Columbia River System Operation Review

Final Environmental Impact Statement

Appendix J

Recreation

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.

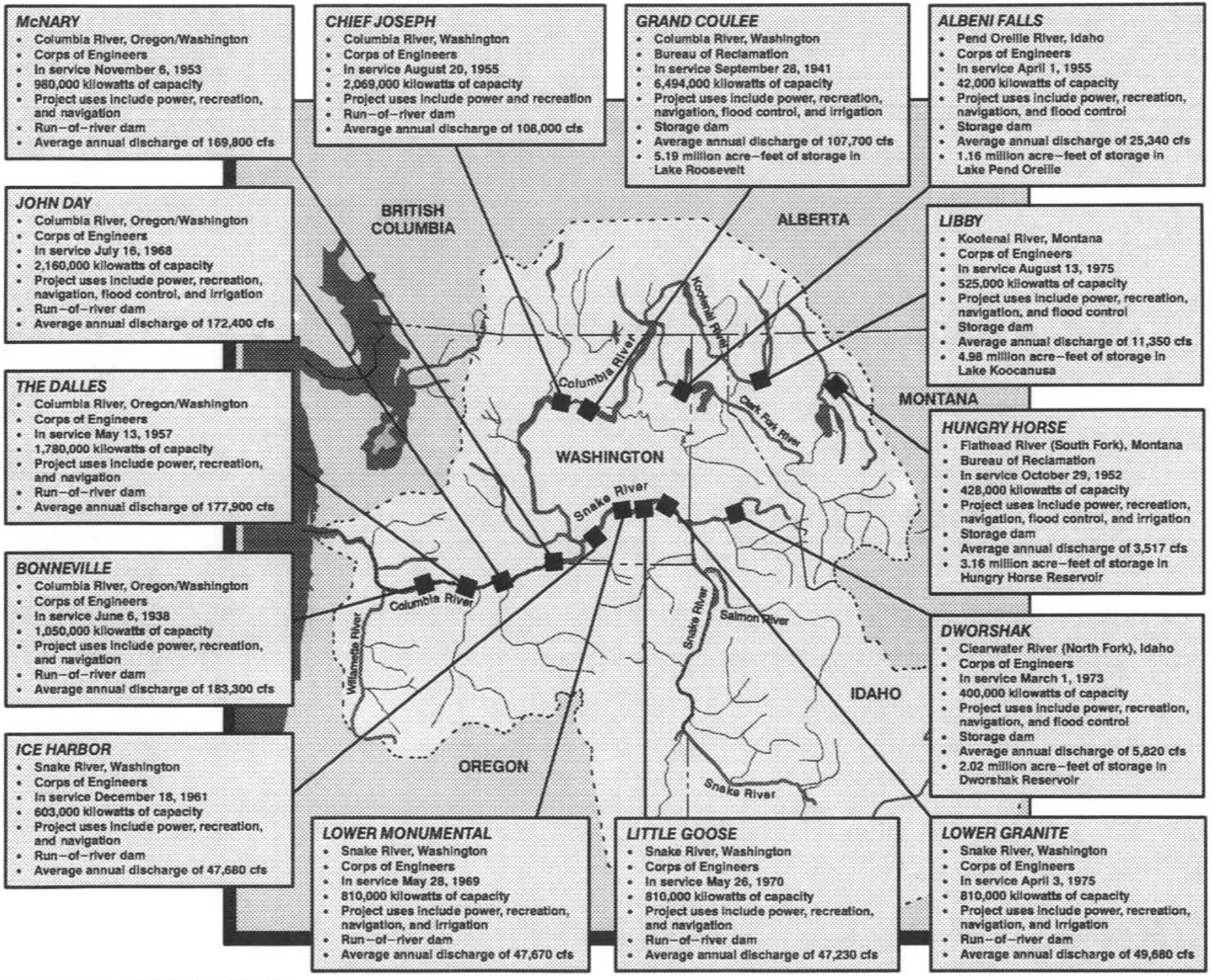
WHAT DO THE TECHNICAL APPENDICES COVER?

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.

There are many interrelationships among the different resources and river uses, and some of the appendices provide supporting data for analyses presented in other appendices. This Recreation appendix relies on supporting data contained in Appendice C, K, N, and O. For complete coverage of all aspects of recreation, readers may wish to review all five appendices in concert.



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.

TABLE OF CONTENTS

TABLE OF CONTENTS – CONT

TABLE OF CONTENTS – CONT

TABLE OF CONTENTS – CONT

TABLE OF CONTENTS – CONT

1995

TABLE OF CONTENTS – CONT

LIST OF TABLES

LIST OF TABLES – CONT

LIST OF TABLES – CONT

LIST OF TABLES – CONT

LIST OF TABLES – CONT

LIST OF FIGURES

LIST OF FIGURES – CONT

LIST OF FIGURES – CONT

LIST OF ACRONYMS

ACEC	Areas of Critical Environmental Concern
AFWG	Anadromous Fish Work Group
ARD	Annual Recreation Days
BC	British Columbia
BLM	United States Bureau of Land Management
BoR	United States Bureau of Reclamation (also referred to as Reclamation)
BPA	Bonneville Power Administration
CBFWA	Columbia Basin Fish and Wildlife Authority
CFS	Cubic Feet per Second
CMS	Cubic Meters per Second
CRGNSA	Columbia River Gorge National Scenic Area.
COE	U.S. Army, Corps of Engineers (also referred to as the Corps)
CBM	Contingent Behavior Method
CVM	Contingent Valuation Method
DEIS	Draft Environmental Impact Statement
EAG	Economic Analysis Group
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FERC	United States Federal Energy Regulatory Commission
FCRPS	Federal Columbia River Power System
FWPRA	Federal Water Projects Recreation Act (1964)
FWS	United States Fish and Wildlife Service
HCNRA	Hells Canyon National Recreation Area
IAM	Recreation Impact Assessment Models
IDFG	Idaho Department of Fish and Game
IPC	Idaho Power Company
IWR	Institute for Water Resources (Corps)
KAF	Thousand Acre–feet
KCFS	Thousand Cubic Feet per Second
Km	Kilometers
MAF	Million Acre–feet
MDFWP	Montana Department of Fish, Wildlife and Parks
MOP	Minimum Operating Pool
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NPPC	Northwest Power Planning Council
NPS	National Park Service
NRCS	United States Natural Resource Conservation Service
NRMS	Natural Resource Management System
NWED	Northwest Environmental Data Base
NWR	National Wildlife Refuge
ODFW	Oregon Department of Fish and Wildlife
ONA	Outstanding Natural Area

ORRRC	Outdoor Recreation Resources Review Commission
OSMB	Oregon State Marine Board
OSP	Oregon State Parks Department
PL	Public Law
PNCA	Pacific Northwest Coordination Agreement
PNUCC	Pacific Northwest Utilities Conference Committee
PUD	Public Utility District
RCG	RCG, Hagler/Bailly, Inc.
RFWG	Resident Fish Work Group
RM	River Mile
RNA	Research Natural Areas
RWG	Recreation Work Group
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SOR	(Columbia River) System Operation Review
SOS	System Operating Strategy
TCM	Travel Cost Method
URC	Upper Rule Curve (see flood control rule curves).
USFS	United States Forest Service
USFWS (FWS)	United States Fish and Wildlife Service
USGS	United States Geological Survey
VERS	Visitation Estimation and Reporting System (Corps)
WDW	Washington Department of Wildlife
WES	Waterways Experiment Station (Corps)
WIAC	Washington State Interagency Committee for Outdoor Recreation
WSP	Washington State Parks
WTP	Willingness to Pay

CHAPTER 1

RECREATION STUDIES SCOPE AND PROCESSES

This appendix contains the results, findings, and conclusions of the detailed studies undertaken by the Recreation Work Group (RWG) through the Columbia River System Operation Review (SOR). Chapter 1 presents a brief, general description of the technical and geographic scope and study process followed by the RWG including: formation of the work group; coordination efforts with the public, agencies and other work groups; recreation issues and concerns raised during the SOR public scoping process; and work group methodologies and findings during major study phases (pilot, screening, and full–scale analysis). Each of these items is described in detail in subsequent chapters and technical exhibits to this appendix.

1.1 THE SOR RECREATION WORK GROUP

1.1.1 Objectives

Through the process of the Columbia SOR, the objectives of the RWG have been as follows:

a. To identify the programs, goals, and objectives of Federal, state, and local agencies and entities with recreation resource management responsibilities in the Columbia River Basin that influence or may be influenced by changes in operation of the system of Federal dams in the Columbia River Basin (the system).

b. To identify the past, present, and potential future recreational users of Columbia Basin reservoirs and rivers and their needs, concerns, and desires regarding system operations.

c. To identify trends in water–dependent and water–related recreation use, including both reservoir and instream, that presently influence, or could in the future influence or be influenced by, Columbia River system operations.

d. To identify and analyze the potential effects of changes in system operations on recreational participation in the Columbia Basin, including predicted impacts of alternatives and selection of preferred alternatives.

e. To identify recreation research and study needs, and to develop and implement recreation research designs, methodologies, and results, including surveys and models, required to accurately evaluate potential recreation impacts.

f. To develop recreation mitigation plans for alternatives selected under the SOR.

1.1.2 Formation

The RWG was one of four work groups initially established to participate in the pilot modeling phase of the SOR (described in more detail under section 1.5). Initial participants on the RWG included representatives from the three sponsoring agencies, U.S. Army Corps of Engineers (Corps), U.S. Bureau of Reclamation (Reclamation) and Bonneville Power Administration (BPA). Throughout the study process, the sponsoring agency representatives had administrative oversight for the work accomplished by the RWG, including:

a. coordination with SOR study management/ analysis group

b. scheduling work group activities

c. administration of contracts

d. obtaining and managing funding

e. preparing written materials for SOR documentation

f. implementation of the public involvement plan.

As the SOR moved into the scoping and screening phases, other Federal, state, and local agencies and others with authorities and responsibilities for managing recreation facilities or resources in the basin, as well as private citizens, were invited to join the RWG.

1.1.3 Participants

1.1.3.1 Tier 1

The RWG has two levels of participation; tiers 1 and 2. Tier 1 is comprised of a core group of representatives who were able to attend and participate in RWG meetings on a regular basis. The RWG met on an average of about once a month beginning in November 1990 with the pilot phase of the SOR and continuing through the completion of the full-scale analysis phase. Most of the meetings were held in Portland, Oregon, which was the most convenient locale for the majority of RWG tier 1 participants. However, meetings were held periodically at other locations throughout the region, including Spokane and Grand Coulee, Washington; Sandpoint and Boise, Idaho; and Libby, Montana, to provide an opportunity for other agencies' representatives and interested members of the public to participate.

Tier 1 participants were also primarily responsible for producing this appendix and other interim products required of the RWG during the SOR process. Individual members of tier 1 determined the appropriate scope of SOR recreation studies. They collected, evaluated, and consolidated information and data, and wrote sections of the appendix. Finally, tier 1 participants reviewed and provided comments on materials produced by other members and consultants of the RWG, and other SOR work groups.

Tier 1 of the RWG included representatives of the following agencies and organizations: (See Exhibit A for complete list):

Federal Agencies

- Corps of Engineers
  - Portland District
  - Seattle District
  - Walla Walla District
  - Waterways Experiment Station
  - Institute for Water Resources
- Bureau of Reclamation
  - Pacific Northwest Region
  - Denver Service Center
- Bonneville Power Administration
- Forest Service, Region 6
- National Park Service, Coulee Dam National Recreation Area

State Agencies

- Oregon
  - Oregon State Parks and Recreation Department
  - Oregon State Marine Board
- Washington
  - Washington State Parks and Recreation Commission
  - Washington Interagency Committee for Outdoor Recreation
- Idaho State Parks

Other Public Entities

- Chelan County Public Utility District No. 1
- Northwest Power Planning Council
- Pacific Northwest Utilities Conference Committee
- British Columbia Hydro and Power Authority (B.C. Hydro)

1.1.3.2 Tier 2

Tier 2 consists of all agencies, entities, and individuals that have expressed an interest/concern regarding recreation issues in the SOR, but by their own

choice have been unwilling or unable to be direct, active participants in tier 1 of the RWG. In general, tier 2 consists of many state and local agency representatives with an interest in the relationship of SOR to recreation at a specific reservoir, subregion or locale, rather than to the system as a whole. These individuals include marina operators, park managers, port directors, and recreation user groups.

Coordination with tier 2 was accomplished primarily through mail. Tier 2 participants were provided copies of all RWG meeting notices, meeting minutes, and other interim work products. The RWG objective was to keep the tier 2 participants informed of the research efforts, results and conclusions of the tier 1 participants. Exhibit A to this appendix provides a complete tier 2 list.

1.1.4 Coordination With Other Work Groups

In order to fully evaluate the potential impacts of changes in operation of the Columbia River system on recreation resources and opportunities, it has been necessary for the RWG to coordinate closely with several other work groups during the SOR process.

1.1.4.1 Resident and Anadromous Fish Work Groups

The Resident and Anadromous Fish Work Groups were responsible for determining the potential effects of changes in system operations on the habitat and biology of their respective species. The RWG coordinated closely with these work groups to translate those changes into effects on fish catching success and fishing participation.

1.1.4.2 Wildlife Work Group

Similar to fish, changes in Columbia River system operations will affect habitat and biology of certain wildlife species. The RWG coordinated with the SOR Wildlife Work Group to attempt to translate wildlife impacts into changes in hunting success and wildlife viewing opportunities.

1.1.4.3 Economic Analysis Group

Recreation is an important sector of the Pacific Northwest economy. Significant local economic infrastructures have developed to support the recreational use of the reservoirs and rivers of the Columbia Basin. Changes in system operation that affect the rates of participation of users will have corresponding impacts on local and regional economies. In general terms, the division of responsibility calls for the RWG to estimate the impacts of SOR alternatives on recreation participation (as defined as changes in visitor days of use). The Economic Analysis Group (EAG) translated those potential changes in recreation participation into economic effects.

The two work groups worked closely to develop tools to evaluate the economic impacts of recreation. The most important of these tools was derived from regionwide recreation user surveys (described in section 3.10) undertaken during the fall of 1993. The results and analytical models developed from the survey are presented in this Final EIS. The RWG had the lead role in developing the survey, but coordinated the effort closely with the EAG. The data collected in the survey included information on both the way recreationists change their recreation participation in response to different operational scenarios, as well as the effect of those changes on the welfare (economic) value of their recreation experience. The user survey also obtained data regarding recreationists expenditures that were used by the EAG to assist in developing estimates of regional economic impacts.

1.2 PUBLIC INVOLVEMENT AND AGENCY COORDINATION

1.2.1 Objectives

During the scoping phase of the SOR, the RWG developed a public involvement program for the recreation element. The objectives were to:

a. Provide a forum for interested publics, including private users, public interest groups, and resource management agencies to express their needs, interests, and concerns regarding management, operation, and development of Columbia Basin reservoirs and rivers for recreation.

b. Identify the programs, goals, and objectives of Federal, state, and local agencies and entities with recreation resource management responsibilities in the Columbia River Basin that influence or may be influenced by system operations.

c. Validate the technical methodologies and approaches used in recreational studies and analysis undertaken through the SOR process from recreation peers and professionals in the region.

1.2.2 Key Publics

This program was targeted at key "publics", including other Federal, state, and local agencies and private entities with recreation resource management responsibilities, state and local political interests, local civic groups, public interest and user groups, professional peers in recreation and related fields, and interested individuals. As previously described in Section 1.1.3.2, most of these key publics were incorporated into the tier 2 mailing list (attached as Exhibit A).

The public involvement objective for tier 2 was to keep these publics informed of the research efforts, results, and conclusions of the RWG tier 1. Coordination with this group was mostly passive. Minutes of the regular RWG meetings were mailed to tier 2 along with other interim documents produced by RWG and other SOR elements.

Rather than attempting to cover the entire Columbia River Basin, public involvement efforts of the RWG were targeted at those specific geographic regions or project areas where recreation issues or concerns were expected to be created, relieved, or exacerbated by the outcomes of the SOR. Generally, impacts were expected to be relatively minor along the run-of-river reservoirs of the lower Columbia River. Impacts were expected to be more significant at the storage reservoirs on the upper reaches of the Columbia River and its tributaries, and under some alternatives for the lower Snake River. Therefore, public involvement efforts for the recreation element were targeted for communities/projects in the upper reaches.

1.2.3 Public Meetings

As previously described, the RWG held regular coordination meetings. The schedule for these meetings was established in advance and meeting notices were mailed to everyone on both the tier 1 and tier 2 mailing lists. RWG meetings were part of an open public process, and members of the public and other interested agencies and organizations were encouraged to participate. Meeting locations were primarily in Portland, Oregon, but were periodically rotated around the region and frequently included field trips to the project sites with agency or group representatives.

In addition to these regular RWG working sessions, RWG members held numerous other meetings around the study area with specific groups, organizations and agencies specifically interested in recreation issues and concerns related to the SOR.

Those meetings are listed below:

Date	Location	Host/Sponsor/Participants
May 16, 1991	Sandpoint, WA	Sandpoint Chamber of Commerce/local agencies
June 4, 1991	Grand Coulee, WA	Lake Roosevelt Forum
November 12, 1991	Sandpoint, ID	Albeni Falls Project
November 13, 1991	Kalispell, MT	Flathead Basin Commission
November 14, 1991	Libby, MT	Libby Dam Project
November 19, 1991	Orofino, ID	Dworshak Dam Project
November 20, 1991	Kennewick, WA	McNary Dam Project
November 21, 1991	Grand Coulee, WA	Grand Coulee Dam
February 5, 1992	Umatilla, OR	Port of Umatilla
February 6, 1992	Crow Butte, WA	Park Manager, Washington State Parks
	Rooster Rock, OR	Park Manager, Oregon State Parks
February 11, 1992	Clarkston, WA	State, county & local agencies/organizations in the Lewiston/Clarkston area:
February 13, 1992	Dworshak Dam, ID	City of Orofino, Orofino Chamber of Commerce and other local business and agency representatives
February 19, 1992	Grand Coulee, WA	Lake Roosevelt Forum, Grand Coulee Chamber of Commerce, local businesses, other Federal agencies
February 21, 1992	Libby Dam, MT	Kootenai N. F., MT. Dept. of Fish, Wildlife and Game, local representatives and business interests from Libby and Eureka
February 25, 1992	Seattle, WA	University of Washington
February 27, 1992	Sandpoint, ID	Sandpoint Chamber of Commerce
August 18, 1992	Libby, MT	Kootenai NF/Libby Chamber/Lincoln County Economic Development
September 8, 1992	Boise, ID	SOR Public Meeting
September 10, 1992	Kennewick, WA	"
September 14, 1992	Clarkston, WA	"
September 15, 1992	Grand Coulee, WA	"
September 21, 1992	Sandpoint, ID	"
September 22, 1992	Libby, MT	"
September 23, 1992	Eureka, MT	"
September 24, 1992	Kalispell, MT	"
September 14, 1992	Wenatchee, WA	Chelan, Douglas and Grant County Public Utility Districts
September 15, 1992	Spokane, WA	Lake Roosevelt Forum
June 7, 1993	Boise, ID	Idaho State Parks

1.3 RECREATION ISSUES AND CONCERNS RAISED DURING SCOPING

1.3.1 Overview

The SOR scoping process and results are described in detail in the Columbia River System Operation Review Scoping Document, published in May 1991. The process is also described in the Preface to this Appendix. This section focuses on specific recreation and recreation-related issues and concerns that were raised during the scoping process. Those issues form the basis for the scope of work undertaken by the RWG through the SOR and described in this Appendix.

The scoping process began in July 1990 with the public announcement by the sponsoring agencies of their intent to prepare the SOR EIS. Public notices were sent to approximately 11,000 groups and individuals, who were asked to comment on the scope of the SOR in writing and/or to attend one of the 15 scoping meetings held in locations throughout the region during August 1990.

1.3.2 General Issues

1.3.2.1 Recreation

In general, comments from participants in the scoping process focused on the importance of recreation to the overall quality of life in the Pacific Northwest, as well as to local and regional economies. Many participants were concerned about the detrimental effects of water releases during peak recreation seasons on recreation suitability of the lakes in the system. Most of those comments were site-specific, with concerns about operation of the upper end storage projects, especially Libby Reservoir and the Kootenai River the most numerous. Site-specific issues and concerns are described in more detail in Section 1.3.3.

1.3.2.2 Geographic Scope

A majority of scoping participants recommended that the SOR study area be expanded to encompass the entire Columbia River Basin, including the upper Snake River and Canadian parts of the basin. Participants felt that a comprehensive review of system operations was impossible without looking at the entire system. This view tended to be supported by state and Federal agencies, particularly those with fish and wildlife interests, Tribes, and fishing-oriented recreation groups. Section 1.4 describes the geographic scope of the SOR as it relates to the work performed by the RWG.

1.3.2.3 Fish

Many scoping participants supported the preservation and enhancement of the system's fish resources as an important new priority of system management, citing their regional, national, and international economic importance. The majority of these comments were related to anadromous fish species. However, trout, kokanee, and other resident fish were also seen as important to many local and regional recreation-dependent economies. This concern was noted frequently in Montana.

1.3.3 Site-specific Issues

The following site-specific recreation issues and concerns were raised during the SOR scoping process.

1.3.3.1 Lower Columbia River

Relatively few issues were raised specific to recreation on the lower Columbia River. Port authorities, marina operators, and park managers expressed concern about the effects of high flows on boating and swimming facilities on the run-of-river projects on the lower Columbia River, as well as on the free flowing reach below Bonneville Dam. State and local agencies and organizations identified windsurfing as a particularly important activity to local economies in the Columbia River gorge that could be affected by changes in system operations.

1.3.3.2 Tri-Cities Area

The Tri-Cities area is a major population center in the Columbia Basin. Changes in operation of the mid- and lower-Columbia and lower Snake River projects could affect recreational opportunities and regional economies in this area.

1.3.3.3 Mid–Columbia Projects

Chelan, Grant and Douglas County Public Utility Districts (PUDs) expressed concern about the effects of system operations on the recreational suitability of the mid–Columbia run–of–river projects. Most of the facilities on these reservoirs are usable over the normal three to four–foot (0.9 to 1.2m) operating ranges. These projects have very limited storage space; high–volume flows released from Grand Coulee and Chief Joseph Projects create unsafe swimming and boating conditions and can temporarily flood out recreation facilities.

1.3.3.4 Grand Coulee/Chief Joseph Projects

By virtue of its status as a National Recreation Area, Lake Roosevelt is especially important to the scope of the SOR. The National Park Service, marina operators, boating clubs, user groups, Colville Confederated Tribes, and Lake Roosevelt Forum all expressed concerns about recreation issues related to operation of Grand Coulee Dam. Use of the reservoir has increased rapidly over the last several years and houseboating is very popular.

Local interests are concerned about any changes in operation that could affect use of the lake. Water quality is also a problem in the lake and may affect safe consumption of fish. Public information about low water elevations and water quality problems may be more detrimental to use than the actual conditions dictate.

Local groups and residents are very interested in improving the resident game fish populations in the lake. Two new hatcheries are expected to greatly increase the kokanee population. Groups and private citizens participate in a very active net pen rearing program for rainbow trout and other species. The impact of reservoir operation on water retention time in the lake may be critically important for determining the health and size of resident fish populations.

Many of the facilities on the lake are usable over a wide range of operations. However, large drawdowns make access to boating facilities difficult, especially to commercial houseboat moorages. Drawdowns of over 8 feet (2.4 m) make swimming beaches unusable.

1.3.3.5 Libby

Business and civic interests, marina operators, commercial fishing guides, Montana Department of Fish, Wildlife and Parks, Kootenai National Forest, and other interests from communities around Lake Koocanusa voiced strong concern about the negative impacts of current operation of the reservoir on recreation, fisheries, and the local economy both within the reservoir and on the Kootenai River downstream.

Residents of Libby and Eureka, Montana, and neighboring communities in British Columbia agreed to the construction of the project based on promises that it would become an important recreation resource. They believe that Federal agencies have reneged on those promises by operating the project primarily for purposes other than recreation. They point out that many of the recreation facilities that were planned on the lake have never been constructed.

Low water elevations have frequently made many of the boating and swimming facilities unusable for long periods during peak recreation seasons. This is especially true in upper reaches of the lake in Canada. Drawdowns also expose large mudflats in the vicinity of Eureka, which have resulted in a dust problem. The kokanee fishery that was once nationally recognized has declined severely in recent years, possibly due in part to reservoir operations.

A blue ribbon trout fishery has developed in the Kootenai River downstream from Libby Dam; trophy size rainbow trout attract anglers from across the nation. Fishing guides and other services that support the fishery are an important sector of the local economy. Severe fluctuations in releases from the dam affect fish biology and fishing success rates.

1.3.3.6 Hungry Horse

Operational concerns similar to those at Libby occur at Hungry Horse, but site–specific scoping comments were limited. There are no communities nearby with large sectors of their economies directly related to recreational use of Hungry Horse.

1.3.3.7 Albeni Falls

Recreational fishing is an extremely important activity at Lake Pend Oreille. A large sector of the local economy is dependent upon fishing and boating use of the lake. Reservoir operations may have an impact on resident game fish biology, particularly kokanee. Local interests would like to see reservoir operations changed to include a higher minimum drawdown level.

1.3.3.8 Dworshak

Recreational use of Dworshak Lake is very important to the local economy of the city of Orofino, Idaho. Drawdowns during the peak recreation season severely constrain use and access to the lake and the usability of facilities. The popular dispersed mini-camps around the lake are very difficult to use if drawdown exceeds about 10 feet (3 m).

The Clearwater River downstream of Dworshak Dam is an important fishery, especially for steelhead. The peak of the steelhead run occurs during the winter and early spring.

1.4 GEOGRAPHIC SCOPE OF RECREATION STUDIES

The SOR Scoping Document (May 1991) describes the geographic scope of the SOR. The geographic scope of recreation studies is based on this overall scope, with some modifications.

1.4.1 Federal Projects

The focus of the SOR recreation analysis is on the 14 Federal projects on the Columbia and lower Snake Rivers and tributaries. Under most of the alternative system operating strategies under consideration, recreational suitability of the five storage projects would be affected to the largest degree by changes in the timing and extent of filling and drawdown (see Chapter 4 for a description of the alternatives and their impacts). These projects are: Hungry Horse, Libby, Grand Coulee, Albeni Falls, and Dworshak.

The remaining 9 Federal projects are run-of-river projects. Four of them are on the lower Snake River: Ice Harbor, Little Goose, Lower Monumental, and Lower Granite. Several of the alternative system operating strategies call for drawing down some or all of these projects for various periods, with potentially significant effects on recreation.

The 5 remaining run-of-river projects are on the middle and lower Columbia River: Chief Joseph, McNary, John Day, The Dalles, and Bonneville. With the exception of John Day, none of the SOR alternatives call for direct changes in these projects. Recreational use of these projects could be affected, however, by changes in timing and velocity of flows released from the Federal storage projects. John Day does have some storage capacity and would be drawn down to minimum operating pool during the summer under several alternatives.

For each of the 14 Federal projects, the RWG performed detailed technical evaluations, including:

a. Inventory of existing recreation sites, facilities, and activities (see Section 1.6.2)

b. Inventory of historical recreation visitation patterns & trends (see Section 1.6.3)

c. Development of recreation impact assessment models to provide quantitative estimates of impacts of the SOR alternatives (see Section 1.6.5)

d. Supplemental qualitative evaluation of the impact of alternatives.

1.4.2 Downstream River Reaches

Undammed river reaches below Federal projects in the system provide critical recreation opportunities throughout the region. The timing and quantity of flows released from storage and run-of-river projects can both benefit and harm recreation resources and opportunities downstream. Important recreational river reaches that may be affected by system operations include:

- Kootenai River below Libby Dam
- Flathead River below Hungry Horse Dam

- Clearwater River below Dworshak Dam
- Snake River below Hells Canyon Dam
- Columbia River (Canada) below Hugh Keenleyside Dam
- Columbia River, Hanford Reach below Priest Rapids Dam
- Columbia River below Bonneville Dam.

All of these river reaches were included in the inventory of recreation sites, and visitation and potential impacts on recreational suitability stemming from changes in system operations are qualitatively described for each. In addition, the RWG prepared models to assess the impact of alternatives on recreation participation on the Columbia River in Canada, the Kootenai, and the Clearwater Rivers. There was adequate visitation data and knowledge of the relationship between flows and recreation participation to allow development of models for these river reaches.

1.4.3 Non–Federal Projects

Recreation impact assessment models were not developed to estimate the effects of SOR alternatives on recreation use of the five PUD run–of–river projects in the Mid–Columbia reach of the river, including Wells Dam, Rocky Reach Dam, Rock Island Dam, Wanapum Dam, and Priest Rapids Dam. However, the RWG worked with Chelan, Grant and Douglas PUDs to inventory recreation sites and visitation and to qualitatively describe the recreational impacts of alternatives. In addition, models were not developed for IPC's Hells Canyon, Oxbow and Brownlee Dams.

1.5 RECREATION PILOT MODELS

The initial phase of the SOR was the Pilot Modeling Phase. From November 1990 to around April 1991, the RWG and several other work groups were formed and asked to develop first cut "pilot" simulation models that could be used as tools to quantitatively estimate the sensitivity of various resources in the Columbia River Basin to changes in system operations. The Recreation Impact Assessment models developed by the RWG in the pilot model phase and further refined in the later study phases are described in detail in chapter 3. The basic "value measure" used by the pilot models to describe impacts of operations on recreation use was impact to visitation as expressed in terms of "recreation days" of use. In summary, the pilot models did show that water–related recreation activities in the Columbia River Basin are affected by changes in reservoir elevations and downstream flows resulting from operation of the dams in the system. The information gathered in the pilot model phase was carried forward into the screening phase.

1.6 SCREENING PROCESS

1.6.1 General

The second major phase of the SOR was the screening process. This process is described in detail in the document entitled Columbia System Operation Review Screening Analysis (August 1992). In summary, during this phase the SOR work groups had two major tasks. First, they developed alternative strategies for operating the Columbia River system of Federal dams. Second, work groups evaluated the impacts of all of the alternatives developed under screening. RWG efforts under each of these tasks are described in more detail below.

1.6.2 Recreation Optimization Alternatives

During the screening phase, RWG and many of the other work groups developed alternative system operating scenarios that would theoretically provide the greatest benefit to their individual river uses. In other words, the RWG was asked to describe system operating strategies that came as close as possible to maximizing benefits for recreation. The work groups were also asked to develop other alternatives that, while perhaps not ideal, would provide an acceptable environment for their river use.

The purpose of developing these alternatives was to learn more about the operating relationships of the various reservoirs and river reaches that make up the Columbia Basin system, to define which river uses are compatible and which conflict, and to determine under what conditions and to what extent

the conflicts occur. The goal of the screening phase was ultimately to use these data to come up with combinations or variations of the alternatives that would define alternative strategies for a multiple-use river system to be evaluated in the final SOR phase, full-scale analysis.

A total of approximately 90 different alternative operating strategies were developed and evaluated during the screening phase (SOR Screening Analysis 1992). The RWG developed three alternatives summarized below.

1.6.2.1 Optimum Recreation Pools (REC-OPTP)

Description. The purpose of REC-OPTP was to maintain optimum lake elevations for recreation in the storage and run-of-river reservoirs. The alternative is expressed in terms of target end-of-month pool elevations for every project in the system. Generally, the target elevation is full pool or within 2 feet (0.6 m) of full during the entire peak summer recreation season. For some storage projects, this involves changing the flood control rule curve to extend the recreation season out to spring/early summer and late summer/fall. Under this alternative, optimum reservoir elevations have priority over downstream flow requirements; drawdown below optimum elevation is not allowed. If pool elevations cannot be achieved due to low water conditions, then pool elevations follow flood control rule curves.

Impacts. Analysis of REC-OPTP showed that, as expected, it would result in significant benefits for recreation at all storage and run-of-river projects. Stable pool elevations would also benefit resident fish and wildlife populations. However, there would be some major tradeoffs associated with this alternative. REC-OPTP would have extreme negative impacts on power peaking capacity in the system. In addition, modification of flood control rule curves would mean some loss of flood control during spring high flow periods with the potential for increased flood damage. Resulting higher spring and early summer flows, as well as lower late summer flows, would negatively affect recreational use of the river reaches downstream of dams in the system.

1.6.2.2 Optimum Recreation Flows (REC-OPTF)

Description. REC-OPTF is similar to REC-OPTP. Its purpose was to provide optimum flows for downstream recreation while maintaining pool elevations in the storage and run-of-river reservoirs as close as possible to the targets specified in REC-OPTP. The alternative is expressed as a target range of desired average monthly flows needed to optimize important recreational opportunities in downstream river reaches. This alternative is based on a recognition that maintaining the target reservoir elevations specified under REC-OPTP could have some negative impacts on downstream recreation under certain conditions. Under this alternative, for projects with target downstream flows, flows have priority over reservoir target elevations. If flows cannot be achieved under flood conditions, flows are kept below flood stage.

Impacts. Analysis of REC-OPTF showed that, as expected, it would result in significant benefits for recreation on downstream river reaches. High quality recreation conditions would be maintained at all of the run-of-river reservoirs and at most of the storage reservoirs. However, there would be significant recreational losses at Grand Coulee (Lake Roosevelt) and Dworshak Reservoir resulting from drafting required to fulfill the downstream target flows.

Tradeoffs of REC-OPTF would be similar to those for REC-OPTP. Modification of flood control rule curves would mean some loss of flood control during spring high flow periods with the potential for increased flood damage. Resulting higher spring and early summer flows would negatively affect recreational use of the Columbia River downstream of Bonneville Dam. In addition, the desired target flows for recreation in the Columbia River below Bonneville would be much higher than average, with extreme impacts on power generating capacity. Stable pool elevations would benefit wildlife populations. However, impacts to resident and anadromous fish species would be mixed.

1.6.2.3 Acceptable Recreation Targets (REC–ACC)

Description. REC–ACC is an alternative that attempts to provide a compromise for reservoir and downstream recreation with other project purposes. It stipulates target ranges of pool elevations and downstream flows in which recreational facilities and opportunities are not seriously impacted. REC–ACC target flows and pool elevations are intended to allow more flexibility in meeting other purposes of the system, while still protecting recreation. For example, target storage reservoir elevations may be anywhere within the top 10 feet (3 m) of the pool during the summer recreation season. Under these conditions, recreation would not be optimum, but most facilities would remain usable while water and storage space in the lake could be made available for other purposes.

Impacts. While REC–ACC was intended to be more flexible than the other two recreation optimization alternatives, it ultimately resulted in much lower recreation use than either of the other two, while still having negative impacts on power and other purposes.

1.6.3 Summary of Screening Evaluations

The results and findings of screening are described in the SOR Screening Analysis. Insights gained to recreation and other closely related project purposes are summarized below.

1.6.3.1 Recreation

The Recreation Impact Assessment models developed in the SOR pilot phase (section 3.4) were used to develop quantitative estimates of the impacts of all 90 screening alternatives on recreation visitation to the projects. For screening, pilot models were developed for only four representative storage projects. The models estimated the impacts of alternative end–of–month pool elevations on participation in four water–related recreation activities; boating, fishing, swimming, and camping/picnicking. For the remaining storage and run–of–river projects and downstream river reaches, the RWG qualitatively described the impacts based on professional knowledge and familiarity with the operating characteristics and recreational facilities in those areas. The overall ranking of the 90 alternatives was based on a combination of both quantitative model results and qualitative evaluations.

Of the 90 screening alternatives, 27 generated good or very good overall recreation benefits. The majority of these included operations which maintained storage projects at or near full pool and run–of–river projects within normal operating ranges during the primary recreation season without adversely affecting downstream flows. Alternatives which achieved these conditions included those which modified the flood control rule curve to increase early spring refill probabilities. This category of alternatives basically maintains projects within normal operating ranges so that all recreation facilities remain usable and accessible.

Under some alternatives, full–pool elevations were achieved at the expense of extremely high or low downstream flows. These involved operating alternatives which significantly modified or adjusted flood control rule curves and returned streamflows to a more natural environment. Several alternatives designed to optimize irrigation and to determine the flexibility in existing flood control rule curves produced positive recreation benefits at storage projects. However, in some cases, these alternatives created high spring/early summer and low late summer/early fall flows in downstream river reaches, particularly the Columbia River below Bonneville Dam, that were frequently outside of the desired range for recreation. This group of alternatives demonstrated a tradeoff between reservoir and downstream recreation which must be balanced when considering multi–purpose objectives.

Recreation at the storage and run–of–river reservoirs in the system were most severely affected under the 42 screening alternatives which included elements of reservoir drawdown and flow augmentation. When reservoir storage was used during the spring and summer to augment flows for anadromous fish, refill probability declined. Under these scenarios, recreation facilities at the storage reservoirs became unusable during the peak summer recreation season

due to very low water levels. Similarly, alternatives that lowered the Snake River run-of-river projects to below minimum operating pool (MOP) to increase river velocities during downstream anadromous fish migration rendered virtually all of the recreation facilities at those projects unusable (during the drawdown time period).

The remaining 21 screening alternatives were ranked as fair for recreation because participation results as indicated by the pilot models did not differ significantly from the base case. In these cases, reservoir levels did not always refill to optimum levels, but elevations remained relatively stable throughout the primary recreation season. Correspondingly, these alternatives tended to maintain downstream river flows and run-of-river pool elevations within ranges that were generally acceptable for recreation.

1.6.3.2 Resident Fish

During the screening process it was discovered that very little information exists to translate the effects of alternatives on resident fish biological values into impacts on recreational fishing success. The Resident Fish Work Group and RWG will continue to work together through full-scale analysis to qualitatively describe the potential impacts of alternative System Operating Strategies (SOSs) on fish habitat and on the numbers and size of fish that might be caught by anglers.

The Recreation and Resident Fish Work Groups went into screening analysis under the assumption that alternatives designed to maximize either recreation or resident fish would be largely mutually beneficial to the other. However, screening results showed that the target pool elevations under the recreation optimization alternatives may be counterproductive to some resident fish species.

1.6.3.3 Wildlife

Two of the recreation optimization alternatives described above (section 1.6.2) also benefited wildlife by reducing seasonal drawdowns, stabilizing pool elevations, and passing natural streamflows.

1.6.4 Participation in Development of SOS 4c: Enhanced Storage Operations

Based on the results of the screening process, the 90 screening alternatives were blended into six alternative SOSs by the SOR Interagency Team. The alternative SOSs and their impacts to recreation are described in more detail in Chapter 4 of this appendix. The RWG was particularly involved in development of one of those alternatives, SOS 4c --Enhanced Storage Operation. RWG worked jointly with the Resident Fish and Wildlife Work Groups to develop SOS 4c.

Recreation, resident fish, and wildlife all benefit from reservoir operations in which pool elevations are held as stable as possible without wide seasonal or shorter term fluctuations. SOS 4 seeks to minimize reservoir fluctuations at the five Federal storage projects in the system by setting monthly elevation targets year-round. Water levels would remain highest during the summer months. Pools that are brought up to full in mid-summer under existing flood control rule curves may be brought up in late spring to benefit recreation, resident fish, and wildlife. SOS 4 also attempts to provide a compromise with system requirements for other purposes, including flood control, power generation, and anadromous fish flows.

1.7 FULL-SCALE ANALYSIS

The final phase of the SOR is analysis of 13 alternative SOSs produced as an outcome of the draft EIS. Analytical methodologies incorporated by the RWG to perform the screening and full-scale analyses are described in Chapter 3. The results of the full-scale analysis, and an assessment of the impacts on recreation resulting from each of the alternative SOSs are presented in Chapter 4 and Chapter 5.

1.7.1 Description of Existing Conditions

The initial step in analyzing the recreational impacts of the SOSs was to inventory existing recreation conditions in the Columbia River Basin. Chapter 2 presents a general description of the outdoor recreation resources, opportunities and facilities that are available in the basin. Although the basin provides a wide variety of high-quality outdoor recreation

experiences, the focus of the evaluations for the SOR was on water–related recreation resources and facilities directly related to the Columbia River and its tributaries that may be affected by operation of the Columbia River system of 14 Federal dam projects. Key elements of the description of existing recreation conditions include:

a. A discussion of the importance of water–related recreation in the Columbia Basin

b. A description of recreation participation along the Columbia River and tributaries, including major activities and use areas

c. A description of the users and user characteristics

d. An analysis of the factors influencing recreational use along the river, focusing on those factors related to system operations

Two major tasks undertaken by RWG as part of the description of existing recreation conditions in the Columbia Basin were to complete detailed inventories of existing sites and facilities in the basin and to estimate total visitor use to the projects and river reaches in the basin.

1.7.1.1 Recreation Site Inventory

RWG completed an inventory of all developed recreation sites and facilities located along the storage projects, run–of–river reservoirs and downstream river reaches within the geographic scope of the SOR. The inventory includes data on the name, location, managing agency, size, number, and type of facilities at every known developed recreation site with direct access to the lakes and rivers. Approximately 250 individual recreation sites are included in the inventory.

The results of the site inventory are summarized in Chapter 2. The complete data base is maintained at the Army Corps of Engineers, Portland District Office, Planning Branch.

1.7.1.2 Recreation Visitation Inventory

RWG also completed a detailed inventory of historic visitation data for water–related recreation activities along the Columbia River and tributaries. These data are critical variables in the recreation impact assessment models used in the screening and full–scale analysis phases. Chapter 2 summarizes the estimated numbers of visitors to the reservoirs and rivers of the Columbia River Basin (within the scope of the SOR) from 1987 to 1991. The methodologies used to collect and consolidate the data are described in detail in Chapter 3 of this appendix. Chapter 3 also describes in detail the problems and limitations associated with this data base.

1.7.2 Recreation Impact Assessment

The purpose of the SOR full–scale analysis phase was to undertake a complete analysis of the potential impacts of the six alternative SOSs. The results of the recreation impact assessment undertaken in this phase are presented in Chapters 4 and 5. Chapter 4 describes the effects of the alternative SOSs individually on each affected project or river reach. Chapter 5 compares and evaluates the tradeoffs between the alternatives.

In the screening phase, assessment of recreation impacts of 90 alternatives was keyed primarily to the pilot models for only four storage projects combined with limited qualitative analysis for run–of–river and downstream river reaches. In comparison, full–scale analysis attempts to assess the full range of potential impacts of the SOSs on all affected reservoirs and river reaches in the system. The key components of full–scale analysis are: (1) quantitative results of recreation impact assessment models and (2) supplemental qualitative evaluations.

1.7.2.1 Quantitative Model Results

The Impact Assessment Models (IAMs) developed by the RWG and used to estimate the quantitative impacts of the alternative SOSs on recreation visitation for the DEIS have been replaced in this FEIS. As early as 1991, the RWG had concluded that the validity of the break–point curves that formed the basis for the IAMs was questioned because evidence

of users actual response to changes in lake elevations and streamflows was absent. Although the lake elevation (streamflow)/activity relationships may approximate reality, for the most part they are not based upon empirical user behavioral response (demand) curves. Other important limitations of the draft EIS modeling approach was: (1) it did not correlate visitation to fishing and hunting success as it may be influenced by the effects of alternative SOSs on fish and wildlife populations; and (2) it does not address shifts in participation across substitutes in the region under the alternative SOSs.

