Embayments, adjacent ponds, and associated tributaries provide an important habitat feature for fish and wildlife resources on these projects. These embayments are relatively unique to the three projects and provide special wildlife values. They provide protected loafing and roosting areas for waterfowl and other waterbirds, in addition to food resources. Embayments are considered bodies of water cut off from the main river by highway or railroad causeways, or other features and are typically connected to the Columbia River via culverts or small channels. Associated tributaries reflect slack–water conditions that extend up tributaries. Adjacent ponds encompass bodies of water adjacent to the river; the source of the water in these sites may arise from subirrigation and/or drainage from adjoining lands.

Thirty–two embayments encompassing 548 acres occur in Bonneville pool. Sixteen of these embayments are less than five acres in extent; only six sites exceed 40 acres in extent. There are 13 adjoining ponds encompassing 46 acres. Four associated tributaries provide 339 acres of slack–water. Drano Lake at the mouth of the Little White Salmon River constitutes 236 acres.

Embayments and adjacent ponds provide 284 acres of backwater habitat in The Dalles pool. No associated tributaries constituting significant slack–water acreage occur.

Eleven embayments are less than five acres in extent; only one site exceeds 40 acres in extent.

Slack–water sites in John Day pool comprise substantially more acreage than comparable areas for either downstream project. There are approximately 17 embayments in John Day pool. Paterson Slough in Umatilla NWR refuge is the largest embayment, with 1,043 acres. McCormack Slough represents another major embayment, with 494 acres. An embayment behind Crow Butte Island represents an additional 165 acres of the total embayment acreage. Other significant embayments occur at Three Mile Island and Willow Creek. Adjacent ponds represent 212 acres with ponds in Paterson Unit, Umatilla NWR and those just downstream of McNary Dam constituting the bulk of the acreage. Slack–water areas of tributaries provide 1,391 acres of backwater habitat with John Day River arm and Willow Creek encompassing 1,272 acres of the total.

Fish Productivity Zone

This measure is not used to address operational impacts for Bonneville, The Dalles or John Day pools. Loss of other habitats, particularly the emergent marsh/riparian zone is considered of more importance.

Submerged Aquatic Plant Bed Zone

The extent and location of submerged aquatic plant beds has not been documented for either Bonneville, The Dalles, or John Day pools. Some backwater areas of these pools are known to support submerged aquatic plant communities. McCormack Slough and Patterson Slough, plus ponds in the Irrigon Wildlife Management Area on John Day pool, contain submerged aquatic plant communities. Observations of foraging concentrations of American coots and American wigeon at other embayments along these pools are strong indicators of the presence of submerged aquatic plant communities. The presence of submerged aquatic plant communities in open water habitat is suspected but not adequately documented.

Benthic Invertebrate Productivity Zone

Benthic invertebrates, principally **Corbicula manilensis**, appear to form an important prey base for diving ducks in Bonneville pool, although sufficient documentation is lacking.

Human Effects

Recreational users are the primary human effect of concern to wildlife resources for below Bonneville Dam, and for Bonneville, the Dalles and John Day dams.

Specific activities of concern include fishing, windsurfing, and boating/picnicking that occur in areas important to wildlife (i.e., nesting islands/locations and brooding/rearing areas). The demand for recreation facilities results in development and loss of wildlife habitat.

Highways and railroads are an existing and significant human effect. Increased urban and residential development is significant in many locations.

2.2.17.2 Wildlife

Waterfowl

Wintering waterfowl probably constitute the most abundant wildlife resource on Bonneville, The Dalles, and John Day projects, with John Day Project supporting very significant numbers of wintering waterfowl. Resident, breeding waterfowl numbers are generally low except for Canada geese (Great Basin Canada geese), which occur throughout all three projects and various duck species in and around the Umatilla NWR.

Bonneville pool supports lesser numbers (estimated 2,500 to 3,000 birds) of wintering waterfowl than either The Dalles or John Day pools. This is substantially attributable to the lack of agricultural lands in the Columbia River Gorge. Wintering concentrations of diving ducks, primarily scaup spp. occur upstream of Home Valley on the Washington shore, at Hegewald Pond in Stevenson, in Government Cove, at Mayer State Park embayment, and along the Oregon shoreline just upstream of Mayer State Park.

Wintering mallards, pintails, American wigeon and American coots occur in fair numbers at Government Cove, Hegewald Pond, Wells Island, Mayer State Park Embayment, and nearshore areas just upstream of Mayer State Park. Adjacent lakes, marshes and backwaters are also important habitats for foraging and loafing. Aquatic vegetation appears to be an important food resource for these species. Breeding ducks are minimal in number.

Canada geese are represented by a substantial nesting population on Bonneville pool. The 1991 nesting survey indicated that 168 goose nests are present on Bonneville pool, with the majority of goose nests associated with islands. Wells Island at Hood River supported 74 nests alone. Islands in Rock Creek embayment at Stevenson (Hegewald Pond) support the next largest nesting concentration. Nearshore areas supporting grass/forb communities are important foraging areas for geese with broods. Lawns at Rock Creek Park and pastures at Bonneville Dam provide significant foraging habitat for geese with broods. Wintering geese are distributed throughout the pool. Concentrations of loafing/roosting Canada geese do occur just below The Dalles Dam.

Waterfowl use in The Dalles pool is primarily associated with islands which are used extensively by nesting Canada geese and also by wintering ducks and geese. Nesting by ducks is minimal which is probably attributable to the lack of marsh/wetland habitat for rearing young.

A total of 117 Canada goose nests were recorded from The Dalles pool during the 1991 survey. Brown's, Little Miller, and Rufus Islands support the majority of nests. Low tailwater elevations in early April 1991 at John Day Dam were required to facilitate repair of the lock. This resulted in substantial land–bridging at Rufus Islands and incidences of predation by dogs (eight) were evident. Vehicular access to the site from the freeway and nearby Rufus contribute to disturbance by man and his pets. Forage resources for geese with broods may be limiting in the pool. Tabor (1976) reported geese with broods using park lawns at Horsethief Lake and Deschutes River State Parks. Grass–forb communities adjacent to the river, embayments, and backwaters are important foraging/loafing areas for geese with broods.

Rufus Islands also represent a high use area for wintering waterfowl. Mallards and Canada geese (2,000 to 3,000 geese) use these islands in significant numbers for loafing and roosting. The presence of shallow backwater, gravel bars, islands

and protection from the wind contribute to the attractiveness of this location for waterfowl. Foraging by most wintering waterfowl occurs in agricultural lands located north and south of the ridgeline above the Columbia River. Miller Island supported grazing geese in the recent past when commercial haying and grazing operations were ongoing. Presently, the pasture appears in a degraded condition and less use by Canada geese would be expected. Minimal forage resources occur within The Dalles pool (i.e. aquatic plant beds) and therefore waterfowl concentrations are less likely to develop. Concentrations of diving ducks, primarily scaup spp. and ring–neck ducks, occur at RM 202 (Oregon shore) and at the Biggs grain terminal. Approximately 1600 diving ducks occur at RM 202 comprised primarily of scaup spp. and ring–necked ducks. The Biggs grain terminal supports approximately 1,500 diving ducks. It is presumed that diving ducks are utilizing benthic invertebrate resources at the RM 202 and spilt grain at Biggs grain terminal.

The John Day pool supports one of the most significant wintering concentrations of waterfowl – particularly Canada geese and mallards – in Oregon and Washington. Backwater areas on John Day pool provide protected areas for wintering waterfowl to escape storms and roost. The USFWS censuses in 1995 documented a maximum of 131,000 ducks wintering on John Day pool upstream of RM 250 for winter 1994/'95. An estimated 20,500 to 58,400 (average 33,550, USFWS surveys 1987–'92) Canada geese also winter on this portion of the pool. Waterfowl resources in the area of major regional significance (25 percent of wintering mallard population, i.e., 131,000 in 1995 for Oregon and Washington.) A peak population of 600,000 ducks, primarily mallards, has occurred in the South Columbia Basin. Approximately 20,000 northern pintails are present in this concentration (J. Annear, Umatilla NWR, pers. comm. 1991). Most of these birds will occur in the vicinity of the Umatilla NWR. Wintering Canada geese number approximately 100,000. Wintering waterfowl are strongly dependent on agricultural crops grown in the region, particularly field corn and winter wheat for forage resources. The Columbia River and its islands provide protected, relatively undisturbed loafing, resting, and roosting habitat for these waterfowl.

Ducks begin arriving in the Umatilla NWR/John Day pool area in August when 30,000 to 50,000 birds, principally northern pintails and green–winged teal, are present (J. Annear, Umatilla NWR, pers. comm. 1991). Mallards begin arriving in substantial numbers in September. A population of 100,000 ducks can be attained by the end of September. These early arriving waterfowl appear to focus on aquatic, emergent, and moist–soil vegetation resources rather than field–feeding. Foraging in agricultural fields is prevalent during winter. Foraging in shallow backwaters, ponds, and wetlands is prevalent therefore in late–summer and early fall.

Geese do not begin arriving in significant numbers until November. Most wintering geese will occur in the vicinity of Umatilla NWR but significant numbers of geese can be located loafing and roosting on the Columbia River throughout the John Day pool and major arms such as the John Day River and Willow Creek backwaters. Protected bays and backwaters are important loafing/roosting areas for wintering birds during high winds and storm events.

Substantially more Canada geese nest in John Day pool (1991: 323 nests) than either Bonneville or The Dalles pool. The majority of nests are located on islands in the Umatilla NWR although McCredie and Three Mile Islands also support substantial number of nests. Most islands are well offshore and therefore protected from mammalian predation. McCredie and Three Mile Islands are relatively nearshore and susceptible to land–bridging.

Brood rearing areas in the John Day pool occur primarily on the Umatilla NWR, particularly at Whitcomb Island, Crow Butte Island backwater, Longwalk Island, McCormack Slough, and Paterson Slough (Tabor 1976). The Oregon shoreline between RM 260 and 265, and Willow Creek Wildlife Management Area, are other important foraging areas for Canada geese with broods. Gently sloping shorelines with grass–forb communities are used by foraging geese (Tabor 1976). Tabor (1976) noted that low water–levels increased the distance geese with broods had to travel to access shoreline forage

from open water. This increase in escape distance could have a significant positive bearing on predator efficiency and a negative effect on percent brood survival.

Waterfowl nesting other than Canada geese is also centered on the Umatilla NWR. The Willow Creek and Irrigon Wildlife Management Areas and McNary Wildlife Park also provide important nesting and brood rearing areas for ducks. Tabor (1976) considered that portion of John Day pool downstream of RM 250 as unproductive waterfowl habitat due to the lack of islands and rocky, steep shorelines. Upstream of RM 250, gently sloping shorelines with adjacent grass–forb communities are more prevalent and provide appropriate habitat conditions for waterfowl. Fourteen–plus species of ducks with an annual production of 2,000 to 2,500 young occur in John Day pool (Tabor 1976, Annear 1983).

Colonial Nesting Birds

Species comprising this complex include herons, gulls, terns, and cormorants. Individual species present at the three Portland District projects include great blue heron, black–crowned night heron, double–crested cormorant, Caspian tern, Forster's tern, and California, glaucous–winged, and ring–billed gulls. These species are primarily dependent on fisheries resources associated with the Columbia River although reptiles, amphibians, small mammals, and invertebrates may provide important forage resources at times. Scavenging and field–feeding by gulls is also common.

Great blue herons are the only colonial nesting waterbird known to nest on Bonneville pool. Wells Island near Hood River, Oregon supported 24 active and 38 total nests in early May 1991 (Torland, ODFW, unpubl. notes). Shallow water, embayments, shorelines and wetlands represent foraging areas for this species. Double–crested cormorants and various gull species occur throughout the project area, typically foraging throughout the pool. Concentrations of gulls are particularly noticeable at The Dalles tailrace where they forage on juvenile salmonids and other fish injured when passing through the ice/trash sluiceway. Gulls loaf on rocks below The Dalles Dam and at Boat Rock just upstream of Bonneville Dam.

Nesting by California gulls and great blue herons occurs in The Dalles pool. Great blue herons nest at Brown's Island (2–plus nests) and Miller Island. Torland (ODFW, pers. comm. 1991) reported 23 heron nests at Miller Island in 1991. The number of active nests is not determined. He noted that there are 12 active of 20 total nests in 1990. California gulls nest on rocky islands upstream of Miller Island (RM 206) and on Little Memaloose Island (RM 195). Tabor (1976) reported 213 nests on rock islands upstream of Miller Island and approximately 275 nests on Little Memaloose Island. Ackerman (USACE, 1991) reported approximately 300 gull nests on the rocky islands just upstream of Miller Island. Torland (ODFW, 1991, pers. comm.) reported that approximately 1,500 nests occurred on these rock islands upstream of Miller Island during a 1983 census. Ring–billed (95 percent) and California gulls (5 percent) are the species present. Torland also reported substantial gull presence at Little Memaloose Island although nesting numbers are unknown. Tabor (1976) reported the presence of a few adult glaucous–winged gulls at the aforementioned gull colonies and considered them probable breeders at these locations. He also reported occasional nesting Caspian and Forster's terns at Rufus Islands.

Concentrations of gulls occur in The Dalles pool immediately downstream of John Day Dam, apparently foraging for juvenile salmonids and other fish injured or stunned during passage through John Day Dam.

The John Day pool supports substantially more colonial nesting species and number of breeding birds than either Bonneville or The Dalles pools. Three Mile Island at RM 256 supports black–crowned night herons, California gulls, ring–billed gulls, and Caspian terns. Tabor (1976) reported Forster's terns as having nested at Three Mile Island. An estimated 35 black–crowned night heron nests occur at this location. The breeding population of California and ring–billed gulls is estimated at 7,000 to 10,000 birds. Approximately 12 Caspian tern nests are located at this site. Sand

Dune Island (RM 274) supports approximately 50 nests each of black–crowned night herons and great blue herons.

Gulls congregate below McNary Dam in order to capture fish injured or stunned passing through the dam; foraging may occur the length of the pool. Foraging by gulls in agricultural fields, freeway rest stops, and garbage dumps is also common. Foraging by herons would primarily occur along shorelines, in wetlands, and throughout shallow backwaters.

Shorebirds

Shorebird use in Bonneville pool is relatively minor. Minor concentrations have been observed on exposed shoreline at Hegewald Pond, Stevenson, and Washington. Mudflats, when exposed, at the mouth of the White Salmon River (delta), Wells Island, Mayer State Park, embayments, and Taylor Lake would provide foraging, loafing, and potentially roosting habitat for migrant shorebirds. Killdeer and spotted sandpipers are the principal nesting shorebirds, nesting just upslope from the high pool line and foraging along the shoreline.