To remedy these concerns, the RWG determined that recreation user surveys should be conducted at a number of Federal projects to enhance the predictability and credibility of the SOR recreation IAMs applied in the draft EIS. To this end, a comprehensive study plan was developed to improve upon the draft EIS analytical tools and to accomplish the following objectives for the final EIS : 1) implement visitor use surveys throughout the Columbia River Basin; 2) apply a Contingent Valuation Method (CVM) to elicit the public's participation and economic valuation response to changes in lake elevations and/or streamflows; 3) estimate contingent valuation and participation user responses to alternative hydrologic conditions; and 4) develop a simulation model that will statistically predict changes in recreation demand and social welfare values under various hydrological (pool levels and streamflow rates), substitution, resource quality, and social, demographic, and economic conditions in the basin.

A survey of Columbia River Basin recreationists was carried out in fall 1993 and designed to provide data needed for the developing the revised models. The statistical estimation tasks and development of a Basinwide simulation demand model were subsequently completed and the results incorporated into the final EIS. The simulation modeling results predict changes in recreation participation for the final set of SOSs and replace the quantitative estimates that were provided in the draft EIS. Chapter 3 describes the conceptual framework of the model development while Appendix J–1 provides a detailed technical description. Chapter 4 of this appendix presents the quantitative estimates of changes in trip taking behavior resulting from changes in the alternative operating alternatives (SOSs) . The monetized non–market value of these changes in visitation to Federal hydro projects are presented in Appendix O (Economic and Social Impacts).

1.7.2.2 Qualitative Evaluations

As in the screening phase, quantitative model results are combined with a qualitative description of the recreational impacts of the alternatives. The purpose of the qualitative analysis is to explain, expand, and clarify the quantitative results of the recreation impact assessment models. In other words, if the models predict a decline in recreation participation over the summer recreation season under a given alternative, the qualitative assessment should clearly describe why the RWG expects the decline to occur.

The qualitative evaluation assesses the impacts of each alternative SOS on the following recreation characteristics:

- Effects on Recreation Facilities/Activities
- Effects on Fish Habitat and Fishing Success
- Effects on Wildlife Habitat/Hunting & Wildlife Viewing Success
- Effects on Recreational Safety and Physical Characteristics
- Effects on Water Quality Parameters Influencing Recreation
- Effects on Aesthetics

1.7.3 Recreation Mitigation

The RWG considered mitigation for recreation impacts as part of the full–scale analysis process. For each final alternative, RWG assessed the level of impact that could be expected. Following that assessment, RWG identified and evaluated opportunities for "avoidance" and/or "minimization" of recreational impacts. Appropriate mitigation measures are recommended in Chapter 4 for each project or river reach under each alternative SOS. A conceptual plan for mitigating the recreation impacts of the Preferred Alternative (PA) is presented in Chapter 5.

CHAPTER 2

RECREATION IN THE COLUMBIA RIVER BASIN TODAY

This chapter presents a general description of the outdoor recreation resources, opportunities, and facilities that are available in the Columbia River basin (the basin). Although the region provides a wide variety of high–quality outdoor recreation experiences, the focus of this chapter is on those water–related recreation resources and facilities directly related to the Columbia River and its tributaries that may be affected by operation of the Columbia River system of 14 Federal dam projects (the system) that are being considered under the SOR. A discussion of the factors related to system operation that influence recreation participation is included.

2.1 GENERAL OVERVIEW

Water and outdoor recreation have an important and direct relationship. In order to understand the effects on recreation that result from operating the Federal water resource projects in the basin, it is necessary to understand this relationship.

Water is used for recreation in two ways. First, it is a resource necessary to perform a wide variety of recreation activities, including boating, swimming, fishing, waterskiing, and windsurfing. Second, in addition to being the medium for some recreation activities, water provides an "aesthetic complement" to many other land–based activities that do not require a body of water to be performed, but are generally enhanced by association with it. People are attracted to landscapes that include aesthetically pleasing bodies of water. They frequently prefer water–related settings for camping, picnicking, sightseeing, hiking, hunting, and nature study.

It is difficult to overestimate the importance of water as a recreation resource, especially in the Basin where opportunities for water–related recreation are so diverse and varied. Recreation is one of the most rapidly growing demands for water in this country. As early as 1962, the Outdoor Recreation Resources Review Commission (ORRRC) reported that "the major portion of outdoor recreation activities take place in water or adjacent thereto...and 44 percent of the population prefers water–based recreation over any other." It is evident that this trend continues in the basin today; Section 2.4 describes the characteristics of recreationists in the region, including their preferences for water–related recreation activities.

The basin is blessed with a diverse landscape that offers a wide variety of outdoor recreation opportunities. It is characterized by several mountain ranges, plateaus, and large river valleys. Recreationists have a choice of settings for water–related recreation ranging from wilderness mountain lakes and streams to urban waterfront parks. The forests and mountains of the Pacific Northwest, many in public ownership, provide some of the most outstanding outdoor recreation opportunities in the country. The abundant and diverse fish and wildlife resources and many outstanding natural and man-made scenic wonders help support a tourist industry that is important to the regional economy.

The principal source of water in the basin is snowmelt from mountain ranges. Streams flowing rapidly out of the mountains provide opportunities for fishing, kayaking, rafting, and other activities in dispersed wilderness and semi–wilderness settings. A large percentage of the land area along headwaters lakes and streams in the region is located in National Forests; the U.S. Forest Service (USFS) has developed an extensive system of recreation sites and facilities along them.

Free–flowing streams and rivers provide important opportunities for recreation activities in settings different from the slack water of lakes. They are an important scenic resource as well, adding to the aesthetically pleasing diversity of the basin's landscape. Many streams have attained national signifi-

cance. The Hell's Canyon reach of the Snake River, Salmon River, Middle Fork of the Clearwater River, Imnaha River, St. Joe River, North and Middle Forks of the Flathead River, Deschutes River, and John Day River are all designated National Wild and Scenic Rivers.

Eventually, these streams flow into the Columbia and Snake Rivers. For a substantial portion of their lengths, the Columbia and Snake Rivers flow through the arid and semi-arid plains and valleys east of the Cascade Mountains. In this part of the basin, the rivers have been highly developed through water resource projects designed to accomplish a variety of purposes. Large man-made lakes bisect the Columbia and Snake River plains, providing expanses of slack water for recreation. In many parts of the basin, these reservoirs are the only water resources available for recreation. Consequently, they are extremely popular with residents.

Recreation is a specifically authorized purpose at several of the projects in the system. In addition, recreation use and development is authorized at all of the projects under generic Federal legislation, including the Federal Water Projects Recreation Act of 1965 (Public Law 89-72) and the Flood Control Act of 1944. Under these authorities, the U. S. Army Corps of Engineers (Corps) and the U. S. Department of Interior, Bureau of Reclamation (Reclamation) are the Federal agencies primarily responsible for providing recreation facilities at the respective lakes which they manage. Recreation facilities are provided at all of the Federal projects being considered under the scope of the SOR.

The Corps and Reclamation also cooperate with other Federal agencies, including the USFS, the National Park Service (NPS), and the U.S. Fish and Wildlife Service (FWS), as well as Idaho, Oregon, and Washington state park departments and other local entities such as counties, cities, and port districts, to build and manage a system of water-related recreation facilities. These include boat ramps, swimming beaches, marinas, campgrounds, picnic areas, and interpretive sites.

Recreational use of the reservoirs occurs year-round but peaks from late spring through early fall. Where compatible with other project purposes, the reservoirs are operated to maintain recreation benefits. Normal operation of the projects for flood control, power generation, and other purposes sometimes conflicts with optimum conditions for recreation.

2.2 RECREATION OPPORTUNITIES AT DIFFERENT TYPES OF SYSTEM ELEMENTS

This section provides a generic description of the operation of the Columbia Basin system, focusing on the different types of elements in the system and the effects of system operations on recreation suitability of each.

In very simplified terms, the Columbia River system is comprised of four types of elements, including free flowing rivers and streams, storage reservoirs, run-of-river reservoirs, and controlled downstream river reaches. The role of each of these elements in operation of the system, the different spectrum of recreation opportunities they provide, and the effects of operations on their recreation suitability are summarized below. In this document, the terms "reservoir" and "lake" are used interchangeably to refer to the bodies of water behind dams.

2.2.1 Free Flowing Rivers and Streams

The free flowing rivers and streams in the basin provide critical water-related recreation opportunities. They are located in headwaters above the Federal water resource projects in the system and, therefore, are not directly affected by operation of those projects. For that reason, free flowing rivers and streams are outside of the scope of the SOR.

2.2.2 Storage Projects

Most of the larger tributaries in the basin have storage projects near their headwaters. The main purpose of the storage projects is to adjust the natural flow patterns of the river to closely conform to water uses; they are characterized by large seasonal fluctuations in water level over a year's operation. They generally store spring and summer runoff to

control floods and to provide flows for power and other purposes when it is needed. The reservoirs are drawn down in mid to late fall and/or before the spring runoff to make storage space available for flood control.

The suitability of the storage reservoirs for recreation is directly related to the degree and timing of seasonal drawdown. Storage reservoirs are at their optimum for recreation suitability when they are at or near full pool. The spring and summer storage season approximately corresponds to the warmest summer months when demand for water–related recreation activities is at its peak in the Northwest. This peak period traditionally occurs between the Memorial Day and Labor Day holidays. The storage reservoirs in the Columbia Basin support an average of 50 to 60 percent of their annual total visitation during that period (Table 2–13).

Operations that delay filling the storage reservoirs until later in the summer or cause them to be drawn down earlier in the fall will have a more severe effect on recreation suitability than similar operations at other times of the year.

Federal storage projects that may be directly affected by operational alternatives considered in the scope of the SOR include:

- Dworshak Dam and Lake on the Clearwater River
- Albeni Falls Dam (Lake Pend Oreille) on the Pend Oreille River
- Libby Dam (Lake Koocanusa) on the Kootenai River
- Hungry Horse Dam and Lake on the Flathead River
- Grand Coulee Dam (Lake Roosevelt) on the Columbia River.

Grand Coulee, the largest storage project in the system, is located on the mainstem of the Columbia. The other Federal storage projects are located near the headwaters of the major tributary streams in the basin.

Recreation resources and opportunities at several non–Federal storage projects in the basin may be indirectly affected by changes in operation of the Federal system. They include:

- Corra Linn Dam and Kootenay Lake on the Kootenai River (Canada)
- Kerr Dam and Flathead Lake on the Flathead River
- Brownlee Dam and Lake on the Snake River.

2.2.3 Run–of–River Projects

The run–of–river projects on the main stems of the lower Snake and middle Columbia Rivers were constructed to serve two major purposes: (1) to provide for power generation, and (2) to provide adequate water depth for navigation over rapids and other obstacles. With the exception of John Day, the run–of–river projects in the basin have only minor amounts of storage space, which is used for hourly regulation of powerhouse discharges to follow daily and weekly load patterns.

Run–of–river projects do not experience the large seasonal fluctuations in pool elevations that characterize storage reservoirs. Most of the water–related recreation facilities along these projects are designed to be usable throughout the normal narrow range of daily and weekly fluctuations. As long as pool elevations are held within that normal range, recreation facilities at run–of–river projects generally remain fully usable.

On the other hand, recreation suitability of the run–of–river projects can be influenced by the velocity and timing of flows passing through them. For example, high–velocity flows can create turbulence and safety hazards for boaters and swimmers or cause downstream erosion.

Federal run–of–river projects that may be directly affected by operational alternatives considered in the scope of the SOR include four projects on the lower Snake River:

- Lower Granite Dam and Lake
- Little Goose Dam and Lake Bryan
- Lower Monumental Dam and Lake Herbert G. West
- Ice Harbor Dam and Lake Sacajawea

And five projects on the Middle and Lower Columbia River:

- Chief Joseph Dam and Lake Rufus Woods
- McNary Dam and Lake Wallula
- John Day Dam and Lake Umatilla
- The Dalles Dam and Lake Celilo
- Bonneville Dam and Lake.

In addition, changes in operation of the system considered under the SOR could affect the recreation resources and opportunities at the series of non–Federal run–of–river projects operated by public utility districts (PUDs) in the middle Columbia River, including:

- Wells Dam
- Rocky Reach Dam
- Rock Island Dam
- Wanapum Dam
- Priest Rapids Dam

2.2.4 Controlled Downstream River Reaches

Undammed river reaches below Federal projects provide critical recreation opportunities throughout the region. The timing and quantity of flows released from storage and run–of–river projects can both benefit and harm recreation resources and opportunities downstream. Important recreational river reaches that may be affected by system operations:

- Kootenai River (Kootenay River in Canada) below Libby Dam
- Clearwater River below Dworshak Dam
- Snake River below Hells Canyon Dam
- Columbia River (Canada) below Hugh Keenleyside Dam
- Columbia River, Hanford Reach below Priest Rapids Dam
- Columbia River below Bonneville Dam.
- Flathead River below Hungry Horse Dam.

2.3 RECREATION PARTICIPATION ALONG THE COLUMBIA RIVER AND TRIBUTARIES

2.3.1 Visitation Estimates

Table 2–1 presents a summary of the estimated visitation to the reservoirs and rivers of the Columbia River Basin (within the scope of the SOR) from 1987 to 1993 (as measured in terms of visitor days). The methodologies used to collect and consolidate the data are described in detail in Chapter 3 of this appendix. Chapter 3 also describes in detail the problems and limitations associated with this data base.

The visitor data includes estimates of use for water–dependent and water–related recreation activities only. Only those developed recreation sites with direct access to the Columbia River and its tributaries are included in the data base. Numerous other upland recreation sites in the Basin without direct access to the rivers and lakes have been excluded.

The Federal agency primarily responsible for managing each lake or river is the primary source of visitation data. Visitation data for all 12 Corps projects in the Basin are contained in the Natural Resource Management System (NRMS) data base maintained by Portland, Seattle, and Walla Walla Districts. NRMS includes all of the recreation facilities that are located on Federal project lands administered by the Corps. Reclamation maintains a similar data base for Hungry Horse and Grand Coulee projects.

Supplemental data were obtained for recreation sites administered by other agencies, including the NPS (Coulee Dam National Recreation Area); USFS (Hells Canyon National Recreation Area and National Forest recreation sites at several lakes and streams); FWS (Umatilla National Wildlife Refuge); state parks departments for Oregon, Washington, Idaho, and Montana; public utility districts along the mid–Columbia River; the Spokane and Colville Confederated Tribes for reservation lands at Lake Roosevelt; and numerous local port districts.

Table 2–1. Summary of Historic Recreation Visitation to Columbia River Basin Reservoirs and Rivers, 1987 – 1993

VISITOR (RECREATION) DAYS (x1,000)								
PROJECT / RIVER REACH	**1993**	**1992**	**1991**	**1990**	**1989**	**1988**	**1987**	**7–YR AVG**
Hungry Horse Dam/Reservoir	93.5	92.4	92.3	88.3	77.0	35.9	75.0	79.2
Libby Dam/Lake Koocanusa	204.7	202.0	188.9	193.0	145.8	172.7	121.0	175.4
Kootenai River below Libby Dam	--	--	--	--	33.9	--	--	33.9
Albeni Falls Dam/Lake Pend Oreille	320	381.4	1337.8	1219.2	1249.3	1242.0	1241.4	998.7
Columbia River, Canada	--	--	154.9	--	--	--	--	154.9
Grand Coulee Dam/Lake Roosevelt	1766.7	1680.1	2347.5	2045.7	1579.8	1706.9	1509.8	1805.2
Chief Joseph Dam/Woods Lake	46.9	46.3	46.7	51.6	48.1	--	--	47.9
Rock Island Dam/Lake	--	--	1368.9	852	586.3	633	N/A	860.1
Rocky Reach Dam/Lake	--	--	730.2	790.7	575.6	529	483.4	621.8
Snake River/Hells Canyon NRA	--	--	50.2	48.7	42.1	39.1	37.4	43.5
Dworshak Dam/Dworshak Lake	150.8	164.7	221.2	198.9	237	239.8	260.4	210.4
Lower Granite Dam/ Lake	1656.5	1866.7	1691.2	1613.7	1422.6	1209.2	1248.7	1529.8
Little Goose Dam/Lake Bryan	250.1	258.2	202.8	191.3	232.3	323.9	242.2	243.0
Lower Monumental /Lake West	140.5	129.5	136.0	120.9	131.3	161.3	157.5	139.6
Ice Harbor Dam/Lake Sacajawea	524.2	516	502.8	446.4	454.3	458.6	472.9	482.2
McNary Dam/Lake Wallula	--	--	2747.5	2779.0	3097.2	2956.2	3276.2	2971.2
The Dalles Dam/Lake Celilo	1411.3	1614.7	2920.1	2802.8	2809.6	1334.2	1038.8	1990.2
John Day Dam/Lake Umatilla	2518.3	2650.9	2545.5	2540.8	2559.4	2257.8	1596.5	2381.3
Bonneville Dam/Lake Bonneville	3164.6	2769.2	3041.7	4910.6	3250.8	2694.8	3325.1	3308.1
TOTAL	**12248.1**	**12372.1**	**20326.2**	**20893.6**	**18532.4**	**15994.4**	**15086.3**	**18076.4**

Wherever possible, average annual visitation was obtained over the last seven complete years of record (1987–1993). For sites where less than seven years of record are available, the most recent year of data was used as a proxy for average annual use.

2.3.2 Major Activities and Use Areas

Table 2–2 displays the breakdown of recreation participation by activity at three typical project areas in the basin. These three project areas were chosen to illustrate the differences in the mix of activities that occur at the lakes in the system. Lake Umatilla (John Day Dam) is typical of the large run–of–river projects on the lower Columbia and Snake Rivers. Lake Dworshak (Dworshak Dam) and Koocanusa are typical of the relatively remote storage reservoirs located on the upper tributary streams. It is interesting to note that, despite their similarity in size

and physical and operational characteristics, the ratio of activity use at lakes Dworshak and Koocanusa varies considerably.

2.3.2.1 Boating

Boating is the most popular water–related recreation activity occurring at most of the lakes and rivers in the system. As shown in Table 2–2, between 13 percent of visitors to Lake Koocanusa and 40 percent of users at Dworshak Lake participate in boating activities.

This category encompasses a variety of different types of boating activities. The types of boating uses vary between the lakes and rivers. A high percentage of boating use at all areas in the system is associated with fishing. At the reservoirs, waterskiing, sailing and cruising, make up the balance of boating use. Houseboating is a popular activity at some of the lakes in the system, particularly Lake Roosevelt, where demand for houseboating has risen dramatically over the last 10 years. Dworshak Lake has over 70 mini–camps scattered around the shoreline and boat–in camping is popular.

In some of the downstream river reaches, kayaking, canoeing, and whitewater rafting are popular. The Hells Canyon reach of the Snake River is a world–class whitewater boating river. Whitewater jetboating and rafting in Hells Canyon is supported by a

Table 2–2. Percent of Visitor Participation by Activity, 1991

Activity	Lake Umatilla 1/	Lake Dworshak 2/	Lake Koocanusa 3/
Camping	12.0	3.2	33.3
Picknicking	25.2	8.4	2.0
Boating	33.0	40.0	13.0
Fishing	31.7	30.5	13.3
Hunting	6.7	2.1	7.0
Sightseeing	15.6	14.1	33.3
Waterskiing	9.9	1.6	0.5
Swimming	14.5	2.8	2.0
Windsurfing	5.0	0.0	0.0
Other	14.8	56.0	7.0
Total 4/	164.0	158.6	111.4

1/ Corps of Engineers, Portland District
2/ Corps of Engineers, Walla Walla District
3/ Corps of Engineers, Seattle District
4/ Total is greater than 100% because visitors participate in more than one activity (ratio of duplication)

substantial guide and outfitter industry in the Lewiston Clarkston area. Most of the downstream river reaches, such as the Clearwater below Dworshak Dam, the Kootenai below Libby Dam, and the Flathead below Hungry Horse Dam, provide outstanding fisheries and support high numbers of driftboats and other fishing–related boating.

Most boating use in the system is highly localized; boaters launch from marinas and boat ramps in the vicinity of where they would like to fish or ski and within that particular area. All of the reservoirs in the system have several boat ramps, courtesy docks and other facilities, and most have at least one marina to provide a complete range of boating services. A small amount of upriver and downriver cruising between reservoirs does occur on the lower Snake and Columbia rivers. Recreational craft can pass through navigation locks at the dams free of charge. In 1989, 634 recreational craft locked through Bonneville Dam.

There are a number of commercial cruise lines that operate on the lower Columbia and lower Snake Rivers. It is difficult to categorize this activity as boating or sightseeing. For example, several commercial operators offer cruises along the entire Columbia River from Portland to the Lewiston/Clarkston area from the spring through the fall. These are typically eight day/seven night trips. The cruise ships will make stops at communities such as Cascade Locks, Hood River, The Dalles, Umatilla and Lewiston/Clarkston, and at other points of interest such as Bonneville Dam along the way. Approximately 95 percent of passengers on the cruise ships also take a side trip up the Hells Canyon by guided jetboat services. Obviously, the cruise ship lines are important to local economies along the rivers.

2.3.2.2 Waterskiing

Waterskiing is a relatively minor activity at most of the lakes in the system in terms of total numbers of participants. As shown in table 2–2, nearly 10 percent of visitors to Lake Umatilla waterski, but only 1.6 percent and 0.5 percent of visitors to lakes Dworshak and Koocanusa waterski. In most cases, however, the reservoirs in the Columbia Basin provide the only large slack–water bodies available to support the activity.

2.3.2.3 Fishing

Fishing is probably second only to boating as the most popular recreational activity on the reservoirs and rivers of the basin. As shown on Table 2–2, annual average participation in fishing ranges from 13 percent of all visitors to Lake Koocanusa up to 30 percent at Lake Umatilla. Although visitation data are less complete or consistent, it appears that the percentage of visitors participating in fishing at downstream rivers is even higher than the lakes. Fishing is the primary purpose for many of the recreational trips taken to facilities in the system. The Columbia River Basin recreational fishery has high seasonal impacts on local economies.

Fishing takes place at numerous and widely dispersed locations throughout the basin, at storage reservoirs, run–of–river reservoirs, and along rivers. A high percentage of the fishing is from boats, although substantial shoreline fishing does occur. A diversity of game fish species are available. Anadromous fish (salmon, steelhead) are caught in the lower Columbia and lower Snake Rivers and many of their tributaries, including the Clearwater River. Different species of warmwater game fish (bass, walleye, sunfish) and coldwater game fish (kokanee, rainbow trout, cutthroat trout, sturgeon) populate all of the rivers and streams in the basin.

2.3.2.4 Hunting

Hunting is a relatively minor activity at most of the lakes and rivers in the system in terms of total numbers of visitors participating. Target game species include big game (deer, elk), upland gamebirds, small mammals, and waterfowl. Most wildlife game species are not significantly affected by changes in operations of the projects in the system. The exception is waterfowl; changes in pool elevations and flows can significantly affect waterfowl habitat with resulting impacts to hunting (and wildlife viewing) success.

Waterfowl hunting is a very important activity at the Umatilla National Wildlife Refuge, located along Lake Umatilla. Hunters use boats on Dworshak

Lake to access deer and elk hunting grounds in the remote areas along the lake.

2.3.2.5 Swimming

Swimming is a relatively minor recreational activity in the system in terms of total visitor use. However, this activity has the potential to be more seriously impacted by project operations than other water–related activities due to the constraints of developed swimming beaches. A certain percentage of swimming also occurs at dispersed or unimproved beaches. Almost all swimming in the basin occurs during the summer months of June, July, and August when water and air temperatures are warmest.

2.3.2.6 Windsurfing

In the few years since windsurfing was introduced to the Columbia River Gorge, it has grown dramatically in importance as a recreation activity and as a source of local economic growth. The activity yearly draws hundreds of thousands of participants, and tens of thousands of spectators have witnessed professional racing events. In 1990, there were an estimated 231,600 windsurfing visitor days in the gorge. Windsurfer expenditures were estimated at $16.5 million (Povey, 1990).

Windsurfing is an extremely important activity at the lower Columbia River reservoirs, including lakes Bonneville, Celilo and, to a lesser extent, Umatilla. Minor amounts of windsurfing do occur at other lakes in the region.

2.3.2.7 Camping

The importance of overnight camping varies by lake or river reach. Nearly all of the lakes and rivers in the system have campgrounds to support overnight use by visitors. Camping facilities range from highly developed, multiple–use parks with paved roads, utility hookups, and flush toilets, to more primitive "forest–type" campgrounds. The lakes and rivers in the system are important destination recreation sites for overnight visitors, who travel to the sites to camp in addition to participating in a variety of other water–related activities. Many campers choose destinations based on their proximity to other recreation activities, particularly boating and fishing. Camping facilities can also be affected by system operations. For example, low water levels can render pumped irrigation facilities and water systems inoperable.

Some campers at the lakes and rivers in the system are travelers passing through the region, who make use of the camping facilities available. This is especially true at the lakes and rivers located near major highways.

2.3.2.8 Picnicking

Picnicking activity is similar to camping in many ways. It is land–based, but most picnickers participate in a "package" of activities which may include water–based recreation such as swimming. All of the lakes and rivers in the system have facilities to support picnicking and related day–use activities. Picnickers tend to be day–use visitors who live in close proximity to the lake or river reach and are making a one–day trip from their home. The importance of picnicking varies by lake or river reach. Picnicking tends to be a more important activity at those project areas with a substantial population center nearby, such as Lake Umatilla, at which 25.5 percent of visitors picnic. This is compared to more remote lakes and rivers such as Lake Koocanusa, at which only 2 percent of visitors are picnickers.

2.3.2.9 Sightseeing

Roads and highways paralleling the rivers and reservoirs of the Columbia Basin provide access to majestic vistas of natural features such as forests, mountains, cliffs, rivers and streams, and waterfalls. The study region has innumerable parks, rest areas, and viewpoints available for sightseers to enjoy these scenic amenities.

Many visitors are attracted to impressive manmade features such as Grand Coulee, Bonneville, and other dams and associated features, including fish hatcheries. Most of the project areas have visitor centers and other facilities designed to interpret project history, operations, and purposes for visitors. Table 2–2, shows that an annual average of from 15 to 33 percent of all visitors to Corps recreation sites

on the Columbia and Snake Rivers participate in sightseeing.

Many historic and prehistoric features are located along the shorelines of the Columbia River and tributaries, including the Lewis and Clark trail, evidence of the Oregon Trail and early pioneer settlement, and historic engineering features such as the dams and navigation locks, and the Columbia River Highway. Petroglyphs and other artifacts provide evidence of the prehistoric importance of the basin.

Some of these cultural resources are inundated by the reservoirs of the Columbia River. Opportunities to view these features actually increase during low water periods. However, as access to these cultural resource sites improves, so do opportunities for illegal vandalism and artifact collection.

2.3.3 Future Recreation Demand

Contemporary literature on the subject of recreation predicts an increased demand for recreation facilities and services throughout the northwestern United States and southwestern Canada. A large part of the attractiveness of the region for both residents and visitors is the quantity and variety of public and private year–round recreation facilities and opportunities. The regional population on both sides of the border has evolved with a societal expectation that this variety of public and private recreation opportunities will be available at all times. As the regional population continues to grow through both the expansion of the existing population base and immigration from outside the region, this expectation will remain and likely strengthen, resulting in a significant increased demand for recreation sites and facilities.

The Columbia River and its tributaries provide a large and varied portion of the fresh water recreation opportunities for residents and visitors in the region. Recreation opportunities available in the Columbia River watershed range from passive, low impact experiences to consumptive, high impact activities. With public ownership of the water surface and a portion of the surrounding lands a norm, significant opportunities exist to meet the increased regional demand for a variety of fresh water recreation facilities and sites.

The Pacific Northwest Outdoor Recreation Committee, comprised of the parks and recreation departments of Oregon, Washington and Idaho and six Federal land management agencies completed the "Pacific Northwest Outdoor Recreation Consumption Projection Study: Tri–State Summary Project" (Hospodarsky, 1989). The Tri–State Summary assessed the future recreation demands for the three state area. Based upon the demographic similarities found throughout the region and the presumption that most of the potential SOR recreation impacts will occur within the three northwestern states, demand results from the Tri–State Summary were used to estimate future recreation demand.

The Tri–State Summary breaks recreation participation into a total of 60 different activities. Eleven of those activities encompass the water–dependent and water–related recreation activities that occur most frequently at the lakes in the SOR. Predicted low, average and high growth rates (scenarios) for these activities, from 1989 through 2010 are listed on Table 2–3.

Although no foolproof method is available to predict the future demand for recreation sites and facilities in the Columbia River Basin, the Tri–State Summary provides some valid estimates of the probable growth of various recreation activities. The growth of these activities is a direct influence on the demand for suitable recreation facilities and sites. The demand for several of the activities supported by recreation facilities and sites at the Federal projects in the Columbia River Basin is expected to more than double by 2010. Demand for many of the other significant recreation activities will come close to doubling during this same 20–year period.

Table 2–3. Estimated Future Recreation Demand in the Columbia River Basin (Oregon, Washington and Idaho)

	Predicted Growth Rates: 1989 – 2010		
Activity	**Low**	**High**	**Average**
Waterskiing	32	92	62
Sailing (not including sailboarding)	40	188	114
Sailboarding	24	88	56
River Boating (non–motorized)	34	149	92
Lake Boating (non–motorized)	51	176	114
Lake Boating (motorized)	29	89	59
River Boating (motorized)	22	67	45
Freshwater Fishing (boat)	25	78	52
Freshwater Fishing (bank or dock)	20	61	41
Swimming	39	117	78
Picnicking	44	121	83
Sightseeing	46	109	78
Recreational Vehicle Camping	39	112	76
Tent Camping with vehicle	46	124	85
Boat Camping	24	62	43

2.4 RECREATIONAL USER CHARACTERISTICS; RESULTS OF PHASE IA SURVEY

This section presents a summary of the results of the Phase IA user survey sponsored by the Columbia River SOR Recreation Work Group (RWG). The Phase IA survey is described in detail in Estimation of Recreation Impacts for the Columbia River System Operation Review: Methods for Phase II (RCG/Hagler, Bailly, Inc., 1993). Its primary purpose was to acquire information about the patterns of water–related recreation use in the region. This information was used to establish sampling strategies for the Phase II full–scale user survey implemented during the summer of 1993. The Phase II survey allowed RWG to construct scientifically and statistically defensible recreation impact assessment model specifications for the final analysis of the SOR alternatives. The results of the Phase II survey were not available in time for inclusion in the draft EIS but have been incorporated into this final EIS. The Phase II User Surveys and resulting recreation impact assessment models are described in detail in Chapter 3 (Section 3.9).

The results of the Phase IA survey are useful in characterizing who uses the Columbia River Basin system, where they come from, and what activities they participate in. These results were derived using the 831 complete or partially complete telephone surveys administered in December 1992. The Phase IA survey gathered information on water–based recreation activities from residents in the Columbia River Basin, which includes regions of the U.S. Pacific Northwest and southwest Canada. Four categories of information were sought: (1) participation rates for water–based recreation; (2) demographic characteristics; (3) trip information by destination (reservoirs, federal projects, and rivers)

and activity (fishing, swimming); and (4) attitudes towards site characteristics.

2.4.1 Participation Rates in Water–Based Recreation

Participation rates are important for a number of reasons. First, they indicate the overall level of demand and therefore the importance of water–based recreation in the region. Second, comparison of the Phase IA survey participation rates with those resulting from other studies allow a gauging of the accuracy of the results. Finally, they can be used in conjunction with the demographic characteristics (e.g., age, gender, income) to identify which personal characteristics are more likely to affect the decision to participate in water–based recreation activities.

Respondents who agreed to take part in the survey were asked if they had participated in water–based recreation in the past 12 months. A total of 565 individuals responded positively (hereafter referred to as "recreators"), leaving 266 respondents who did not participate ("non–recreators"). This gives an overall participation rate in the Columbia River Basin of 68 percent.

Comparisons were made between Phase IA survey participation rate results and recreation participation statistics reported elsewhere to ascertain if the results are reasonable. Unfortunately, these comparisons are tenuous at best since the other statistics do not specifically measure overall participation in water–based recreation. Instead they report participation rates for individual activities or narrowly defined groups of activities, e.g., fishing, waterskiing, motorboating. And the degree of overlap in activities is unknown.

For example, in 1987, 57 percent of Washington households engaged in fishing and 72 percent engaged in water–related activities, encompassing a diversity of activities, ranging from boating to beachcombing, (Washington Outdoors, 1987). Clearly some boaters must also fish, but the degree of overlap is unknown so we cannot estimate the overall participation rate for water–based activities such as boating or fishing. Similarly, the 1988 Oregon Statewide Comprehensive Outdoor Recreation Plans (SCORP) reports that 52 percent of Oregon households fished and 43 percent engaged in water activities such as boating and windsurfing. The 1988 Montana Statewide Comprehensive Outdoor Plans (MDFWP, 1990) also reports rates for activities: 56.4 percent of households fish, 32.6 percent motorboat, 11.4 percent canoe and 42.3 percent swim in lakes.

To the extent that the data can be disaggregated into similar categories, Phase IA survey participation rates were consistently lower than in the SCORP reports for the various states. For example, the information that survey respondents gave for fishing trips suggest angler participation rates of 25.44 percent in Washington, 39.57 percent in Oregon, and 45.83 percent in Montana. Activity–specific rates from the survey are lower than rates predicted in the SCORPs.

There are some important features of the Phase IA survey that would tend to produce lower participation rates for specific activities such as fishing. First, respondents to the survey recorded fishing trips only if fishing was the primary purpose of one or more of their recreation trips. Second, fishing trip data was only collected for trips to freshwater sites in the region. Any saltwater anglers who didn't also take a freshwater fishing trip would be excluded from the total number of anglers. Finally, respondents were asked to only consider their recreation activities for the past 12 months. Consequently, the survey would have excluded people who considered themselves anglers, but haven't actually fished in the past 12 months.

Recreation participation rates from the Phase 1A survey are reported by state or province of residence in Table 2–4. Participation rates for Idaho, Montana, and Alberta are somewhat higher than the 68 percent participation rate for all regions. This may be due to some type of sampling bias or to actual differences in participation rates. While a participation rate of 68 percent cannot be verified through comparison with other reported statistics, it doesn't appear to be unreasonably high.

Table 2–4. Phase IA Survey Participation Rates for Water Based Recreation

State/Province	Yes	%	No	%
Washington	267	66%	134	34%
Oregon	155	67%	75	33%
Idaho	68	73%	25	27%
British Columbia	38	66%	20	34%
Alberta	19	76%	6	24%
Montana	18	75%	6	25%
TOTAL	**565**	**68%**	**266**	**32%**

2.4.2 Characteristics of Non–Recreators

The survey gathered a variety of information from non–recreators in order to identify which factors influence the recreation participation decision. First, specific reasons for not participating were explored and second, demographic characteristics were requested. The 266 non–recreators were asked to respond to a list of eight possible reasons for their lack of participation. Table 2–5 shows these reasons and the number of times a yes response was recorded, along with the percentage of the 266 respondents who answered yes. The most common reason for not participating was that the respondent was too busy. The second most common reason was not owning a boat. This result was not anticipated, so it prompted additional analysis. It was found that although these respondents were located throughout the region, this was the most frequent reason among persons living in counties adjacent to the federal projects. Furthermore, "lack of time" was also relatively less important to this group of respondents than it was to all non–recreators. Finally, fewer than 10 percent of all non–recreators and 5 percent of those living in proximate counties said that fluctuating water levels in lakes and rivers was a reason for non–participation. This may indicate that operating changes aren't necessarily an important factor in the decision to participate or not participate. However, this outcome has no bearing on the importance of water levels to the destination decision of recreators.

Non–recreators were then given an opportunity to state their own reasons for not participating. Out of 116 people responding, 40 indicated that they were too old. This suggests a point that will be reiterated below: age is an important determinant of participation in water based recreation. Furthermore, 16 respondents cited reasons relating to health, some of which could be age–related, e.g., arthritis. Lack of interest in water–based activities is the only other response which occurred with some frequency (22 responses).

Table 2–5. Phase IA Survey Participants Reasons for Not Participating in Water Based Recreation

Reason	Number of Yes Responses	Percentage of Non–recreators
You are too busy	136	51.1
You don't own a boat	129	48.5
You do not enjoy water based activities	97	36.5
You live too far from the water	64	24.1
It is usually too crowded	54	20.3
It is too expensive	49	18.4
The water quality is poor	45	16.9
The levels reservoir and river levels change too much	21	7.9

There are a number of demographic differences between recreators and non–recreators, as shown in Table 2–6. First, non–recreators are on average older than the recreators. This is to be expected since some forms of water–based recreation are physically demanding. Second, non–recreators in the survey also tended to have smaller households, due primarily to the absence of children (household members aged 18 or younger). These results are consistent with the differences in ages between the two groups.

Table 2–6. Phase IA Survey: Demographic Characteristics of Recreators and Non–Recreators

Characteristic	Recreators (s.d.)*	Non–recreators (s.d.)*
Mean Age	39.7 (13.1)	52.3 (18.0)
Median Age	39	53
Average Household Size	3.07 (1.45)	2.34 (1.33)
Average Number of Children in Household	1.06 (1.23)	0.46 (0.96)
Mean Income	$42,939 (22,162)	$32,963 (22,261)
Median Income	$35,000	$25,000

*s.d. = Standard Deviation

Finally, mean 1992 household income for the non–recreators is about $10,000 below the mean income for recreators. Fewer than 20 percent of the non–recreators cited expense as one of the reasons they didn't participate in water–based recreation. It ranked sixth out of the eight reasons for yes responses (see Table 2–5). This suggests that income may not be very important. It is possible that this ambiguous result is due to the relatively high incomes indicated by the survey. A comparison of median income figures from the survey results and median income figures from Statistical Abstract of the United States: 1992 shows that the survey is consistently higher. This may be due to some form of self–reporting bias or it may be due to survey participation bias. For example, if a disproportionately large number of higher income people responded to the survey, that could diminish the importance of income to recreation participation in the results.

The survey results also indicate that gender influences the participation decision. Female respondents, who accounted for 47.7 percent of the completed surveys, comprised 59.3 percent of the non–recreators. This is due to the different participation rate between men and women. Almost 75 percent of the men surveyed were recreators, while only 60 percent of the women were recreators. As noted earlier, differential male/female survey participation rates and recreation participation rates may be producing the higher recreation participation rates for Idaho, Montana, and Alberta that were reported in Table 2–4.

2.4.3 Participation Rates in Specific Activities

Collecting data on the number of trips that were taken for a specific recreation activity is important for two reasons. First, it indicates what type of recreation activities are more important than others. Second, it illustrates the degree to which individuals currently substitute across activities.

Trip information was collected for the following activities: fishing, boating, swimming, other water–based, nonwaterbased, and multiple activities. The last activity category was included to identify recreational trips that were primarily multi–purpose. For each of the six activities, a respondent was asked how many trips he took in the past 12 months where the main purpose of the trip was to engage in that activity.

This type of trip information was requested in the two different branches of the survey. The 377 recreators who followed the reservoir branch of the survey gave activity information for their reservoir trips. In the river branch, 314 people gave activity information in for their river trips.

Table 2–7 shows, for each of the six activity categories, the number of respondents who took at least one trip. The results are divided into three columns. The first shows how many of the 565 total number of recreators engaged in each activity regardless of whether the trip was a reservoir trip or a river trip. The second column shows these results for the subset of people who made reservoir trips. Finally, the third column contains the people who took river trips and the activities they engaged in on those trips. The percent is reported next to each number.

Recreation trip modeling is difficult when trips involve multiple activities; it is less complicated when trips are activity specific, e.g., waterskiing trips or fishing trips. The information of particular interest in Table 2–7 is the large number of respondents who took multiple purpose trips; in fact, more people took multiple purpose trips (316) than any other kind.

Table 2–8 shows that recreators engage in a variety of activities. This table demonstrates the variety that occurs across trips rather than during trips. The numbers in the left column indicate how many different "types" of trips an individual reported taking.

The averages are conditional means; e.g., given the subset of recreators who took at least one fishing trip to reservoirs, the number indicates the average number of reservoir angling trips this group took in the past 12 months.

The median number of trips per person are also reported since the averages tend to be biased upwards by recreators who reported large numbers of trips. Two conclusions can be drawn: trips to reservoirs are fairly evenly distributed across the six activities, whereas trips to rivers are less evenly distributed; and more trips per person are taken to reservoirs. As the results show, the average number of reservoir trips is almost everywhere higher than average number of river trips. The two numbers are similar only for fishing and non–waterbased activities. The range of average trips across activities is smaller for reservoirs (Two trips) than for rivers (Four trips). These results suggest that recreation at reservoirs is more intensive, i.e., visitors take more trips on average. Furthermore, no activities routinely dominate reservoir recreation.

2.4.4 Federal Project Visitation

This section discusses two important categories of results pertaining to the trip data gathered for each of the Federal projects. First, overall participation rates are reported. These indicate which projects attract more visitor and trips. Second, origin/destination results are presented.

Table 2–7. Phase IA Survey: Number of Recreators Taking Trips by Activity

Primary Activity	Total 2/	Reservoir	River 1/
Fishing	258 (45.6%)	197 (52.4%)	189 (60.6%)
Boating	248 (43.9%)	198 (52.6%)	123 (39.4%)
Swimming	240 (42.5%)	178 (47.3%)	141 (45.2%)
Other Water Based	181 (32.0%)	121 (32.3%)	113 (36.2%)
Non–waterbased	279 (49.4%)	206 (55.2%)	174 (56.1%)
Several Activities	316 (55.9%)	236 (63.6%)	186 (59.8%)

1/ All numbers exclude outlier
2/ Reservoir and river numbers will not sum the total since some respondents will be reflected in numbers at both locations.

Table 2–8. Phase IA Survey: Average Number of Trips by Activity

Primary Activity	Reservoir		River	
	Mean (s.d.)*	Median	Mean (s.d.)*	Median
Fishing	8.7 (13.46)	5	8.9 (11.55)	5
Boating	7.5 (12.36)	4	4.7 (5.8)	3
Swimming	9.1 (14.27)	5	7.9 (12.99)	3
Other Water Based	7.6 (10.46)	4	5.3 (5.91)	3
Non–water based	7.1 (9.92)	4	6.9 (15.38)	3.5
Several Activities	8.6 (10.06)	5	6.9 (7.39)	4

*s.d. = Standard Deviation

2.4.4.1 Participation Rates

The trip information should indicate two things. First, it should indicate which locations and activities are relatively more important in terms of water–based recreation, if indeed any are. Second, the trip information provided by each respondent should indicate whether there is a propensity to substitute across recreation sites and/or activities. Furthermore, since it is also known where the respondents live and which Federal projects they have visited, conclusions can be derived regarding travel patterns to the projects.