Nongame Birds

Many species of nongame birds occur in the vicinity of the three Portland District projects. Most species are associated with upland habitats adjacent to the project. Riparian and wetland habitats directly influenced by waters of the Columbia River are important to many nongame species as well as the ecotone to upland habitats. The pool areas also support a number of species.

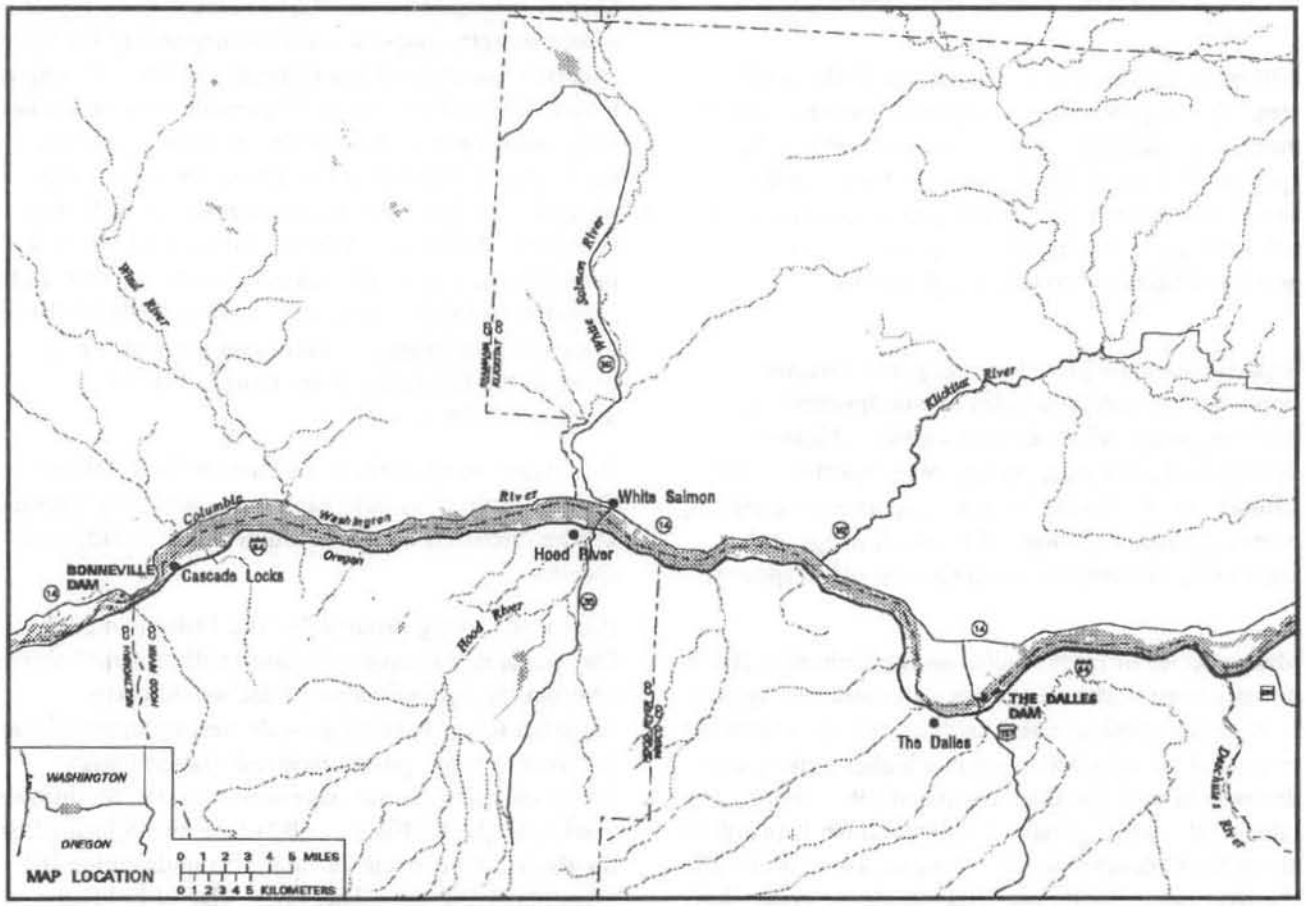

Figure 2–16. Bonneville and the Dalles Projects

Migrant and wintering western grebes occur on Bonneville pool in minor numbers. Presence of pied-billed grebes is generally associated with embayments, backwaters, and ponds along the river. Rail occurrence in the Bonneville pool area would be associated with emergent vegetation occurring in wetlands and embayments.

Bird species that forage for insects in the airspace over the pools are present in substantial numbers. Approximately 1,000 to 2,000 cliff swallow nests are estimated to occur on the powerhouses, spillway, and other structures at Bonneville Dam. Highway bridges, structures, and rock cliffs adjacent to Bonneville pool support many more nesting cliff swallows. Nesting barn swallows are also numerous at these locations. Violet-green and tree swallows use cavities in snags, live trees, cliffs, structures, and

pilings for nesting and are abundant in the pool area. Insect production in riparian, wetland, embayment, and backwater areas are important for these species. Common nighthawks and Vaux's swifts would also benefit from insect production from these habitats; riparian habitats also provide roost and perch locations for common nighthawks.

Riparian habitats provide nesting and foraging requisites for several species of woodpeckers, flycatchers, and chickadees plus warblers, kinglets, orioles, and grosbeaks, among other species. Marsh habitats are important to several species of sparrows, warblers, rails, blackbirds plus marsh wrens and common yellowthroats in addition to other species.

Many species of birds would use the Columbia River or associated backwaters for a water source. Typically, riparian/marsh/wetland habitats and the ecotones to upland habitats will support a higher density and diversity of bird life than dryland shrub-steppe, talus, cliff, and/or grassland habitat which is prevalent along the Columbia River. Habitats associated with the river generally support trees or dense grass-forb cover offering more structural diversity and better forage resources than adjacent upland habitats.

Upland Gamebirds

Ruffed grouse, ring-necked pheasant, California quail, turkey, mourning dove, band-tailed pigeon, and common snipe occur along the Bonneville pool. None of these species would be considered abundant.

Chukar would be the most abundant species in The Dalles project vicinity (BPA 1984). They occur primarily on the adjacent slopes in habitat comprised of upland grasses and cliffs/rimrock.

Similar to other species present along John Day pool, upland gamebirds are also more abundant in the upper reaches of the pool, particularly in the Umatilla NWR. This is a reflection of suitable habitat occurrence.

Raptors

Osprey represent the most abundant nesting raptor whose foraging requirements are dependent on the fisheries resources of the Columbia River. Nesting is principally confined to the Bonneville pool area where substantial forested habitat occurs adjacent to the river. Approximately ten to 12 osprey nests occur along the Oregon and Washington shores of Bonneville pool (Anderson, WDFW and Torland, ODFW, pers. comm., 1991). Members of these pairs would be expected to forage extensively in Bonneville pool and associated backwaters. Additional pairs of osprey occur in the Columbia River Gorge, but are associated with lakes.

Discussion on occurrence and use of the Portland District projects by bald eagles and peregrine falcons will be discussed under threatened and endangered species.