Trip information for the Federal projects was collected from the 377 respondents who answered questions in the reservoir branch of the survey. For each project, they were asked to give the number of trips they had taken to that project in the past 12 months. A total of 234 (62 percent) respondents took at least one trip to a project (project users).

The demographic characteristics of project users were compared with other recreators who did not visit the projects. The results indicate that two groups are quite similar in terms of age and household characteristics. The one exception is that project users have slightly lower household incomes.

Project–specific trip results are reported in Table 2–9, which shows the number of respondents who visited each project. The third column reports the mean number of trips per person to each project. The mean trip figure is a conditional mean, i.e., the average "conditioned" on the fact that the individuals visited the project at least once.

Among the projects drawing the most visitors in the sample were Bonneville and The Dalles. This not surprising given their proximity to large population centers and major highways. The Snake River between Brownlee and Lewiston/Clarkston, which is relatively more isolated, also drew a large number of visitors. As expected, those with the fewest visitors were Dworshak, Libby, and Hungry Horse, which are relatively remote headwaters reservoirs.

The recreation patterns of the former will dominate the results. Consequently, if they are more likely to visit the closest projects such as Bonneville and less likely to visit distant projects such as Dworshak, then the final results will show more visitors for Bonneville and fewer for Dworshak.

2.4.4.2 Destinations and Origins for Water–Based Recreators

A fundamental assumption economists make in travel cost/recreation demand models is that the further an individual lives from a recreation site, the less likely (other things held constant) that individual is to visit the site. This is based on the idea that a recreator faced with two alternative destinations that are equal in every other respect will maximize net benefits by visiting the closer site, i.e., by minimizing travel costs. Travel, including the cost of travel time, can make up a large share of the overall cost for recreation activities, such as fishing and boating, which require travel to specific locations. Origin and destination relationships for trips to the Federal projects were studied to verify that travel cost is indeed a factor in recreation site decisions.

Table 2–9. Phase IA Survey; Participation at Federal Projects for the 565 Participants in Water Based Recreation

Project	Participants	Mean Trips per Person (s.d.)
Grand Coulee/Lake Roosevelt	56	3.5 (5.96)
Chief Joseph/Rufus Woods Lake	59	2.5 (5.20)
McNary Dam/Lake Wallula	49	4.1 (7.08)
John Day/Lake Umatilla	60	3.3 (6.40)
The Dalles/Lake Celilo	72	2.8 (3.12)
Bonneville/Lake Bonneville	83	3.7 (3.66)
Snake Between Lewiston and Brownlee	79	2.7 (3.07)
Snake Between Lewiston and Tri–Cities	52	3.1 (3.38)
Dworshak/Dworshak Reservoir	18	2.0 (1.41)
Hungry Horse/Hungry Horse Reservoir	18	2.1 (2.08)
Libby Dam/Lake Koocanusa	16	6.8 (13.6)
Albeni Falls/Lake Pend Oreille	37	3.2 (5.96)

Project visitation data is shown disaggregated by state or province in Tables 2–10 and 2–11. The first table contains information regarding the number of respondents who visited each project. Table 2–11 reports the total number of trips that were recorded for each of the projects by state or province of origin. In spite of the large region involved, these results still suggest that location is an important determinant for trip–taking behavior. For example, households in western Montana were more likely to visit Hungry Horse, Libby, or Albeni Falls than the other projects, while Oregon residents were less inclined to visit these projects than the ones on the Columbia River.

Table 2–10. Phase IA Survey: Number of Households Visiting Each Project by State/ Province

Project	Total	Idaho	Montana	Oregon	Washington	Alberta	British Columbia
Grand Coulee	56	4	0	8	43	0	1
Chief Joseph	59	11	0	17	29	0	2
McNary	49	4	0	17	25	0	3
John Day	60	4	2	29	24	0	1
The Dalles	72	10	2	31	27	0	2
Bonneville	83	8	1	39	33	1	1
Middle Snake	79	2	1	17	31	0	1

Table 2–10. Phase IA Survey: Number of Households Visiting Each Project by State/Province – CONT

Project	Total	Idaho	Montana	Oregon	Washington	Alberta	British Columbia
Lower Snake	52	9	1	9	32	0	1
Dworshak	18	7	0	2	9	0	0
Hungry Horse	18	2	6	3	7	0	0
Libby Dam	16	5	4	0	6	1	0
Albeni Falls	37	10	4	3	18	1	1

Table 2–11. Phase IA Survey: Total Number of Trips to Each Project by State/Province

Project	Total	Idaho	Montana	Oregon	Washington	Alberta	British Columbia
Grand Coulee	193	9	0	11	172	0	1
Chief Joseph	145	15	0	29	99	0	2
McNary	201	51	0	34	113	0	3
John Day	200	48	2	81	68	0	1
The Dalles	198	29	2	108	56	0	3
Bonneville	304	17	1	207	77	1	1
Middle Snake	212	86	1	38	86	0	1
Lower Snake	159	45	1	22	90	0	1
Dworshak	36	20	0	2	14	0	0
Hungry Horse	38	3	19	5	11	0	0

The importance of location is evident in data disaggregated at the county level. People living in adjacent counties are twice as likely to visit a project as the average recreator in the region. County–level data also reveal that major urban populations are another important source of project visits. Residents in counties with populations of more than 100,000 took 50.1 percent of the project visits.

2.4.5 Substitution Across Projects

Substitution across the projects (and more generally across all recreation locations) is important because it influences the degree to which welfare measures will be affected by changes in system operation.

Recreation demand literature shows that changes that impact recreation at a project which does not have substitutes will have greater welfare impacts than those at one with substitutes, all other things being equal. The reason for this is simple. If access to the only recreation outlet nearby is lost, an individual is willing to pay a great deal to prevent that loss. If many alternative outlets exist, an individual would be willing to pay less to avoid the loss.

Substitution across projects is indicated in that almost two–thirds of the 234 project users surveyed visited more than one project; 156 (66.7 percent) recreators took trips to two or more of the projects. The following details how this breaks down by

number of projects visited: 60 people visited two projects; 36 people visited three projects; 27 people visited four projects; 20 people visited five projects; 6 people visited six projects; 4 people visited seven projects; and 3 people visited eight projects. This means that if operating changes affect some projects but not others which may act as substitutes, then welfare changes will be diminished.

Evidence of substitution across locations isn't limited to the federal projects, as Figure 2–1 shows. This chart summarizes the trip behavior of the 565 recreators by destination category. One group of interest is the 101 recreators (left–side path) who took reservoir trips––to both project reservoirs and other reservoirs––and river trips. All together, 160 or 68 percent of the project users also visited other reservoirs or rivers.

An anomaly in Figure 2–1 is the 111 recreators who didn't visit reservoirs or rivers (right–side path). One possible explanation is that these respondents didn't understand some section of the survey. Another is that they engage in water–based recreation, but not at any of the sites included in the survey. For example, they may swim at public or private pools. Given that most of these individuals live near coastal waters also suggests that some may be saltwater recreators rather than fresh water recreators.

2.4.6 Recreator Attitudes

An ideal recreation demand model should include all factors that determine the choice of recreation site. Among these factors are site characteristics which affect the quality of recreation. As previously indicated, economists presume that recreators will prefer a site which offers a higher quality recreational experience to one of lesser quality, all other factors, including distance, being equal. For example, a boater located equidistant between two lakes will prefer to visit the lake that offers better boating. Site characteristics that distinguish the better lake could include the number and quality of boat ramps, docks, and marinas; water conditions such as temperature, surface area and turbidity; degree of

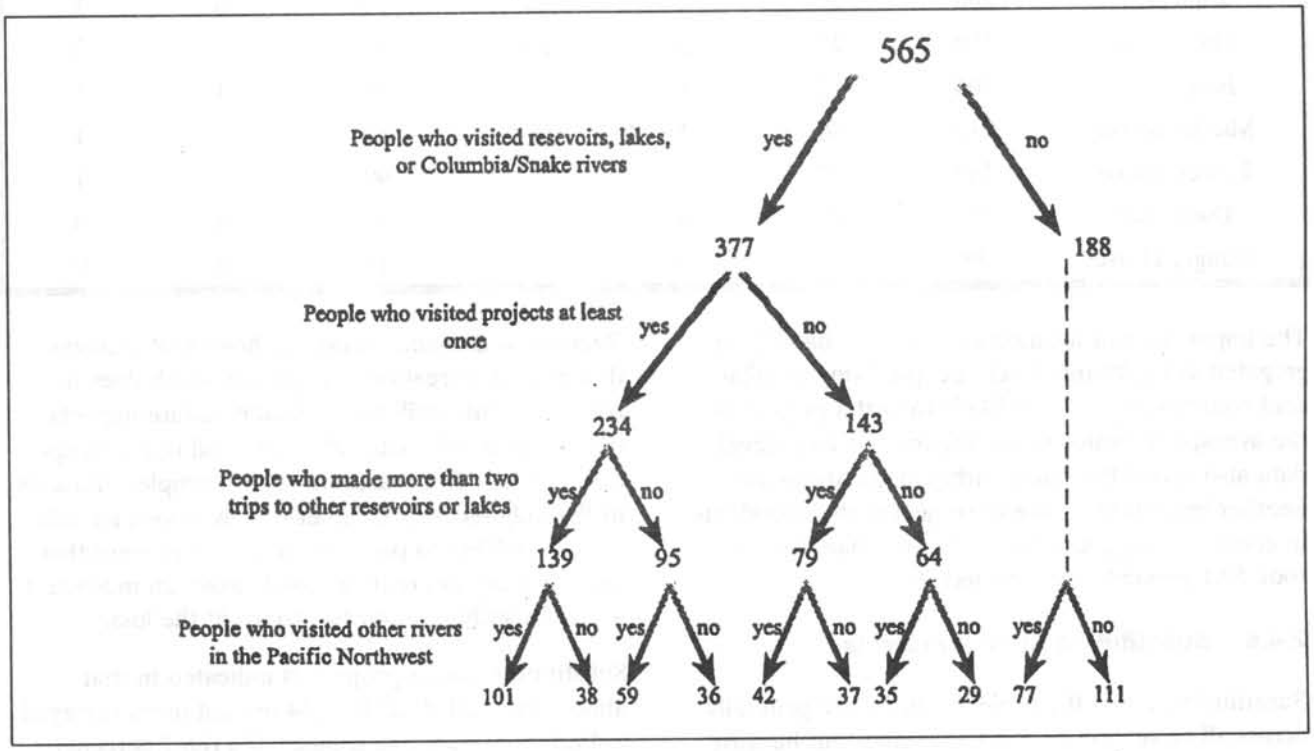


Figure 2–1. Destinations of People Who Engaged in Water–Based Recreation

congestion; and availability of amenities such as fuel. Section 2.3 includes a more detailed discussion the site characteristics which are relevant to different water–based activities.

The Phase I survey was designed to gather information that would indicate the importance of certain site characteristics. In both the reservoir branch and the river branch of the survey, the respondents were asked to indicate how important a site characteristic is in terms of their destination choice. The scale they were given comprised the following response choices: very important, somewhat important, somewhat unimportant, very unimportant, and don't know.

Table 2–12 shows the number of times the very important and very unimportant responses were recorded for each characteristic. Comparing the responses of all reservoir users with those of river users reveals some similarities. First, the most important characteristic, regardless of destination, is that a site have a high environmental quality. Other characteristics drawing similar responses addressed the cost of the site and whether it was not very crowded (which are relatively important), how close the site was to home (which was considered very important by fewer than one third of the respondents) and novelty of the site (the least important characteristic).

A number of characteristics are more important for reservoir trips than for river trips: large water surface, good boat ramp access, recreational activity variety, good public facilities, and good beach area. Since these amenities are more likely to be available at reservoirs than rivers, one would expect them to be more important to reservoir visitors. The one characteristic that was relatively more important to river visitors was the quality of fishing. This is

Table 2–12. Attitudes About Importance of Recreation Site Features (All Numbers are Percentages)

Characteristic	Users of Reservoirs, Lakes, Columbia & Snake Rivers						Users of Other Rivers	
	All Users		Project Users		Project Non–users		All Users	
	Very Import.	Very Unimp.	Very Import.	Very Unimp.	Very Import.	Very Unimp.	Very Import.	Very Unimp.
Close to Home	29%	07%	25%	08%	35%	05%	28%	09%
Large Water Surface	19	11	22	12	14	11	12	18
Good Fishing	40	23	45	16	31	33	46	15
Good Boat Ramp Access	43	14	46	11	37	17	26	22
Variety of Recreational Activities	49	05	55	05	40	06	32	09
New Place	08	18	11	17	04	20	8	17
Good Facilities	52	05	49	06	57	05	40	10
Good Beach Area	35	09	34	08	37	10	23	16
Not Very Crowded	44	02	46	03	40	01	48	04
Inexpensive	43	05	43	04	42	07	40	05
High Environmental Quality	76	02	78	00	73	01	76	01

consistent with the activity results reported in Table 2–7, where fishing was the most popular river activity but fourth in popularity among reservoir activities.

The results for the reservoir branch are further disaggregated into project users and non–users to see if there are any differences. In many respects the answers for these two groups are similar. Again there is agreement on the importance of environmental quality, cost, and degree of crowding. Furthermore, the presence of good beach area is relatively important to both groups. Some characteristics appear to be somewhat more important to the project users: whether a site is a new place to visit, good boat ramp access, and large water surface. Since one group that would consider boat ramps and large surface areas important are pleasure boaters, these results indicate the possibility that the projects are attracting a larger share of pleasure boaters than other reservoirs or lakes in the region. Two site characteristics are slightly more important to non–users: good public facilities and proximity to home.

The most noticeable differences between project users and non–users include the importance of good fishing and recreational variety. A larger share of the project users than non–users considered these attributes very important, and in the case of fishing quality, one–third of the non–users considered this to be very *un*important compared to only 16 percent of the users. First, this outcome indicates that catch rates are an important factor in the project users' choice of an angling recreation site. Second, returning to the issue of substitution across activities, the responses show this to be particularly important for project users.

2.4.7 Conclusions

The Phase IA survey resulted in a number of important conclusions about water–based recreation patterns in the Columbia River Basin.

- Non–recreators are different from recreators; they tend to be older, have smaller households, fewer children living at home, and lower incomes. This suggests that demographic characteristics are important variables that influence participation.
- Recreators engage in a variety of water–based activities as evidenced by the large proportions taking multiple purpose trips and by the large number who took more than one type of trip (i.e., trips in more than one of the six activity categories). Furthermore, whether a site supports a variety of recreational activities is found to be relatively important among the recreators who took at least one trip to a project.
- A large share of the recreators engage in substitution across location. Of the 565 recreators, 237 (41.9 percent) reported trips to both reservoir and rivers. Of the 234 project users, 66.5 percent reported visiting more than one of the projects. Furthermore, 59.4 percent of the project users visited other reservoirs, and 68.4 percent of them also took river trips.
- Demographic differences between recreators who use the federal projects and those who do not are minimal. This suggests that other factors play a more important role in the decision of whether to visit a project. These include site characteristics and location.
- A majority of the project trips recorded originated either in adjacent counties (44.5 percent) or in major population areas (50.1 percent; 17.3 percent from counties that are also adjacent to projects). These results reflect the large share of urban respondents in the general population survey.
- Recreator attitudes towards site characteristics are consistent with a number of expectations. For example, large surface area and good boat ramps are more important for reservoir trips than for river trips. The reverse is true for catch rates, which is consistent with the activity data results where fishing is relatively more popular vis a vis other activities for river trips than for reservoir trips. Some characteristics are more important to people who reported using at

least one of the federal projects than they are to people who only visited other lakes and reservoirs. These include good boat ramp access, large surface area, good fishing, and recreational variety.

2.5 FACTORS INFLUENCING RECREATIONAL USE IN THE COLUMBIA BASIN

2.5.1 Seasonality of Visitor Use

Table 2–13 summarizes the 1989 monthly visitation to three typical projects in the region, lakes Umatilla, Dworshak and Koocanusa. The seasonality of recreational use is a very important consideration in analyzing the potential effects of reservoir operations. While pool elevations and river flows are important factors influencing the seasonality of recreational use, they are not the only factors. Other factors that must be considered include weather conditions and the availability of other similar recreation resources. The primary recreational activities, including sightseeing, fishing, boating, and waterskiing occur year round at most of the project areas in the basin. However, the peak period of use occurs during the warm, dry summer months.

Annual visitation typically builds slowly, beginning in April and continuing in May. This corresponds to the period during which the storage projects are beginning to refill. The weather at that time of year is variable; it is improved over the winter but can still be very cool and damp, particularly at the upper elevation storage projects such as Libby and Hungry Horse. Much of the visitation to the projects during the spring can be directly attributed to the opening of fishing seasons.

Visitation tends to increase rapidly from the end of May through June and July, and peaks in August. As shown, the projects typically receive over 50 percent of average annual visitation during this period. The term "peak recreation season" roughly corresponds to the period between Memorial Day and Labor Day weekends. During this period, weather is most amenable for water–dependent and water–related recreation activities throughout the Pacific Northwest. Most students are out of school for the summer, and families take their vacations during this period. During the summer, the storage projects are generally refilled and held as high as possible to promote and support recreation use.

Visitation generally begins to decline in September. This decline occurs regardless of reservoir operations. For example, pool elevations at John Day Project/Lake Umatilla, stay relatively stable year–round; like most run–of–river projects, it does not experience large seasonal drawdowns. Nonetheless,

Table 2–13. Seasonality of Columbia River Recreation Use, 1989

	Monthly Use as a Percent of Total Annual Use		
	Lake Umatilla 1/	Lake Dworshak 2/	Lake Koocanusa 3/
January	3.4	2.4	1.2
February	3.6	3.5	1.6
March	5.8	6.6	3.6
April	7.7	6.3	5.5
May	8.6	9.6	8.8
June	11.3	16.6	11.6
July	13.5	20.2	20.4
August	15.2	17.7	23.4
September	12.8	7.2	13.3
October	9.6	4.8	6.0
November	5.1	2.6	2.9
December	3.5	2.6	1.6

1/ Corps of Engineers, Portland District
2/ Corps of Engineers, Walla Walla District
3/ Corps of Engineers, Seattle District

approximately 45 percent of average annual visitation occurs during the three peak summer months. In comparison, Lake Koocanusa, a storage project with large seasonal pool fluctuations, receives approximately 55 percent of its total visitation from June through August.

Weather is the most important factor influencing the seasonal use and demand for water–related outdoor recreation in the basin. Climatic effects (such as temperature and precipitation) have direct short and long–term effects on visitor use. During wet years, there generally is adequate water to maintain high pool elevations in the storage reservoirs across the basin. Because such a high percentage of visitation occurs during the short summer season, a cool, wet summer can have low annual total visitation no matter at what elevation the reservoirs are maintained. This is especially true if the weather is poor during one or more of the three important summer holiday weekends (Memorial Day, Fourth of July, or Labor Day).

By the same token, during hot, dry summers, demand for water–related recreation can be very high. Visitation to rivers and reservoirs may be high in spite of low pool elevations or flows. This is especially true if there are few or no other similar recreation resources near the users.

2.5.2 Accessibility to Water

Accessibility to water is a critical factor in influencing recreation use; the more accessible a water body is to users, the higher the recreation use will be. Access to water is directly influenced by reservoir pool elevations and downstream flows.

2.5.2.1 Usability of Water–Based Recreation Facilities

One of the primary effects of large seasonal drawdowns in storage reservoirs is a reduction in the usability of recreation facilities. Most of the recreation facilities at the reservoirs are designed to remain operational during the summer recreation season. During low water years, water levels may drop so many of the facilities remain unusable for some or all of the peak recreation season.

This effect may also occur at run–of–river reservoirs and downstream river segments but is generally less pronounced since the smaller physical variations in pool elevations and flows allow facilities to remain usable across the full range of normal operations.

Types of facilities that are directly affected by reservoir operations include boat ramps, fixed and floating boat docks and moorage, and swimming beaches. Certain land–based facilities, including picnic and camping sites, trails, and parking areas may also be indirectly affected.

Boat ramps generally become unusable as water levels drop near or below the end of the ramp. Most ramps require a minimum water depth of 3 feet at the toe to be fully usable. Depths of less than 3 feet limit the functional use of a ramp by restricting the size of boats that can be launched and also create safety hazards. In some cases, even 3 feet of depth may not be adequate to allow launching of larger boats, particularly fixed–keel sailboats.

At the larger storage reservoirs, many of the ramps are located on steep slopes. Large drawdowns may require boat launchers to negotiate long and steep ramps. This greatly increases the difficulty and time required to launch each boat. This is especially true at those ramps where there is not enough room to provide a turnaround or low water parking lots. Without low water parking, boaters may have to transport their vehicle and boat trailer long distances from shoreline to boat and back again. Even where boat ramps remain in the water, these impacts of drawdown may discourage many users, particularly the elderly and disabled.

As noted above, most of the ramps on the run–of–river reservoirs on the Columbia and Snake Rivers are designed to remain usable over the normal (average) operational range of the reservoirs. Relatively few ramps are designed to remain usable at pool elevations below the minimum operating pools at any of the lakes. Some of the ramps become only marginally usable at minimum pool with inadequate depth for safe launching of larger trailered boats.

Marinas and Fixed and Floating Boat Docks generally are designed to remain usable over the normal operational range of the reservoirs during peak recreation seasons. However, as water levels fall,

water depths in sheltered marinas and boat basins become shallower, restricting boat access to facilities. Fixed and floating boat docks may become increasingly unusable as the amount of moorage or float space remaining in water decreases. At some marinas, shallow water conditions limit the use of a certain number of moorage spaces close to shore.

Shallow depths within protected boat basins, often caused by sedimentation and shoaling, can be a problem at low pool elevations.

Dredging may be an acceptable option for mitigating low–flow impacts at some of the boat ramp, marinas and boat moorage sites in the study area.

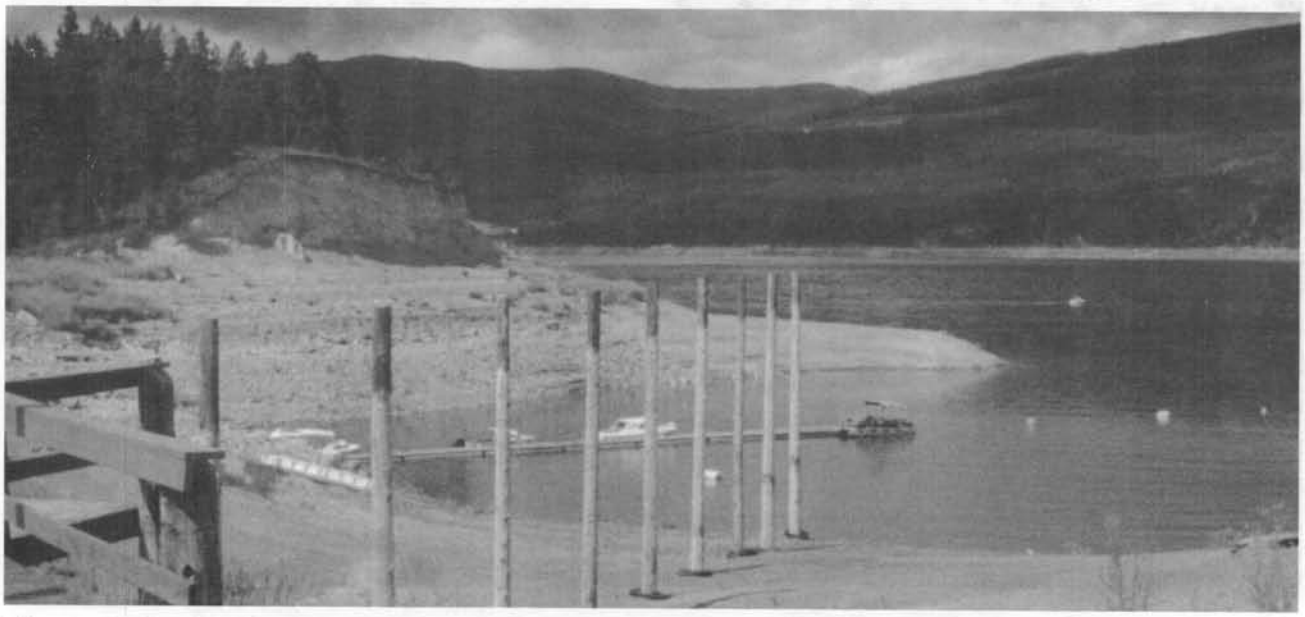


Figure 2–2. Typical Effects of Drawdown on Boating Facilities at Storage Reservoirs (Lake Koocanusa)

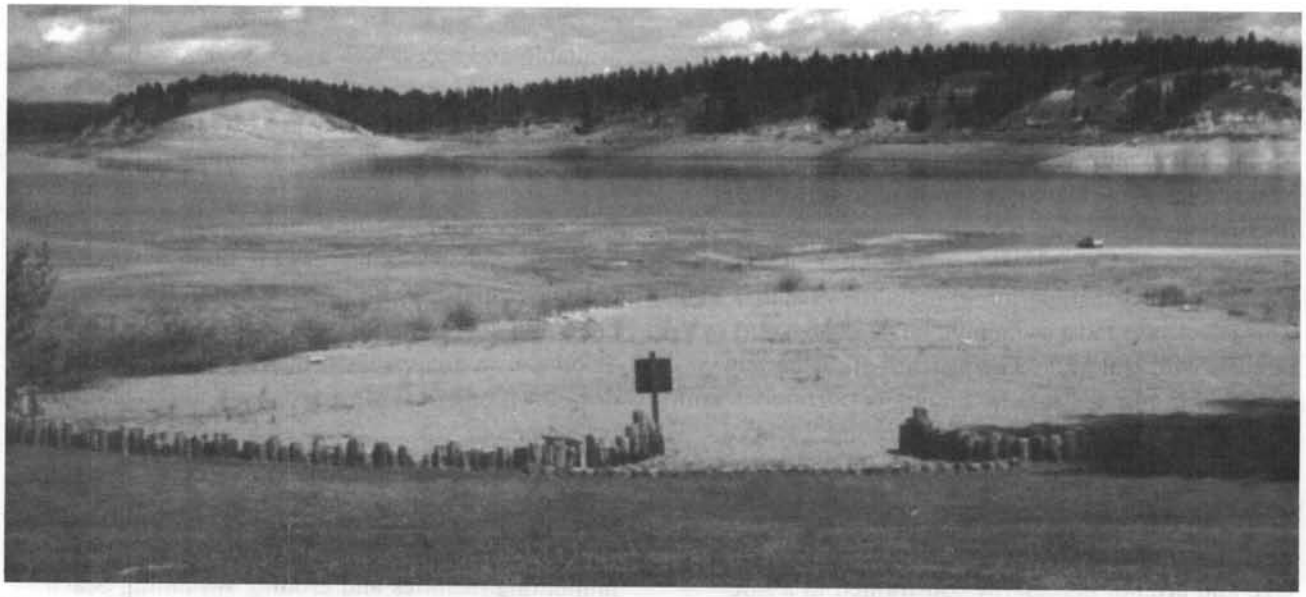


Figure 2–3. Typical Effects of Drawdown on Swimming Beaches at Storage Reservoirs (Lake Koocanusa)

Figure 2–4. Typical Effects of Extreme Drawdown at Run–of–River Reservoirs (Lower Granite)

Swimming Beaches. Swimming occurs at developed swimming beaches as well as at dispersed locations around the entire shorelines of the Columbia River Basin's lakes and rivers. Developed swimming beaches are generally more sensitive to water level fluctuations than other types of facilities. Beaches are most usable within at least 5 feet of full pool. There is usually a rapid degradation in usability after that level. This is because most swimming beaches are used by families with children. The beaches are generally designed to provide safe swimming opportunities up to about 6 to 7 feet in depth. After around 5 feet of drawdown, beach areas become marginal for swimming by even small children.

Adults and older children can swim anywhere in the lake and are not necessarily constrained to a safe beach area. To some extent, as water levels are lowered a greater amount of shore area becomes available and access to a water body may be improved. This is important because sunbathing, socializing and shore–play are often important components of the activity "swimming." Larger sand beach areas are also desired by windsurfers and waterskiiers who use the shoreline for takeoffs and landings. When beach areas are limited, some of these activities may be restricted. On the other hand, if beach substrates are muddy, rocky, stumpy, or otherwise unappealing, their exposure from drawdown or low flows may have a negative impact on swimmers.

In some river reaches and run–of–river projects, high flows may also impact swimming beaches by inundating facilities and eroding swimming beach areas. High flows may also create unsafe swimming conditions.

Irrigation Intakes. Many larger parks and recreation areas use either river water or well water to irrigate grass areas and other plantings. This is particularly true along the run–of–river projects on the Columbia and Snake Rivers. Most park irrigation intakes are designed to remain operational over the full range of reservoir operations. However, most of the irrigation systems operate less efficiently at low pool levels since the water has to be drawn up higher distances. In addition, because of local physical constraints, some irrigation intakes are located high enough so that they will not be able to draw water at minimum operating pool.

Short–term drying of park irrigation intakes is not a serious problem; long–term drying of intakes could result in either serious damage to park landscaping and plant materials, or to requirements for costly alternatives.

2.5.2.2 Land–based Facilities

Camping and picnicking facilities, trails, parking areas, and other land–based recreation facilities are not directly affected by water–level fluctuations. However, indirect impacts include an increased distance from the facilities to water, and large drawdowns decrease aesthetic quality.

Visitation to these facilities is primarily affected insofar as visitor use patterns may change in response to effects on associated water–based recreation activities such as boating or fishing. Many of the major recreation sites on the river were designed and built as destination sites; recreationists are attracted to them because of the full complement of recreation opportunities that they provide. As swimming beaches, boat ramps, moorage and other water–dependent facilities become unusable, recreationists will begin to use other alternative sites within the region that provide the full range of activities desired.

2.5.3 Water–Surface Area (Recreational Carrying Capacity)

As the water levels fluctuate in reservoirs and rivers, the amount of surface area available for water–based recreational use changes. At the large storage reservoirs where large seasonal drawdowns substantially diminish lake surface areas, the impact on recreational carrying capacity can be significant.

As a result of these effects, boaters, waterskiiers, anglers, windsurfers, and swimmers may be concentrated into smaller areas. The numbers of recreationists and types of activities that may be safely accommodated at a water body may be reduced. Congestion is not a serious problem in the basin except during peak use periods at popular access points such as Hood River during windsurfing events. Generally, surface area is not as critical a factor in constraining recreational carrying capacity as are other factors such as access facilities.

Because of the steep, confined topography of the Columbia River and Snake River channels, a drop in pool elevation will not cause a correspondingly large reduction in lake surface area except at a few locations where the lakes inundate former terraces or bottomlands and the bottom is flat or shallow. However, these locations tend to be popular sites for water–based recreation.

An existing safety concern at Hood River, The Dalles, and other locations in the region is the potential for conflicts between windsurfers and barges and other commercial craft in the navigation channel. Decreases in the size of the pool at high–use areas, such as Hood River and The Dalles, may shorten the reach that windsurfers have to sail, concentrating more participants into a smaller area in the channel. Under present operations, and at present levels of windsurfing and navigation use this has not been a serious problem; education and coordination between commercial navigators and windsurfers appears to have solved most of the issues.

In some cases, reduced water area in lakes and rivers concentrates fish, possibly improving chances for fishing success.

2.5.4 Recreational Safety Hazards

Reservoir operations and the resulting fluctuations in pool elevations and stream flows can cause a variety of different safety hazards for recreationists.

2.5.4.1 Exposed Hazards

Low water levels may expose dangerous tree stumps, rocks, and shoals that are hazardous to activities such as boating, waterskiing, and windsurfing. The rocky shoreline of the Columbia River is dangerous under normal operating conditions; most recreationists are aware of the normal hazards. A change of operations, such as dropping reservoir pools or river flows below normal operating conditions, will expose new rocks, shoals, stumps and other hazards with which recreationists are not familiar.

Sandy shorelines on the Columbia River downstream from Bonneville Dam, particularly those around Government, Reed, Lemon, and other islands, become very popular in summer for boating, waterskiing, and camping. As water levels drop, the beaches in this area of the river become larger and more appealing. Eventually, however, as water levels become extremely low, sediments and large shoals restrict boat access to side channels and islands.

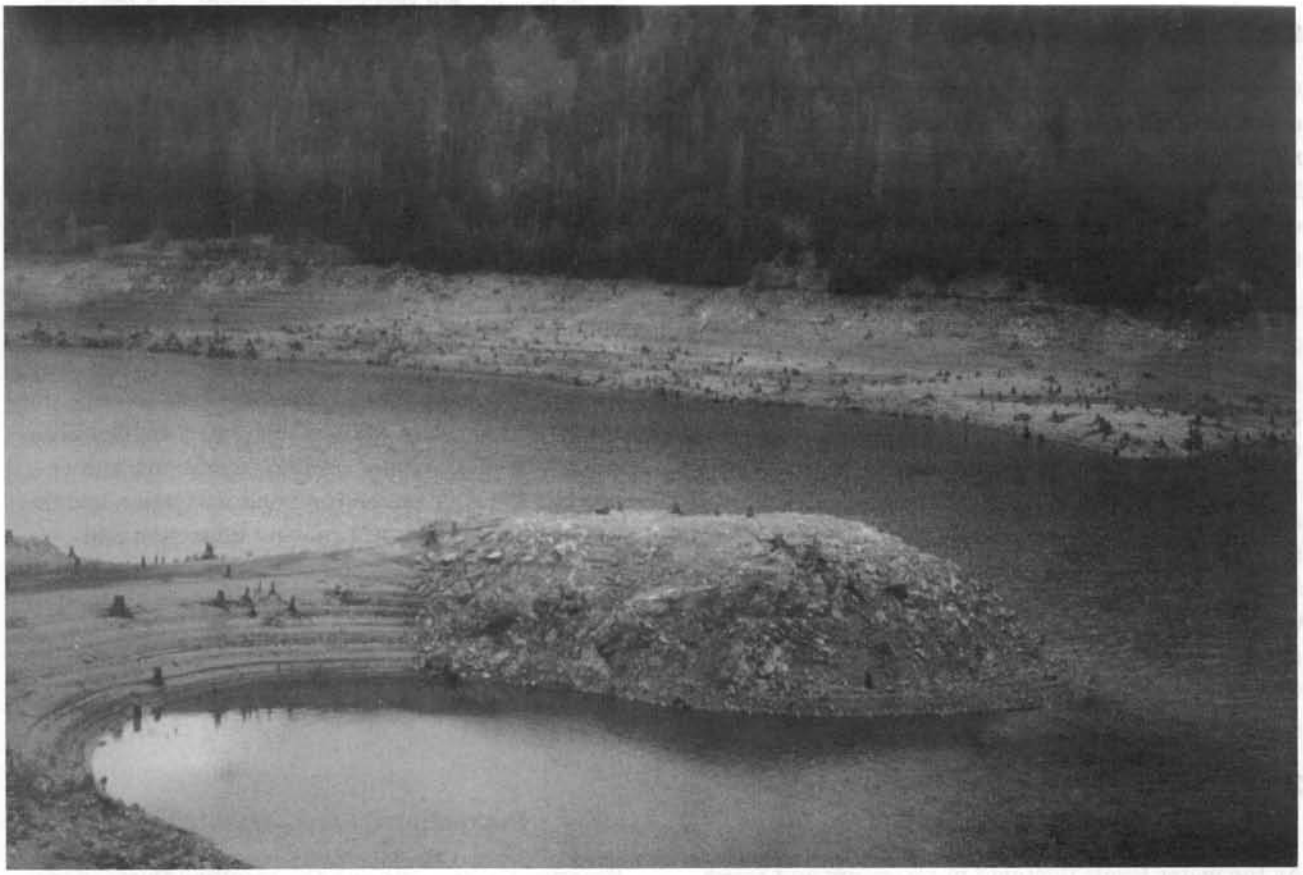


Figure 2–5. Typical Exposed Shoreline Hazards Following Drawdown

2.5.4.2 Water Velocity and Flow–Related Hazards

High water velocities are an existing hazard in the system. The powerful hydrodynamics associated with operation of the dams can be particularly dangerous for small craft. Safety hazards for recreational navigation occur both above and below the dams during releases. For example, releases from the navigation lock at The Dalles Dam create significant turbulence in the tailwater area downstream.

High velocity flows from some of the dams in the system may also result in undesirably low water temperatures downstream. This occurs at Hungry Horse Dam, where releases create low temperature flows in the Flathead River downstream. In addition to being unappealing for swimmers, rafters, and possibly fishermen, this may also be a safety hazard.

River velocities vary considerably with natural river flows. Most recreationists are prepared to deal with a wide range of water velocities as a natural hazard. There are some special hazards, however, that must be considered. Jetties and other in–water obstacles in the vicinity of the projects create special flow–related hazards. Boating, swimming, or other recreation accidents, injuries and fatalities may occur as a result of high flow velocities.

One special hazard involves the anchoring of fishing boats in high flow areas, particularly in tailrace areas below Bonneville and the other dams. The river below Bonneville Dam is a very popular sturgeon fishing location. There have been numerous cases of capsized boats and drownings in that area over recent years by boaters attempting to anchor with inadequate equipment or knowledge.

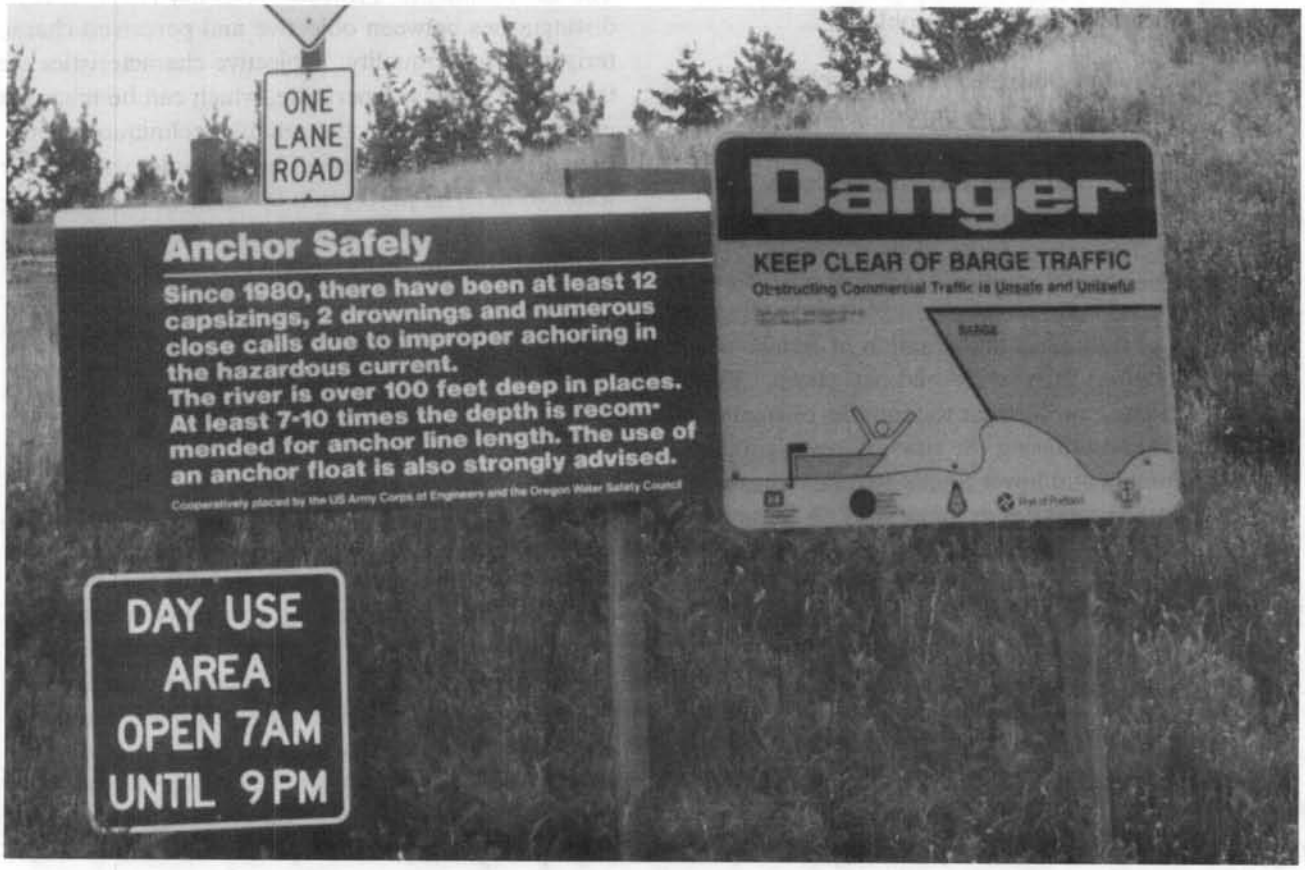


Figure 2–6. Changes in Flows Released from Dams Creates Boating Safety Hazards

Oregon State Marine Board has recommended that safety zones and navigational barriers near the dams should be established and signed, and the possibility of providing sound warnings during releases should be considered.

2.5.5 Other Physical Effects

2.5.5.1 Shoreline Erosion

Shoreline erosion caused by wind–driven wave action has impacted recreation facilities and made access difficult in some places around the shorelines of the reservoirs. Wave–cut erosion at the low pool line has contributed to significant damage around the shoreline of many lakes and may impact facilities such as the toes of boat ramps. Erosion at the maximum pool level has created precipitous slopes along the edge of some of the lakes. During the winter at high pool periods, wind–driven waves may cause significant bank erosion problems.

In addition to impacting facilities at developed recreation sites, erosion also impacts general recreational use and access at dispersed locations along the shoreline. Erosion can also severely impact cultural resource sites.

2.5.5.2 Shoaling

Deposition of sediments and creation of shoals creates difficulties for recreational navigation. Shoaling is a particular problem at the mouths of smaller tributary streams entering the run–of–river project on the Columbia and lower Snake Rivers. Construction of shoreline facilities at many sites on these lakes requires special designs to prevent severe sediment deposition. Some parks and marinas have continuing dredging requirements due to sedimentation.

2.5.5.3 Seep Lakes and Embayments

Along the lower Columbia and Snake Rivers there are numerous small lakes separated from the main stems of the river by railroad and highway embankments. These water bodies fluctuate up and down with the run–of–river reservoirs. Some of these lakes are connected directly to the river by culvert or channel, while others are fed directly by seepage or groundwater. Drawing the reservoirs down causes a corresponding drop in depth and surface area of the lakes with potentially negative effects on the recreational fishery and riparian wildlife habitat.

2.5.6 Water Quality

Water quality has a direct effect on the suitability of water bodies for many recreation activities. Complicating any assessment of the effects of water quality on recreation is the fact that, while many of the individual parameters of water quality (turbidity, clarity, odor, or aquatic growths) are easily perceived by human sensory organs, many others (coliform bacteria, Ph, and toxic chemicals) are generally perceived only through scientific measurement techniques not available to the ordinary recreationist.

The Environmental Protection Agency (EPA, 1978) distinguishes between objective and perceived characteristic of water quality. Objective characteristics are those, like water temperature, which can be measured using known accurate and reliable techniques. Perceived characteristics reflect how people perceive the water to be. The perception involves an assessment––possibly erroneous––of the objective characteristics and a reaction to that assessment. Recreational demand may be more closely related to perceived characteristics than the ones only a scientist can measure. The EPA has separated variables of water quality into three categories: (1) hygenic factors, (2) aesthetic factors, and (3) indirect nuisance factors.

2.5.6.1 Hygenic Factors

Hygenic factors basically are pollutants that pose direct health hazards through contact or ingestion. An important characteristic of variables in this category is that they do not change the perceived desirability of water. Since a recreationist ordinarily cannot perceive these pollutants, there is no effect on the desirability of a water body. Variables included in this category are coliform bacteria and other pathogenic pollutants, concentrations of toxic substances such as pesticides and herbicides, pH, and alkalinity.

Figure 2–7. Bank Protection is Needed to Prevent Shoreline Erosion at Many Recreation Sites

Since these hygenic factors directly affect health and safety, they are most important to participants in direct–contact recreation activities, such as swimming, waterskiing, or windsurfing, where the risk is greatest for disease, illness, or injury through ingestion or contact. To a lesser extent, knowledge of the existence of hygenic factors may also influence other activities as well.

These variables are usually imperceptible to human sensory organs, and they don't directly influence water–related, non–contact activities. However, the knowledge or belief that a water body is clean or the fear that it is dirty may affect the psychological enjoyment of water–related activities.

System operations do not add to pathogen populations in the rivers and reservoirs of the Columbia Basin, but reduced flows or pool elevations may concentrate existing pollutants. Ingestion or direct contact with concentrations of toxic substances such as pesticides, herbicides, heavy metals, and other pollutants can also lead to injury or illness. In addition, many of these substances are carcinogenic. Substances such as pesticides and herbicides used in agriculture can be carried into the drainage system by return irrigation flows.

2.5.6.2 Aesthetic Factors

Aesthetic parameters of water quality are primarily those which can be detected by human senses and therefore alter a water body's perceived suitability for recreation use. These parameters include water temperature, odor, color, turbidity, oil and grease slicks, foam, litter and other debris, algae, aquatic weeds, and dead fish. Because the general appearance of a water body is an important factor in its acceptance for recreation use, these parameters are closely related to recreation demand. Humans are not likely to recreate in water openly perceived as dirty, so these factors are important to both direct and indirect–contact activities. In cases where water is grossly polluted, land–based activities may also be affected. The most obvious example is the negative impact of obnoxious odors emanating from an adjacent water body on camping or picnicking facilities.

One of the most important water quality variables is temperature. Excessively warm or cold water temperature has an adverse effect on the enjoyment of swimming and may be unhealthy. Perhaps more importantly, high or low water temperatures often create biological conditions unsuitable for recreation or game fish habitat (EPA, 1978). Warm water temperatures in combination with nutrients may stimulate growths of obnoxious aquatic weeds and algae. The color and clarity of water are also important for both aesthetic and safety reasons.

2.5.6.3 Indirect Nuisance Factors

Indirect nuisance factors are parameters of water quality that may stimulate or cause a nuisance or undesirable environment in waters used for recreation. Two major subcategories under this heading include conditions that stimulate undesirable aquatic growths and factors that directly and indirectly have adverse effects on aquatic life.

One potentially important water quality problem for recreationists in the Columbia River Basin is growths of algae and higher order aquatic plants. Such growths are aesthetically unpleasant and, if excessive enough, may hinder participation in water–based activities such as swimming, boating, fishing, or water skiing. High water temperatures and nutrients (especially nitrogen and phosphorus) may stimulate growth of aquatic plants, especially when found in combination. Factors that directly or indirectly impact aquatic life include toxic pollutants, oxygen–consuming substances, temperature, and silt–forming materials.

2.5.7 Fishing Success

Fishing is an extremely important recreational activity in the basin. It is the primary activity driving a large percentage of the recreation trips to the reservoirs and rivers in the system. As shown on Table 2–2, between 13 and 33 percent of all visitors to different Corps lakes in the basin go fishing.

Fishing success is a very important influence on recreation participation. Any change in fishing success will ultimately affect overall recreation participation. Lakes or rivers with reputations as high–quality fishing locations attract increasing numbers of anglers. Correspondingly, as fishing success declines, anglers can be expected to look for alternative sites where success may be better.

If fishing success at a given lake or river declines over time, there may be a delay in the corresponding decline in visitation of several years or seasons, as anglers continue to return based on past success. Likewise, it may take several years for the reputation of an improved fishery to build to a point where visitation increases are observed.

Fishing success can be defined in terms of several variables, the most important of which are fish numbers and size. The importance of fish numbers is obvious. Fishing success is most often defined in terms of the numbers of fish caught per unit of effort (time). Fish size may not be important to some anglers. However, it is particularly important at those lakes and rivers in the Columbia Basin that support trophy sport fisheries.

The diversity of game fish species available in any given reservoir or river reach may be important and attracts fishermen. Some anglers target anadromous species such as salmon or steelhead. Others may target specific resident coldwater or warmwater game fish and still others may be interested in catching a variety of fish on any given trip. The peak seasons for fishing for different species vary, allowing anglers to target different species at different times of the year.

The reservoir elevations and river flows that are outcomes of system operation directly affect fish and fish habitat. Any operation that affects game fish species, positively or negatively, can be expected to have a corresponding effect on fishing success. Technical Appendices C, Anadromous Fish and K, Resident Fish, describe the sport fisheries available throughout the region and the impacts of operations on them. Section 2.7 summarizes angling opportunities on a project or river reach basis.

2.5.8 Wildlife Hunting and Viewing Opportunities

Wildlife is an important recreation resource in the basin. Hunting is one of the single most popular activities to occur on public and private lands throughout the basin. Although, as shown on Table 2–2, hunting comprises a relatively small proportion of the total water–related recreational use at lakes and rivers in the system. Wildlife viewing is a popular activity in its own right. In addition, the opportunity to view wildlife adds to the enjoyment of most visitors. As with fish, wildlife hunting and viewing success can be defined in terms of wildlife diversity, numbers, and size. Appendix N describes wildlife resources of the system in more detail.

2.5.9 Aesthetic Quality

Aesthetically pleasing views are a critical component of most outdoor recreation activities. Visual quality can be directly affected by operation of the system. The aesthetic appearance of the reservoirs in the system is directly related to pool elevation. In general, a lake will appear more aesthetically appealing when it is at or near full pool than when it is drawn down. Visual quality is reduced as drawdowns expose views of mudflats, eroded slopes, and water–bleached rocks and stumps.

Visual impact of drawdown is generally most significant at the storage reservoirs, where seasonal drawdowns up to 155 vertical feet expose large zones. Exposed shorelines in the storage projects contrast significantly in color and texture with the adjacent forested uplands.

In comparison, the run–of–river reservoirs on the Columbia and Snake Rivers experience only a 3 to 5–foot daily fluctuation. The resulting drawdown does not have a significant visual impact.

2.5.10 Summary: Influence of System Operations on Recreation

Previous sections of this chapter have described the potential physical effects of river flows and reservoir elevation on recreation resources. The following section will attempt to describe the influence of these potential physical effects on recreation participation trends.

Moderate shifts in river flows and reductions in reservoir pool elevations probably have little or no effect on water–related recreation. Water–based facilities on the rivers and reservoirs of the basin usually, although not always, are designed to be usable within the normal range of water level fluctuations. Recreationists will remain relatively insensitive to moderate water level reductions as long as the capabilities of the resource and water–based recreation facilities to support such activities are not impaired.

However, as pool elevations or stream flows continue to drop, a point will be reached where the ability of a water–based recreation resource to provide quality recreation experiences begins to decline. This decline occurs as the physical effects of system operations discussed in the preceding sections become more apparent. As access to the water is

impaired, as facilities become unusable, as safety hazards become more pronounced, or as aesthetics decline, there will probably be a corresponding decline in recreation attendance.

To determine the point at which the quality of a river or reservoir for recreation begins to decline because of lowered water levels, a variety of factors need to be considered. Factors that influence the recreation characteristics of a water body include: 1) the range of acceptable operations for boat ramps and other facilities, 2) water surface area, 3) reservoir or stream–bed cross–section, 4) slope of beaches, 5) soil character of beaches, and 6) types of activities to be accommodated.

These factors are interrelated and will differ for each river and reservoir. For example, the recreation use of a wide and shallow river or reservoir would probably be more adversely affected by a 10–foot drop in water surface elevation than would a narrow and deep river or reservoir. Eventually, as water levels continue to decline, a point may be reached where the quality of recreation experiences provided by a water body, and therefore recreation demand, will drop to zero. Logically, this situation will most likely occur when the physical resources can no longer support recreation activities. The most obvious example is that water–based activities must cease when all the water in a river or lake is withdrawn.

Under present operating conditions, there is generally enough water in all of the lakes and rivers to meet recreation needs throughout the basin during wet and normal water years. However, in dry years, natural water shortages may drop water levels of rivers and reservoirs in the basin to the point that recreation demand is affected.

In order to accurately assess the effects of water level reductions on recreation participation, some other factors need to be considered. Sensitivity to water withdrawals varies between different activities. Water–based recreation activities, such as boating, swimming, and fishing, will obviously be more sensitive than land–based activities, such as picnicking or sightseeing, since the former are directly related to water on a performance level while merely providing an aesthetic complement for the latter.

Even among water–based activities, performance requirements vary. Certain types of boating activities such as waterskiing and sailboating require large, unobstructed water surfaces, while others, such as canoeing, kayaking, and rafting, are best done on small water surfaces and swift–moving streams. For example, during low water years, navigation in the Hells Canyon reach of the Snake River may become very difficult for some of the large tour boats that normally travel it while it remains accessible to smaller craft, such as rafts, drift boats and kayaks.

The level of sensitivity of various activities to water level fluctuations is an important consideration because it may help to determine the change in the mix of recreation activities that may occur as a result of proposed changes in operation of the Columbia River system. A related point is that recreationists engage in a combination of activities. Few people go on a trip only for boating, swimming, or picnicking; they frequently combine several activities. The distribution of time among those activities may change in response to changes in system operations.

In other words, in addition to influencing total numbers of recreation participants, low water levels may also influence the ways in which people choose to recreate. Most likely, as the level of drawdown becomes more severe and effects on recreation resources more apparent, there may be a shift away from water–based activities while land–based activities become relatively more important.

2.6 MANAGING AGENCIES/ENTITIES ROLES AND RESPONSIBILITIES

This section provides a brief description of the authorities and responsibilities of agencies and entities managing recreation facilities or resources in the region.

2.6.1 Federal Agencies

2.6.1.1 Corps of Engineers

The Corps constructed and operates 12 projects in the SOR study area. The Corps is the Federal agency primarily responsible for managing recreation resources and providing recreation facilities at those projects. Historically the Corps has relied on the assistance of non–Federal sponsors to assist in the construction, operation, and management of its recreation areas and programs.

The Flood Control Act of 1944 gave the Corps specific authority to provide public outdoor recreation facilities at its projects. Section 4 of the Act states, in part:

"The Chief of Engineers is authorized to construct, maintain and operate public park and recreational facilities in reservoir areas under control of (the Department of the Army), and to permit the construction, maintenance and operation of such facilities".

Public Law (P.L.) 89–72, the Federal Water Project Recreation Act of 1965, mandated that full consideration be given to outdoor recreation and fish and wildlife enhancement as equal project purposes; that planning relative to the development of recreation potential be coordinated with existing and planned Federal, state and local public recreation developments; and that non–Federal public agencies be encouraged to provide not less than 50 percent of the recreation facilities development costs and assume all operations, maintenance, and replacement of recreation facilities after construction was completed.

Although P.L. 89–72 was Congressionally applied to projects authorized during or after 1965, an agreement was formulated between the Corps and the Office of Management and Budget applying the cost–sharing provisions of P.L. 89–72 retroactively to all projects authorized prior to 1965.

The Corps currently administers 12 projects in the basin. In 1991, there were approximately 220 recreation sites at these lakes. Some sites are managed directly by the Corps. However, most of the sites are managed by other Federal agencies, including USFS and the USFWS, the states of Oregon, Washington, and Idaho, and a variety of other local entities such as counties, cities, and port districts,

Other agencies manage large natural resource areas for recreation along with other purposes. The USFWS, and Idaho, Oregon and Washington state fish and wildlife agencies manage a number of wildlife refuges along the Columbia River. These areas have some facilities such as access, parking, trails, and boat ramps that support generally dispersed public use consistent with fish and wildlife objectives. Most of the numerous state and Federal fish hatcheries along the river also allow public access and provide facilities to promote and interpret their missions.

2.6.1.2 Bureau of Reclamation

Reclamation constructed and operates two storage projects within the Columbia River Basin, Grand Coulee Dam and Hungry Horse Dam. Reclamation is authorized to manage recreation resources and provide recreation facilities at those projects. Similar to the Corps, Reclamation has relied on the assistance of non–Federal sponsors to assist in the construction, operation, and management of its recreation areas and programs under Public Law 89–72 (see Section 2.6.1.1).

Hungry Horse Dam and Reservoir were authorized by P.L. 329 on June 5, 1944. Project construction was completed in July 1953. Authorized project purposes include flood control, power, recreation, and fish and wildlife. The dam, powerplant, and visitor center are operated by Reclamation. Remaining project lands surrounding the lake are operated by the USFS.

Grand Coulee Dam was authorized under the Rivers and Harbors Act of August 30, 1935. Construction began in 1933 and was completed in 1942. The third

powerplant was authorized by P.L. 89–561 in September 1966. Construction was completed in 1980. Congress authorized NPS to administer Franklin D. Roosevelt (FDR) Lake behind Grand Coulee Dam as a National Recreation Area in August 1946.

2.6.1.3 Forest Service

The USFS administers six National Forest units within the SOR study area. National Forest lands are managed for recreation as well as for range, timber, watershed, and fish and wildlife purposes. The National Forests offer a diversity of recreation opportunities in a wide range of settings, from primitive to developed. The USFS operates a variety of developed recreation facilities located on rivers and reservoirs in the system. These facilities include campgrounds, picnic areas, boat launches, and trails. In addition, dispersed recreational use occurs in numerous undeveloped water–related sites.

Recreational use of USFS sites and facilities is influenced by the operation of the river system to a greater or lesser extent. Much depends upon the type and purpose of the adjacent project. The Columbia River Gorge National Scenic Area and the Hells Canyon National Recreation Area are impacted somewhat by the present operation of the river. Recreation sites on Lake Pend Oreille in the Idaho Panhandle National Forests, behind Albeni Falls Dam, experience only slight effects at present. Recreation use at sites and facilities on Lake Koocanusa (Libby Dam) in the Kootenai National Forest and on Hungry Horse Reservoir (Hungry Horse Dam) in the Flathead National Forest are directly impacted by operation of the river system.

2.6.1.4 National Park Service

The NPS manages three units of the National Park System that are on or near the Columbia River. The units are Fort Clatsop, Fort Vancouver, and Coulee Dam National Recreation Area. The two forts are historically linked to the river, but they are not affected by the present operation of the system. Coulee Dam National Recreation Area, located on Lake Roosevelt behind Grand Coulee Dam, was established in 1946 to provide water–based recreation to the general public. The operation of the river system directly impacts the recreation use of Lake Roosevelt.

Recreation and other interests on Lake Roosevelt are managed under an agreement that spells out the management authority and geographic areas that are under the jurisdiction of each entity. The managing entities are Reclamation, the NPS, the Colville Confederated Tribes, and the Spokane Tribe of Indians. The NPS manages approximately 55 percent of the total reservoir and related lands under the title of Coulee Dam National Recreation Area. The NPS is authorized by Congress to administer federal project areas for recreation use pursuant to cooperative agreements. In 1970, Congress redefined the National Park System and included these areas as full units of the Park System.

2.6.1.5 Fish and Wildlife Service

The FWS, as the Federal focal point for national fish and wildlife concerns, is responsible for migratory wild birds, mammals (except certain marine mammals), inland sport fisheries, and fish and wildlife research. The objective of the FWS is to assure that the American people have the maximum opportunity to benefit from fish and wildlife resources as part of their environmental stewardship responsibilities based on ecological principles, scientific knowledge and management of the nation's fish and wildlife resources. FWS also administers a national education program to promote understanding, appreciation, and wise use of resources (U. S. Department of Interior, 1979).

The FWS is authorized to administer Federal lands that are managed as habitat refuges for the nation's fish and wildlife resources. There are two National Wildlife Refuges within the SOR study area, Saddle Mountain along the Hanford Reach of the Columbia River, and Umatilla along the John Day Project. Umatilla National Wildlife Refuge contains twenty miles of the Columbia River and adjacent uplands on both the Oregon and Washington sides of the

river managed primarily for waterfowl habitat. National Wildlife Refuge lands are open for hunting, wildlife viewing, fishing and other activities consistent with wildlife management objectives.

The FWS also manages 14 National Fish Hatcheries within the basin. Most of the hatcheries present interpretive programs and some have facilities to provide public access to rivers.

2.6.2 Oregon State Agencies

2.6.2.1 Oregon State Parks and Recreation Department

The Oregon State Parks and Recreation Department is responsible for acquisition, improvement, maintenance, and operation of Oregon's state park system. There are eight Oregon State Parks located on rivers and reservoirs in the system. Most of these are on Lake Bonneville (Bonneville Dam) and Lake Celilo (The Dalles Dam) in the Columbia River Gorge.

In addition to operating state parks, the Department gives technical assistance to local government agencies on park matters, develops and maintains the Statewide Comprehensive Outdoor Recreation Plan (SCORP), and administers the Federal Land and Water Conservation Fund matching grant program in Oregon. The Department also administers several special programs, including the State Historic Preservation Program, Oregon Recreational Trails System, and the State Scenic Waterways.

2.6.2.2 Oregon State Marine Board

The Oregon State Marine Board issues certificates of numbers and titles to approximately 180,000 undocumented vessels in the state. Marine Board revenues received from boat registrations and fuel taxes are used to enforce boating laws, for boating safety programs, and to develop, maintain, and improve public boating facilities.

The Marine Board does not operate or administer any boating facilities but cooperates with Federal, state and local agencies to provide facilities in the state for the benefit of boaters. It also promotes uniform laws and regulations relating to boating; provides funding and training to county sheriffs and the state police to enforce those laws; publishes brochures, provides boating safety courses, and otherwise promotes safe boating practices. The Marine Board also regulates recreational boating, places waterway markers on state waters, and regulates the use of sanitary facilities on vessels to prevent pollution.

2.6.2.3 Oregon Department of Fish and Wildlife (ODFW)

ODFW formulates the general programs and policies of the state concerning the management of fish and wildlife resources and establishes seasons, methods, and bag limits for recreational and commercial take of the resource. Sport license and tag fees are deposited in the state Fish and Wildlife Fund for use by the department. In 1990 about two million sport licenses and tags were issued in the state.

ODFW also operates a variety of facilities designed to enhance fish and wildlife resources. Along the reservoirs and rivers of the system, ODFW operates and maintains fish hatcheries, wildlife areas, public shooting grounds, and hunting and fishing access areas.

2.6.3 Washington State Agencies

2.6.3.1 Washington State Parks and Recreation Commission

The State Parks and Recreation Department is responsible for acquisition, improvement, maintenance, and operation of Washington's state park system. There are a total of over 100 state parks, of which 12 are located on rivers and reservoirs in the system. The Commission also administers several special programs, including State Scenic Rivers, and boating and water safety.

2.6.3.2 Washington Interagency Committee for Outdoor Recreation

The Interagency Committee for Outdoor Recreation (IAC) facilitates investments in outdoor recreation and natural resources. IAC administers grant programs for the acquisition and development of lands and facilities for parks, water access, trails, natural areas, and wildlife habitat. IAC also conducts Statewide Comprehensive Outdoor Recreation Planning and provides technical assistance, coordination, and advocacy.

2.6.3.3 Washington Department of Wildlife

The Washington Department of Wildlife is responsible for preserving, protecting, and perpetuating the state's wildlife. The department sets times, places, manners, and quantities in which wildlife can be taken, and researches the habits and distribution of various species of wildlife in the state.

2.6.4 Idaho State Agencies

The Idaho State Parks Department is responsible for acquisition, improvement, maintenance and operation of Idaho's state park system. Idaho State Parks within the SOR study area include Dworshak at Dworshak Lake, Farragut at Lake Pend Oreille, and Hells Gate at Lower Granite Lake. The Idaho State Parks Department also administers the State Wild and Scenic rivers program.

Idaho Department of Fish and Game (IDFG) is responsible for preserving, protecting and perpetuating the state's fish and wildlife resources. IDFG also develops and manages dispersed recreational access points and facilities.

2.6.5 Public Utility Districts

Within the middle Columbia River in Washington are five run-of-river projects operated by Chelan, Douglas, and Grant County Public Utility Districts (PUDs). As part of their licensing from the Federal Energy Regulatory Commission (FERC), the PUDs were required to prepare and implement an "Exhibit R", which is a statement and plan regarding steps taken to provide public recreation in conjunction with their projects. The PUDs, in conjunction with the State of Washington and local municipalities have developed and manage extensive recreation facilities along that reach of the river.

2.6.6 Native American Indian Tribes

Tribal reservation lands adjacent to (and in some cases encompassing portions thereof) the lakes and rivers of the Columbia Basin include the Nez Perce Reservation along the Clearwater River and Dworshak Lake, and the Colville Confederated Tribes and the Spokane Tribe reservations along Lake Roosevelt. Reservation lands provide substantial recreation opportunities for Native Americans and the public. Some reservation lands are open to the public for hunting, fishing and other activities through permit systems managed by the tribes. The tribes cooperate with FWS and state fish and wildlife management agencies to increase sport fish and wildlife management efforts. The tribes have also participated in the development of marinas, resorts and other commercial recreation facilities.

2.7 RIVER REACH OR SUBBASIN DESCRIPTIONS

For purposes of describing the existing recreation condition, the basin has been subdivided into nine different subbasins or river reaches which are directly influenced by operation of the Federal dams in the system.

Figure 2–8. Lake Koocanusa

2.7.1 Kootenai River (Libby Project/Lake Koocanusa and Kootenai River downstream)

This subregion encompasses Lake Koocanusa (Libby Dam) and the Kootenai River downstream. Lake Koocanusa is located on the Kootenai River in the extreme northwest corner of Montana and southeastern corner of British Columbia (B.C.), Canada (known as the Kootenay River in Canada). Formed behind Libby Dam, Lake Koocanusa is about 90 miles (145km) long and extends nearly 42 miles (68km) into Canada with a total of 5 million acre–feet (6,170 m^3) of usable storage (Figures 2–9 and 2–10). The U.S. portion of the reservoir is entirely contained within the Kootenai National Forest.

The project location is fairly remote, but accessible from regional population centers. It is approximately 140 miles (225 km) west of Kalispell, Montana; 211 miles (339 km) northwest of Missoula, Montana; and 160 miles (257 km) from Spokane, Washington. The upper end of the reservoir is approximately 20 miles (32 km) southeast of Cranbrook, B.C.

Downstream of Libby Dam, the Kootenai River follows a free–flowing meandering course, dropping about 5 feet per mile. Nine miles (14 km) west of the town of Libby, Montana the river passes over scenic Kootenai Falls, which forms a natural barrier to upstream fish migration.

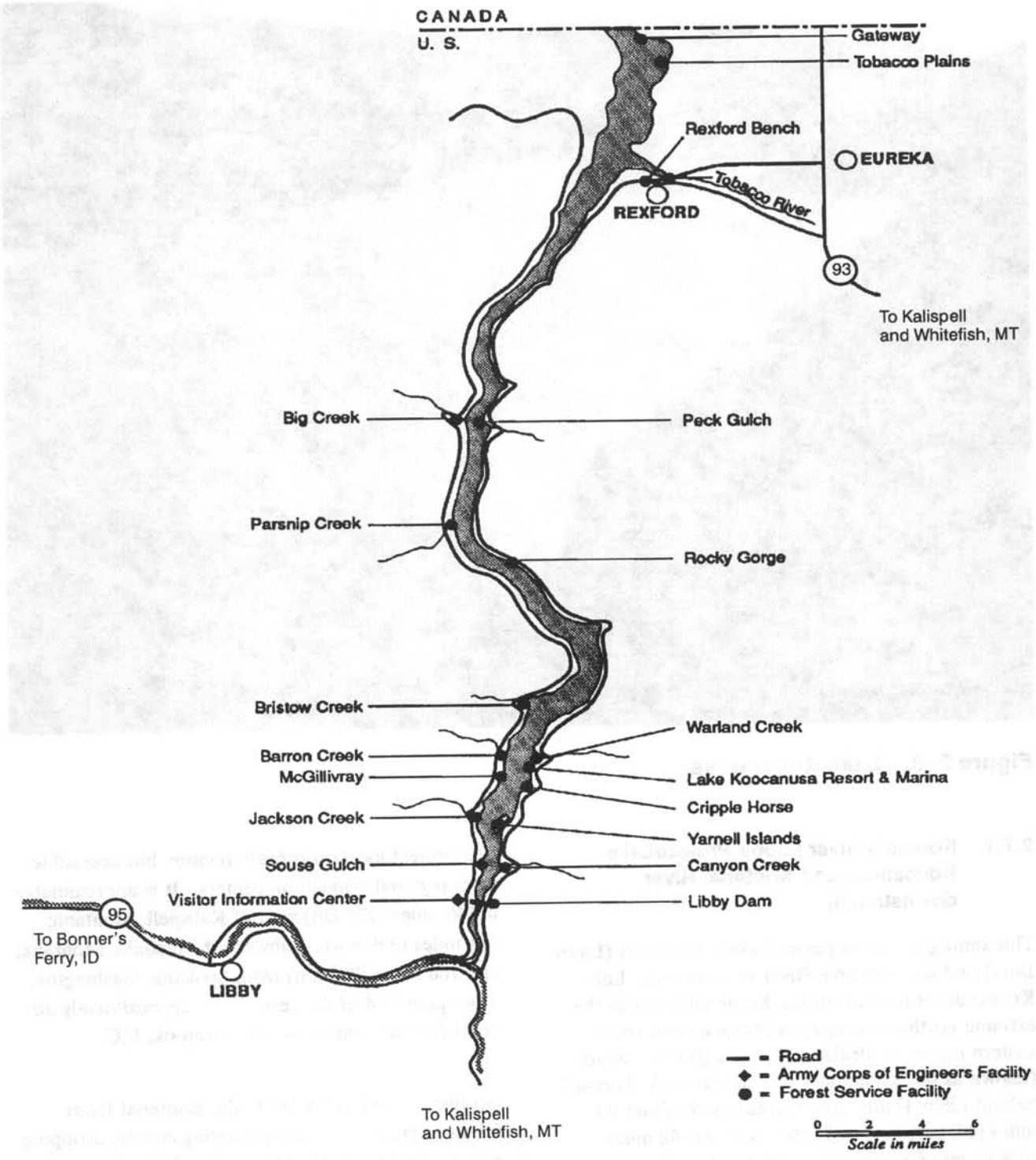


Figure 2–9. Map of Lake Koocanusa – USA

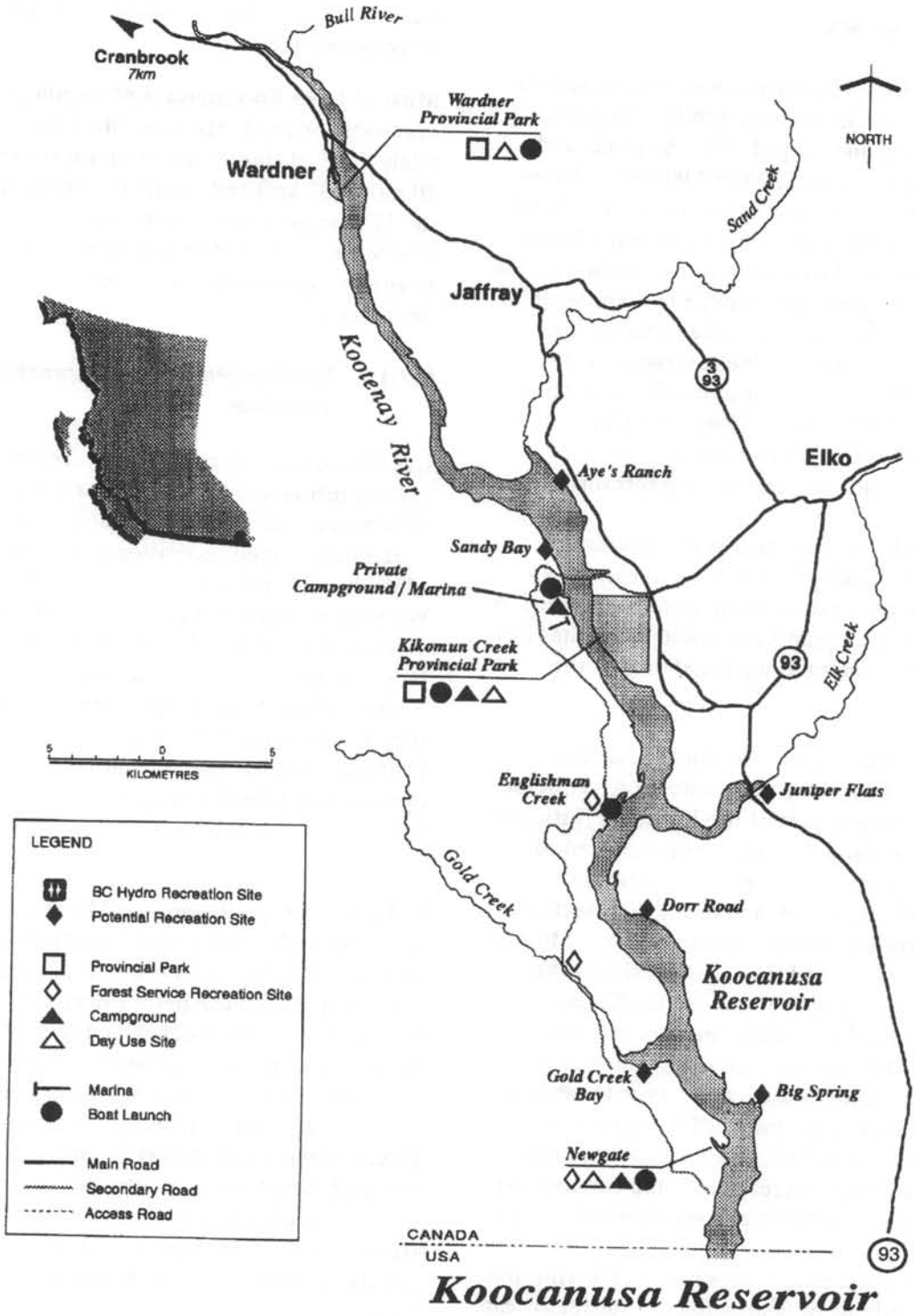


Figure 2–10. Map of Lake Koocanusa – CANADA

2.7.1.1 Aesthetics

The slopes of the Purcell and Kootenai mountains adjacent to Lake Koocanusa and the Kootenai River are steep and rugged. Nearby peaks and ridges rise as much as 3,000 to 4,000 feet (900 to 1200 m) above the reservoir and river. The reservoir section of the river valley is generally linear and narrow (from 3 to 4 miles or 5 to 6 km wide) in Montana, but opens up to from 5 to 10 miles (8 to 16 km) wide in British Columbia. Due to the relatively lineal nature of the reservoir, north/south views of the reservoir and valley can extend as far as 3 to 5 miles (5 to 8 km). East/west views, on the other hand, are generally restricted by the narrow valley and the nearby steep terrain.

The valley hillsides and nearby mountains are covered with stands of coniferous trees such as ponderosa pine, western larch, and Douglas fir. A variety of riparian plants are found along the river, and to a lesser extent along the shores of the reservoir.

Most of the land adjacent to the U.S. section of the reservoir and along the Kootenai River below Lake Koocanusa is part of the Kootenai National Forest. These lands are generally managed for timber production, wildlife, and recreation. Privately owned parcels of land in the U.S. section are concentrated near the town of Libby. Most of the private land near Libby that overlooks the Kootenai River is residential. In the Canadian section of Lake Koocanusa, much of the land adjacent to the reservoir is Crown land and is managed for timber production. Private lands are concentrated near the towns of Newgate and Wardner, B.C. Land uses on these private lands include residential, recreational, and commercial. Some residential properties have views of the lake.

Most of the potential viewers of the reservoir and river are residents of nearby towns. Residents can view the reservoir and river from a number of locations including private property, local roads, and recreation facilities. Recreationists and tourists from outside the immediate area can also view the reservoir and river from nearby roads and recreational facilities.

Most of Lake Koocanusa is physically and visually accessible by road. Montana State Highway 37 parallels the east side of the reservoir for over 20 miles (32 km) and nearly the entire west side of the U.S. section of the reservoir is paralleled by USFS roads. In British Columbia, B.C. Provincial Highway 3 crosses over the reservoir near Wardner, B.C.

2.7.1.2 Existing Parks And Recreation Facilities

Lake Koocanusa is an important regional recreational resource on both sides of the U.S./Canadian border. As shown in Table 2–14, there are over 15 developed recreational sites on both sides of the border and a number of dispersed sites. With the exception of day–use facilities administered by the Corps, all recreational facilities on the U.S. side of the lake are managed by the USFS. These include 10 developed and nine dispersed sites located primarily on the east side of the lake. Features found at USFS facilities include developed and dispersed campgrounds, picnic areas, fishing access points, boat ramps ,and swimming beaches.

Lake Koocanusa Resort and Marina is located approximately 6 miles upstream from Libby Dam on the east bank. This resort is privately managed and has a special use permit from the USFS. It is the most extensively developed recreational facility on the lake and has features that include moorage slips, rental cabins, a cafe–bar–convenience store, rental boats, and a service shop. Mariners Haven Marina and Resort Campground, located at Rexford, Montana, also provides overnight and day–use facilities, a marina, and convenience store. On the Canadian side of the lake, Koocanusa Lake Campsite & Marina provides similar facilities.

The Corps manages a visitors center, viewpoint observation tower, fishing access site, boat moorage, and a day–use area.

In the Canadian section of the reservoir, there are two provincial parks located adjacent to the reservoir, Wardner and Kikomun Creek. Kikomun Creek Provincial Park is the more developed of the two and has boat ramps and a campground. Both have picnic areas and swimming beaches. The B. C. Ministry of Forests, Forest Service, operates two recreation sites with campgrounds and boat access facilities at Newgate and Englishman Creek.

Kootenay River Cruises, a private facility on the Canadian section of the project operates a campground with 15 camp sites and a charter boat service. The facility is located approximately 1 mile north of the town of Wardner. A commercial campground, boat launch ramp, marina and store is located on the west shore of the reservoir, opposite Kikomun Creek.

2.7.1.3 Principal Managing Agencies/Entities

Corps of Engineers. The Corps is the Federal agency primarily responsible for providing day–use facilities in the immediate area of the dam, both upstream and downstream. Visitor facilities include a visitor center, viewpoints, boat ramp and moorage, and several dispersed fishing access sites downstream.

The U.S. Forest Service. USFS is the major land management agency around Lake Koocanusa; Kootanai National Forest encompass the lake including the Rexford and Fisher River Ranger Districts, respectively. The USFS administers 15 recreation sites. All of the USFS recreation areas are located adjacent to the lake, including campgrounds, picnic areas, swimming beaches, boat launches, trails and trailheads, viewpoints, and historic and prehistoric sites.

Bristish Columbia Provincial Government. The Ministry of Environment, Lands and Parks is the management authority for Kikomun and Wardner parks. These parks are well maintained and show an increase in visitation over the last five years. The Ministry of Forests manages Forest Service recreation sites at Newgate and Englishman Creek.

Montana Department of Fish, Wildlife, and Parks. The State of Montana has jurisdiction over the fisheries in the reservoir and the river downstream. The department, under cooperative agreement with the Corps, operates and maintains the fish hatchery at Murray Springs near Rexford, Montana.

2.7.1.4 Major Activities and Use Areas

Recreational activities at Lake Koocanusa are water oriented. Fishing is perhaps the most popular activity, with 45 percent of all visitors reporting fishing and related activities as their primary recreational activity (Corps NRMS data, 1989–1993). A factor in the reservoir's popularity is that the U.S. portion is open to fishing year–round. Most anglers fish during the spring and summer from boats; however, ice fishing occurs during some winters. In the Canadian section of the reservoir and near creek mouths and large bays, anglers often fish from shore. Important game fish include westslope cutthroat, bull and rainbow trout, kokanee, Rocky Mountain whitefish, and burbot. According to NDFWP creel surveys, in 1985, kokanee accounted for 96 percent of all fish harvested from the lake. The kamloops strain of trout has been introduced by MDFWP to feed on kokanee. A reduction in the number of kokanee in Lake Koocanusa may increase their average size. Stocked Kamloops trout will provide a trophy fishery as they reach their ultimate large size.

Other recreation activities at Lake Koocanusa include picnicking, swimming, sightseeing, power boating, sailing, canoeing, camping, and hiking. Swimming and picnicking were the second most popular activities, with 25 percent of recreationists surveyed reporting the two activities to be their primary activity while at the reservoir. Swimming is particularly popular with residents from Libby, Eureka, and Rexford.

Table 2–14. Existing Recreation Sites and Facilities Lake Koocanusa and Kootenai River

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
1/ Alexander Creek						3		3		
Barron Creek	1	1						1		
1/ Blackwell Flats	1	1				4		4		
2/ Canyon Creek								10		
1/ Dunn Creek						9		9		
Downstream Vista						3		1		
Headrich RV	1	1	8	80				10		
Kikomun Provincial Park	1	2				51	1	98		
Koocanoosa Marina and Resort (Cripple Horse)	1	2	50	1500		3		50	45	1
Mariner's Haven	1	1	30	300				52	30	1
McGillvary	2	2				24	2	53		
Newgate	1	1						40		
Ostrich RV	1	1	60	500				25	55	
Rexford Bench	1	2				7		103		
Rocky Gorge	1	1						0		
Souse Gulch	1	2	5	196		44	3	0		
Tobacco Plains	1	1				12		0		
Visitor Center						2		0		
Wardner Provincial Park	1	2				7		0		
Peck Gulch	2	2				7		75		
Lake Koocanusa Marine	1	2	65	620			1	192		
2/ Warland Flats	1	1				6		24		
2/ Yarnell Islands						5		5		
TOTAL	**19**	**25**	**218**	**3196**	**0**	**187**	**7**	**755**	**130**	**2**

1/ Kootenai River below Libby Dam

2/ Undeveloped or minimally developed sites

The Kootenai River below Libby Dam has developed into an excellent rainbow trout fishery, with success rates that are comparable to the best blue–ribbon streams in Montana. Although fishing is frequently restricted by water level fluctuations caused by hydropower peaking operations at the dam, it is far superior to that which existed in the free–flowing river prior to dam construction. In recent years, a large but underused whitefish population has developed in the river and this population is assumed to be a factor contributing to smaller rainbow trout sizes now characterizing the catch (Skaar, 1992).

Normal minimum discharge from Libby Dam into the Kootenai River is 4,000 cfs, although under certain conditions the minimum discharge might be reduced to 3,000 cfs. Discharges below 8,000 cfs are provided on weekends and holidays from May 1 to September 15 when practical to enhance fishing opportunities. An effort is made to maintain these flows from three hours before sunrise to one hour after sunset on weekdays. The purpose of this is to benefit anglers by improving fishing in the river.

2.7.1.5 Visitor Use

Table 2–15 summarizes visitor use at Lake Koocanusa from 1987 to 1993. Only one complete year of census data is available for the Kootenai River downstream of Libby Dam. Recreation at Lake Koocanusa is primarily summer oriented. Approximately 85 percent of the recreational use of the reservoir occurs during July, August and September.

Table 2–15. Lake Koocanusa/Kootenai River visitation summary, 1987–1993.

CORPS OF ENGINEERS RECREATION SITES								
MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	7–YR AVG
Jan	7.5	7.2	5.4	5.0	1.4	1.3	1.8	4.2
Feb	8.5	9.9	7.2	7.5	1.4	2.1	2.8	5.6
Mar	9.2	11.2	8.6	8.2	6.1	5.7	5.3	7.8
Apr	18.9	14.8	17.2	11.4	15.7	19.0	11.8	15.5
May	14.5	17.4	19.8	16.1	16.2	22.2	11.9	16.9
Jun	26.7	27.1	28.9	21.4	21.5	29.4	24.5	25.6
Jul	24.8	32.3	31.0	35.2	31.7	29.2	24.2	29.8
Aug	28.4	30.5	25.2	29.9	17.5	33.5	17.5	26.1
Sep	20.6	15.6	14.8	27.7	15.6	13.5	9.6	16.8
Oct	12.0	12.7	9.8	11.5	8.4	7.3	4.7	9.5
Nov	16.6	13.2	12.2	10.4	4.4	6.9	3.9	9.7
Dec	17.0	10.1	8.7	8.7	5.9	2.6	2.9	8.0
Subtotal	**204.7**	**202.0**	**188.9**	**193.0**	**145.8**	**172.7**	**121.0**	**175.4**
OTHER RECREATION SITES								
US Forest Service	n/a	n/a	n/a	n/a	257.4	n/a	n/a	
Canadian Parks	n/a	n/a	117.0	135.8	128.6	n/a	n/a	
Kootenai River Creel Census	n/a	n/a	n/a	n/a	33.3	n/a	n/a	
TOTAL	**204.7**	**202.0**	**305.9**	**328.8**	**565.1**	**172.7**	**121.0**	

Approximately one–half of the recreational users of Lake Koocanusa are from Montana, with 65 percent from Flathead or Lincoln counties (Corps, 1985). Out–of–state visitors tend to come from Idaho, eastern Washington, or British Columbia and Alberta. Recreationists can be categorized into two main groups: nonresident anglers without children who stay in campgrounds between one week and two months, and local residents who fish, picnic and swim for the day or camp for the weekend.

Fishing guide services are available on the downstream reaches of the river. This is a popular and growing aspect of the local recreation economy; records from the local guide services indicate that these anglers come from all parts of the country including the midwest, west coast and the northeast. Creel surveys indicate that the greatest fishing occurs during the month of June.

2.7.1.6 Regional Facility Needs

Local interests believe the lack of stable pool elevations and the negative publicity associated with such operations have hindered the development of Lake Koocanusa as a recreation destination. The lake is between two highly developed recreation areas, Lake Pend Oreille in Idaho and Flathead Lake in Montana. Both of these areas offer better transportation facilities (regular air service and major highways), and operations vary only 10 feet throughout the season on the lakes. Lake Koocanusa can be drawn down over 160 feet through the season, with summer refill never assured.