Raptor use along Bonneville, The Dalles, and John Day pools is primarily associated with upland habitats, wherein their principal prey base would occur. Riparian forest habitats provide nesting opportunities for some species, particularly red-tailed hawks, Swainson's hawks, and American kestrels. Swainson's hawks, on the USFWS's (1982) Sensitive Species List for Region One, occur in riparian stands within the Umatilla NWR, John Day pool. Use of riparian habitats during migration would be expected by sharp-shinned and Cooper's hawks. Northern harri-

ers would make use of grassland, marsh, and wetland communities. Golden eagles would occur along the upper end of Bonneville pool and throughout The Dalles and John Day pools. Their use would be primarily associated with cliffs, shrub–steppe, and other upland habitats. Great–horned and western screech–owls would represent the principal owl species in riparian habitats associated with the projects. Short–eared owls would by present in wetland and marsh plant communities, principally during migration and winter.

Aquatic Furbearers

Aquatic furbearers occurring at each project would include muskrat, beaver, river otter, and mink. Tabor (1976) notes that density of these species, as a group, is higher for the Bonneville pool area than for The Dalles and John Day pools. Beaver use in Bonneville pool is strongly associated with riparian habitats and protected areas, including embayments, inlets, ponds, and sloughs (Tabor 1976). Mink are more abundant in Bonneville pool than in the other two pools. They exhibit high use of riprap, particularly where it occurs in conjunction with embayments (Tabor 1976). Muskrats occur primarily in embayments and sloughs where wetland plant communities are present. Densities are low in Bonneville pool (Tabor 1976).

Density of aquatic furbearers are low in The Dalles pool and reflect the lack of riparian habitat available (Tabor 1976). Beaver is present where riparian shrub or hardwoods occur.

Aquatic furbearer density is also low in the John Day pool (Tabor 1976). The lack of riparian habitat between RM 216 and 263 significantly contributes to the lack of these species. Most aquatic furbearers occur upstream of RM 263 where more suitable habitat is present than for downstream locations (Tabor 1976). Riparian forest, principally cottonwoods, are an important habitat feature for beaver. Muskrats are associated with cattail–bulrush marshes. Otter are common in John Day pool with most observations upstream of RM 263 (Tabor 1976).

Terrestrial Furbearers

Terrestrial furbearers occurring in riparian habitats associated with Bonneville pool include raccoon, coyote, bobcat, porcupine, striped skunk and opossum (Tabor 1976). Red fox are also present in project area (BPA 1984). Raccoon use of riparian habitats is generally greater than for other terrestrial habitats (Tabor 1976). Raccoons are also the most abundant terrestrial furbearer. Striped skunks are next highest in abundance (Tabor 1976).

Terrestrial furbearers occurring in riparian habitats associated with The Dalles pool include raccoon, coyote, bobcat, porcupine, and striped skunk (Tabor 1976). Shrub–willow habitat is the most important habitat for raccoons (Tabor 1976). Striped skunks and raccoons are the most abundant species along The Dalles pool.

John Day pool riparian habitats support coyotes, badgers, striped skunks, and raccoons (Tabor 1976). Coyotes are the most abundant species, though they exhibited a preference for sagebrush habitat. Raccoons, the next most abundant species, are most prevalent in riparian habitats (Tabor 1976).

Big Game

Black–tailed deer occur in terrestrial habitats adjacent to Bonneville and The Dalles pools with this species most prevalent adjacent to Bonneville Project. Tabor (1976) notes that they are most commonly observed in habitats south of I–84 which forms a relatively effective barrier to deer movement. He further noted that density of black–tailed deer is low adjacent to Bonneville pool. Density of mule and black–tailed deer adjacent to The Dalles pool is also low. Use on the Oregon shore is more restricted to the canyon walls due to the Interstate highway abutting the shoreline whereas in Washington deer use occurs in areas adjacent to the river as Highway 14 is located high on the canyon wall (Tabor 1976). Mule deer are the only species of big game observed in habitats adjacent to John Day pool (Tabor 1976). Bitterbrush habitat appears as the most important habitat for mule deer in the John Day pool area although Tabor (1976) believes that cottonwood/willow and marsh habitats are more important to deer

than their surveys indicate. He notes that islands in the John Day pool, particularly those on Umatilla NWR, appear to be important fawning areas for mule deer. The lack of predators on these islands is cited as a probable factor for the high use observed during the spring and summer.

Reptiles and Amphibians

Tabor (1976) reports six species of reptiles and amphibians associated with riparian/water habitats in the Bonneville pool area. A number of other species are expected to occur in the Bonneville pool area but are not detected. Pacific chorus frog concentrations are noted in large willow habitat. The author states that large willow habitat in the Bonneville pool area do not appear to be of great importance to amphibians or reptiles.

Seven species are reported in riparian/wetland habitats along The Dalles pool; other species not recorded are expected to occur (Tabor 1976). He notes that most habitats censused in this area are sparsely populated with reptiles and amphibians with Pacific chorus frogs being most abundant. Large willow habitat have the highest diversity of species although number of individuals encountered is low. Shrub willow habitat, which is subject to periodic inundation receives little use by this species complex (Tabor 1976).

Marsh/riparian habitat along the John Day pool support seven species; other species may occur (Tabor 1976). Woodhouse's toad is abundant in marsh habitat. The ecotone between marsh and upland habitats is most important to lizards and snakes (Tabor 1976). Prey populations/availability in and near marsh habitat are probable attractants to lizards and snakes. The Great Basin spadefoot toad and Woodhouse's toads are the major species associated with marsh cottonwood–willow habitats (Tabor 1976). These two species use marshes for breeding habitat.

Western painted turtles are abundant in the Irrigon Wildlife Management Area of John Day pool. The complex of emergent marsh, open water with abundant submerged aquatic plants, and associated sparsely vegetated uplands support this population.

Benthic Invertebrates

Specific information for benthic populations in Bonneville and the Dalles areas is limited.

The extensive shallow water habitat on the upper John Day pool probably supports good benthic invertebrate populations, since physical conditions appear conducive to these species. However, the nature and composition of benthic invertebrates in John Day pool is not well known.

Endangered, Threatened, and Sensitive Species

Bald eagles and peregrine falcons are the principle Federally–listed threatened and endangered species potentially affected by the proposed alternatives. A number of state (Oregon and/or Washington) listed species occur in the project area but are not generally considered to be affected by proposed actions.

One bald eagle nesting territory is associated with Bonneville pool; another territory occurs near the mouth of the Sandy River. Since impacts from operational alternatives are not considered to extend below the mouth of the Willamette River, the numerous nesting and wintering bald eagles downstream of the Willamette River are not expected to be impacted.

Wintering bald eagles are most common (40 birds) on John Day pool and are associated with the large concentration of wintering waterfowl. Fewer birds (10 to 15 each) are associated with The Dalles, Bonneville, and below Bonneville areas.

Peregrine hacking operations and natural nesting occur in the Columbia River Gorge. Approximately six nest sites are currently known.

2.2.18 Columbia River Below Bonneville Dam to the Willamette River Mouth

2.2.18.1 Physical Habitat

The area below Bonneville Dam is a free flowing stretch of the Columbia River. The Columbia River from Bonneville Dam (RM 145) to the mouth of the Willamette River (RM 101) encompasses 44 miles of river. Tidal fluctuations, although minor in magnitude, occur in this reach of the river. Peak river

flows, typically occurring during May and June, still impact the riparian areas along the river. Low flows occur during late summer and early fall and result in the exposure of extensive mudflats.

Riverine habitats present include sloughs, backwaters, shorelines, islands, mudflats and riparian zones. Railroads and highways usurp a substantial portion of the riparian zone in this reach. Human development of adjacent shorelands is prevalent below the Interstate 205 bridge. Agricultural areas encompass a substantial amount of the flood plain in this reach. A number of relatively large islands are also present. Three National Wildlife Refuges, i.e. Pierce, Franz, and Steigerwald, are present along the Washington shore.