Figure 2–11. Columbia River Above Lake Roosevelt

2.7.2 Upper Columbia Reach (Canada above Grand Coulee to Hugh Keenleyside Dam)

2.7.2.1 General Overview

The Upper Columbia Reach stretches approximately 80 kilometers (50 miles) from the Hugh Keenleyside Dam in B.C., to the northern tip of Lake Roosevelt near the mouth of Onion Creek in Washington State (Figure 2–12).

The scenic and recreational resources of the Upper Columbia Reach are unique in the Columbia River Basin. This reach still possesses much of the grandeur and environmental quality the river displayed before the era of industrialization. It possesses a unique sport fishery, is part of a critical winter range for wildlife, has several ancient Indian village sites along its shores, and is part of the longest navigable inland waterway in western North America.

While the Upper Columbia reach in B.C. possesses a unique set of recreational resources, it is virtually unknown to outdoor enthusiasts from outside of the immediate region. Though tourist traffic is low, it is used intensively for recreation by local residents. In 1991 local residents expended approximately 150,000 person days of outdoor recreation on the reach (Mallette, 1991).

The most popular form of in–stream recreation is fishing for a wide variety of species, especially trophy sized rainbow trout. The most popular near–stream recreation activities are sightseeing and picnicking. Hiking and swimming are also popular as access to the reach and surrounding area is excellent. Boating, both by local residents and those traveling up from Lake Roosevelt, is also popular. Each year, the reach plays host to river–boat and drag–boat races held during the summer festivals at Trail and Castlegar.

There are a number of specific sites and facilities used for recreation throughout the reach. However, a significant amount of recreation use is not site specific. There is also a need for upgrading and construction of more infrastructure, especially a marina with boat mooring capacity.

2.7.2.2 Existing Parks and Recreation Facilities

While there is a significant amount of recreation pursued on the Upper Columbia Reach, good quality facilities and sites are limited. From river kilometer 1,192 (mile 745) at the Canada–United States International Boundary to kilometer 1,247 (mile 779.5) at the Hugh Keenleyside Dam, there are 9 identified recreation sites that may be impacted by the operation of the Columbia River System. The facilities range from developed day use facilities and boat ramps to virtually undeveloped and unmanaged recreation areas. These sites are listed and described on Table 2–16, which includes the site name, the managing agency and a summary of the facilities at each location.

While some recreational activities pursued in the reach are site specific, such as most swimming and sightseeing, a significant amount is not. For example, virtually all of the fishing is done at sites other than those listed in Table 2–16. Easy access makes the pursuit of recreation throughout the reach common place. There are a number of upland recreation sites within the study area, but they have been excluded from further analysis in the SOR because it is assumed that these sites without a direct relationship to the river will not be impacted by project operations.

2.7.2.3 Managing Authorities

There are a number of different agencies responsible for managing the recreation sites on the Upper Columbia Reach. Such agencies can be broken down into three categories. The first is service clubs. The second is municipal and regional governments. The final category is comprised of the agents and representatives of the Provincial and Federal Governments of Canada.

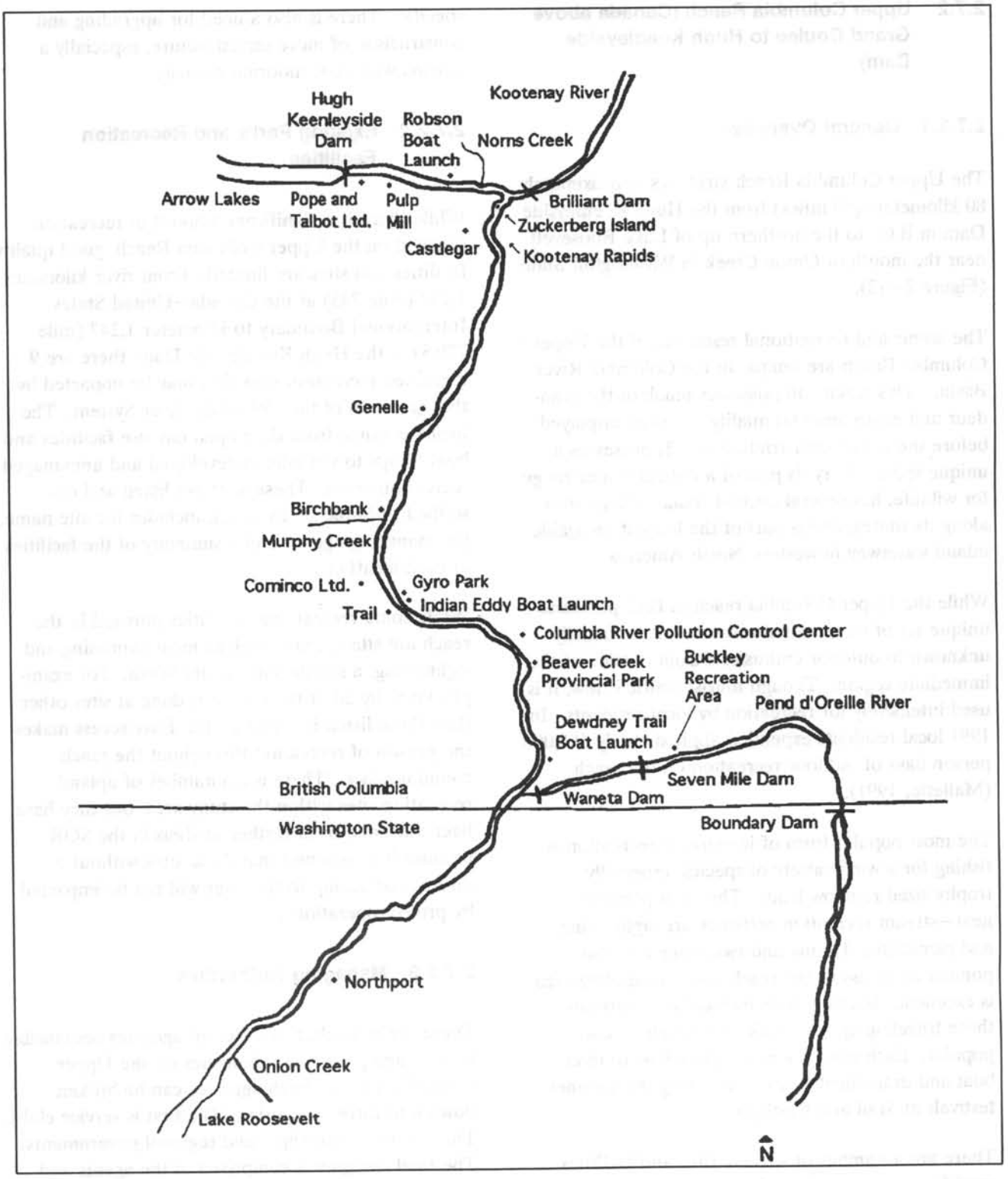


Figure 2–12. Map of the Upper Columbia River, Canada

Table 2–16. Existing Recreation Sites and Facilities in the Upper Columbia Reach

(River Kilometer 1192–1247 – River Mile 745–779.5)			
Number	Site Name	River Kilometer	Management Agency
1	Beaver Creek Provincial Park	km. 1198–1201 mi. 749–750.5	Ministry of Environment, Lands, and Parks
2	Rock Island	km. 1205 mi. 753	Unmanaged
3	Canada Customs Dock	km. 1208 mi. 755	Canada Customs
4	Indian Eddy Boat Launch	km. 1209 mi. 755.8	City of Trail
5	Gyro Park	km. 1209.5 mi. 756	City of Trail
6	Waterloo Eddy	km. 1230 mi. 769	Unmanaged
7	Zuckerberg Island Historical Park	km. 1237 mi. 773	Castlegar Historical
8	Robson Boat Launch	km. 1247 mi. 779.5	Unknown

The Castlegar Historical Society operates and maintains the Zuckerberg Island Historical Park (Number 7 on Figure 2–12) in Castlegar. Zuckerberg Island possesses significant historical resources; including a turn of the century Russian Mission and several ancient Indian archaeological sites.

The cities of Trail and Castlegar manage the parks and recreational facilities within their jurisdiction. These parks provide day use areas with extensive walkways and boat launching facilities (4,5).

B.C. Hydro, a Crown Corporation of the British Columbia Government, maintains and operates a lock in the Hugh Keenleyside Dam (9). There is no charge for using this bypass facility which operates year round from 8 a.m. to 4 p.m. daily. The Ministry of Environment, Lands and Parks is the management authority for Beaver Creek Provincial Park (1). This park has been poorly maintained in the last few years and the overnight campsite was recently closed.

Canada Customs maintained a boat dock (3) at the city of Trail 16 kilometers (10 miles) upstream of the Canada–United States International Boundary where boaters traveling up from Lake Roosevelt stop and phone Canada Customs to register their entrance into Canada. The dock is presently not functional and there are plans to move the facility to Indian Eddy.

2.7.2.4 Special Recreation, Preservation and Natural Resource Areas

The land–use pattern adjacent to the Upper Columbia Reach is diverse. It includes heavy and light industrial, urban cityscapes; residential, rural, small scale agricultural plots; and undeveloped natural areas. Outside of the specific recreation sites mentioned in Table 2–7, none of the adjacent land has been designated as a special recreation, preservation or natural resource area.

2.7.2.5 Major Activities and Use Areas

Fishing. The Upper Columbia Reach contains a unique and robust recreational fishery. The Columbia is considered to be one of the last, large rivers with a significant rainbow trout population left in Western North America (Mallette, 1992) and is said to be the "most productive" inland fishery in British Columbia (Hume, 1991). In addition to the natural state of the fishery, it is also the benefactor of the large fish enhancement program being undertaken on Lake Roosevelt. Since Lake Roosevelt is actually a reservoir and has limited spawning habitat, a number of kokanee and rainbow trout released into the lake spend part of their life cycle in the Upper Columbia Reach feeding and spawning. Catch rates for trout and kokanee have increased significantly on the reach since the enhancement program on Lake Roosevelt got underway in the mid 1980's (Malette, 1991).

Fishing is the most popular in-stream use of the Upper Columbia Reach. It comprises approximately 10 percent of the total recreation days. Most of the fishing activity is dispersed throughout the region. The Columbia River recreational fishery supports populations of wild and stocked rainbow trout, walleye, white sturgeon, kokanee, Dolly Varden char (bull trout), mountain and lake whitefish, burbot, brook trout, brown trout and some Chinook salmon.

The fishery is presently used almost exclusively by local residents in the evening. Since access to the river is excellent, with most areas less than a 5 minute walk from paved or good quality gravel roads, people see fishing the Columbia as part of their daily routine. In recent years the unique nature of this fishery has begun to be recognized with a number of guiding licenses being issued for the reach.

Sightseeing and Picknicking. Sightseeing and picnicking are the most popular forms of near-stream recreation use in the reach area. They comprise approximately 77 percent of total recreational days. Sightseeing is accomplished both from vehicles as well as on foot. The area is marked by many distinct natural and manmade vistas. These include an excellent view of area mountains and high rock bluffs, old abandoned orchards and semi-rural landscapes, waterfalls, park land, forested hills and the sight of one of the few, accessible, big free-flowing rivers left in Western North America. Many people take advantage of the numerous opportunities to see wildlife in its natural habitat. Observing kokanee and rainbow trout in area creeks during spawning time is growing in popularity.

Bird-watching is also very popular as opportunities exists to view osprey, bald and golden eagles, turkey vultures, great blue herons, many species of ducks, as well as numerous other species of birds throughout the year. Due to the large number of dam projects in the Upper Columbia River Basin, the lowlands along the Upper Columbia reach have become a very important winter habitat for deer and elk in the region. While large groups of deer (up to 50) have been spotted moving along the river shore throughout the region, Fort Shepherd Flats is their prime wintering habitat. Mule deer, white-tailed deer and elk are readily seen here throughout the winter, as well as in the summer months.

Swimming. Swimming is a popular recreational activity in the Upper Columbia Reach, comprising approximately 5 percent of total recreation days. While swimming occurs throughout the area, it is concentrated at Gyro Park in Trail and at areas such as Pass Creek Park near Castlegar.

Boating. The Columbia River offers one of the few river boating opportunities in the Upper Columbia River Basin and in British Columbia as a whole. Boating occurs throughout the reach area and makes up about 2.5 percent of total recreation days. While most of the boating is done in conjunction with fishing, people do boat for the sheer pleasure of experiencing the excitement of this large free-flowing river. Access for boaters to the river is good as there are cement boat ramps which are usable to varying degrees at high, medium and low water levels at Beaver Creek, Indian Eddy and Robson. There is also a gravel boat ramp across the river from Fort Shepherd Flats and a "natural" boat access point at Waterloo Eddy.

The bulk of the boating done on the reach is done by local residents, but it is growing in popularity for tourist boaters originating from Lake Roosevelt. Boaters from Lake Roosevelt often travel up across the Canada–United States International Boundary, through the reach, and onto the Arrow Lakes via the lock in the Hugh Keenleyside Dam. The stretch of water between the Grand Coulee Dam and the northern terminus of the Arrow Lakes at Revelstoke, B.C., is 480 kilometers long (300 miles). As Lake Roosevelt grows in popularity as a tourist destination point, traffic between Lake Roosevelt and the reach is likely to increase significantly.

In addition to boating for pleasure there are two major boating events that take place on the reach each summer. In conjunction with the Castlegar Sun Festival each June, high–powered drag–boat races are held just below the Hugh Keenleyside Dam. The water conditions for drag boats are said to be optimal and speeds in excess of 240 kph (150 mph) are attained. There are also high–powered white water riverboat races held on the reach every summer.

Canoeing, kayaking, waterskiing and rafting are also pursued on the reach each summer. The waterskiing and kayaking experiences are unique to this portion of the Columbia. Local waterskiers claim that skiing on the deep, wide, portion of the river downstream of Blueberry Creek is better than on a lake. The river flows so quickly that it dissipates waves rapidly leaving waterskiers with a smooth water surface most of the time.

As the river flows past Rock Island it forms a large whirlpool from 2.5 to 4.5 meters in depth (8 to 15 feet) and a large back eddy. Kayakers can ride the large waves that range from .9 to 1.2 meters (3 and 4 feet) of this back eddy in a circular motion, spending several hours on this massive piece of rotating water.

The Upper Columbia Reach is also the site of a number of other outdoor activities. These include hunting, camping, hiking and climbing along the river and its tributary streams, as well as artifact collecting, picnicking, berry picking and mountain bike riding.

Most of the hunting pursued along the reach is concentrated at Fort Shepherd Flats. The bulk of the picnicking is concentrated at the designated parks, but does occur randomly throughout the area. Artifacts of the Interior Salashin Indians have been found at every major creek entering this portion of the Columbia River. Picking wild huckleberries and asparagus is also pursued at different places. As previously noted, while the Upper Columbia Reach is virtually unknown to people from outside the region, it offers as diverse an amount of recreational pursuits as any river in Western North America.

2.7.2.6 Visitor Use

Table 2–17 summarizes person day estimates of outdoor recreation use in the Upper Columbia Reach (Stephenson 1984). There is no government agency or legislation that dictates the ongoing collection of recreation data in British Columbia.

Limited visitation data are available for the identified recreation sites and facilities on the Upper Columbia Reach. Information exists for Pass Creek Park which accommodated 5,000 visitors in the summer of 1981. Beaver Creek Provincial Park had 43,239 day use visitors in 1992, and as stated earlier, a significant portion of recreation activity is dispersed within the reach.

Clearly, the Upper Columbia Reach is used heavily by local residents for recreation. While it does not entertain many tourists at this point in time, the potential to do so is strong. There has traditionally been a steady, if not large, amount of boat traffic between Lake Roosevelt and the reach. As tourist traffic builds on Lake Roosevelt, it will likely translate into an increase in transboundary tourist traffic. As the impact of the fish enhancement program on the lake has acted to bolster an already strong sport fishery, this will likely act as a magnet for fishermen from across North America in the future.

Table 2–17. Person Day Estimate Of Recreational Activity In The Upper Columbia Reach

(River Kilometer 1192–1247 – River Mile 745–779.5)		
ACTIVITY	PERSON DAY ESTIMATE	YEAR
Sport Fishing	14,850	1991
Boating (Local Boaters)	3,544	1991
Boating (Via Lake Roosevelt)	Not Available	
Swimming	7,600	1991
Picknicking & Sightseeing	119,146	1991
River–Boat Racing	3,500*	1990
Drag–Boat Racing	6,250*	1990
TOTAL	154,890	

* only includes those viewing the events

2.7.2.7 Regional Facility Needs

There is a need for a marina and mooring facilities on the Upper Columbia Reach. The construction of a marina could be incorporated into the plans to develop the Twin Rivers Park area in Castlegar. Mooring facilities could also be constructed at the boat ramps at Beaver Creek, Indian Eddy and Robson. Indian Eddy, Robson or the potential marina site in Castlegar would likely be the best sites for larger facilities.

2.7.2.8 Seasonal Nature of Visitor Use

Virtually all of the recreational activities pursued on the reach occurs from April through October. The only exception is some winter fishing and hunting which are not greatly affected by water levels.

2.7.3 Flathead River Subregion (Hungry Horse Project, Flathead River, and Flathead Lake)

2.7.3.1 General Overview

Hungry Horse Dam and Reservoir and the Flathead River lie within the Flathead Basin. The basin covers about 8,400 square miles (13,516 km^2) in northwestern Montana and includes about 450 square miles (724 km^2) in Canada along the west slope of the Continental Divide. Scenic mountains, canyons, and broad valleys are the major land forms in the basin. Major mountains include the Whitefish, Salish, Livingston, Flathead, Swan, and the Mission Ranges. Forests cover about 82 percent of the land area of the basin. The Flathead River drainage, most northeasterly of basins within the Columbia River system, has some 3,500 miles (5,632 km) of streams. Hungry Horse reservoir is among the 450 lakes in the basin.

The Flathead River originates at the confluence of its South and Middle Forks along the western edge of Glacier National Park in northwest Montana. From there it flows south for 9 miles (15 km) before being joined by the South Fork near the town of Hungry Horse. It then flows through a narrow canyon before reaching the town of Columbia Falls, 5 miles farther downstream. Below Columbia Falls, the river spills out into the Flathead Valley. As it progresses downstream, it meanders increasingly before spilling into Flathead Lake some 55 miles from the river's origin.

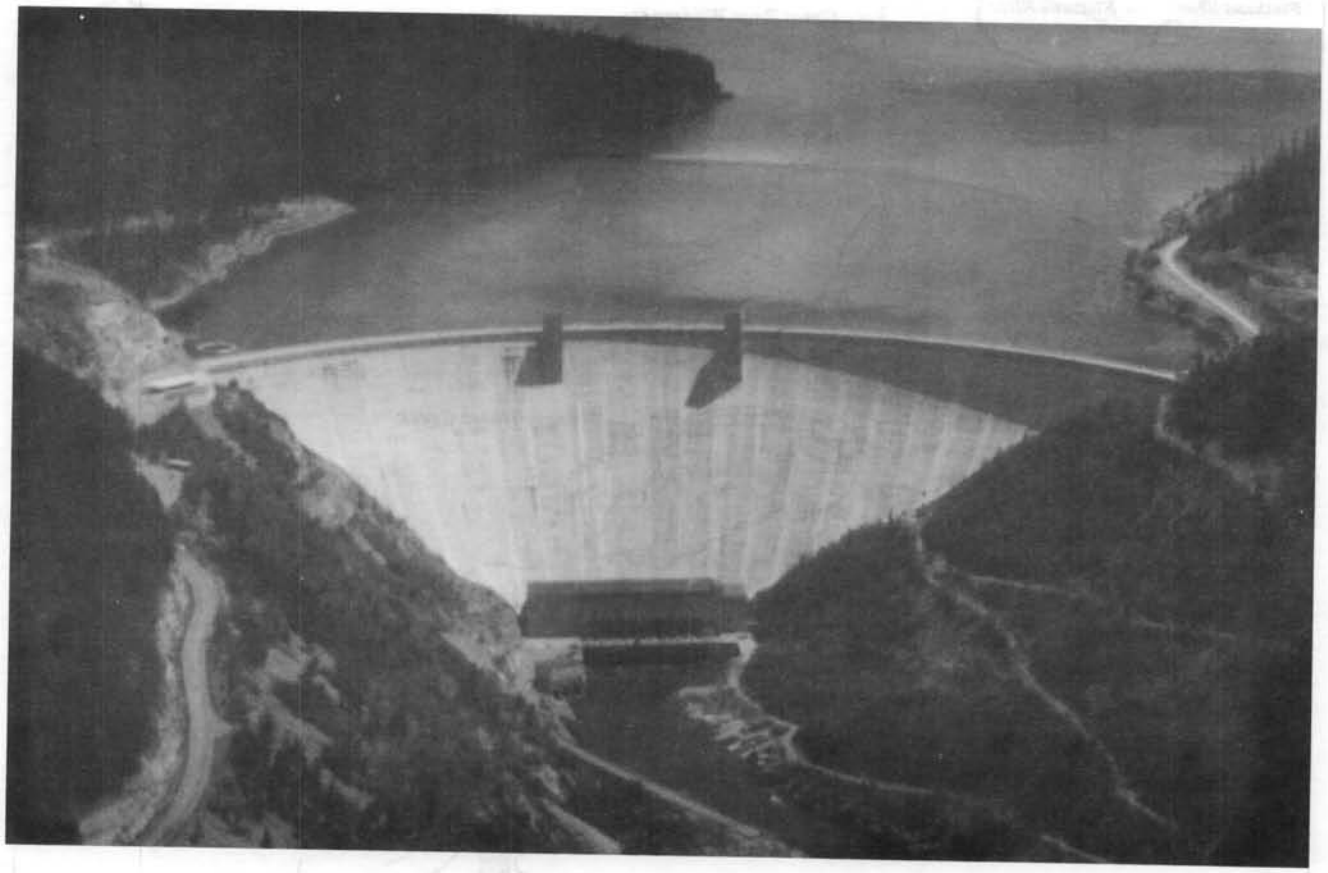


Figure 2–13. Hungry Horse Reservoir

The Middle Fork of the Flathead River originates at the northern end of the Bob Marshall Wilderness and flows in a general northwesterly direction through the Great Bear Wilderness before reaching the confluence with the North Fork. From Bear Creek downstream it forms most of the southern boundary of Glacier National Park.

The South Fork of the Flathead River originates at the southeast end of the Bob Marshall Wilderness and runs north through the heart of the wilderness before entering Hungry Horse Reservoir. The South Fork flows for 5 miles below the dam before reaching the mainstem confluence.

Hungry Horse Dam, built in 1953, is located on the South Fork Flathead River, 15 miles south of the west entrance to Glacier National Park and 20 miles (32 km) northeast of Kalispell. The reservoir, with an active capacity of 2,982,000 acre–feet, is the farthest upstream and the third largest reservoir in the Federal Columbia River power system. The reservoir is roughly 35 miles (56 km) long and surrounded by the Flathead National Forest. (Figure 2–14)

Over 60 percent of the land in the Flathead Basin is in public ownership, with 5 percent managed by the state of Montana. The Flathead Indian Reservation covers one–fourth of the basin, which takes in the Pablo and Ninepipe National Wildlife Refuges and the National Bison Range.

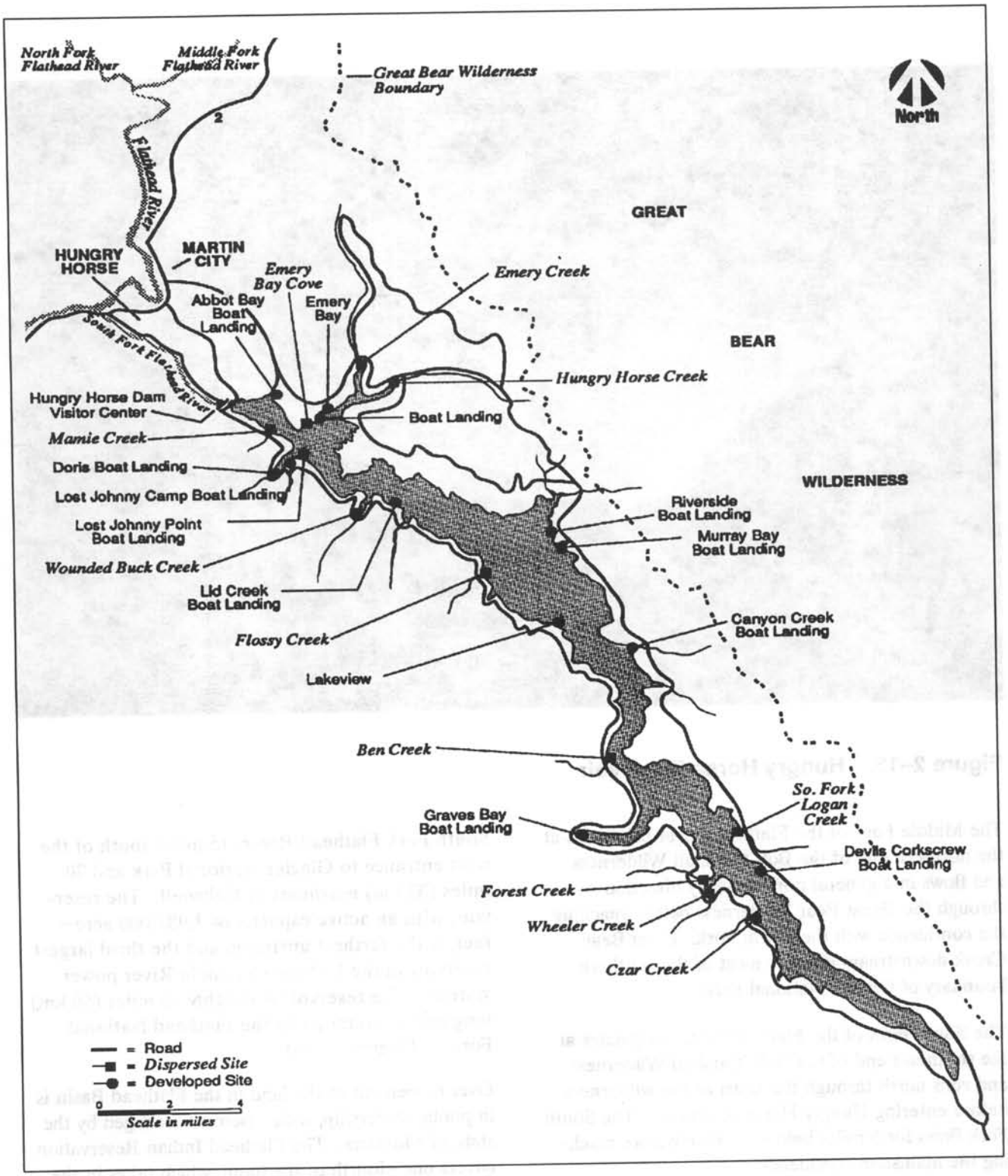


Figure 2–14. Map of Hungry Horse Reservoir

2.7.3.2 Aesthetics

Hungry Horse Reservoir is located in the South Fork Flathead River Valley between the Swan and Flathead mountain ranges. The mountainous terrain adjacent to the reservoir is steep with peaks ranging up to approximately 8,000 feet in elevation. The slopes adjacent to the reservoir and river are covered with coniferous forest, while riparian vegetation is found along the river. Views from the shores and pool of Hungry Horse Reservoir are confined to the river valley and adjacent mountains. Views can extend 10 to 12 miles (19 km) up and down the reservoir.

Access to Hungry Horse Reservoir is from a local, mostly gravel road that circles the reservoir and connects to U.S. Highway 2. Because the reservoir is not visible from U.S. Highway 2, it is not seen by the numerous travelers using this route to access Glacier National Park. The primary viewers of the reservoir are recreationists using the lake or traveling by the reservoir on their way to locations upstream in the South Fork Flathead drainage. To some extent, the Hungry Horse campgrounds serve as overflow facilities when campgrounds at Glacier National Park are full.

The mainstem of the Flathead River is visible to many more people than is Hungry Horse Reservoir. The river is adjacent to U.S. Highway 2 in the Badrock Canyon reach, just below the confluence with the South Fork, and flows under the highway at the town of Columbia Falls. From Columbia Falls to Flathead Lake, the river flows through the Flathead Valley. Views near the river, however, are in some places restricted due to adjacent terrain and trees lining the river. Land uses adjacent to the river include scattered rural residential developments, and long stretches of natural appearing undeveloped lands. Primary viewers of the mainstem in this area consist of local residents, river recreationists, and motorists traveling on U.S. Highway 2.

2.7.3.3 Recreation and Natural Resources

Major recreation resources in the basin include Glacier National Park; the National Bison Range; Flathead Lake; Jewel Basin Hiking Area; Flathead National Forest, which includes the Bob Marshall, Great Bear, and Mission Mountains Wilderness Areas, and Flathead river units of the National Wild and Scenic River System; portions of Kootenai and Lolo National Forests; and Hungry Horse Reservoir. All of these resources are regionally or nationally significant.

The relatively pristine nature of the area is one of the primary recreation attractions. In addition to the area's high scenic quality, visitors have an opportunity to view an abundance of wildlife. Several threatened or endangered species are present in the area, including the gray wolf, grizzly bear, bald eagle, and the peregrine falcon. Big game species include deer, elk, and moose. Other wildlife includes migratory waterfowl, fur bearing animals, and nongame species.

The fishery of the Flathead River–Lake system is nationally reknowned, attracting thousands of anglers annually. Although the system includes perch, bass, whitefish, and several species of trout, the kokanee fishery is the most important, though it has declined significantly in recent years. Most of the kokanee spawn in the mainstem Flathead River from the South Fork confluence downstream to the inlet. Hungry Horse Reservoir has one of two fishable lake bull trout populations in Montana.

2.7.3.4 General Visitation

Overall, visitation is increasing in the Flathead basin. The Montana Statewide Comprehensive Outdoor Recreation Plan (SCORP, MDFWP, 1990) predicts that visitor use will continue to increase with population growth. Out–of–state visitor use contributes to the rise in use, and the area draws international tourists to such attractions as Glacier Park as well.

Major recreation activities which occur in the basin are camping, picnicking, fishing, swimming, sightseeing, boating, waterskiing, hunting, horseback riding, and snow related activities.

Hungry Horse Reservoir is not considered a primary recreation destination spot in the basin. As pressure increases on surrounding recreation sites, overflow use goes to Hungry Horse Reservoir. Approximately 50 percent of the visitors to Hungry Horse Reservoir live within 50 miles of the reservoir. Roughly 8 percent come from a 50 to 250 mile (80 to 400 km) radius of the reservoir. The remaining visitors come from outside the region, claiming Hungry Horse as an incidental stop on there way to their primary destination within the Flathead Basin (Ben–Zvi, 1990).

2.7.3.5 Recreation Sites, Facilities and Opportunities

Hungry Horse Reservoir. The USFS manages 6,729 acres of land around Hungry Horse Reservoir by a Memorandum of Agreement with Reclamation dated March 12, 1969. At Hungry Horse Reservoir, there are seven developed recreation sites along the west side of the reservoir and eight developed sites along the east side, including two reservoir island sites. Total facilities presently include 174 single camp units, one group camp site with a 150 person capacity, 27 picnic units, 11 single boat ramps, three interpretive signs, and associated sanitary facilities. Table 2–18 lists recreation facilities at Hungry Horse Reservoir.

Table 2–18. Hungry Horse Reservoir Recreation Facilities

Site	Camping Units 1/	Boat Ramp 2/	Picnic Units 3/
West Side			
1. Doris Creek	Dispersed	Yes	Dispersed
2. Lost Johnny C.G.	Yes	Yes	Dispersed
3. Lost Johnny Point	Yes	Yes	Dispersed
4. Wounded Bear Ob. Pt.	Dispersed	No	Dispersed
5. Lid Creek	Yes	Yes	Dispersed
6. Lakeview	Yes	No	Dispersed
7. Graves Creek	Yes	Yes	Dispersed
East Side			
1. Abbot Bay	Dispersed	Yes	Dispersed
2. Emery Bay	Yes	Yes	Dispersed
3. Riverside	Dispersed	Yes	Dispersed
4. Murray Bay	Yes	Yes	Yes
5. Canyon Creek	Dispersed	Yes	Dispersed
6. Devil's Corkscrew	Yes	Yes	Dispersed
7. Fire Island	Boat in	N/A	Dispersed
8. Elk Island	Boat in	N/A	Dispersed

1/Vault toilet sanitary facilities generally provided at all sites.
2/All boat ramps single lane.
3/In addition to developed picnic sites, picnicking occurs at campgrounds and other sites on a dispersed basis.

The primary recreation activities at Hungry Horse Reservoir are camping, fishing, boating, and sightseeing. Use is increasing in non–reservoir dependent activities, such as huckleberry picking and hunting. Recreation visitation at Hungry Horse Reservoir has fluctuated significantly in the last five years. Table 2–19 presents annual visitor use from 1987 through 1991.

Flathead River. The USFS also manages lands above and below Hungry Horse Dam and Reservoir along the South, Middle and North Forks of the Flathead River. There are several developed recreation sites on the Middle Fork Flathead River, all of them are off of Highway 2, within 30 miles (48 km) of West Glacier. There are also several developed sites along the South Fork Flathead River at the southern end of Hungry Horse Reservoir. All of these are river access sites, including put in/take out points, sanitary facilities, and parking areas. Camping occurs on a dispersed basis only. There are no developed sites along the South Fork below Hungry Horse Dam.

Results of a 1989 statewide survey (MDFWP, 1989) indicated that the economic value of the Flathead River fishery from the confluence of the South Fork to Flathead Lake was $1.4 million annually. Fishing pressure has steadily increased, although there are no creel census numbers presently available.

Angler use and success is seasonal, depending on the river fishery. Lake Superior white fish provide a tremendous fishery from early November through the end of December. Bull trout are fished from April through early May, then again from late June through July, on a catch and release basis. Kokanee, which historically provided excellent sport fishing opportunities, has declined drastically in abundance in recent years, most notably since 1986. The most prized fishery presently is bull trout, west slope cutthroat, and kokanee.

Table 2–19. Hungry Horse Lake Visitation Summary, 1987 – 1993.

MONTH	VISITOR – DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feb	0.5	0.5	0.5	0.4	0.4	0.2	0.4	0.4
Mar	1.4	1.4	1.4	1.3	1.1	0.5	1.1	1.2
Apr	3.2	3.2	3.2	3.0	2.6	1.3	2.6	2.7
May	3.7	3.7	3.7	3.5	3.0	1.4	3.0	3.2
Jun	14.9	14.7	14.7	14.0	12.2	5.7	12.0	12.6
Jul	27.6	27.3	27.3	26.5	22.4	10.6	22.1	23.4
Aug	29.4	29.0	29.1	27.7	23.9	11.3	23.6	24.9
Sep	8.2	8.1	7.9	7.5	7.5	3.1	6.4	6.9
Oct	2.8	2.7	2.8	2.6	2.3	1.1	2.2	2.4
Nov	1.4	1.4	1.4	1.3	1.1	0.5	1.1	1.2
Dec	.5	0.5	0.5	0.4	0.4	0.2	0.4	0.4
TOTAL	**93.5**	**92.4**	**92.3**	**88.3**	**77.0**	**35.9**	**75.0**	**79.2**

For 1993 and 1992, estimated visitation by month is based on historical use patterns.

Other recreation use which occurs along the river consists primarily of floating, sightseeing and dispersed camping and picnicking. Although recreation use figures are not available along the Flathead River, the USFS indicates that use is steadily increasing.

2.7.3.6 Regional Recreation Problems and Needs

Recreation related problems at Hungry Horse Reservoir and along the Flathead River are primarily due to reservoir operations. The quality and quantity of recreation use at Hungry Horse Reservoir is dependent to a large extent on summer reservoir levels. Use of the recreation facilities is directly or indirectly affected by reservoir levels. In general, low reservoir levels can isolate camping and picnicking facilities, leave some boat ramps out of water, and greatly reduce the reservoir area aesthetics. This has a negative impact on recreation management, and visitor use and enjoyment.

As reservoir levels drop and land based facilities become isolated, visitors move with the shoreline. Since these areas are not equipped with waste or sanitary facilities, trash and sanitary waste is often left along the shoreline, creating unsanitary and unsightly conditions. In 1988, Hungry Horse Reservoir experienced one of the driest water years and lowest reservoir levels on record. This left many of the boat ramps inoperable throughout the recreation season. This also corresponded with one of the lowest seasons of use, with only 36,000 recreation days recorded for that year.

Without access to the water due to inoperable boat ramps, visitors go elsewhere for water based recreation use. All of the 11 available ramps are operable at full pool (3560 feet), nine ramps are operable at 3552 feet, six ramps are operable at 3532 feet, and a single ramp is operable at 3500 feet. As reservoir levels decline so does use.

Aesthetic quality is important since one of the primary recreation activities at Hungry Horse Reservoir is sightseeing. Low or fluctuating reservoir levels that affect the resident fishery are also important; decline in angler success reduces overall use of the area.

Reservoir operations also affect recreation use on the Flathead River. Erratic releases from the dam, cold water temperatures, and poor angler opportunities reduce visitor enjoyment along the Flathead River. On occasion, erratic water releases have stranded anglers and created problems for river floaters. Cold water released from the dam is undesirable for water contact sports; use increases as the water warms to natural conditions. Generally, flows have not been compatible with downstream fishery maintenance needs. The river fishery, primarily the kokanee, has declined significantly, reducing angler opportunities.

A higher quality recreation experience could be achieved at Hungry Horse if reservoir levels were maintained between elevations 3552 feet and 3532 feet throughout the recreation season. This would ensure good boater access, convenient use of associated land–based facilities, high quality reservoir aesthetics, and would reduce recreation management problems. To the extent that high, stable reservoir levels would improve the resident fishery, it would also benefit recreation use. A change in downstream flows to support the river fishery, raise water temperatures, and moderate erratic flows would all improve conditions for downstream recreation use.

Figure 2–15. Keller Ferry Recreation Area at Lake Roosevelt (Coulee Dam National Recreation Area)

2.7.4 Grand Coulee (Lake Roosevelt) Subregion

2.7.4.1 General Overview

This subregion begins at Grand Coulee Dam and extends to the upstream limits of Lake Roosevelt, a distance of approximately 130 miles (209 km). Lake Roosevelt lies within semi–arid eastern Washington on the leeward side of the Cascades. Clouds have lost much of their moisture as they have passed over mountain ranges to reach the Columbia Basin, and arctic fronts typically pass to the east of the area, which results in winters that are mild by inland Northwest standards. Summer winds are moderate, allowing the lake surface to be reasonably calm during the recreation season. The large surface area and relatively warm water temperature of the reservoir provide water–oriented recreation opportunities to a growing number of visitors each year.

Access to Lake Roosevelt is by point access such as old road endings or by continuous access provided by roads that parallel the shoreline. Except for point access, the southern half of the reservoir is inaccessible by roads due to steep banks and rock outcroppings. The northern half of the reservoir is paralleled by Highway 25 on the east bank and by paved county roads and Highways 20 and 395 on the west bank; however, intermittent steep banks and intervening private property preclude continuous public access to the lakeshore.

Vegetation within the Lake Roosevelt area ranges from grasslands and sagebrush in the southern section to forest communities in the north. Grasslands dominate the reservoir shorelines from the dam up to the Spokane River confluence. From this point, the grasslands begin to yield to forest species until the upper reservoir reaches are predominately forested. Due to the fluctuating nature of Lake Roosevelt, very few perennial marshes exist along the shoreline. More common are intermittent wetland areas which seasonally flood and provide temporary wildlife habitat.

Most of the reservoir shoreline is composed of clay, silt and sand. The remainder of the shoreline is glacial till, basalt, granite, sedimentary and metamorphic rocks. Wave action has exposed numerous

sandy beaches that are particularly suited to recreation use.

Wildlife is plentiful. Animals most frequently sighted are coyotes, porcupines, marmots, and squirrels. Black bear are present but seldom seen. Located on a secondary flyway, the lake attracts a variety of waterfowl. Bald eagles and ospreys are frequently sighted in the area.

Cultural sites within the area include Fort Spokane, established in 1880 at the confluence of the Columbia and Spokane Rivers. St. Paul's Mission, a restored log church originally constructed by Jesuits in 1847, is located near the town of Kettle Falls. The inundated site of a Hudson Bay Company trading post is located in the same vicinity. The Kettle Falls archaeological district, dating back 9,000 years, is one of the most significant sites in the Northwest.

The primary attraction for visitors to the Lake Roosevelt area is water based recreation. Annual visitation for the last several years has exceeded 1.5 million visitor days. The most popular activities are camping, sightseeing, fishing, hiking, boating, and picnicking. Table 2–20 summarizes project visitation from 1987 to 1991.

Table 2–20. Lake Roosevelt Visitation Summary, 1987 – 1993.

NATIONAL PARK SERVICE RECREATION SITES								
MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
Jan	10.7	11.8	15.4	26.7	15.3	19.4	3.2	14.6
Feb	14.5	18	37.2	24.9	20.4	27.3	3.9	20.9
Mar	19	36.9	65.7	74.7	37.8	47.6	22.9	43.5
Apr	43.3	54.5	108.6	104.6	49.2	81.5	34.8	68.1
May	95.1	91.5	122	156.8	133.6	110.5	88.2	114.0
Jun	212.6	183	174	157.7	155.1	164.8	149.2	170.9
Jul	275.3	263.8	281.8	306.9	232.5	338	253.9	278.9
Aug	315.7	287.5	434.8	318.7	268.4	331.3	261.8	316.9
Sep	85.2	78.6	341.8	185.8	104.2	157.6	140.1	156.2
Oct	71.3	58.7	132.5	103.4	50.1	67.5	61.3	77.8
Nov	46.5	37.8	49.5	64.2	30.9	21.3	34.1	40.6
Dec	27.5	17.9	26.2	35.6	18.2	17.5	13.8	22.4
Subtotal	**1216.7**	**1140.0**	**1789.5**	**1560.0**	**1115.7**	**1384.3**	**1067.2**	**1324.8**
OTHER RECREATION SITES								
Colville Reservation	35	32.8	40	n/a	n/a	n/a	n/a	
Spokane Reservation	8.8	8.2	10	n/a	n/a	n/a	n/a	
Grand Coulee Visitor Center (USBR)	506.2	499.1	508	485.7	464.1	322.6	442.6	
Subtotal	**550**	**540.1**	**558**	**485.7**	**464.1**	**322.6**	**442.6**	
TOTAL	**1766.7**	**1680.1**	**2347.5**	**2045.7**	**1579.8**	**1706.9**	**1509.8**	

2.7.4.2 Aesthetics

The landscape adjacent to Lake Roosevelt is relatively natural and undeveloped except for occasional farms and small communities. One of the unique landscape features of Lake Roosevelt is the marked difference in topography and vegetation types between the northern and southern portions of the 130 mile long reservoir.

In the northern section of the reservoir, the river valley is shallow and visitors to the reservoir are afforded views of both the valley and the mountains beyond. Stands of coniferous forests cover the hills and line the shores. Most of the northern half of the reservoir is easily accessible by roads. Washington Route 25 parallels 70 miles of the east shore from Fort Spokane to the headwaters. The west shore has good road access from Inchiliem north to Barstow via paved county roads, State Highway 20, and U.S. Highway 395.

In the southern section of the reservoir (Fort Spokane to the dam) the forested areas thin out and the predominant vegetation turns to sagebrush, bitterbrush, and other arid species. In this portion of the reservoir, the canyon walls rise from the shoreline and views from the reservoir are frequently restricted to basalt cliffs and narrow terraces within the canyon rim. Road access is limited with no parallel roads and only infrequent point access to the last 50 miles of reservoir above Grand Coulee Dam. Views of the lake are possible from a few small communities, including Grand Coulee and Seven Bays in the south section of the reservoir and Kettle Falls and Marcus to the north.

Recreationists visiting the lake are key viewers of the lake. Because much of the recreation at Lake Roosevelt occurs on the lake in boats, a large number of recreationists view the lake and adjacent landscape from the waters of the lake. Many recreationists view the lake from the shoreline at the numerous overnight and day–use recreation facilities located along the reservoir.

2.7.4.3 Recreation Sites and Facilities

Reclamation provides visitor facilities and guided tours at the dam. Facilities include a large visitor center, picnic and turf areas below the dam, and various overlooks and parking areas. A popular laser light show is played nightly across the face of the dam during the tourist season. The visitor center is open year–round.

The majority of recreation facilities on Lake Roosevelt are provided by the NPS, the Colville Confederated Tribes and the Spokane Tribe. The two tribes and the NPS provide a wide array of visitor facilities along the 600 miles (965 km) of shoreline on Lake Roosevelt. These sites range from highly developed and intensively used campgrounds and day–use areas to primitive sites that can only be accessed by boat.

There are also commercial facilities available at several privately run marinas that are under the jurisdiction of the managing agencies. Rental houseboats are very popular at the marinas. Plans for extensive additional marina facilities are under way by all three managing agencies. The recreation sites are listed and described in Table 2–21.

All of the recreation facilities and recreation activities on Lake Roosevelt are directly impacted by reservoir operations. Excessive drawdown during the recreation season has a particularly negative impact on recreation use.

2.7.4.4 Managing Authorities

Coulee Dam National Recreation Area was established in 1946 by the Secretary of the Interior's (Interior) approval of the Tri–Party Agreement which included the NPS, Reclamation, and Bureau of Indian Affairs. NPS operations under such agreements are authorized by Public Law 79–633. Reclamation operates Grand Coulee Dam in accordance with established criteria developed to meet authorized purposes. Reclamation administers lands in the immediate vicinity of the dam and at other sites that are necessary for project operations. Even though Reclamation directly administers a small percentage of the total project lands, the legislated project operations take priority over the other land uses administered by the tribes and NPS.

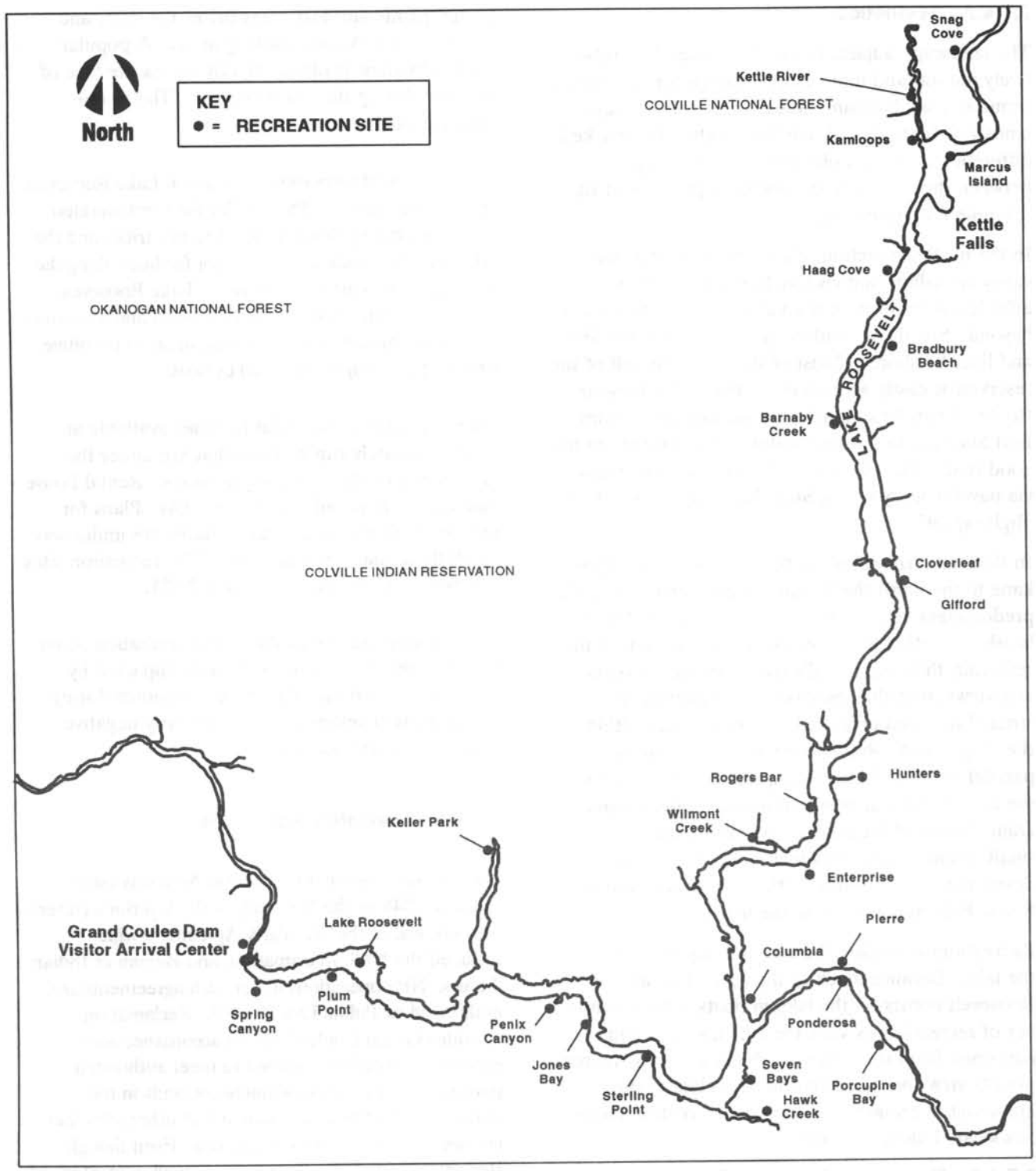


Figure 2–16. Map of Lake Roosevelt/Coulee Dam National Recreation Area

Table 2–21. Lake Roosevelt Recreation Facilities

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
Bradbury Beach	1	1		40		2		5		
China Bend	1	1		20						
Cloverleaf				40		4		7		
Crystal Cove								3		
Detillion				40				12		
Enterprise								13		
Evans	1	2		140		15		34		
Fort Spokane	1	4	15	420		64		67		2
French Rock	1	1		20						
Gifford	1	4	10	400				47		
Goldsmith								3		
Haag Cove				20		6		16		
Halverson Canyon								1		
Hanson Harbor	1	1		20						
Hawk Creek	1	1		60				28		
Hunters	1	4		200		6		39		3
Jones Bay	1	1		40				6		
Kamloops				20				17		
Keller Ferry Marina	1	4	51			20	1	55		2
Kettle Falls Marina	1	4	70			46	1	89		1
Kettle River			2	20				12		
Lincoln Mill	1	2		60		3				
Marcus Island	1	1		20		3		27		
Napolean Bridge	1	1		20						
North Daisy	1	1		20						
North George	1	1		40				12		
Penix Canyon								3		
Plum Point								4		
Ponderosa								8		
Porcupine Bay	1	4		240		20		32		
Seven Bays Marina	1	4	180							
Snag Cove	1	1		20				9		
Spring Canyon Marina	1	4	15			61	1	87		1
Sterling Point								5		
Summer Island				40				6		
TOTAL	**23**	**49**	**353**	**1960**	**0**	**250**	**3**	**647**	**0**	**9**

The reservoir and related lands were administered under the 1946 Tri–Party Agreement until 1974 when Interior directed that the agreement be expanded to include the Colville Confederated Tribes and the Spokane Tribe. The Secretary's directive was the result of an Interior Solicitor's opinion that the two tribes have exclusive rights to hunting, boating, and fishing for those areas of the reservoir that are within the two reservations. A new management agreement was signed by Interior and the new managing entities on April 5, 1990. The agreement confirms and establishes management authority for the two tribes for project lands within their respective reservations. The tribes administer approximately 45 percent of the project lands and waters. The remaining lands and waters continue as the Coulee Dam National Recreation Area, a unit of the National Park System.

2.7.4.5 Major Activities and Use Areas

Camping. The most popular form of outdoor recreation on the reservoir is camping. The use of recreational vehicles is the most popular form of camping, with tent camping and houseboats also very popular for overnight stays on the reservoir. The NPS provides most of the camping opportunities with over 650 developed campsites at 29 campground locations. The tribes have five developed campgrounds that contain over 60 campsites. The tribes also maintain several primitive sites that are approved for camping. In addition to the approved sites, a good deal of random camping occurs within undeveloped areas along the lakeshore.

Sightseeing. Scenic overlooks, an attractive visitor center, and a spectacular laser light show attracts well over one–half million visitors to the immediate vicinity of the Grand Coulee Dam. Sightseeing on Lake Roosevelt takes place by boat or along roadways on the northern end of the reservoir. Sightseeing by vehicle is restricted on the southern end of the reservoir due to limited access.

Fishing. Primary sportfish species in Lake Roosevelt include rainbow trout, walleye, sturgeon, kokanee, smallmouth bass and perch. The trout fishery at Lake Roosevelt steadily improved in recent years due to the effort of volunteers who raise fish in net pens for release into the reservoir. In addition, BPA has recently constructed two new fish hatcheries for the reservoir as part of its fish and wildlife mitigation program. The hatchery program will produce primarily kokanee. As a result of these efforts, the fishing use at Lake Roosevelt has increased substantially and is expected to continue to increase over the next several years, if reservoir operations allow. The operation of the reservoir, particularly drawdown, can be detrimental to the resident fish population. (See SOR Appendix K, Resident Fish).

Boating. Powerboating is a major recreation activity on Lake Roosevelt. Sailboating is somewhat limited due to the lack of consistent winds during the summer months. The continuing popularity of boating can be confirmed through the statistics for boat launches within the National Recreation Area. The boat launches recorded in 1991 indicates that boating use has more than doubled since 1988. With the recent addition of several new launch ramps and with more marina facilities in the planning stage, this increase is likely to continue.

Houseboating. There has been a steady rise in demand for luxury houseboat rentals since the first 10 boats were introduced in 1987. The rental houseboat fleet grew to 50 boats by 1993, and the number will rise as new marinas currently in the planning stage come on–line in future years. The Concession Management Plan for Lake Roosevelt sets the maximum allowable number of rental houseboats at 200 for the entire reservoir. A specific number of boats are allocated to each marina site in order to spread the boats throughout the reservoir.

Swimming and Picnicking. Day use activities, primarily swimming and picnicking, account for a significant portion of visitor use. NPS maintains six swimming beaches with life guards at popular day–use sites. Picnicking is frequently a companion activity with swimming, as turf areas and picnic tables are provided near the swim beaches. Adults bring their children to the swim areas and then watch the children from the adjoining turf/picnic areas. Swimming and related activities are highly affected by reservoir levels. As the reservoir level is

reduced, the swimming areas become separated from the turf/picnic areas. With lake elevations of 10 feet or more below high water, the swim areas become unusable due to unsafe topography and bottom composition.

2.7.4.6 Visitor Use

Visitation at Coulee Dam National Recreation Area for 1986 – 1993 is shown on Table 2–20. The visitation at the portion of the reservoir within the two Indian reservations is estimated at 50,000 visitors per year. Visitation statistics for the reservoir are understated since accurate counts of dispersed, non–site specific recreation use are not included. Visitation at Reclamation facilities at Grand Goulee Dam is approximately 500,000 per year. Over 75 percent of the annual visitation occurs from June through October, with the highest monthly visitation occurring in August.

2.7.4.7 Facility Needs

As visitation continues to increase, new facilities will be needed at Lake Roosevelt. A straight line projection of existing trends (1985 to present) would indicate a future increase of approximately 200,000 visitors per year. Even if the rise in visitation does not continue as sharply as it has over the last several years, there is still reason to expect a continuing rise in visitation.

The increase in fishing success and increased advertising by concessionaires have contributed to the sharp rise in visitation in recent years. With the completion of two new fish hatcheries, the fishing is likely to improve, thereby continuing the need to increase boat launching and parking facilities. In addition, plans are already being prepared for significant increases in concessionaire facilities. Both of the Indian Tribes are proposing major new marinas for their reservation shorelines, and the NPS has plans to add a new marina near the dam.

Regardless of any projected increases in visitation, new facilities are needed to accommodate existing visitation. All major launching facilities on Lake Roosevelt receive overflow use on summer weekends. The existing demand for campsites and day use facilities exceed available facilities on most summer weekends. All facilities are overused on warm weather holidays.

Three new launch ramps and parking areas were constructed in the spring of 1993. Three additional ramps were completed in 1994. Existing campgrounds and parking lots are being evaluated for expansion potential.

2.7.5 Albeni Falls (Lake Pend Oreille)

2.7.5.1 General Overview

Albeni Falls Dam lies within one of the most scenic areas of northern Idaho and the Northwest. Its long, narrow reservoir extends 25 miles (40 km) from the dam to connect with the state's largest natural lake, Lake Pend Oreille, which itself is 43 miles (69 km) long and over 1,000 feet deep. Totally encircled by mountains, this lake has a renowned fishery. Over fourteen species of game fish inhabit the lake, including kamloops, kokanee, whitefish, perch, crappie, bluegill, largemouth bass, rainbow, brown, and brook trout. A 32–pound bull trout, the state's largest, was taken from this lake.

Nearby Lake Coeur d'Alene, Priest Lake, Upper Priest Lake, the Kaniksu National Forest, and the Coeur d'Alene National Forest are other attractions in the area. Winter activities are close by at Schweitzer Basin, a major destination ski resort.

Albeni Falls/Lake Pend Oreille is easily accessible, located only 50 miles from Spokane, Washington, and 48 miles from Coeur d'Alene, Idaho. Washington State Highway 2 provides access from the dam to north Spokane and Interstate 90 and Washington State Highway 95 provide access from Coeur d'Alene. Amtrak service is available at Sandpoint, Idaho, as is jet service at the Spokane Airport.

Figure 2–17. Priest River Recreation Area at Lake Pend Oreille

2.7.5.2 Aesthetics

Although Lake Pend Oreille is surrounded by mountains, the dominant visual feature is the large reservoir itself. Views of opposite shores 2 to 18 miles (3 to 29 km) away are possible along the main body of the reservoir. From Sandpoint to Albeni Falls Dam, the reservoir is much narrower (approximately .25 to .5 mile wide) than it is in the main body of the reservoir and is riverine in character. Viewing is limited by nearby forested hills to the river valley itself.

Most of Lake Pend Oreille is located adjacent to the Coeur d'Alene and Kaniksu National Forests and is undeveloped. Development has been concentrated on private land near the communities of SandPoint, Priest River, and small communities on the lake such as Hope and Bayview. Developed uses include residential and recreational single family homes, condominiums, marinas, and campgrounds. Many residences and facilities near the reservoir have been located to take advantage of views of the water.

The primary viewers of the reservoir include residents of local communities, recreationists and tourists, travelers on U.S. Highways 2 and 95 and Idaho State Highway 200, and Amtrak riders who can view the north and east sides of the reservoir. The reservoir can be seen from several local roads, such as the East River Road. Residential and vacation homes located on or near the reservoir have often been sited to take advantage of water views. The lake is very popular for recreation, which provides campers, boaters, and other users with opportunities to enjoy views of the reservoir.

2.7.5.3 Existing Parks And Recreation Facilities

Pend Oreille Lake is a major regional recreational resource for the northern Idaho area. As shown in Table 2–22, there are 27 developed recreation sites scattered around the shoreline. The Corps operates four campgrounds and two day use parks on the lower reservoir portion of the project. USFS operates three campgrounds and day–use sites on the main lake. Idaho State Parks operates the largest public campground and day–use park at Bayview at the southern tip of the lake. There are also several Corps' owned dispersed sites managed by Idaho Department of Fish and Game. There are private marinas and private resorts which offer a full range of facilites, including RV campgrounds, cabins, condominiums, and hotel rooms. The Corps manages a visitors center and viewpoint observation areas at the main dam site.

2.7.5.4 Principal Managing Agencies/Entities

Corps of Engineers. The Corps is the Federal agency primarily responsible for providing facilities on the 25 mile (40 km) stretch of the the reservoir impounded by the dam. This includes four campgrounds at Albeni Cove, Priest River, Riley Creek, and Springy Point; two day–use areas at the visitors center and Trestle Creek; and 13 wildlife management areas. Two wildlife areas that offer passive recreation opportunities, including wildlife and scenic observation, are Mallard Bay and Oden Bay.

The U.S. Forest Service (USFS). USFS is the major Federal land management agency around Lake Pend Oreille. Kaniksu National Forest and the Coeur d'Alene National Forest encompass the lake on the south and east sides, respectively. The USFS administers three recreation sites adjacent to the lake, including campgrounds, picnic areas, swimming beaches, boat launches, trails and trailheads, and viewpoints.

Idaho Department of Fish and Game. The department manages two areas at Morton Slough and at Johnson Creek, which include camping, picnicking, and boat launch areas.

Idaho Department of Parks and Recreation. This state department operates and manages the largest public park on the lake, Farragut State Park near Bayview. This park has over 200 campsites and includes day–use areas, a marina, and unique museum of old Navy photographs.

City of Sandpoint. The Sandpoint Parks Department operates and maintains a large intensively developed city park on the north shore of the lake, within the city limits. This facility includes a beach, playing fields, and boat launch ramps, and it is adjacent to a large private marina.

2.7.5.5 Major Activities and Use Areas

Recreation and tourism are significant economic activities at Lake Pend Oreille and are likely to become more important with increased population growth. The primary market area is within a 100–mile radius or a two–hour drive of the lake and includes parts of Washington, Idaho, Montana, British Columbia and southern Alberta. User data show swimming, boating, fishing, camping, sightseeing, picnicking, hiking, horseback riding, hunting, and snowmobiling to be popular. Swimming, boating, outdoor games (including golf), cycling, and skiing are experiencing rapid growth.

Native sport fishes in Lake Pend Oreille are westslope cutthroat trout, bull trout and mountain whitefish. Other sport fishes have been stocked or have been introduced into the lake over the years. These species include kokanee, rainbow trout, Gerrard (Kamloops) trout, lake whitefish, brook trout, brown trout, lake trout, yellow perch, black crappie, largemouth bass, brown bullhead, pumpkinseed and northern pike.

The Gerrard rainbow trout of Lake Pend Oreille attracts a large share of the angling effort. Native to Kootenay Lake, British Columbia, this fish lives longer than other trout species and grows to an unusually large size on a diet of kokanee. A world record rainbow trout, weighing 37 pounds was caught in Lake Pend Oreille in 1947.

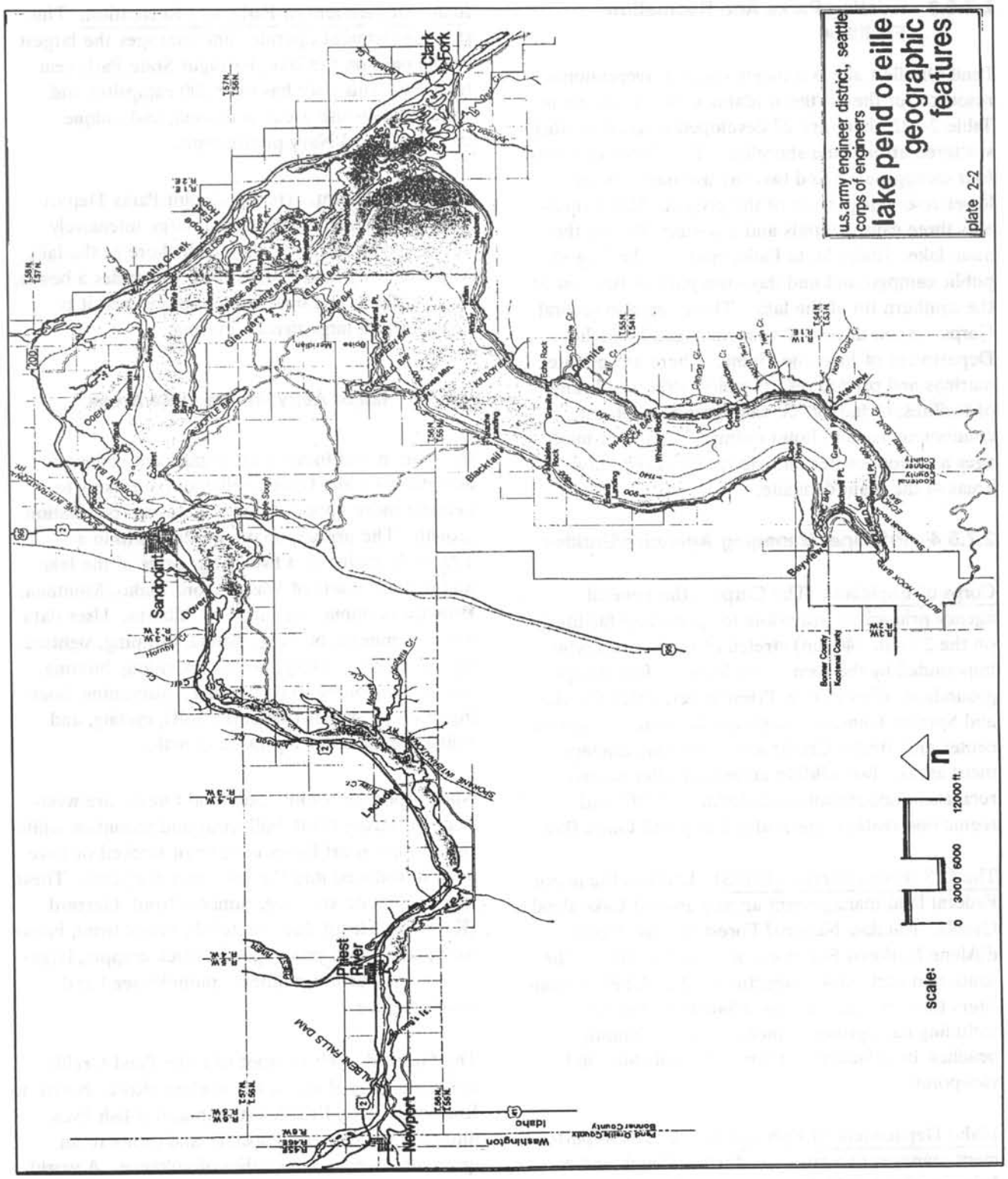


Figure 2–18. Map of Lake Pend Oreille

Table 2–22. Existing Recreation Sites and Facilities, Lake Pend Oreille Subregion

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
Dam Site Vista						10				
Albeni Cove	1	1				8		13		
Bayview Marina	1	2	200	–						
Beyond Hope Resort	1	2	244	–						
Bottle Bay Resort & Marina	1	2	100	–			4			
Dock N' Shop	1	2	16	–						
Edgewater Resort										
Evans Landing	1	1								
Farragut State Park	1	2						137		
Fox Farm Resort	1	2								
Garfield Bay	1	2	30	–				27		
Green Bay Marina	1	1	70	–						
Idaho Country Resort	1	2	100	–						
Johnson Creek	1	1				5		5		
Maiden Rock										
Morton Slough	1	1								
Pend Oreille Landing	1	1								
Priest River	1	1				15		20		
Rainbow Resort	1	2								
Red Fir Resort	1	2	15	–						
Riley Creek	1	1				47	2	69		
Samowen	1	1								
Sandpoint City Beach	1	2	26	–						
Sandpoint Marina			130	–						
Springy Point	1	1				10		40		
Trestle Creek	1	1				6				
Windbagg Marina	1	2	75	–						
Whiskey Rock Bay	1	1						9		
TOTAL	**21**	**38**	**2088**	**–**	**0**	**101**	**6**	**320**	**0**	**0**

From 1951 to 1965, the Lake Pend Oreille Kokanee fishery was the most popular in Idaho. Kokanee harvest began to decline in the 1960's and reached a low in 1986. The current kokanee harvest is only 10 to 20 percent of historic levels. Idaho Department of Fish and Game believes that several factors have caused the fishery decline in Lake Pend Oreille, including fluctuations in lake levels due to operation of Albeni Falls Dam. (See Technical Appendix K, Resident Fish).

Numerous private resorts and marinas are located around the lake, including sites near Sandpoint, Trestle Creek, Hope, Lakeview, Bayview (Scenic Bay), Ellisport Bay, Garfield Bay, Bottle Bay, Marin Bay, Camp Bay, and Glengary Bay. These sites provide camping, swimming, picnicking, boat launches and moorage, food, gas, and lodging.

The local business organizations are working hard to promote the region as a year–round destination resort. The development of Schweitzer Basin just north of the lake over the last several years has included significant captial investment in facilites which have increased winter vistation greatly.

2.7.5.6 Visitor Use

Table 2–23 summarizes visitation to Lake Pend Oreille from 1987 to 1993. Recreation at Lake Pend Oreille is primarily summer oriented. Approximately 75 percent of the recreation use of the lake occurs during May, June, July, August, and September.

Table 2–23. Lake Pend Oreille Visitation Summary, 1987–1993.

CORPS OF ENGINEERS RECREATION SITES								
MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
Jan	0.7	2.6	2.0	1.3	0.8	0.8	0.7	1.3
Feb	0.1	2.2	1.5	0.4	0.9	1.2	1.4	1.1
Mar	2.6	3.9	3.6	2.4	4.1	3.2	3.4	3.3
Apr	10.2	5.6	9.9	14.1	11.0	12.0	11.3	10.6
May	38.4	38.8	25.7	16.2	29.0	28.2	32.8	29.9
Jun	50.9	73.5	48.3	43.8	62.4	57.7	79.8	59.5
Jul	72.6	106.2	197.8	107.0	110.9	106.0	95.0	113.7
Aug	87.6	99.4	104.7	91.6	88.6	95.3	84.6	93.1
Sep	43.4	32.9	43.6	40.9	43.2	38.5	36.5	39.9
Oct	8.6	11.4	12.5	13.3	9.3	10.4	7.9	10.5
Nov	2.6	4.1	4.3	4.2	4.8	4.8	4.9	4.2
Subtotal	**204.7**	**202.0**	**188.9**	**193.0**	**145.8**	**172.7**	**121.0**	**175.4**
OTHER RECREATION SITES								
Sandpoint City Beach	n/a	n/a	n/a	573.3	n/a	n/a	n/a	
Farragut State Park	n/a	n/a	n/a	250.0	n/a	n/a	n/a	
US Forest Service	n/a	n/a	n/a	55.6	n/a	n/a	n/a	
Subtotal	**n/a**	**n/a**	**n/a**	**878.9**	**n/a**	**n/a**	**n/a**	
TOTAL	**320.0**	**381.4**	**456.9**	**1217.2**	**368.4**	**361.1**	**360.5**	

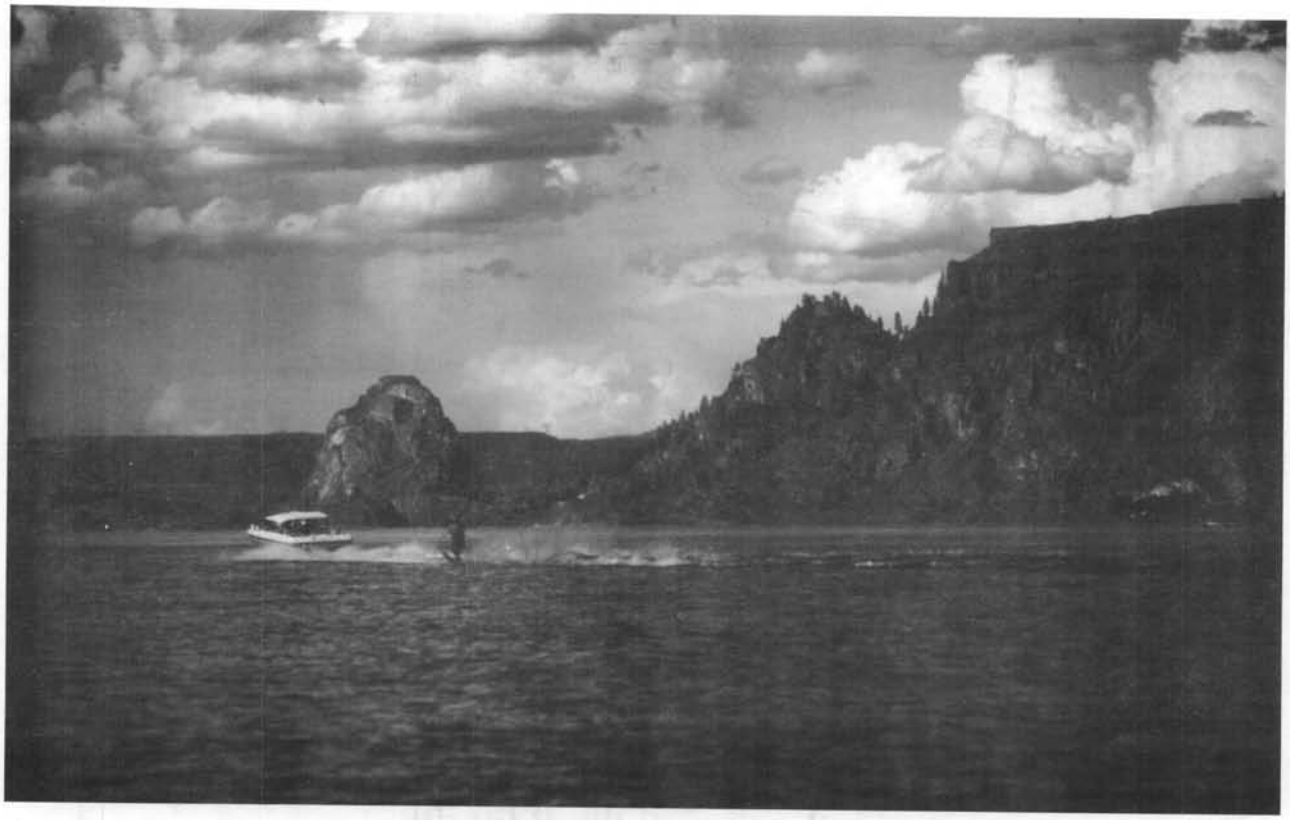


Figure 2–19. Waterskiing on Rufus Woods Lake

2.7.6 Middle Columbia River (Chief Joseph and PUD Projects)

2.7.6.1 General Overview

The middle Columbia River subregion stretches from the upper end of the McNary Project, Lake Wallula in the south to the upper end of Chief Joseph Project (Rufus Woods Lake) just below Grand Coulee Dam. This reach of the river is characterized by a series of six run–of–river projects, including five Public Utility District (PUD) reservoirs (Priest Rapids, Wanapum, Rocky Reach, Rock Island, and Wells), and one Corps project (Chief Joseph) (Figure 2–20). Also included in this subregion is the stretch of the Columbia River known as the Hanford Reach. Located downstream from Priest Rapids Dam, it is the last free–flowing stretch of the Columbia River in the United States above Bonneville Dam.

This subregion is located in a relatively remote portion of central Washington and, consequently, does not cater to an immediate large metropolitan population as do the projects below the Snake River confluence. The scenic and recreational amenities of the mid–Columbia River are measurably different than those of the Lower Columbia and can be further divided into the upper and lower basins, and the Hanford Reach. The projects are also significantly smaller in size than the lower Columbia projects and are more diverse in nature.

Upper Basin. The upper part of this subregion encompasses the Chief Joseph, Wells, Rocky Reach, and Rock Islands reservoirs. The city of Wenatchee is the largest city within this area and is the largest population base for visitors to the region. Consequently, the two projects closest to the city, Rock Island and Rocky Reach, feature a highly developed infrastructure of parks and visitor–use facilities (Figure 2–21). Facilities are less developed at Wells Dam and sparsely developed at Chief Joseph project.

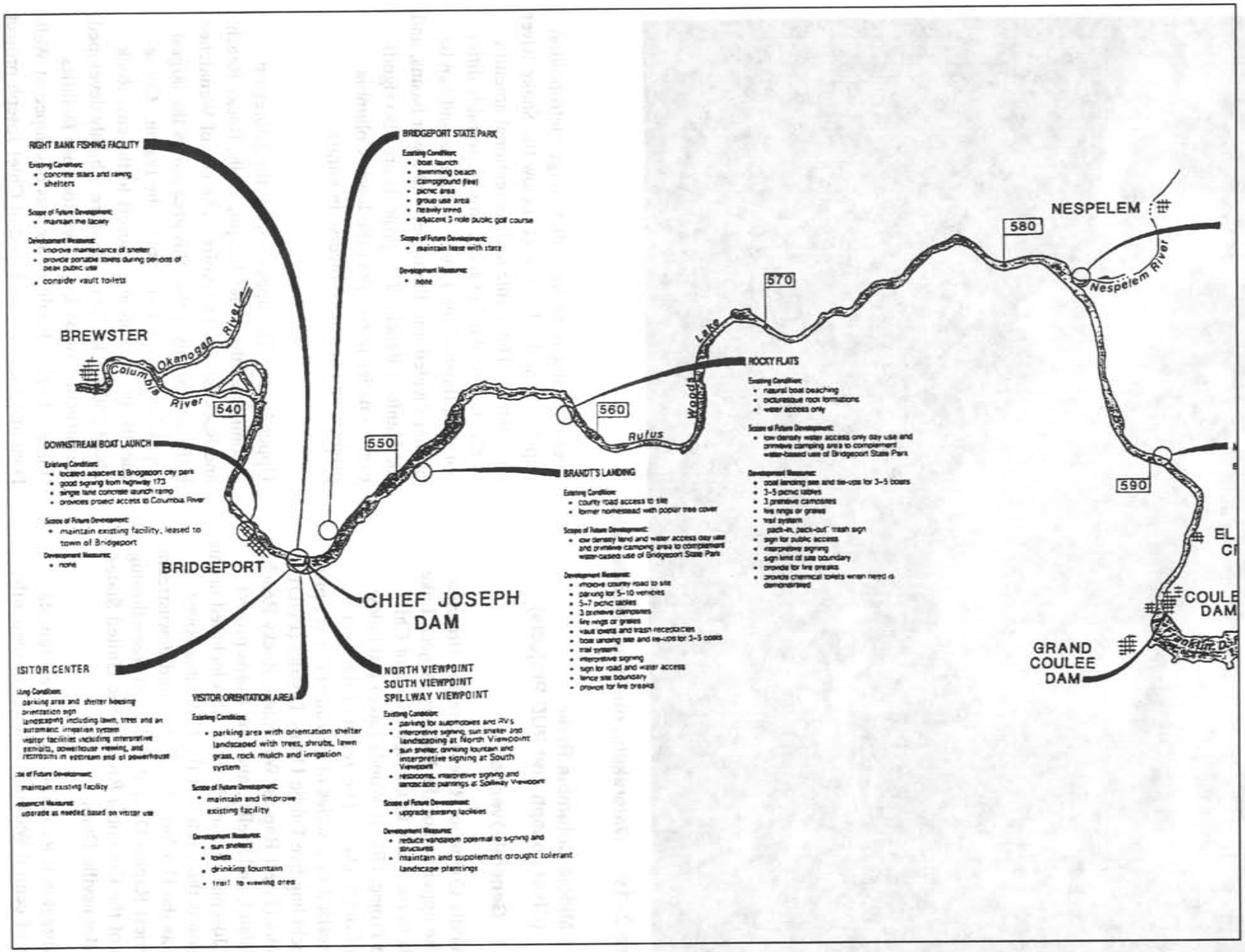


Figure 2–20. Map of Chief Joseph Project

1 Manson Bay Park

Location: Downtown Manson

Lake overview, swimming, picnic area, restrooms, 3 boat docks, winter only boat launch. 6 acres.

Managing Agency: Manson Park and Recreation District

P.O. Box 248 Manson, WA 98831

(509) 687-9635

2 Old Mill Park

Location: 2 miles east of Manson, Highway 150

One boat launch, short-term moorage, rest area, restrooms, marine dump station, boat trailer parking. 20 acres.

Managing Agency: Manson Park and Recreation District

P.O. Box 248 Manson, WA 98831

(509) 687-9635

3 Chelan Riverwalk Park

Location: Chelan River, City of Chelan

(?) mile scenic river loop trail, boat launch, short-term moorage, boat trailer parking, grass playfield, restrooms, picnic areas, picnic shelter, 12 acres.

Managing Agency: Chelan County Public Utility District

P.O. Box 1231. Wenatchee, WA 98807

(509) 663-8121

4 Chelan Falls Park

Location: Community of Chelan Falls

One boat launch, short-term boat moorage, parking, extensive day use facilities, picnic shelters, restrooms, showers, shoreline trail, a tennis court, playground equipment, swimming area. 53 acres.

Managing Agency: Chelan County Public Utility District.

P.O. Box 1231. Wenatchee, WA 98807

(509) 663-8121

Picnic shelter reservations accepted. Call the number above for more information.

Note: Opening date Fall, 1992.

5 Beebe Bridge Park

Location: 21 miles north of Orondo, Highway 97

Camping, 27 tent/R.V. sites with electricity and water, restrooms, showers, parking, day use facilities, picnic shelters, swimming area, 2-lane boat launch, short-term boat moorage, tennis courts, playground equipment, shoreline trail, R.V. dump station. 56 acres.

Managing Agency: Chelan County Public Utility District

P.O. Box 1231, Wenatchee, WA 98807

(509) 663-8121

Picnic shelter reservations accepted. Call the number above for more information.

Note: Opening date Fall, 1992

6 Daroga State Park

Location: 8 miles upriver from Orondo, Highway 97

Camping, 25 tent/R.V. sites with electricity and water, 17 walk-in or boat-in sites, baseball/soccer field, 2-lane boat launch, boat trailer parking, combination tennis & basketball court, short-term moorage, swimming, restrooms, showers, picnic shelters, volleyball, tennis, 2.5 mile shoreline trail, R.V. dump station. 140 acres.

Managing Agency: Washington State Parks & Recreation Commission

HCR Box 38A Orondo, WA 98843

(509) 884-8702

Reserve picnic shelters and group camp. Camping available on a "first come-first served" basis.

(509) 664-6380 (General information)

7 Orondo River Park

Location: 3 miles upriver from Orondo, Highway 97

10 RV sites (5 with electricity and water), showers, swimming, 1-lane boat launch, boat trailer parking, short-term moorage, picnic shelters, concessions, JetSki rentals & marine gas available. 5 acres.

Managing Agency: Port of Douglas County

P. O. Box 122 Orondo, WA 98843

(509) 884-4700 or (509) 784-1796

Reservations for camping and picnic shelters accepted. Write above address.

8 Entiat Park

Location: City of Entiat, Highway 97A

Camping (103 tent sites and 31 RV sites with complete hookups), boat launch, boat trailer parking, short-term moorage, swimming, restrooms, showers, RV dump station, playground equipment, picnic shelter, picnic areas. 40 acres.

Managing Agency: City of Entiat, Park & Recreation Department

P. O. Box 228 Entiat, WA 98822

(509) 784-1500

Camping reservations for RV sites accepted. Write above address

9 Turtle Rock Island

Location: 1/2 mile upriver from Lincoln Rock State Park

Limited day use facilities for boaters, boat dock for short-term moorage, beach area, picnic tables, sanitary facilities. 1/2 acre.

Note: Presently under design. Opening date 1994.

10 Rocky Reach Dam

Location: 7 miles north of Wenatchee, Highway 97A

Extensive "award winning" landscaping, picnic areas, picnic shelter, playground equipment, horseshoes, Visitor Center, fish viewing room, historical galleries, restrooms. 38 acres.

Managing Agency: Chelan County Public Utility District

P. 0. Box 1231 Weratchee, WA 98807

(509) 663-8121

Picnic shelter reservations accepted. Call the number listed above.

11 Lincoln Rock State Park

Location: 7 miles north of East Wenatchee, Highway 2

Camping (94 tent/RV sites: 35 with electricity and water, 32 with electricity, water and sewer, 27 standard), baseball/soccer field, 3-lane boat launch, boat trailer parking, short-term moorage, swimming, restrooms, showers, picnic shelters, playground equipment, volleyball, tennis, horseshoes, amphitheatre, RV dump station. 60 acres.

Managing Agency: Washington State Parks & Recreation Commission

Route 3, Box 3137 East Wenatchee, WA 98802

(509) 884-8702

Camping reservations accepted in person or write above address.

12 Wenatchee Confluence State Park

Location: North Wenatchee on both sides of the Wenatchee River where it joins the Columbia River.

Camping (59 tent/RV sites: 51 with electricity, water and sewer, 8 standard), baseball/soccer field, 2-lane boat launch, boat trailer parking, swimming, restrooms, showers, picnic shelter, volleyball, tennis, playground equipment, Wenatchee River pedestrian bridge, 4.5 miles of trail, wildlife areas, interpretive graphics, RV dump station. 200 acres.

Managing Agency: Washington State Parks & Recreation Commission

Camping available on a "first come-first served" basis (no reservations accepted).

For information on availability, call (509) 664-6373.

13 Walla Walla Point Park

Location: City of Wenatchee, (adjoins Wenatchee Riverfront Park), entrance on Walla Walla Street.

"Fourplex" soccer/softball complex (each with field lights), swimming, 1.1 miles of trail, tennis, volleyball, horseshoes, restrooms, picnic areas. 10 acres.

Managing Agency: City of Wenatchee, Parks & Recreation Department

P. O. Box 519, Wenatchee, WA 98807

(509) 664-5980

14 Wenatchee Riverfront Park

Location: City of Wenatchee (entrances, Worthen and Fifth Streets)

1.2 miles of shoreline trail, "special event" mini-railroad, ice rink, 2-lane boat launch, short-term moorage, boat trailer parking, restrooms. 31 acres.

Managing Agency: City of Wenatchee, Parks & Recreation Department

P. O. Box 519 Wenatchee, WA 98807

(509) 664-5980

15 Rock Island Hydro Park

Location: 2 miles south of East Wenatchee, Highway 28

Baseball/soccer fields (1 with lights), picnic areas, picnic shelter, swimming, boat launch, boat trailer parking, tennis, volleyball, 1.1 miles of trail, restrooms. 70 acres.

Managing Agency: Chelan County Public Utility District

P. O. Box 1231, Wenatchee, WA 98807

(509) 663-8121

Picnic reservations accepted. Call the number listed above.