Beaches below Bonneville are sandy. Deep, sandy loam prevails in adjacent riparian and agrarian lands. An accumulation of organic material is present in the riparian zones. Shoreline erosion, particularly in areas with sandy soils is prevalent. Erosive areas include the shoreline along Franz NWR and Sand Island at RM 132. Gravel/cobble bars are present on the upstream portions of Ives and Pierce Islands.

Barren Zone

Each year, lowering water levels expose sand and silt that is barren for part of the year.

Riparian Habitat

Black cottonwood and various species of willows are the dominant tree species for riparian areas in this reach of the Columbia River. Mature black cottonwoods are the dominant tree species in terms of height. Willows range in size from invasive stands on sand bars and beaches to mature stands comprising a major component of the overstory vegetation. Tree species comprising lesser components of the riparian zone include Oregon ash and black hawthorn.

Shrub willows, red osier dogwood, young cottonwoods and Himalaya blackberry are predominant shrub components. A dense shrub layer is often present. Reed canarygrass, nightshade, trailing blackberry, and stinging nettles are common groundcover components of the vegetation. Reed canarygrass can dominate ground cover in many locations.

Mature riparian forests provide perch and nesting habitat for bald eagles and osprey in this reach. Many species of passerines, including yellow warblers and Swainson's thrushes, use the riparian forest and shrub habitat for foraging and nesting. Decadent trees, either a result of maturity or from wind/ice snappage provide opportunities for cavity nesters such as downy woodpeckers. Great blue herons also use the riparian stands for nesting. Canada geese will nest within the riparian forest, generally along the edge, on islands. Beaver use shrub willow and cottonwood stands for foraging; denning occurs in the bankline.

Emergent Wetlands

Emergent wetlands below Bonneville Dam are primarily limited to backwater sloughs and ponded areas away from the main Columbia River. Franz Lake at Franz NWR contains an extensive stand of wapato. Old slough channels, embayments and ponded areas on Government Island, Sandy River Delta, Steigerwald Lake, Ainsworth State Park (RM 138 to 139) and other riverine areas support emergent wetlands. Often, these areas are dominated by reed canarygrass.

These habitats provide forage, loafing, and night roost locations for waterfowl. The extensive wapato stand at Franz Lake supports a substantial (1,000−plus) population of wintering tundra swan in addition to other waterfowl species. These sites also provide foraging areas for various species of waterfowl, great blue herons, rails, passerines such as red−winged blackbirds, swallows, and marsh wrens, and other species of birds, mammals and amphibians.

Submerged Aquatic Plant Beds

Emergent wetlands are expected to occur in sloughs. embayments and ponded areas where water depth is sufficient to support submergent plants. The substantial fluctuation in flows and elevations of the Columbia River below Bonneville limits the development of submergent aquatic plant beds.

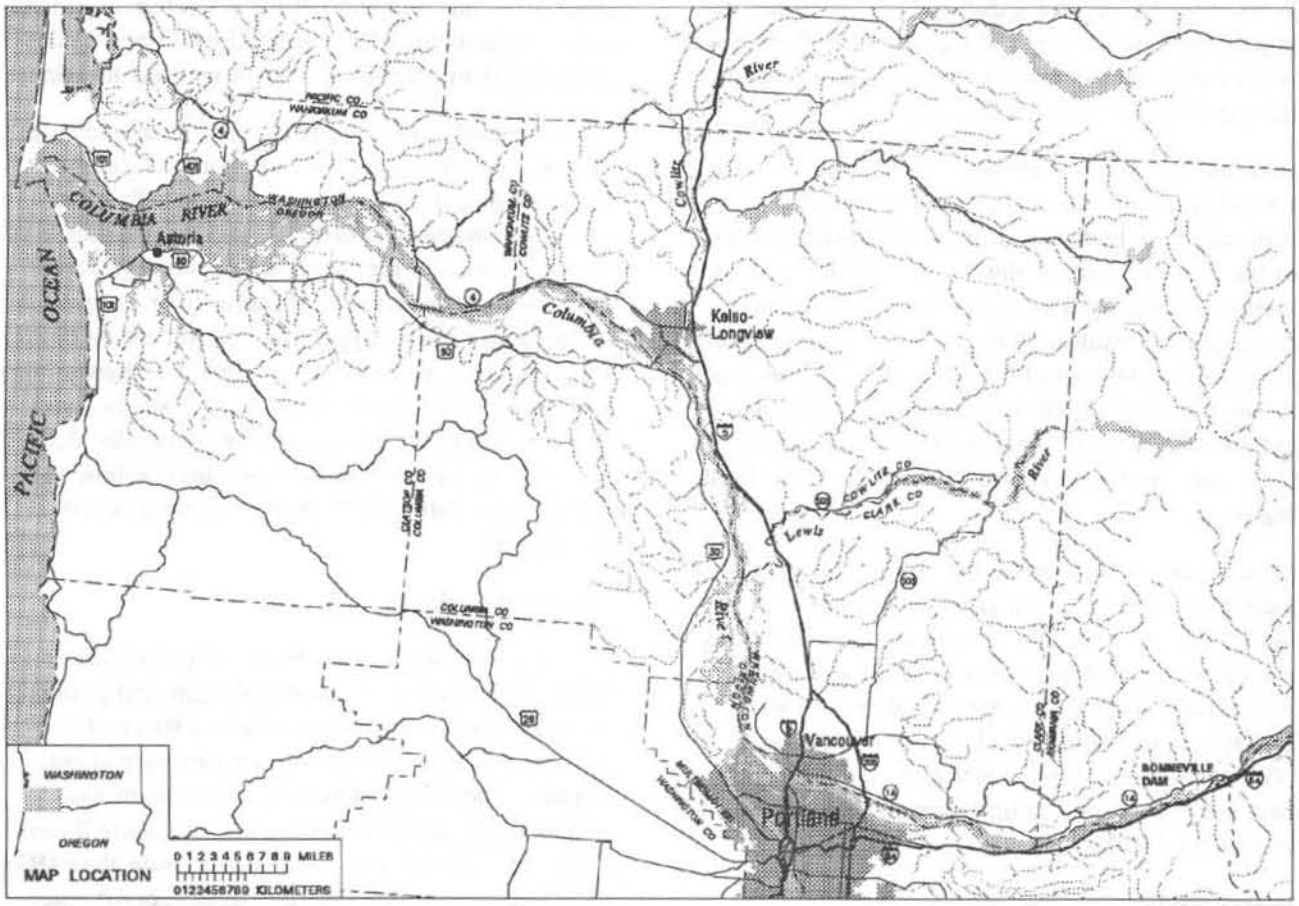

Figure 2–17. Columbia River Below Bonneville Dam to the Willamette River Mouth

Upland Habitat

Upland habitat varies by location and extent of human activities/development that have occurred over time. Extensive grass/forb habitat occurring along this reach is typically associated with agricultural or former agricultural operations (livestock), such as at Pierce NWR, Steigerwald Lake, Government Island, and Sandy River delta. Placement of construction–borrow material for Bonneville Second Powerhouse has resulted in the development of a large grass–forb upland site at Hamilton Island immediately below Bonneville Dam.

Upland forests are typically Douglas–fir in composition. Red alder and big leaf maple are common understory/early successional stage tree species. Oregon white oak occurs on more xeric sites.

Island Habitat

This reach of the Columbia River is dominated by a number of large islands. Hayden Island occurs just upstream of the mouth of the Willamette River. This island is heavily developed on its upstream end while the lower half contains riparian forest and grass/forb uplands. Interstate 5 and the railroad bisect Hayden Island. Lemon, Sand, McGuire and Government Islands form a large island complex at RM 112 to 117. Government Island is bisected by Interstate 205. These islands contain grass–forb uplands, riparian forest, sloughs, and small lake habitats. Gary and Flagg Islands are riparian forest dominated islands off the Sandy River delta. Reed Island at RM 124 to 127 is comprised of riparian forest and grass–forb upland. Another Sand Island

occurs at RM 131 to 132. Riparian forest and a large, erosive sand bluff on the northeast shoreline dominate this island. Pierce and Ives Islands are located just downstream of Bonneville Dam. A number of these islands are grazed. Others remain in their natural state.

Human Disturbance Zone

Human disturbance is prevalent along this reach of the Columbia River because of the large urban population centers of Portland and Vancouver, the presence of major highways and railroads along both shores, and the recreational draw presented by the Columbia River. A number of major state parks are located along this reach of the Columbia River.

Primary Fish Production Zone

Major migrations of anadromous fish species, including spring, summer and fall chinook, chum, sockeye, and coho salmon, winter and summer steelhead, shad, and white sturgeon pass through this reach of the Columbia River. Natural production of these anadromous fish is generally limited in tributary streams because of run declines associated with habitat degradation, harvest, and presence of a large component of hatchery fish in the runs. The Washougal and Sandy Rivers are the principal tributary streams providing production of anadromous fish. Hardy and Hamilton Creeks support remnant runs of chum salmon. White sturgeon spawn in the Columbia River below Bonneville Dam. Massive numbers of shad migrate through this reach of the Columbia River. Angling for these species is an important draw for recreationists in the Columbia River below Bonneville Dam.

Resident fish present – many of them arising from introductions – include smallmouth and largemouth bass, walleye, and various sun fish. Sport fishing, particularly for bass and walleye occurs in this reach. The bounty program for squawfish has encouraged anglers to fish for this species.

2.2.18.2 Wildlife

Waterfowl

Wintering waterfowl account for the majority of waterfowl use in this reach. Steigerwald and Franz National Wildlife Refuges along with the Government Island area represent the major wintering waterfowl sites. The dense stand of wapato at Franz NWR supports 1,000–plus tundra swans at peak periods during the winter.

Nesting by Canada geese along this reach is not as significant as for Bonneville pool or for the Columbia River downstream of Portland. Production of ducks is minor and generally associated with sloughs, ponds and backwater areas.

Colonial Nesting and Shorebirds

A great blue heron colony is located at Reed Island. Cliff swallows have substantial nesting colonies on the powerhouses and spillway structures at Bonneville Dam. Purple martins nest in old pilings at Skamania Landing and in the Vancouver area. Spotted sandpipers and killdeer nest along exposed beaches in this reach. Few migrant shorebirds use the Columbia River between Bonneville Dam and the city of Portland, although they occur downstream of Portland.

Songbirds

The riparian forest supports numerous passerine species including Swainson's thrushes, song sparrows, western wood peewees and robins. Barn, tree, violet–green and cliff swallows are abundant in this reach.

Raptors

Red–tailed hawks and osprey are probably the most abundant nesting raptors in this reach. Osprey are very dependent on the river for foraging and associated riparian and coniferous forest habitats for nest sites. Two bald eagle nests and two peregrine

eyries are associated with the area below Bonneville Dam. Wintering bald eagles are also present.

Furbearers

The array of terrestrial furbearers present along this reach of the Columbia River is typical for western Oregon and Washington. Tabor (1976) did note gray fox on both shores. The Washington observations are of special note because the species had not been documented previously in Washington. Beaver, river otter and mink are probably the most abundant aquatic furbearers. Muskrat would be expected to occur in backwaters, sloughs and ponded areas which support emergent marsh habitat.

Big Game

Black–tailed deer represent the principal big game species along the Columbia River in this reach. Roosevelt elk may occasionally occur in habitats adjacent to the river, but generally occur upslope from the highways and railroads.

Small Mammals

Tabor (1976) recorded 16 species of small mammals along this reach of the Columbia River. He noted that riparian habitat – specifically ash/cottonwood/willow – had the highest diversity of small mammals. Deer mice, vagrant shrew, and Townsend's vole are the most abundant small mammal in his study for this reach.

Tabor (1976), based on a literature survey effort, reported that seven species of bats had been collected near this reach of the Columbia River and that ten species could be expected to occur in the area. Bats are observed during his study foraging over riparian stands and adjacent open water habitats. Roosting in riparian forest stands is suspected although not confirmed. He observed that bats appear most abundant in the ash/willow/cottonwood stands.

Reptiles and Amphibians

Tabor (1976) observed ten species of reptiles and amphibians along the Columbia River below Bonneville Dam. He reported that 23 species may occur in the general area. Tabor (1976) reported that the presence of permanent ponds greatly enhanced the likelihood of the presence of these species. Western painted turtles occur in Columbia Slough, a former attached side channel of the Columbia River in the Portland area of this reach.

Endangered, Threatened and Sensitive Species

For the Columbia River from its mouth to McNary Dam, the USFWS has listed Columbian white–tailed deer, peregrine falcon and bald eagle. Columbian white–tailed deer occur in the lower Columbia River in the vicinity of Cathlamet–Skamokawa, Washington, but not in the project area. Peregrine falcons have established nesting territories along Bonneville and The Dalles pools. Wintering peregrines would be expected along John Day pool given the large prey base available. Bald eagles have established nesting territories along Bonneville pool and downstream of Bonneville Dam. Wintering birds occur along all pools but are prevalent along John Day pool. The large waterfowl concentration on John Day pool serves to attract bald eagles to the location.

One proposed plant species, *Howellia*, is listed by the USFWS as occurring in the project area.

The USFWS has also identified 25 sensitive or candidate species along these three projects. These include three mammals, five birds, three amphibians or reptiles, one fish, five invertebrates and eight plant species.

2.3 SCIENTIFIC NAMES

2.3.1 Plant

alder – *Alnus* spp.