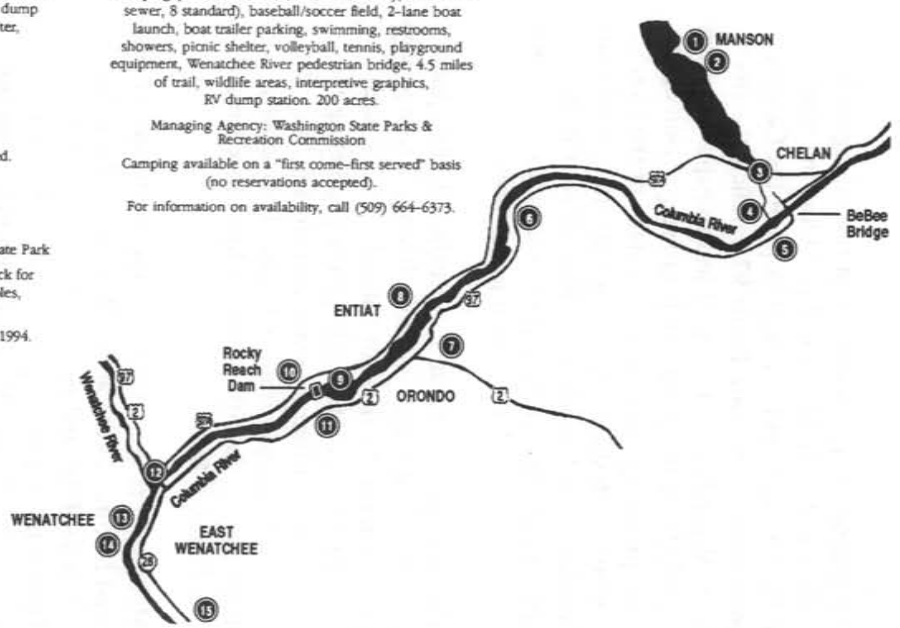


Figure 2–21. Map of Middle Columbia PUD Projects

Transportation in this portion of the subregion is limited, with U.S. Highway 2 providing the main link to the heavily populated west slope of the Cascade Mountains. U.S. State Route 97 parallels the river from Wenatchee north almost to Bridgeport through the middle of the prime apple growing region of the state, providing direct access to many of the river's amenities. Residents from metropolitan Seattle and Tri–Cities, and residents of Wenatchee, Chelan and other local communities create a significant demand for water–related recreation in this area.

The most popular form of recreation in the upper part of the subregion is scenic driving. The highways provide access to vistas of natural features, such as the east Cascade Mountains, cliffs paralleling the river canyon, tributary rivers and streams, and the famed Washington fruit orchards. This activity drops off significantly as the visitors move toward Chief Joseph Dam.

Many visitors are attracted to the impressive engineered features of the area. Most of the dams have visitor facilities and viewpoints, and Chief Joseph Dam is the second largest power producing dam in the United States. There are also numerous fish hatcheries and fish ladders located at the PUD projects, which are also popular visitor attractions.

The subregion is popular for its water–related recreation opportunities. The upper subregion and adjacent streams and lakes have long been popular for fishing, swimming, and boating. The growth in population of inland communities such as Wenatchee and Chelan has increased visitation significantly. The spectacular growth of the coastal cities of Seattle, Tacoma, and Everett has also contributed to higher usage as more and more people seek to escape the urban environment.

Lower Basin. Land uses within and adjacent to the lower basin are notably different than the upper basin since the river moves east away from the mountains, and the climate is drier. Facilities range from the hydroelectric dams, small suburban residential areas, resorts, wildlife areas, an Indian village, an Army base, agricultural acreage, and a variety of recreational developments. The Wanapum Indian village at Priest Rapids Dam and the Army's Yakima Firing Center occupies much of the west shore of the river between Priest Rapids Dam and Sentinel Gap. Interstate 90, the link between Seattle and Spokane, bisects the area on the north near the remote project of Wanapum. It provides the best access to the lower basin. Various other Washington state highways provide intermediate access to other sections of the subregion. Lack of good highways will constrain future development of facilities to meet public demand, particularly along the lower stretches of the river from Quincy down to Richland, where access is very limited.

Thousands of visitors from various parts of the country visit the lower basin and use its resources for recreation at such sites as Gingko/Wanapum State Park. Boating on the river is accommodated by nine boat launches and the marina at Crescent Bar. Hunting and fishing occur by boat and are accessed by roads that serve the shoreline at various points, primarily along the east shore. Camping is also a major activity and occurs both at developed facilities and in unregulated areas.

Hanford Reach. The Hanford Reach, located between Priest Rapids Dam on the north and the upper end of Lake Wallula (McNary pool) on the south, is unique in being the last undammed reach of the Columbia River in the United States above Bonneville Dam. The Hanford Reach and adjacent wildlife refuge/recreation areas provide year–round recreational opportunities. Sport fishing, flatwater boating, and waterfowl hunting are the primary recreation activities. Other activities include waterskiing, upland hunting, and nature viewing. The greatest recreation use occurs during September and October in conjunction with peak waterfowl hunting and salmon (e.g. fall chinook) fishing seasons. Hunting begins during October and extends through January.

The Hanford Nuclear Reservation, operated by the U.S. Department of Energy (DOE), encompasses almost the entire south and west shorelines of the Hanford Reach. Public use and access is restricted in the Hanford Reservation and in the Saddle Mountain National Wildlife Refuge, located north of the river.

The Wahluke Wildlife Recreation Area, operated by the Washington Department of Wildlife (WDW), is the primary public use recreation area along the Hanford Reach. WDW estimates that 91 percent of visits to the Wahluke Recreation Area are for sports fishing and hunting.

Salmon, steelhead, sturgeon, and smallmouth bass are the primary sport fish for anglers using the Hanford Reach. The abundance of fall chinook in the Hanford Reach makes it a very important area along the Columbia mainstem and tributaries for sport harvest of salmon. Summer–run steelhead are fished nearly as heavily as salmon. The majority of fishing occurs between Vernita Bridge and the Priest Rapids Dam, downstream of the Ringold Hatchery, and in the vicinity of White Bluffs.

Waterfowl hunting is the primary hunting activity in the Hanford Reach. Hunters do not confine themselves to the shoreline; they venture into sloughs and onto islands throughout the reach. Large populations of resting and migrating waterfowl use the reach between August and April.

In addition to accommodating hunting and fishing access, the Hanford Reach provides opportunities for flatwater boating. Jet and propellor–driven boats are able to access the entire Hanford Reach. Non–motorized boats stay primarily in the vicinity of Vernita Bridge, White Bluffs Ferry Landing, and Ringold Hatchery. Most recreational boating is a day–use activity. The Vernita Bridge boat launch, maintained by the Washington Department of Fisheries, is the most frequently used boat launch along the reach.

2.7.6.2 Aesthetics

The middle Columbia subregion is composed of two physically and visually distinct areas. The four upstream projects (Chief Joseph, Wells, Rocky Reach, and Rock Island) are located in a narrower section of the Columbia River valley than the downstream section. Views from these upper reservoirs are limited primarily to the steep canyon walls covered with grass and sagebrush. Because the projects are run–of–river projects located in a relatively narrow canyon (from approximately 0.25 to 0.5 mile wide in most places), the project pool is not as wide or the views as expansive as in many parts of the two lower basin projects

The terrain adjacent to the two downstream projects, Wanapum and Priest Rapids, is flatter, and the river canyon is wider compared to the upstream projects. Due to the wider canyon, the reservoir's pools are generally wider than the pools of the upstream projects. Both pools extend to approximately 2 miles in width near the dams.

A variety of uses occur on lands adjacent to the middle Columbia projects. Most of the land adjacent to the reservoirs is undeveloped. Several state parks and state wildlife areas are located on or near the reservoirs. Some areas are developed for agriculture, including numerous orchards on the valley floor and lower terraces. The largest communities near the reservoirs are Wenatchee and East Wenatchee, which are separated by the pool of the Rock Island project. Other smaller communities along the reservoirs include Bridgeport, Brewster, Pateros, Entiat, Rock Island, Vantage, and Schwana. The adjacent communities have various combinations of residential, recreational, commercial, and industrial areas near the reservoirs.

Although long segments of the reservoirs are not accessible by road, there are some locations where highways and/or local roads allow views of the reservoirs. Major roads from which the river can be viewed include: U.S. Highway 97 which follows the river from Brewster to Wenatchee; U.S. Highway 2, which crosses the river at Wenatchee and follows it (in conjunction with U.S. 97) to Orondo; U.S. 97 Alternate along the west bank from Wenatchee to near Lake Chelan; Washington State 28 from Wenatchee to below Rock Island Dam; U.S. Interstate 90, which crosses the river at Vantage; and Washington State 243, which generally parallels the river from Interstate 90 to below Priest Rapids.

2.7.6.3 Recreation Sites and Facilities

To support the high levels of recreational use that occur in the subregion, a system of parks and recreation sites has been developed, particularly on the

Chelan County PUD projects (Rock Island and Rocky Reach) in and near Wenatchee. From river mile 125 below Priest Rapids Dam to river mile 620 at the upper end of Rufus Woods Lake, water–related recreation sites or areas have been identified that may be impacted by operation of the Columbia Riversystem dams (Table 2–24). These sites range from highly developed and intensively used urban parks with facilities to support a variety of recreational activities, to minimally improved fishing access sites.

Next to sightseeing, fishing is the second most popular recreational activity on the mid–Columbia reservoirs. Fishing takes place at developed recreation sites and at numerous dispersed locations throughout the study region. The Columbia River recreational fishery for anadromous species, sturgeon, and more recently, for walleye, is of particular importance. Surveys of resident fish communities in Lake Rufus Woods show fish abundance to be very low with only a few sportfish species present. Enough walleye are entrained through Grand Coulee Dam to support a walleye sport fishery in the lake. Resident game fish abundance is also relatively low in the other mid–Columbia reservoirs. (See Appendix K: Resident Fish).

The mouths of Columbia River tributary streams, including the Yakima, Wenatchee, Chelan, Methow, Okanogan, and Nez Perce Rivers, are particularly important recreational fishing sites. A number of the recreation facilities are located adjacent to these rivers and were provided largely to promote fishing access. The tailrace areas below the dams are also important recreational fishery sites. Facilities have been provided by the Corps and PUDs at each of these project areas to provide fishing access.

The majority of boating use occurring within the subregion, is associated with fishing. Waterskiing is the second most popular activity. Most boating use on all six lakes is highly localized; boaters launch from boat ramps in the vicinity of where they would like to fish or ski and stay within that particular area. Unlike the lower Columbia, there are no locks in any of these projects so boating is restricted to a single lake at a time.

Swimming is a relatively minor recreational activity at the mid–Columbia reservoirs. However, this activity has the potential to be more seriously impacted by project operations than other water–related activities due to the constraints of developed swimming beaches. These areas are very "flow sensitive" so that extreme flows are detrimental to use. Almost all swimming in the Columbia River occurs during the summer months of June, July, and August when water and air temperatures warm.

There are approximately 10 developed swimming beaches at parks along the mid–Columbia River within this subregion. An unknown percentage of swimming also occurs at dispersed or unimproved beaches.

2.7.6.4 Managing Authorities

Corps of Engineers. The Corps is the Federal agency primarily responsible for providing recreation facilities on Lake Rufus Woods. Visitor facilities include a visitor center, viewpoints, and fishing access sites.

Washington State Parks. The Corps cooperates with Washington State Park Department in the operation of Bridgeport State Park, the only major recreation site at the Chief Joseph project that includes a campground, day–use park, and golf course on the lake. Other local entities such as Douglas County, and the town of Bridgeport cooperate in the management of limited water–related recreation facilities, including boat ramps, swimming beaches, campgrounds, picnic areas, golf course, and interpretive sites.

Public Utility Districts. There are three Public Utility Districts (PUDs) within the subregion that operate and manage the hydroelectric facilities on the river. They are Chelan, Douglas, and Grant County PUDs. Chelan PUD operates the most extensive and urban facilities on the river, ranging from baseball and soccer fields to campgrounds on the Rock Island and Rocky Reach projects. Douglas PUD owns and manages Wells Dam, which also has several campgrounds and boating access areas.

Table 2–24. Existing Recreation Sites and Facilities, Middle Columbia River

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
**PROJECT: PRIEST RAPIDS DAM										
Priest Rapids HMA	1	1								
**PROJECT: ROCK ISLAND DAM										
Rock Island Hydro Park	1	1				20	1			
Walla Walla Point Park							1			
Wenatchee Confluence State Park	1	2				20	2	59	51	1
Wenatchee Riverfront Park	1	2				27				
SUBTOTAL	3	5	0	0	0	67	4	59	51	1
**PROJECT: ROCKY REACH DAM										
Beebe Bridge Park	1	3				36	1	27	27	
Chelan Falls Park		2				39	1			
Daroga State Park	1	2	2			75	2	42	25	2
Entiat Park	1	1				81	1	134	31	
Lincoln Rock State Park	1	3	4			60	3	94	67	
Orando River Park	1	1	5		1	12	1	10	5	
Rocky Reach						30	2			
SUBTOTAL	6	12	11		1	333	11	307	155	2
**PROJECT: WANAPUM DAM										
Ginkgo State Park	1	2	11		3	52		50	50	
**PROJECT: WELLS DAM										
Boat Launch	1	1								
Bridgeport	1	1				5	1	33	12	
Chief Joe State Park	1	2				20		20	20	1
Columbia River Boat Launch	1	1								
Dam Overlook										
Pateros						3	3			
SUBTOTAL	4	5				28	4	53	32	1
**PROJECT: CHIEF JOSEPH DAM										
Bridgeport State Park	1	1				5	1	33	12	
TOTAL	**16**	**26**	**11**	**0**	**4**	**485**	**20**	**502**	**300**	**4**

Grant County PUD owns and operates the lower two projects, Wanapum and Priest Rapids, which are the least developed in the subregion.

The Corps licenses the management of the lands on both shores of Lake Rufus Woods. The Bureau of Land Management has jurisdiction on the south bank and the Colville Indian Tribe on the north bank.

2.7.6.5 Special Recreation, Preservation and Natural Resource Areas

Much of the land along the mid–Columbia River adjacent to Priest Rapids and Wanapum Reservoirs, and Lake Rufus Woods are dedicated natural resource preservation and management areas. These lands are managed by Federal and state agencies for natural resource values. In addition to supporting some of the developed recreation sites described above, these lands are also available for dispersed and low–density recreation activities consistent with other resource management objectives.

Wildlife Refuges. This category includes both federally and state managed areas that have been set aside for the management, conservation, preservation, and enhancement of fish and wildlife resources. These areas are generally located along the Columbia River and are especially important in the habitat for migratory waterfowl. They generally have some public access facilities such as parking, trails and boat ramps that support dispersed public use consistent with fish and wildlife objectives. Most of the numerous state and Federal fish hatcheries along the river also allow public access and provide facilities to promote and interpret their missions.

Saddle Mountain National Wildlife Refuge, located along the north side of the Columbia River is administered by the FWS. The refuge is managed for public use; there are several developed public access points with parking, restrooms, trails, interpretive displays, small boat ramps, and waterfowl blinds. The refuge is very popular for waterfowl hunting. Other activities include, fishing, boating, hiking, and wildlife viewing.

State Wildlife Areas and Habitat Management Areas managed by the WDW along the mid–Columbia River include Priest Rapids, Crab Creek, Quilomene, Quincy, and Colockum. Many of these lands are licensed from the PUDs, which also manage specially designated lands along all five reservoirs for fish and wildlife purposes.

Wild and Scenic Rivers. The purpose of Federal and Washington state wild and scenic rivers programs is to maintain rivers in a free flowing state; maintain, protect, and enhance existing scenic/recreation values; and to make these values accessible to the public. The Hanford Reach of the Columbia River is currently under study by the NPS. The study area extends from 1 mile below Priest Rapids Dam (river mile 396) downstream approximately 51 miles to Lake Wallula (McNary pool) to north of Richland, Washington (river mile 345). The study was authorized by Public Law 100–605 was conducted by NPS with the support of the USFWS and DOE. These three agencies comprised the study team.

A three–agency study team developed a draft EIS that called for the area to be designated a National Wildlife Refuge with Wild and Scenic River overlay. This proposal would combine a Wild and Scenic River designation of the river and its immediate corridor with National Wildlife Refuge designation of upland areas north and east of the river. The refuge would incorporate two parcels which are currently in an administrative refuge status under the administration of the USFWS and WDW.

2.7.6.6 Visitor Use

Table 2–25 summarizes visitor use to the Columbia River in this subregion. No visitation data are currently available for the dispersed, non–site specific recreational use that occurs at all of the reservoirs. For this reason, the visitation statistics from the table underestimate the total use.

Table 2–25. Middle Columbia River Visitation Summary, 1987–1993.

MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
CHIEF JOSEPH PROJECT/LAKE RUFUS WOODS								
Corps of Engineers Recreation Sites								
Jan	0.3	0.66	0.6	0.6	0.4	0.3	0.3	0.5
Feb	0.7	0.8	0.8	0.6	0.3	0.5	0.4	0.6
Mar	1.4	1.4	1.2	0.9	0.8	0.4	0.4	0.9
Apr	1.7	2.3	2.1	2.2	1.8	1.3	3.3	2.1
May	3.9	3.9	4.4	3.5	3.5	4.7	4.8	4.1
Jun	4.6	4.5	4.8	5.2	5.2	3.3	4.3	4.6
Jul	5.4	5.1	5.5	5.9	6.0	5.4	4.8	5.4
Aug	5.3	5.3	5.4	7.0	6.6	4.9	3.9	5.5
Sep	4.1	3.5	3.9	4.8	4.1	3.6	3.1	3.9
Oct	2.7	2.1	2.0	1.5	2.2	1.6	1.1	1.9
Nov	1.0	1.1	0.9	0.9	0.8	0.6	0.3	0.8
Dec	.6	0.3	0.7	0.5	0.7	0.4	0.3	0.5
Subtotal	**31.9**	**30.9**	**32.3**	**33.7**	**32.5**	**26.9**	**27.2**	**30.8**
Other Recreation Sites								
Bridgeport State Pk.	15.0	15.5	14.4	17.9	15.6	––	––	
TOTAL	**46.9**	**46.3**	**46.7**	**51.6**	**48.1**	**––**	**––**	
ROCK ISLAND DAM AND LAKE								
TOTAL	**––**	**––**	**1368.9**	**852.0**	**586.3**	**––**	**––**	
ROCKY REACH DAM AND LAKE								
TOTAL	**––**	**––**	**730.2**	**790.7**	**575.6**	**529.0**	**483.4**	

Visitation data are not available for privately operated recreation sites on Rock Island and Rocky Reach Reservoir. Most visitation occurs on Chelan PUD sites; including those operated by Washington State Parks and other local entities.

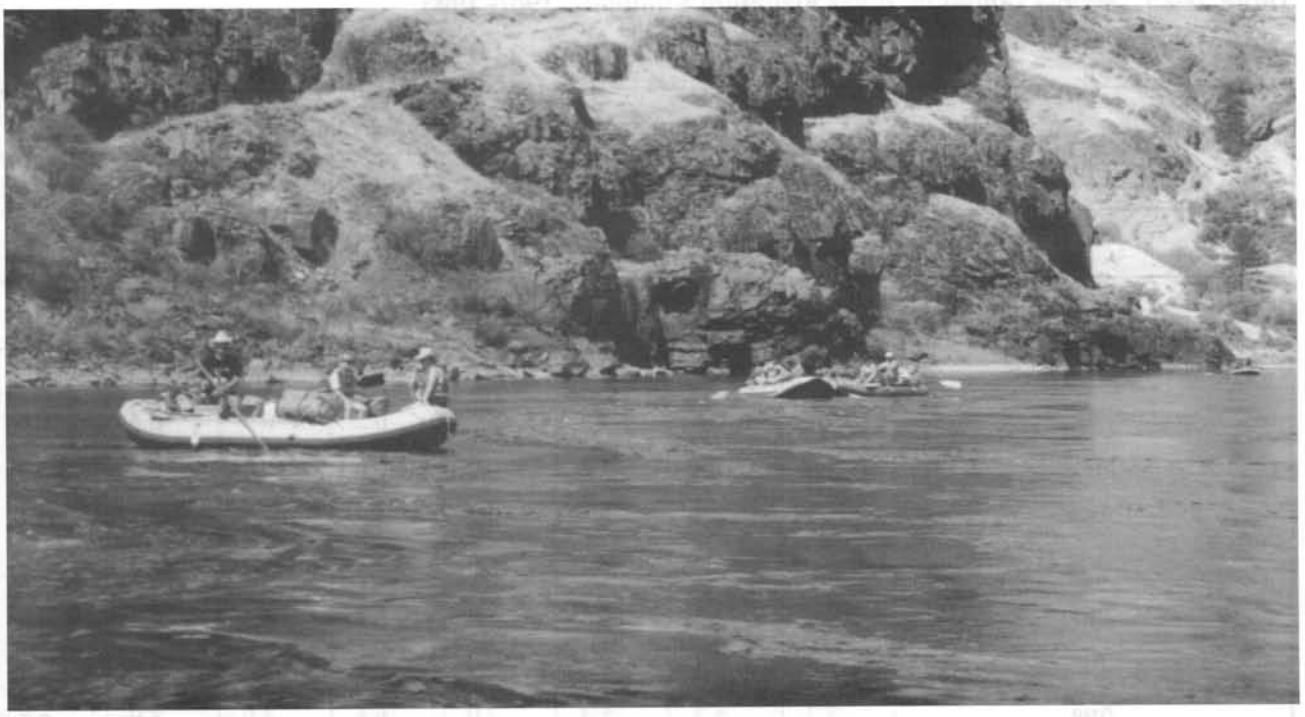


Figure 2–22. Rafting on the Snake River in Hells Canyon

2.7.7 Middle Snake River (Brownlee, Hells Canyon, and Oxbow Projects and the Snake River through Hells Canyon)

2.7.7.1 General Overview

The recreational resources of the middle Snake River are those from the Washington–Oregon border (river mile 176) upstream to approximately Weiser, Idaho (river mile 345). This 170 mile stretch of river offers a rich and diverse array of outdoor recreation opportunities that are important from a national, regional, and local perspective. From river mile 247 downstream to the Washington–Oregon border, the Snake River is within the Hells Canyon National Recreational Area (HCNRA). Upstream of HCNRA, the middle Snake River is impounded by a series of three non–Federal hydroelectric dams known as the Hells Canyon Complex (Complex).

2.7.7.2 Aesthetics

The Hells Canyon Complex of dams is located in the spectacularly steep and narrow Hells Canyon. The slopes adjacent to the projects are generally covered with grasses and sagebrush, with patches of riparian vegetation found along reservoir edges and up side canyons. Due to the narrow and steep canyon walls, views within the canyon are very restricted. Near Brownlee Dam, the canyon begins to widen and remains fairly consistent in width for the length of the reservoir. Views at Brownlee are still restricted to within the canyon, but the width allows for more panoramic views.

Most of the land adjacent to the middle Snake subregion is undeveloped. There are some parcels of private property adjacent to the project, but most are located in the more agricultural southern end of the reservoir near Weiser. Use of public and private lands near the reservoir includes livestock grazing, recreation, and scattered rural residential.

Access to most of the Brownlee project is limited to the Snake River Road which is a 42–mile–long (68 km), narrow, winding gravel road located on the western side of the reservoir. The road is used by recreationists and local residents, and offers a range of views of the reservoir that include panoramic views from high above the reservoir and close views from the shores. Most viewers at Brownlee would likely be recreationists. Due to the area's sparse population and lack of major highways, the number of local residents and travelers viewing Brownlee from nearby roads is not large.

Below the Complex, the Snake River flows through the HCNRA. Views in the canyon are very restricted, and are generally only of the immediate river, riverside environment, and adjacent steep, high slopes and cliffs. There is very limited road access to the canyon between Hells Canyon Dam and Rodgersburg, Oregon. Most viewers in the HCNRA see the canyon from private or commercial watercraft.

2.7.7.3 Hells Canyon Complex

The Complex consists of three dams and associated reservoirs––Brownlee, Oxbow, and Hells Canyon––constructed, owned, and operated by Idaho Power Company (IPC). Although it is not part of the Federal system of hydroelectric projects, the Complex is indirectly linked to the operation of the 14 Federal projects under study in the SOR. The effects of a new system operating strategy may be reflected in IPC operations that respond to additional Water Budget requests, flood control shifts, and storage requirements. For the purposes of this study, it is assumed, however, that the IPC projects will not be affected by changes in system operations considered under SOR. Thus, this section only briefly discusses the type and nature of recreational facilities and resources found in the Complex to provide a perspective on the diverse local and regional outdoor recreational opportunities available in the Middle Snake region.

Brownlee Dam is the largest of the three hydroelectric projects and is the only storage project, with a capacity of 980,250 acre–feet. The dam and reservoir extend about 60 miles, from River Mile 285 to the pool headwaters at Weiser, Idaho. The two remaining dams, Oxbow and Hells Canyon, are run–of–river projects with storage capacity of 5,420 acre–feet and 98,820 acre–feet, respectively. IPC operates the dams within guidelines set in the Federal Energy Regulatory Commission (FERC) license for the Hells Canyon Project, No. 1971.

Recreation Facilities. Recreation is one of the primary authorized project purposes, along with power generation, flood control, and navigation. IPC has developed an array of recreation sites to promote recreation opportunities in the Complex. IPC recreational sites in the Complex include Hells Canyon and Copperfield Parks located at the Hells Canyon pool, McCormick Park at the Oxbow pool, and Woodhead Park at the Brownlee pool. These parks are all fully equipped day–night use facilities, with RV electrical hookups, showers, and boat ramps available at all but Woodhead Park. Because Brownlee reservoir has increasingly been used as a primary regional recreation area in recent years, IPC requested FERC permission to expand, upgrade, and improve recreational facilities at its Woodhead Park facility on Brownlee reservoir.

In addition to IPC's private facilities, there are six recreational developments located on or near reservoirs in the Complex that are managed by various Federal, state, and county park and land management agencies, including USFS, Bureau of Land Management (BLM), and Oregon State Parks. Over the years, IPC has contributed substantial funding to help improve and expand these publicly operated recreational areas. Some non–IPC facilities, such as Hewitt Park, Steck Park, and Farewell Bend State Park, are highly developed and offer the public complete day–night use opportunities and boat launching capability. For the most part, however, reservoir access is limited and several primitive, undeveloped park facilities occur throughout the Complex.

Recreational Activities. Recreation is an important use of the middle Snake River. There are many outstanding recreational opportunities, including boating, fishing, waterskiing, camping, picnicking, backpacking, hiking, sightseeing, hunting, and wildlife viewing. In recent years, recreational use, especially at Brownlee, has continued to increase because an extremely popular warm–water fishery for smallmouth bass, channel catfish, and panfish now exists in the reservoir.

This increased recreational demand is reflected by comparing 1982 and 1991 estimated visitation statistics reported for IPC recreation sites in the Complex. Over that time, use increased almost 300 percent, from 302,777 annual visitor days in 1982, to 890,500 in 1991. Similarly, angler creel census data collected at Brownlee reservoir by Idaho Department of Fish and Game and Oregon Department of Fish and Wildlife reveal an exponential growth in angling activity over the last 20 years. In 1970, only 64,068 angler–hours were spent fishing at Brownlee, compared to 2,942,553 angler–hours in 1989 (BLM, 1991).

2.7.7.4 Hells Canyon National Recreation Area (HCNRA)

The HCNRA straddles the middle Snake River and includes 652,488 acres in the Hells Canyon Wilderness (194,132 acres) and the Snake River segment of the National Wild and Scenic River system. Hells Canyon is the deepest gorge in North America and is rated as one of America's scenic wonders and natural heritages (CH2M Hill, 1984). The scenic river flows through the Hells Canyon Corridor, forming the boundary between Oregon and Washington, and includes portions of the Nez Perce, Payette, and Wallowa–Whitman National Forests. HCNRA extends through three national forests, but is managed by the USFS Wallowa–Whitman National Forest, headquartered in Clarkston, Washington.

This approximately 70 mile (113km) river stretch was preserved to maintain its unique and remarkable free flowing characteristics under the Hells Canyon National Recreation Area Act of 1975 and Wild and Scenic River Act of 1968. The HCNRA boundary originates at river mile 180, about 33 miles (53 km) upstream from Asotin, Washington (river mile 147) and stretches to Hells Canyon Dam at river mile 247. The 31.5 mile (51 km) section of river between Hells Canyon Dam and Pittsburg landing (river mile 214.5) is designated "Wild" under the Wild and Scenic Rivers Act. From Pittsburg landing to the Wallowa–Whitman National Forest, the 36–mile (58 km) section of the river is classified "Scenic". Downstream of HCNRA to the upper end of the Lower Granite pool, the Snake River has also been studied by the NPS for inclusion in the National Wild and Scenic Rivers system because of the numerous recreational activities that occur along this 33–mile (53 km) section.

HCNRA is a nationally significant recreational resource that may be directly affected by changes in the operation of Federal projects. The extent to which changes in system operations may cause IPC operations to vary could indirectly impact the quality of flow dependant recreational activities occurring in HCNRA. Specifically, depending on the amount and timing of water volumes stored, released, and passed downstream through the Complex, HCNRA flows may become extremely variable during the important recreational season. HCNRA river managers have expressed concerns about the boating, navigation, and environmental hazards caused by radical fluctuations in flows, which apparently occurred with some regularity in May and June, 1991 (Seamans, 1991). Severe fluctuations in flows (6–24 kcfs) washed out rapids, stranded boaters, led to boating accidents, dewatered prime fish and wildlife habitat, caused excessive sandy beach erosion, and resulted in high nitrogen supersaturation levels occurring below Hells Canyon Dam. Flows falling below 8,000 cfs (227 cms) have stranded commercial tour boats in the Rush Creek stretch of HCNRA.

2.7.7.5 Recreation Facilities

Due to the wild and scenic character of the river, most of the recreation sites found in HCNRA are

largely primitive, remote, or only semi–developed camping and boating beaches (Table 2–27). There are 88 such sites in HCNRA, of which only three, Pittsburg Landing, Kirby Creek Resort, and Kirkwood Historic Ranch, are considered to be semi–developed public or private recreation sites. Most of the remote sites are small and provide multi–day boating recreationists with overnight camping and day–use access to HCNRA. They may accommodate up to 30 people, generally have a beach and chemical toilet, and may contain water and a picnic table. In some cases, the semi–developed locations offer boat launching and landing ramps to accommodate power boat users of HCNRA (i.e. Pittsburg Landing, Hells Canyon Creek). The USFS monitors the use of these sites to ensure that crowding, noise, pollution, visibility, and other aesthetically unappealing attributes are effectively controlled or eliminated where possible.

There are only a handful of what are considered to be more developed recreation sites located within, and in one instance outside the HCNRA boundary (Table 2–26). The most developed site is found downstream of the HCNRA at the Grand Ronde boat launch. It is considered an important site since it provides the only public launch usable by big power boats between the HCNRA boundary and Asotin, Washington, and it is the major take–out point for float boat traffic originating in HCNRA. The few remaining developed or semi–developed sites (i.e., Pittsburg Landing, Dug Bar, and Hells Canyon Creek) provide the only passenger car access to HCNRA, but overnight camping facilities are limited.

2.7.7.6 Recreation Activities

HCNRA is nationally renowned for its unique and challenging whitewater float and power boat recreation opportunities. Float boat recreation occurs primarily in the form of private and commercial rafting and kayaking excursions through the many challenging rapids in HCNRA. Float trips usually originate at Hells Canyon Creek launch site (at the base of Hells Canyon Dam) and typically involve multi–day trips through Hells Canyon Gorge. A recent survey of HCNRA visitors found that 80 percent of commercial floaters and 76 percent of private floaters spent 2 to 6 days on the river (Krumpe et. al., 1989). Float boaters also enter the "Scenic" river section from the lower Salmon River, originating at Graves Creek/Pine Bar or Hammer Creek/White Bird on the main Salmon.

Power boats are typically private or commercial jet boats (20–to 30–foot private and up to 50 feet commercial) which most frequently launch in the downstream sections of the gorge and make single or multi–day round–trips through HCNRA. Krumpe (1989) found that the majority of commercial power boat trips (85 percent) were one to two days, while 40 percent of private jet boat spent 3 to 4 days on the river. Private jet boaters also launch and take–out in the most upstream section of HCNRA (Hells Canyon Creek).

Many diverse activities are important to those visitors who access HCNRA via private and commercial float and jetboats. For example, the preferred activities for a typical private float visitor to HCNRA are, in order of priority: rafting, camping, viewing wildlife, photography, swimming, fishing, visiting historic or cultural sites, hiking, kayaking, and hunting (Krumpe et. al., 1989). Similarly, the most important activities for commercial floaters were rafting, camping, viewing wildlife, visiting cultural sites, and photography. In contrast, private jet boaters view power boating, fishing, viewing wildlife, photography, and camping as the most important reasons for recreating in HCNRA. Commercial jet boat users value power boating, visiting cultural sites, viewing wildlife, and photography. These survey statistics indicate, that visitors who access the river on private jet boats place a greater emphasis on camping, fishing, and swimming activities because this group spends a generally longer time recreating on the river. Moreover, float boat and commercial jet boat recreationists appear to be orientated more to camping and sightseeing activities.

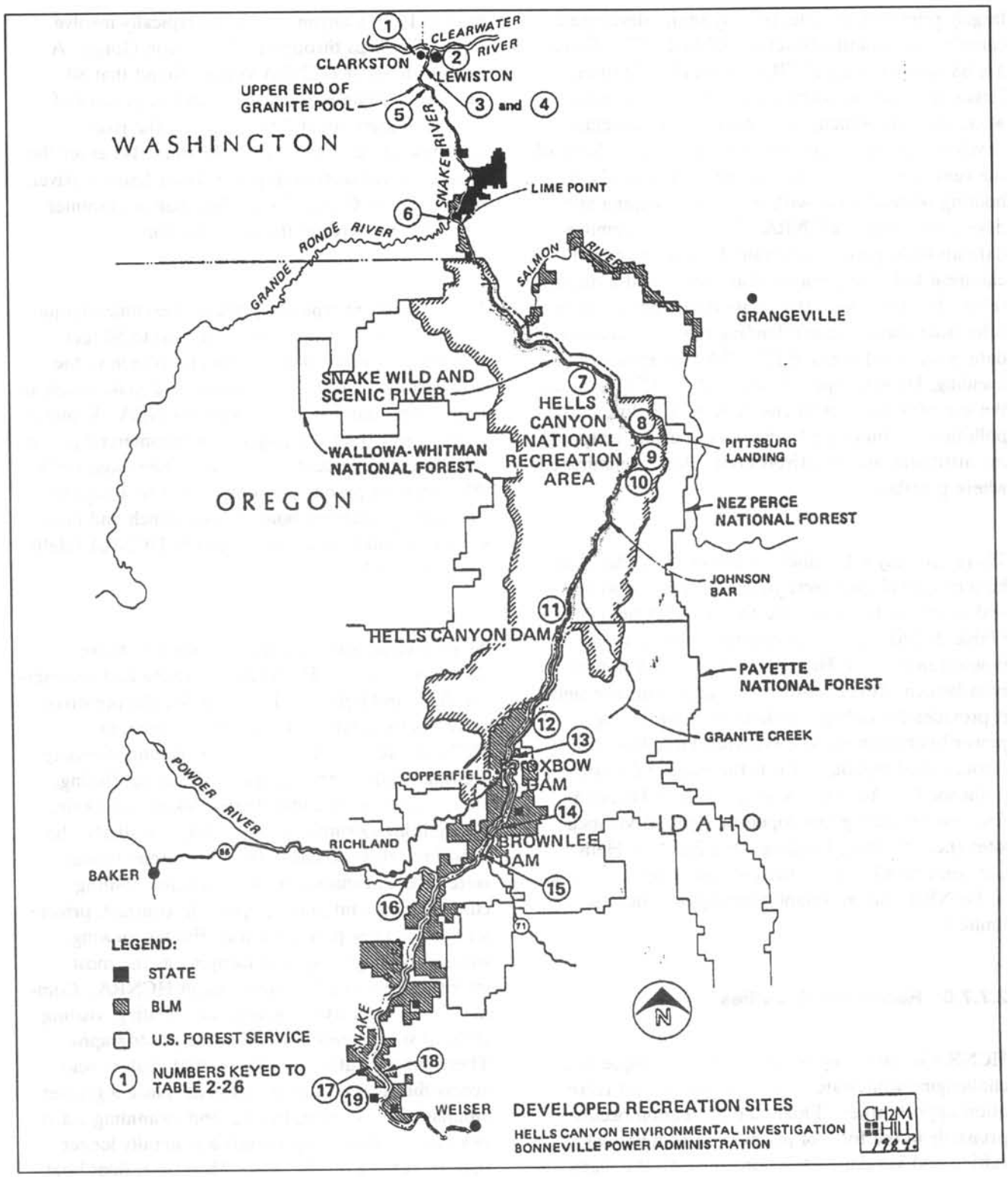


Figure 2–23. Map of Snake River Hells Canyon Reach

Table 2–26. Recreation Facilities, Hells Canyon National Recreation Area

Map Key	Name	Owner	State and River Mile	Picnic Tables	Camp-sites	Beach	Boat Ramp	Boat Dock	Drinking Water	Toilets	Other Facilities
1	Swallow Park & Marina	COE	W–141	Y	N	Y	Y	Y	Y	Y	Coast guard station, bike trail
2	Southway Snake River Access	COE	I–142	N	N	N	Y	N	N	N	Bike path to Wells Park
	Greenbelt Launch Site	COE	W–138	N	N	N	Y	N	N	Y	Greenbelt bike path
3	Wells Gate Marina	Private	I–144	N	N	N	N	Y	Y	Y	
4	Hells Gate Park (960 acreas)	IDPR	I–144	55	93	1,200 ft	Y	N	Y	Y	Trails (foot, bike, horse), visitor center, horse control
5	Chief Looking Glass Park & Marina	COE	W–145.5	N	N	N	N	Y	Y	Y	Showers
6	Grande Ronde Boat Ramp	WDOG	W–168.5	N	N	N	Y	N	N	Y	
7	Copper Creek Resort	Private	O–205.5	N	N	N	N	Y	Y	Y	Several buildings for housing guests
8	Lower Pittsburg Landing	HCNRA	I–215	I	U	N	Y	N	Y	Y	Fuel tanks nearby
9	Kirby Creek Resort	Private	I–219	N	N	Y	N	Y	Y	Y	Lodge for guests and owner's home
10	Kirkwood Historic Ranch	HCNRA	I–220.5	N	N	N	N	Y	N	N	Restored historic ranch, museum, interpretive program Ranger station (trailer)

Table 2–26. Recreation Facilities, Hells Canyon National Recreation Area – CONT

Map Key	Name	Owner	State and River Mile	Picnic Tables	Camp-sites	Beach	Boat Ramp	Boat Dock	Drinking Water	Toilets	Other Facilities
11	Hells Canyon Creek Launch	HCNRA	O–247	I	N	N	Y	Y	N	Y	Ranger station (trailer)
12	Hells Canyon Park (10 acres)	IPCo	I–263.5	4	44	200 ft	Y	Y	Y	Y	Showers, trailer hook-ups
13	Cooperfield Park	IPCo	O–258(e)	N	100	Y	Y	N	Y	Y	Showers, trailer hook-ups
14	McCormick Park (7.3 acres)	IPCo	I–284	3	3B	Y	Y	Y	Y	Y	Trailer hook-ups
15	Woodhead Park (68.1 acres)	IPCo	I–287	10	Y	150 ft	2	Y	Y	Y	
16	Hewett Park	Baker Co.	O–293(e)	Y	35	N a/	2	Y	Y	Y	
17	Spring Recreation	BLM Vale	O–327	Y	U b/	N	Y	?	Y	Y	
18	Steck Recreation Site (12 acres)	BLM Boise	I–328	33	38	Y	Y	Y	Y	Y	Fish cleaning station
19	Farewell Bend State Park (72 acres)	ODOT	O–333–5	73	94	Y	Y	Y	Y	Y	Showers, trailer hook-ups, trailer dump station

FOOTNOTES
a/ Swimming in undesignated area. Rocky shoreline.
b/ Gravel parking area has capacity for 40 RV's.

GUIDE TO ABBREVIATIONS

COE Corps of Engineers
IDPR Idaho Department of Parks and Recreation
WDOG Washington Department of Game
IPCo Idaho Power Company
BLM Bureau of Land Management and District name
ODOT Oregon Department of Transportation
IDFG Idaho Department of Fish and Game
N – No Y – Yes # – of sites or linear feet of beach

Table 2–27. Hells Canyon National Recreation Area Visitation Summary, 1987–1991

Project:	HELLS CANYON NATIONAL RECREATION AREA VISITOR DAYS (in 1,000's)				
	U.S. Forest Service Recreation Sites				
1991	1990	1989	1988	1987	AVERAGE
50.2	48.7	42.1	39.1	37.4	43.5

The popularity of HCNRA and its unique combination of activities and resource attributes cannot be overstated. Float and jet boat users state that they value most highly the scenery, the excitement, the natural splendor, the historic and cultural attractions, and escape from routine that a river trip in Hells Canyon provides (Krumpe et. al., 1989). Moreover, the river offers excellent fishing opportunities for steelhead trout and world–class sturgeon. In recent years, hunting for upland game bird (chukar) and mule deer has increased in popularity especially during the unregulated fall season.

2.7.7.7 Visitor Use

Evidence that the demand for boating related recreation in HCNRA is increasing in popularity is reflected by the annual visitation statistics compiled by the USFS. Table 2–27 provides visitation data for private and commercial float and power boat use (in service days) during the regulated season (the first Friday before Memorial Day weekend through September 15) from 1987–1991. A distinct upward trend in visitation is evident, with visitation increasing 38.3 percent over the last five years. Because of this increasing demand and the potential for heightened user conflicts in HCNRA, USFS recently completed a Limits of Acceptable Change (LAC) planning process to address the desire and need for the USFS to change the Recreation Management Plan for the Snake River in HCNRA (Krumpe and McCoy, 1991). Several recommendations to improve management of recreational use in HCNRA were proposed through this LAC process. USFS has recently implemented new regulations to manage recreation visitor use of HCNRA by amending the River Management Plan.

2.7.8 Clearwater River (Dworshak Project and Clearwater River Downstream)

2.7.8.1 Overview

This subregion includes Dworshak Dam and lake, located on the North Fork of the Clearwater River, the North Fork of the Clearwater River below Dworshak Dam, and approximately 40 miles (64 km) of the Clearwater River from its confluence with the North Fork to Lower Granite Lake at Lewiston, Idaho. Dworshak Dam impounds a lake which extends 54 miles (87 km) up the North Fork of the Clearwater River.