alder buckthorn – *Rhamnus alnifolia*

antelope bitterbrush – *Purshia tridentata*

arrowleaf balsamroot – *Balsamorhiza sagittata*

bank monkeyflower – *Mimulus clivicola*

Barrett's breadtongue – *Penstemon barrettiae*

Bebb willow – *Salix bebbi*

black cottonwood – *Populus trichocarpa*

black hawthorn – *Crataegus douglasii*
black locust – *Robinia pseudo–acacia*
blue grass – *Poa* spp.
bluebunch wheatgrass – *Agropyron spicatum*
box elder – *acer negundo*
bristly cryptantha – *Cryptantha interrupta*
broad–fruit mariposa – *Calochortus nitidus*
brome grasses – *Bromus* spp.
buckwheat – *Eriogonum* spp.
bulrush – *Scirpus* spp.
Canadian buffaloberry – *Sheperdia canadensis*
cattail – *Typha latifolia*
ceanothus – *Ceanothus* spp.
cedar – *Thuja plicata*
Ceratophyllum demersum
cheatgrass – *Bromus tectorum*
chokecherry – *Prunus virginiana*
cocklebur – *Xanthium strumarium*
Columbia milk–vetch – *Astragulus columbianus*
Columbia River mugwort – *Artemisia lindleyana*
Columbia yellow – cress – *Rorippa columbiae*
compressed bluegrass – *Poa compressa*
creeping Oregon grape – *Berberis repens*
curly leaf pondweed – *Potamogeton crispus*
Cusick's lupine – *Lupinus cusickii*
dense sedge – *Carex densa*
dogbane – *Apocynum* spp.
Douglas fir – *Pseudotsuga menziesii*
Douglas' constricted onion – *Allium constrictum*
duckweed – *Lemma* spp
elodea – *Elodea* spp.
Eurasian watermilfoil – *Myriophyllum spicatum*
flowering rush – *Butomus umbellatus*
giant helleborine – *Epipactis gigantea*
giant wildrye – *Elymus giganteus*
golden currant – *Ribes aureum*
gooseberry – *Ribes* spp.
Grand fir – *Abies grandis*
gray cryptantha – *Cryptantha leucophaea*
hardstem bulrush – *Scirpus acutus*
Hazel's prickly phlox – *Leptodactylon pungens hazeliae*
heartleaf arnica – *Arnica cordifolia*
Howell's fleabane – *Erigeron howellii*
Idaho fescue – *Festuca idahoensis*
Jessica's aster – *Aster jessicae*
kinnikinnick – *Arctostaphylos uva–ursi*
lodgepole pine – *Pinus contorta*
Lombardy poplar – *Populus nigra*
lupine – *Lupinus* spp.
Macfarlane's four–o–clock – *Mirabilis macfarlanei*
mallow ninebark – *Physocarpus malvacea*
mock azalea – M*enziesia ferruginea*
mock orange – *Philadelphus lewisii*
mountain alder – *Alnus incana*
needlegrass – *Stipa veridula*
northern wormwood – *Artemesia campestris*
northwest raspberry – *Rubus nigerrimus*
obscure buttercup – *Ranunculus reconditis*
oceanspray – *Holodiscus discolor*
Palouse goldenweed – *Haplopappus liatriformis*
paper birch – *Betula papyifera*
pine – *Pinus monticola*
Pinegrass – *Calamagrostis rubescens*
Piper's daisy – *Erigeron peperianus*
poison ivy – *Rhus radicans*
Polygonum amphibium
pond lily – *Nuphar* spp.
Ponderosa pine – *Pinus ponderosa*
pondweed – *Potamogeto*n spp.
prairie Junegrass – *Koeleria cristata*

pygmy–weed – *Tillaea aquatica*
quaking aspen – *Populus tremuloides*
rabbitbrush – *Chrysothamnus* spp.
redosier dogwood – *Cornus stolonifera*
reed canarygrass – *Phalaris arundinaceae*
reedgrass – *Calamagrostis* spp.
Rocky Mountain juniper – *Juniperus scopulorum*
Rocky Mountain maple – *Acer glabrum*
rose – *Rosa* spp.
rough fescue – *Festuca scabrella*
rushes – *Juncus* spp.
Russian olive – *Elaeagnus angustifolia*
sagebrush – *Artemisia* spp.
sago pondweed – *Potamogeton pectinatus*
sandbar willow – *Salix exigua*
Saskatoon serviceberry – *Amelanchier alnifolia*
scurfpea – *Psoralea laceolata*
sego lily – *Calochortus apiculatus*
shining flatsedge – *Cyperus rivularis*
Siberian elm – *Elmus pumila****(spelling?)
silver fir – *Abies alba*
Sitka alder – *Alnus sinuata*
smooth desert parsley – *Lomatium laevigatum*
smooth sumac – *Rhus glabra*
Snake River goldenweed – *Haplopappus radiatus*
snow eriogonum – *Eriogonum niveum*
snowberry – *Symphoricarpos* spp.
Spaulding's silene – *Silene spauldingii*
spike rush – *Eleocharis* spp.
spruce – *Picea* spp.
squaw currant – *Ribes cereum*
Suksdorf's desert parsley – *Lomatium suksdorfii*
sweetclover – *Melilotus officinalis*
thickspike wheatgrass – *Agropyron dasytachyum*
thimbleberry – *Rubus parviflorus*
thistle – *Circium* spp.
triangular–lobed moonwart – *Botrychium ascendens*
tumble mustard – *Sisymbrium altissimum*
watercress – *Rorippa nasturtium–aquaticum*
western hemlock – *Tsuga heterophylla*
western larch – *Larix occidentalis*
white mulberry – *Morus alba*
white poplar – *Populus alba*
white spiraea – *Spiraea betulifolia*
willow – *Salix* spp.
Wood's rose – *Rosa woodsii*
yarrow – *Achillea millefolium*

2.3.2 Birds

American avocet – *Recurvirostera americana*
American coot – *Fulica americana*
American kestrel – *Falco sparverius*
American robin – *Turdus migratorius*
Baird's sandpiper – *Calidris bairdii*
bald eagle – *Haliaeetus leucocephalus*
bank swallow – *Raparia riparia*
Barrow;s golden–eye – *Bucephala clangula*
belted kingfisher – *Ceryle alcyon*
black–headed grosbeak – *Pheucticus melanocephalus*
black tern – *Chlidonias niger*
black–billed magpie – *Pica pica*
black–crowned night heron – *Nycticorax nycticorax*
black–necked stilt – *Himantopus mexicanus*
blue bird – *Sialia* spp.
blue grouse – *Dendrogapus obscurus*
burrowing owl – *Athene canicularia*
California gull – *Larus californicus*
California quail – *Callipepla californica*
Canada geese – *Branta canadensis*
Caspian tern – *Sterna caspia*
Cassin's finch – *Carpodacus cassinii*

chukar – *Alectoris chukar*
Clark's grebe – *Aechmophorus clarkii*
cliff swallow – *Hirundo pyrrhonota*
Columbian sharp–tailed grouse – *Typanuchus phasianellus columbianus*
common flicker –*Colaptes auratus*
common goldeneye – *Bucephala clangula*
common loon – *Gavia immer*
common merganser – *Mergus merganser*
common nighthawk – *Chordeiles minor*
common raven – *Corvus corax*
common redpoll – *Carduelis flammea*
common snipe – *Gallinago gallinago*
cordilleran flycatcher – *Empidonax occidentalis*
dark–eyed junco – *Junco hyemalis*
dipper – *Cinclus mexicanus*
downy woodpecker – *Picoides pubescens*
European starling – *Sturnus vulgaris*
ferruginous hawk – *Buto regalis*
flammulated owl – *Otus flammeolus*
Forsters tern – *Sterna forsteri*
fox sparrow –*Passerella iliaca*
gadwall – *Anas strepera*
golden–crowned kinglet – *Regulus satrapa*
golden eagle – *Aquila chrysaetos*
goshawk – *Accipiter gentilis*
grasshopper sparrow – *Ammodramus savannarum*
gray jay – *Perisoreus canadensis*
great egret – *Casmerodius albus*
great horned owl – *Bubo virginianus*
Great blue heron – *Ardea herodias*
greater yellowlegs – *Tringa melanoleuca*
gyrfalcon – *Falco rusticolis*
hairy woodpecker – *Picoides villosus*
harlequin duck – *Histrionicus histrionicus*
hermit thrush – *Catharus guttatus*
horned grebe – *Podiceps auritus*
horned lark – *Eremophila alpestris*
house finch – *Carpodacus mexicanus*
house sparrow – *Passer domesticus*
house wren – *Trooglodytes aedon*
Hungarian partridge – *Perdix perdix*
killdeer – *Charadrius vociferus*
lesser yellowlegs – *Tringa flavipes*
Lewis' woodpecker – *Melanerpes lewis*
loggerhead shrike – *Lanius ludovicianus*
long–billed curlew – *Numenius americanus*
long–billed dowitcher – *Limnodromus scolopaceus*
long–eared owl – *Asio otus*
mallard – *Anas platyrhynchos*
merlin – *Falco columbarius*
mountain chickadee – *Parus gambeli*
mountain quail – *Oreotyx pictus*
mourning dove – *Zenaida macroura*
northern goshawk – *Accipiter gentilis*
northern oriole – *Icterus glabula*
northern phalarope – *Phalaropus lobatus*
northern shrike – *Lanius excubitor*
osprey – *Pandion haliaetus*
peregrine falcon – *Falco peregrinus anatum*
pileated woodpecker – *Dryocopus pileatus*
pine siskin – *Carduelis spinus*
pintail – *Anas acuta*
poorwill – *Phalaenoptilus nuttallii*
prairie falcon – *Falco mexicanus*
red–breasted nuthatch – *Sitta canadensis*
red–eyed vireo – *Vireo olivaceus*
red–necked grebe – *Podiceps grisegena*
red–tailed hawk – *Buteo jamaicensis*
red–wing blackbird – *Agelaius phoeniceus*
ring–billed gull – *Larus delawarensis*

ring–necked pheasant – *Phasianus colchicus*
rough–legged hawk – *Buteo lagopus*
rough–winged swallow – *Stelgidopteryx serripennis*
ruffed grouse – *Bonasa umbellus*
rufous hummingbird – *Selasphorus rufus*
sage sparrow – *Amphispiza belli*
sanderling – *Calidris alba*
sandhill crane – *Grus canadensis*
scaup – *Aythya* spp.
semipalmated plover – *Charadrius semipalmatus*
short eared owl – *Asio flammeus*
snowy owl – *Nyctea scandiaca*
solitary sandpiper – *Tringa solitaria*
solitary vireo – *Vireo solitarius*
song sparrow – *Melospiza melodia*
spotted sandpiper – *Actitis macularia*
spruce grouse – *Dendrogapus canadensis*
Steller's jay – *Cyanocitta stelleri*
Swainson's hawk – *Buteo swainsoni*
Swainson's thrush – *Catharus ustulatus*
teal – *Anas* spp.
Townsend's warbler – *Dendroica townsendi*
tundra, whistling swan – *Cygnus columbianus*
turkey – *Meleagris gallopavo*
turkey vulture – *Cathartes aura*
turkey vulture – *Cathartes aura*
western grebe – *Aechmophorus occidentalis*
western kingbird – *Tyrannus verticalis*
western meadowlark – *Sturnella neglecta*
western sage grouse – *Centrocercus urophasianus*
western tanager – *Piranga ludoviciana*
western wood pewee – *Contopus sordidulus*
white pelican – *Pelecanus erythrorhynchus*
white–crowned sparrow – *Zonotrichia leucophrys*
white–winged crossbill – *Loxia leucoptera*
wigeon – *Anas americana*
wood duck – *Aix sponsa*
yellow warbler – *Dendroica petechia*
yellow–rumped warbler – *Dendroica coronata*

2.3.3 Mammals

badger – *Taxidea taxus*
beaver – *Castor canadensis*
bighorn sheep – *Ovis canadensis*
black bear – *Ursus americanus*
black–tailed jackrabbit – *Lepus californicus*
bobcat – *Lynx rufus*
bushy–tailed woodrat – *Neotoma cinerea*
cottontail rabbit – *Sylvilagus nuttalli*
cougar – *Felis concolor*
coyote – *Canis latrans*
deer mouse – *Peromyscus maniculatus*
elk – *Cervus canadensis*
grasshopper mouse – *Onochomys leucogaster*
gray wolf – *Canis lupis*
Great Basin pocket mouse – *Perognathus parvus*
grizzly bear – *Ursus arctos*
house mouse – *Mus musculus*
least chipmunk – *Eutamias minimus*
long–legged myotis – *Myotis volans*
long–tailed weasel – *Mustela frenata*
lynx – *Lynx canadensis*
Merriam's shrew – *Sorex merriami*
mink – *Mustela vison*
moose – *Alces alces*
mountain goat – *Oreamnos americanus*
mule deer – *Odocoileus hemionus*
Muskrat – *Ondatra zibethica*
northern pocket gopher – *Thomomys talpoides*
Norway rat – *Rattus norvegicus*
Pacific fisher – *Martes pennanti pacifica*

Pacific western big–eared bat – *Plecotus townsendii townsendii*

pallid bat – *Antrozous pallidus*

pine marten – *Martes americana*

porcupine – *Erithizon dorsatum*

Preble'shrew – *Sorex preblei*

pygmy rabbit – *Brachylagus idahoensis*

river otter – *Lutra canadensis*

sagebrush vole – *Lagurus curtatus*

short–tailed weasel – *Mustela erminea*

snowshoe hare – *Lepus americanus*

striped skunk – *Mephitis mephitis*

Thompson's big–eared bat – *Corynorhinus rafinesquei*

Townsend's ground squirrel – *Spermophilus townsendii*

western harvest mouse – *Reithrodontomys megalotis*

white–tailed deer – *Odocoileus virginianus*

wolverine – *Gulo gulo luscus*

woodland caribou – *Rangifer tarandus*

yellow–bellied marmot – *Marmota flaviventris*

yellow pine chipmunk – *Eutamias amoenus*

2.3.4 Reptiles and Amphibians

garter snake – *Thamnophis elegans*

gopher snake – *Pituophis melanoleucus*

Great Basin spadefoot toad – *Spea intermontanus*

Larch Mountain salamander – *Plethodon larselli*

long–toed salamander – *Ambystoma macrodactylum*

northern alligator lizard – *Gerrhonotus coeruleus*

northern red–legged frog – *Rana aurora aurora*

Pacific rattlesnake – *Crotalus viridis*

Pacific treefrog – *Pseudacris regilla*

painted turtle – *Chrysemys picta*

rubber boa – *Charina bottae*

sagebrush lizard – *Sceloporus graciosus*

short–horned lizard – *Phrynosoma douglassii*

side–blotched lizard – *Uta stansburiana*

Spotted frog – *Rana pretiosa*

western pond turtle – *Clemmys marmorata marmorata*

western skink – *Eumeces skiltonianus*

western toad – *Bufo boreas*

Woodhouse's toad – *Bufo woodhouseii*

western yellow–bellied racer – *Coluber constrictor*

2.3.5 Fish

chinook salmon – *Oncorhynchus tshawytscha*

coho salmon – *Oncorhynchus kisutch*

mountain sucker – *Catostomus platyrhynchus*

mountain whitefish – *Prosopium williamsoni*

paiute sculpin – *Cottus beldingi*

reticulate sculpin – *Cottus perplexus*

sandroller – *Percopsis transmintana*

sockeye – *Oncorhynchus nerka*

steelhead trout – *Oncorhynchus mykiss*

white sturgeon – *Acipenser transmontanus*

smallmouth bass – *Micropterus dolomieui*

2.3.6 Invertebrates

California floater – *Andonta californiensis*

Columbia pebblesnail – *Fluminicola columbianus*

Columbia River limpet –

Columbia River spire snail – *Lithoglyphus columbiana*

immaculate green hairstreak – *Callophrys affinis affinis*

shortface lanx – *Lanx nuttalli*