This region has a typical western interior climate. Summers are warm with little precipitation while winters are cold and wet with precipitation falling as rain or often snow. The subregion consists of the mixed coniferous forest surrounding the Dworshak pool and then transitions into the arid grasslands of the Columbia Plateau at Lewiston. The Clearwater River corridor below Dworshak Dam contains significant riparian vegetation adjacent to the river until it reaches the impoundment area of Lower Granite Lake just above Lewiston.

The population density of this subregion is low with only one major population center, Lewiston, Idaho, and Clarkston, Washington, located at the western edge of the region. The combined population of these two adjacent towns is approximately 40,000. The economic base for the region is primarily agriculture, with wheat farming predominant on the western end and wood products production on the eastern end.

Figure 2–24. Dent Acres Recreation Area at Dworshak Lake

Access to the Clearwater River is fair with a number of river access sites constructed adjacent to U.S. Highway 12, which follows along the river in this reach. Public access at Dworshak is fair, though limited to the vicinity of the dam, two upstream road crossings, and several road ends. All other access to public land at Dworshak is, for the most part, limited to those visitors using a boat or other water craft.

The major recreation activities in the region are sightseeing, fishing, boating, camping, and hunting. With limited public land and water access in the subregion, except along the Dworshak/Clearwater River corridor, most visitors are attracted to the variety of public resources and the activities available in the corridor. A number of visitor access sites have been developed at Dworshak and on the Lower Clearwater River. Recreation on Dworshak is primarily a summer activity while the Clearwater River is nationally known for excellent fall and winter steelhead fishing.

2.7.8.2 Aesthetics

Dworshak Reservoir winds through remote, forested foothills of the Bitterroot Range. The reservoir generally ranges from 0.5 to 1 mile wide. Views from the water and the shoreline are of the reservoir itself and the adjacent foothills. Views up and down the reservoir range from 1 to 5 miles (1.6 to 8 km).

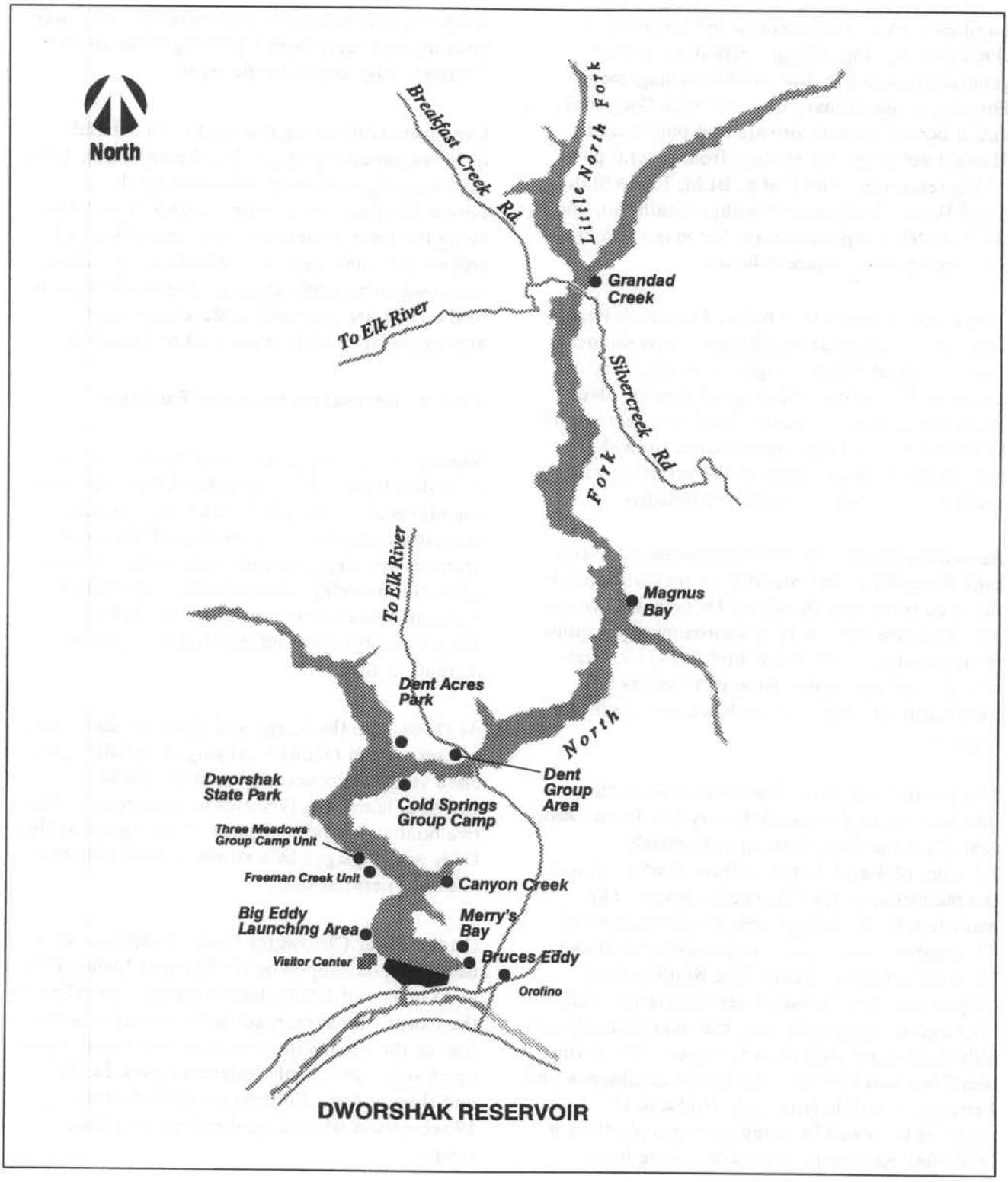


Figure 2–25. Map of Dworshak Lake

Land uses on and adjacent to the reservoir include forestry, log rafting, recreation, power generation, and fish and wildlife management. Forestry is the primary land use near Dworshak, and it occurs on both private and public land. Harvest activities are evident from several parts of the reservoir. The USFS, BLM, Idaho State Land Board, Burlington Northern Railroad, and the Potlatch Corporation are the major owners and managers of adjacent lands.

There are no roads that follow Dworshak Reservoir for any appreciable distance. Several local roads, most of which are gravel or dirt, provide access to Dworshak. Most go to specific places along the reservoir, usually developed recreational facilities. Viewing opportunities from shore are limited to those areas of the reservoir with roaded access and/or developed facilities.

Recreationists are the primary viewers of Dworshak Reservoir. The majority of recreationists in the area travel specifically to Dworshak to recreate. Because Dworshak is approximately 4 miles from the area's only major highway (U.S. Highway 12) and not visible from it, travelers not specifically driving to Dworshak can not see the reservoir.

The North Fork of the Clearwater River flows into and out of Dworshak Reservoir. From Dworshak Dam the river flows approximately 1.5 miles (2.4 km) to the southwest where it joins the mainstem of the Clearwater River. The mainstem flows through very scenic sections of Clearwater Canyon and merges with the Snake River at Lewiston, Idaho. The winding river canyon and steep hillsides restrict views within the canyon. Generally only the river and adjacent hillsides can be seen from the river. The mainstem Clearwater River between the confluence and Lewiston is visible from U.S. Highway 12. As a result, it is viewed by many more people than is Dworshak Reservoir. Viewers include local residents, recreationists, and travelers. Highway turnouts and recreational parking areas allow relatively easy access to the river.

Land ownership along the river is mixed and includes ownership by the Nez Perce Indian Tribe, the Federal government (managed by the U.S. Forest Service), and private entities. Land uses along the river include forestry, recreation, fish and wildlife management, agriculture, industry, and residential development. The lands adjacent to the river are generally undeveloped until approximately 5 to 10 miles east of Lewiston.

2.7.8.3 Recreation Sites and Facilities

Numerous recreation sites and facilities have been developed along the lower Clearwater River corridor and on the public land surrounding Dworshak Reservoir. A number of different agencies and organizations have been instrumental in the planning, construction, and maintenance of these recreation areas and sites. Table 2–28 provides information on specific recreation sites.

At Dworshak, the Corps and State of Idaho manage recreation facilities ranging from fully developed vehicle access camping areas, picnic areas, and boat launching facilities to numerous primitive boat access mini–camps. The marina at Big Eddy was damaged by a storm in June 1992 and has not operated since.

On the lower Clearwater River, recreation sites have been developed by the State of Idaho (Fish and Game and DOT), local counties, the NPS and the Corps. Most recreation sites along this section of the Clearwater River are not highly developed and provide only toilet and trash facilities and river access. Approximately half of the 19 recreation sites along the river have boat ramps.

Table 2–28. Dworshak Lake Recreation Sites and Facilities

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAM SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
Big Eddy	1	2				4				
Bruces Eddy		4								
Canyon Creek	1	1				2		12		
Dent Acres	1	3				6	1	50	50	1
Dworshak Visitor Center										
Freeman Creek–Dworshak State Park	1	2			3	25	1	92	52	3
Grandad Creek		1								
Merrys Bay						3				
Mini–Camps								76		4
Powerhouse Road and N.F. River										
Three Meadows Group Camp										
Viewpoint #2										
TOTAL	**4**	**13**	**0**	**0**	**3**	**40**	**2**	**230**	**102**	**4**

2.7.8.4 Major Activities

Recreation use in this subregion includes both overnight and day–use activities. On the lower Clearwater River, fishing is by far the major recreation activity. Over 80 percent of the visitation on this section of river occurs during steelhead season, which runs from October to April. Boating use during the steelhead season is high, but this activity is in conjunction with fishing use. During the summer season, uses on the Clearwater River include sightseeing, power boating, trout fishing, swimming, camping, and rafting. The Clearwater Recreation Survey (Krump, 1987) found that 74 percent of the recreation users on the Clearwater River were from Idaho and 37 percent of those were from the local area.

Along the lower Clearwater River, summer use of the river for rafting, tubing (floating the river on an inner tube) and swimming is increasing. Traditionally summer is the season of lowest use on this section of the Clearwater, due to the high numbers of fall and winter steelhead anglers. A continued increase

in summer usage will bring additional impacts to the recreation sites along the river.

For those visitors interested in history, human use in the corridor extends from the earliest Native American settlement to pre–European contact with Nez Perce communities, to early Euro–American explorations, including the Lewis and Clark Expedition, to the gold mining boom of the late 19th century. At several sites, interpretation of the Nez Perce presence along the river is provided by the NPS as part of that agency's Nez Perce Parkway.

Located near the confluence of the North Fork of the Clearwater River and the main fork of the Clearwater are the Dworshak National Fish Hatchery and the Clearwater Fish Hatchery. The former is operated by the USFWS, the latter by Idaho Department of Fish and Game. Interpretive facilities at both hatcheries provide visitors with information on the purpose for the hatchery and how it operates.

2.7.8.5 Visitor Use

Table 2–29 shows visitor use at Dworshak Lake from 1987 through 1993. There is no current, consolidated visitor use data available for the Clearwater River.

Recreation use at Dworshak Lake is more varied than on the Clearwater, and the significant recreation season occurs during the summer months. Sightseeing, boating, fishing, camping, and picnicking are the most popular recreation activities at Dworshak. In the summer, water–contact activities, including swimming and water skiing, are very popular and become an important part of the recreation mix on the reservoir. In the fall months, sightseeing, fishing, and hunting are the recreation activities most common on the lake and the surrounding public land. Recreation surveys by the Corps in the mid–1980's indicated that the majority of visitors to Dworshak were from within a 100–mile radius of the lake.

The lake has a regionally important fishery. Kokanee are currently the most sought after game fish species and are known for their large size in Dworshak Lake relative to other lakes and reservoirs in Idaho. Other sports species include rainbow trout, bull trout and smallmouth bass. The bass population appears to be healthy and has increased over time.

Table 2–29. Dworshak Lake Visitation Summary, 1987–1991.

CORPS OF ENGINEERS AND IDAHO STATE PARKS RECREATION SITES								
MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
Jan	3.0	3.5	6.2	6.5	4.8	5.8	4.5	4.9
Feb	3.8	5.2	8.8	7.3	7.7	9.0	8.2	7.1
Mar	7.8	9.1	13.1	14.8	13.7	15.6	18.7	13.3
Apr	9.0	5.4	12.8	14.4	14.7	16.4	15.1	12.5
May	19.4	20.8	19.9	18.4	20.5	24.6	27.6	21.6
Jun	26.3	38.3	29.4	31.5	39.9	42.4	48.3	36.6
Jul	40.2	30.1	50.5	42.5	45.6	52.5	42.7	43.4
Aug	22.8	26.7	46.5	33.4	46.8	34.7	43.2	36.3
Sep	7.9	7	15.4	12.9	19.0	16.1	19.8	14.0
Oct	4.7	8.2	8.2	6.7	10.3	10.7	19.8	9.8
Nov	3.4	3.9	3.9	5.8	6.9	6.2	6.7	5.3
Dec	2.5	6.5	6.5	4.7	7.1	5.8	5.8	5.6
TOTAL	**150.8**	**164.7**	**221.2**	**198.9**	**237.0**	**239.8**	**260.4**	**210.4**

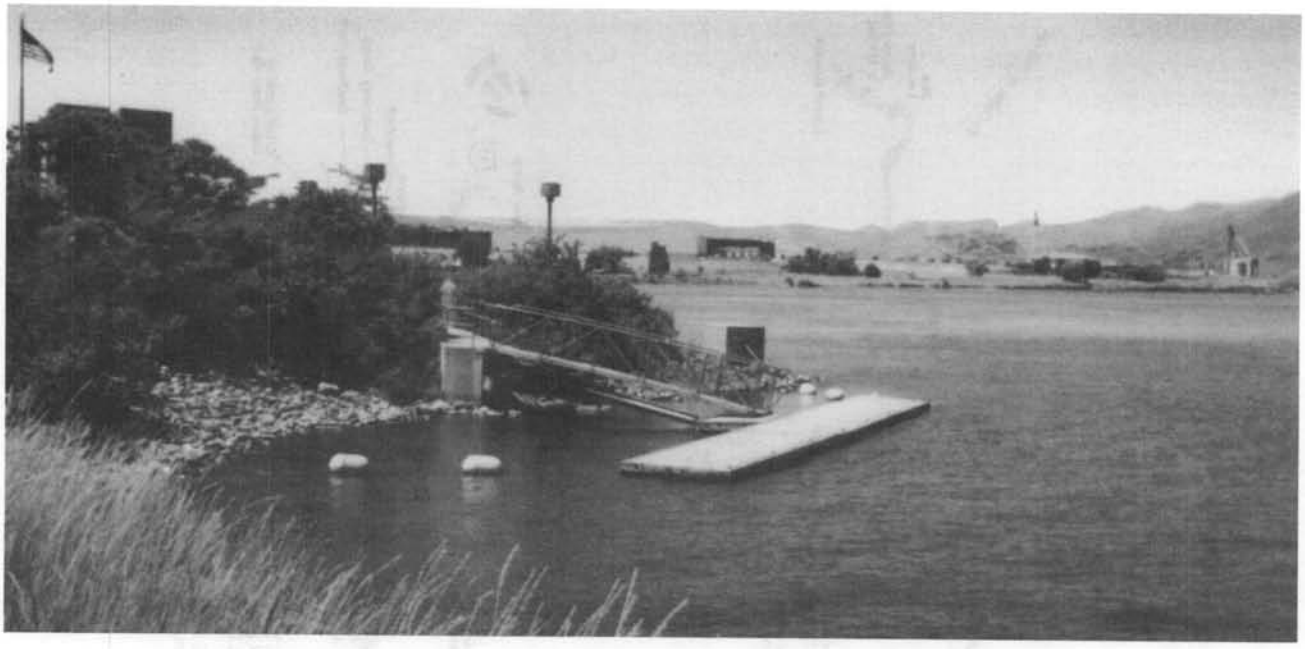


Figure 2–26. Lewiston Levee at Lower Granite Lake

On Dworshak, the boat access mini–camps provide a unique recreation opportunity for lake visitors. At the Dworshak Visitor Center, visitors find information on the recreation opportunities at the lake and the surrounding region, the history of the region, and details on construction and operation of Dworshak Dam. Visitors may also tour the dam and powerhouse.

2.7.9 Lower Snake River Subregion (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Projects)

2.7.9.1 Overview

This subregion includes the four Corps run–of–river projects on the lower Snake River between its confluences with the Clearwater and Columbia Rivers. The projects are Ice Harbor (Lake Sacajawea), Lower Monumental (Lake West), Little Goose (Lake Bryan), and Lower Granite (Lower Granite Lake) (Figure 2–27). This region includes approximately 140 total river miles (225 km), including the Snake and part of the Palouse and Tucannon Rivers. The major portion of this river subregion is located in the narrow gorge formed by the Snake River and is characterized by basalt cliffs and steep talus slopes. The climate is characterized by relatively low precipitation, wide temperature variations, low humidity, high evaporation, and abundant sunshine. Trees are scarce, and the vegetative cover consists mainly of grasses, forbs, and low shrubs.

Population density in the immediate area of the lower Snake River corridor is low. The major population centers in the region are located at the extreme west and east ends of the river corridor. The Tri–Cities area, with a combined population of 120,000 in Richland, Kennewick, and Pasco, lies within a 25 mile driving distance of Lake Sacajawea on the Columbia River. At the opposite end are the two communities of Lewiston and Clarkston with a combined population of 40,000. These towns are typical to the region, having an agricultural socio–economic base generated largely by the surrounding wheatlands and forests.

The steep, rugged character of the Snake River Canyon has limited both the recreational development and road access to the water. A large part of the river corridor is currently inaccessible by road. Because of the limited public land base in the region, the majority of the recreational demand is water oriented, and comes from within a 100–mile radius of the river corridor.

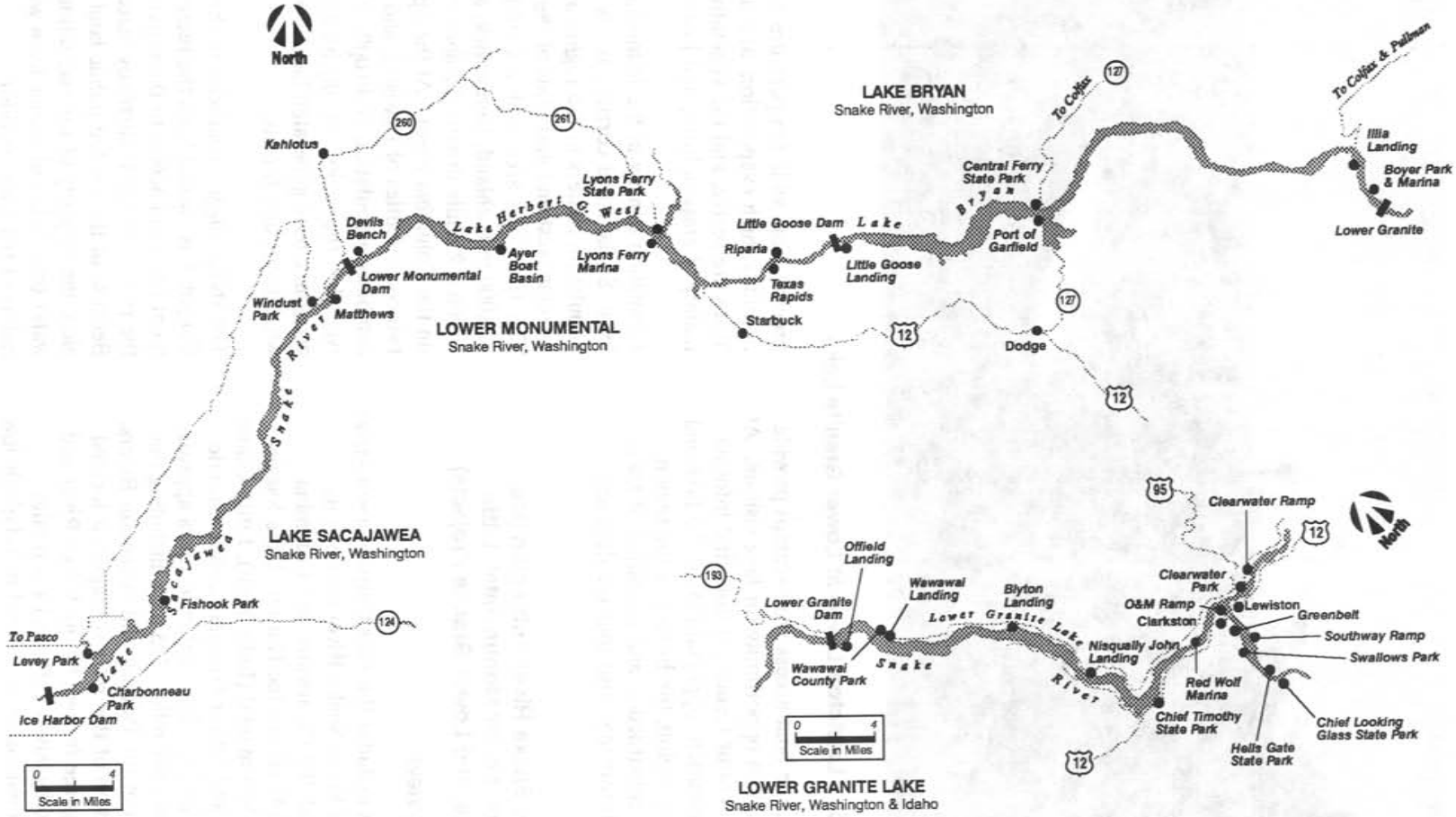


Figure 2–27. Lower Snake River

The most popular recreation activities are day–use activities: swimming, picnicking, boating, fishing, and sightseeing. Camping and hunting account for a smaller percentage of the total recreational use primarily due to the lack of appropriate facilities and limited access. Recreational use is very seasonal with the high–use period during the summer months and lower use during the remaining three seasons.

2.7.9.2 Aesthetics

The lower Snake River passes through the Blue Mountains and Columbia basalt plain of Oregon and Washington. The landscape in the western, downstream end of the subregion is characterized by low hills covered with steppe vegetation. Upstream in the central and eastern sections of the subregion, the river valley is deeper as the side walls of the canyons rise from between 200 to 2,000 feet above the reservoirs. The steep, rugged buttes and canyon walls framing the reservoir are the dominant landscape features in the central and eastern sections of the subregion. Views within the river valley are contained by the steep hillsides that form the walls of the canyon. Due to the twisting nature of the river valley, views within the valley rarely extend beyond 2 to 3 miles (3 to 5 km). Reservoir pool width generally varies from 1 to 1.25 miles (1.6 to 2 km).

Land uses near and adjacent to the project pools include agriculture, port facilities, recreation, and residential. Development near the reservoirs is fairly intensive at the eastern and western ends (Lewiston–Clarkston and the Tri–Cities, respectively). Parks, marinas, and housing developments adjacent to the river create a suburban/urban character in places. By contrast, the remote interior portions of the subregion are less developed and relatively difficult to access.

With two exceptions, the lower Snake projects are not visible for any great length from major roads or highways. Wawawai River Road (a county highway) and State 193 follow the north side of Lower Granite, and U.S. 12 follows Lower Granite approximately 7 miles (11 km) on the south side from Clarkston to Silcott. Near Pasco, U.S. 12 crosses the river again and offers views of the river near it's confluence with the Columbia. The river is also crossed in six locations (including at all four dams) by state or county highways.

Most viewers of the projects are recreationists using the projects; local residents, primarily of Lewiston–Clarkston and the Tri–Cities, and travelers on U.S. 12 at either end of the lower Snake reach.

2.7.9.3 Recreation Sites and Facilities

The Corps manage both sides of the river from the Tri–Cities, Washington, to Lewiston, Idaho. Recreation facilities on the Snake River vary from full–service state parks to primitive boat launching areas. These areas are primarily water oriented and are developed where public roads come down to or cross the river. Developed facilities in this subregion include 28 boat ramps and 11 swimming beaches. Development on the shoreline is designed to be usable during the full range of the operating pool, normally five feet or less. A large number of the recreation sites are leased to state and local entities for operation and maintenance. Specific site information is available in Table 2–30.

Due to the rural agricultural nature of land ownership in southeastern Washington, northeastern Oregon, and northern Idaho, the majority of the developed recreation facilities in this region are located on the Snake River corridor, on public land managed by the Corps. These facilities are an important economic as well as recreational resource to the region. The operation of the Snake River dams and lakes may have a very significant impact on this recreation resource.

Table 2–30. Lower Snake River Recreation Facilities

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
**PROJECT: LOWER GRANITE DAM AND LAKE										
Blyton Landing		1								
Chief Looking Glass Park	1	2				4				
Chief Timothy State Park	2	4				32		33	33	
Clearwater Park										
Clearwater Ramp	1	2								
Greenbelt Ramp		2								
Hells Gate State Park	1	6				60	1	93	64	
Lewiston Leree Parkway						4				
Lower Granite Dam						4				
Nisqually John Landing		1								
Offield Landing		1								
Red Wolf Marina	1	1				6				
Southway Ramp	1	2								
Swallows Park	2	6				22				
Wawawai County park						10	2	9		
Wawawai Landing		1								
SUBTOTAL	9	29	0	0	0	142	3	135	97	0
**PROJECT: LOWER MONUMENTAL DAM/LAKE WEST										
Ayer Boat Basin	1	2				2	2			
Devils Bench										
Lower Monumental Dam	1	2				3				
Lyons Ferry Marina	1	1				4		43	18	
Lyons Ferry State	1	2				19		52		
Riparia										
Texas Rapids	1	1				4				
SUBTOTAL	5	8				32	2	95	18	
**PROJECT: LITTLE GOOSE DAM/LAKE BRYAN										
Boyer Park & Marina	1	3				16		28	28	
Central Ferry State Park	1	4				30		62	30	
Garfield County	1	2								
Illia Dunes										
Illia Landing		1				2				

Table 2–30. Lower Snake River Recreation Facilities – CONT

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
Little Goose Dam						3				
Willow Landing	1	1				2				
SUBTOTAL	4	11				53		90	58	
**PROJECT: ICE HARBOR/LAKE SACAJAWEA										
Big Flat										
Charbonneau Park	1	2				88	1	54	54	1
Fishhook Park	1	2				72	1	101	42	
Hollebeke										
Ice Harbor Dam	1	2				3				
Lake Emma										
Levey Park	1	1				123	1			
Lost Island (Votau)										
Matthews										
Walker										
Windust Park	1	1				32		28		
SUBTOTAL	5	8				318	3	183	96	1
TOTAL	**23**	**56**	**0**	**0**	**0**	**545**	**8**	**503**	**269**	**1**

2.7.9.4 Special Recreation

Visitor centers are available at all the Corps dams on the Snake River. These centers generally include information on power production, navigation, archaeology, geology of the canyons, history of the river, recreation opportunities, and fish transportation and passage facilities. There is a fish hatchery at Lyons Ferry operated by the State of Washington that has interpretive facilities.

2.7.9.5 Major Activities

The most popular forms of recreation in this river subregion are day–use related. Sightseeing, picnicking, boating, swimming, fishing, and camping is the ranking of preference. Demand for camping is low because of the lack of developed facilities, the limitations of the road network, and the attractiveness of higher elevation camping during the warmer summer months. Very few of the existing campgrounds are on a major highway, and they are used primarily by the local population living within 100 miles.

Because of the hot, dry summers, swimming is a very important seasonal activity. The swimming facilities available are all developed on the river banks and are very dependent on the lake elevation. At minimum operating pool, most of the swimming beaches are not usable and support facilities are long distances from the water. There are some excellent natural beaches in the mid–section of the river; however, very few support facilities have been provided at these areas.

Day–use activities are primarily centered around the developed, landscaped, and irrigated recreation areas. Areas without irrigation are used more heavily in the early spring and fall, when the weather is milder. In this subregion, where there are few native shade trees, summer is too warm for much extended recreational use in undeveloped areas with little shade structure.

2.7.9.6 Visitor Use

Table 2–31 shows visitor use to the lower Snake River projects from 1987 to 1993. Lower Granite Lake supports approximately 60 percent of the total use of the four projects combined, reflecting its proximity to the Lewiston/Clarkston population center. Ice Harbor project receives the next highest use due to its proximity to the Tri–cities area. Lower Monumental and Little Goose projects are relatively inaccessible to major population centers and, consequently, support low levels of visitor use.

Table 2–31. Lower Snake River Visitation Summary; 1987–1993

	VISITORS (x 1,000)							
MONTH	1993	1992	1991	1990	1989	1988	1987	AVG
LOWER GRANITE LOCK & DAM / LOWER GRANITE LAKE								
Jan	42.4	65.7	95.5	70.2	39.2	62.3	40.3	59.4
Feb	68.5	82.7	89.4	82.4	37.8	69.7	52.4	69.0
Mar	112.3	197.3	14.5	109.9	84.7	75.9	89.2	97.7
Apr	116.7	125.8	130.1	118.7	99.9	108.3	100.1	114.2
May	174.2	183.1	160.1	161.5	129.0	164.3	98.1	152.9
Jun	195.5	304.0	211.6	273.0	187.1	171.9	176.7	217.1
Jul	232.0	227.6	228.7	200.2	203.6	107.5	190.3	198.6
Aug	251.6	236.5	294.1	224.0	167.5	173.7	160.2	215.4
Sep	169.9	129.5	152.7	99.3	158.9	71.7	125.7	129.7
Oct	142.5	149.5	149.5	99.5	132.1	76.5	86.9	119.5
Nov	103.0	93.6	93.6	104.6	123.5	80.6	82.2	97.3
Dec	47.9	71.4	71.4	70.4	59.3	46.8	46.6	59.1
Subtotal	**1656.5**	**1866.7**	**1691.2**	**1613.7**	**1422.6**	**1209.2**	**1248.7**	**1529.8**
LOWERMONUMENTAL & DAM / LAKE BRYAN								
Jan	3.0	3.3	3.8	3.0	5.7	3.7	7.3	4.3
Feb	3.7	6.0	5.5	2.5	4.2	6.7	4.5	4.7
Mar	3.2	3.3	3.8	3.2	5.1	4.8	4.8	4.0
Apr	9.6	7.6	9.4	8.9	10.4	11.6	13.9	10.2
May	18.1	13.8	14.4	14.7	15.4	15.1	15.8	15.3
Jun	20.2	23.1	22.5	19.8	20.0	22.1	19.3	21.0
Jul	23.6	22.2	19.4	23.2	21.9	28.8	18.5	22.5
Aug	23.1	17.8	24.0	17.4	21.8	34.3	31.2	24.2
Sep	15.6	16.1	16.9	16.6	16.0	14.9	16.6	16.1
Oct	9.6	7.6	7.6	5.7	5.0	9.0	9.6	7.7
Nov	5.7	4.8	4.8	3.6	3.4	6.5	12.2	5.9
Dec	5.1	3.9	3.9	2.3	2.4	3.8	3.8	3.6
Subtotal	**140.5**	**129.5**	**136.0**	**120.9**	**131.3**	**161.3**	**157.5**	**139.6**
LITTLE GOOSE LOCK & DAM / LAKE WEST								
Jan	3.8	4.6	3.2	6.1	4.6	3.1	5.8	4.5
Feb	3.5	4.9	4.8	4.4	4.1	4.7	5.5	4.6
Mar	9.1	22.7	8.5	8.2	7.6	2.6	8.0	9.5
Apr	12.8	21.3	16.3	9.2	22.9	23.1	21.0	18.1
May	34.6	30.7	18.9	20.9	25.8	30.0	27.7	26.9
Jun	44.5	45.2	32.8	33.1	37.4	51.8	38.3	40.4
Jul	35.8	44.4	35.9	37.0	47.9	83.0	39.7	46.2
Aug	42	33.5	41.4	38.3	37.4	68.8	44.8	43.7
Sep	26.2	27.1	17.2	15.6	26.3	22.0	22.3	22.4
Oct	17.6	11.8	11.8	8.4	7.5	13.1	12.8	11.9
Nov	15.4	7	7.0	6.4	6.7	15.8	10.4	9.8
Dec	4.8	5	5.0	3.7	4.1	5.9	5.9	4.9
Subtotal	**250.1**	**258.2**	**202.8**	**191.3**	**232.3**	**323.9**	**242.2**	**243.0**

Table 2–31. Lower Snake River Visitation Summary; 1987–1993 – CONT

MONTH	VISITORS (x 1,000) 1993	1992	1991	1990	1989	1988	1987	AVG
ICE HARBOR LOCK & DAM / LAKE SACAJAWEA								
Jan	4.5	3.7	4.3	5.2	7.5	6.3	4.8	7.3
Feb	5.7	10.5	4.9	3.9	5.2	17.1	6.0	10.7
Mar	35.8	27.8	39.5	22.3	17.1	12.3	16.5	34.3
Apr	25.8	46.2	25.9	33.3	36.1	39.7	29.9	47.4
May	69.6	59.3	57.5	51.8	48.8	49.0	71.7	81.5
Jun	62.9	100.1	101.5	79.4	73.3	91.2	78.2	117.3
Jul	143.3	116.7	79.3	106.3	102.1	84.0	104.2	147.2
Aug	96.9	88.2	102.3	87.1	98.4	82.6	101.8	131.5
Sep	33.9	29.6	53.7	26.9	34.9	33.3	33.5	49.2
Oct	24.5	18.5	18.5	18.1	19.1	27.2	13.7	27.9
Nov	10.3	8.8	8.8	8.5	5.9	9.0	6.7	11.6
Dec	11	6.6	6.6	3.6	5.9	6.9	5.9	9.3
Subtotal	**524.2**	**516.0**	**502.8**	**446.4**	**454.3**	**458.6**	**472.9**	**675.0**
Total	**2571.3**	**2770.4**	**2532.8**	**2372.3**	**2240.5**	**2153.0**	**2121.3**	**2587.4**

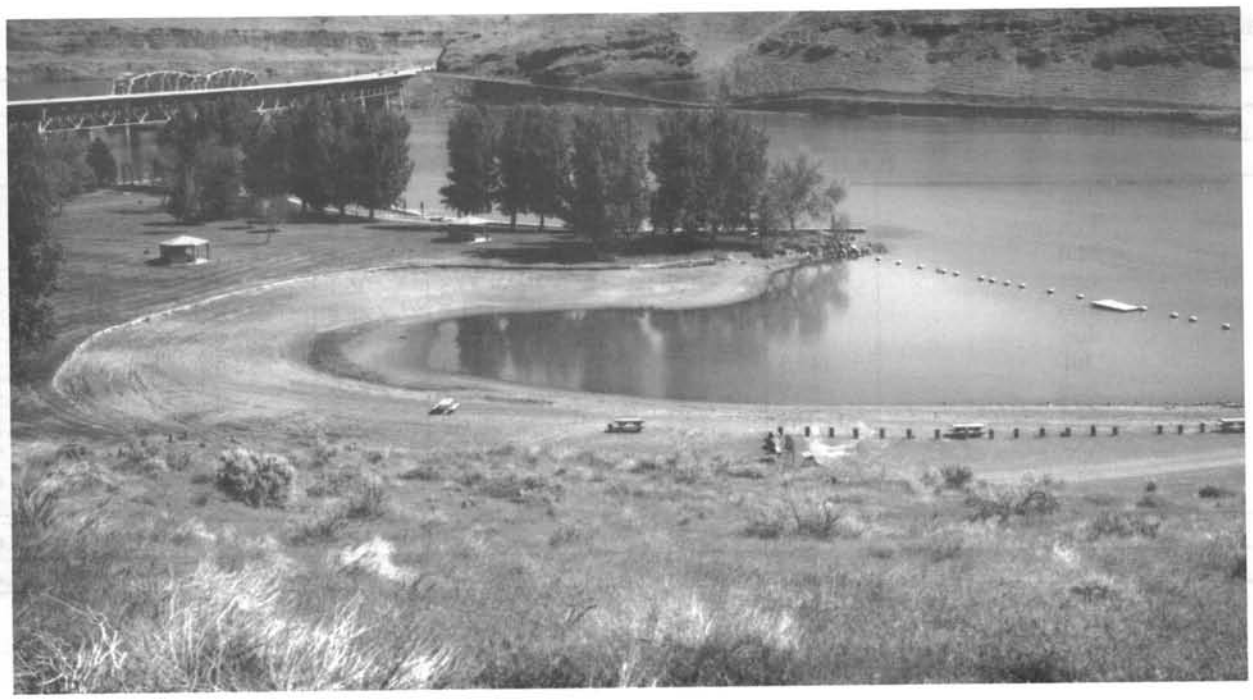


Figure 2–28. LePage Park at the mouth of the John Day River

2.7.10 Lower Columbia River Subregion (McNary, The Dalles, John Day, and Bonneville Projects, and Columbia River below Bonneville Dam)

2.7.10.1 Overview

This subregion encompasses the four Corps run–of–river reservoir projects on the lower Columbia River, including McNary (Lake Wallula), John Day (Lake Umatilla), The Dalles (Lake Celilo), and Bonneville (Lake Bonneville) Projects. Also included in this region is the Columbia River below Bonneville Dam (Figure 2–29). A large percentage of the water surface area in the region available for recreational use is contained in the impoundments behind the four Columbia River dams.

The scenic and recreational amenities of the lower Columbia River have gained national and international renown. In recognition of those amenities, Congress created the Columbia River Gorge National Scenic Area (CRGNSA) in 1986.

Interstate 84 in Oregon and Washington State 14 parallel the river providing direct access to its amenities. National and international travelers, residents from the metropolitan Portland and Tri–Cities, and residents of Hood River, The Dalles and other local communities create a significant demand for water–related recreation along Lakes Wallula, Umatilla, Celilo, and Bonneville. Those highways constrain development of additional facilities to meet future public demand.

The most popular form of recreation in the region is scenic driving. The highways provide access to majestic vistas of natural features such as forests, mountains, cliffs, rivers and streams, and waterfalls. Many visitors are attracted to impressive constructed features such as Bonneville and The Dalles Dams, fish hatcheries, and fish ladders, which are also popular visitor attractions. The region is also rich in history and prehistory. Features such as Native American petroglyphs, the route of the Lewis and Clark Expedition and the Oregon Trail, and historic navigation locks can be viewed and interpreted.

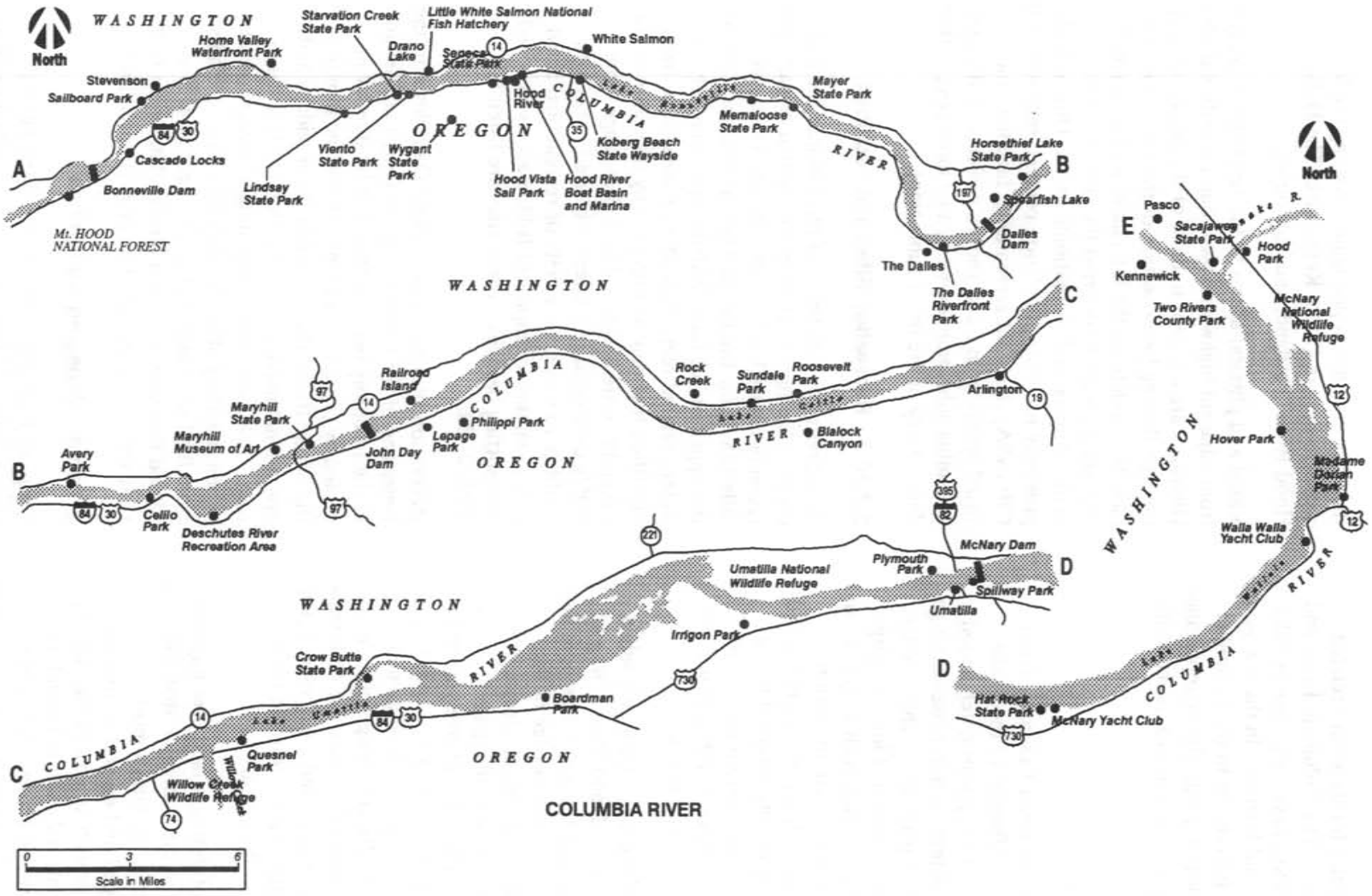


Figure 2–29. Map of Lower Columbia River

The region is also popular for its water–related recreation opportunities. The Columbia River and adjacent streams and lakes have long been popular for fishing, swimming, and boating. In the few years since windsurfing was introduced to the Columbia River gorge, it has grown dramatically in importance as a recreation activity and as a source of economic growth.

2.7.10.2 Aesthetics

The eastern section of the lower Columbia River subregion starts at the confluence of the Snake River and continues west to approximately Hood River, Oregon. The eastern section passes through the arid Columbia basalt plain and is characterized by cliffs and rock outcroppings that line the gorge interspersed with arid vegetation such as grasses and sage brush. The gorge in the eastern section is sufficiently deep that views from the reservoirs and adjacent highways are generally confined to the gorge. The reservoirs in the eastern section are generally from 1 to 2 miles wide, although parts of Lake Umatilla are as wide as 5 miles.

The western section of the lower Columbia subregion starts at approximately Hood River, Oregon, and continues west through the South Cascades and the CRGNSA to the northeastern edge of the Willamette Valley, and to the Pacific Ocean. The Columbia Gorge section of the subregion is characterized by high, steep, sidewalls, relatively narrow reservoir pool widths (1 to 3 miles) and lush, tree–covered slopes. Views are generally contained within the gorge by the adjacent topography. West of the foothills of the South Cascades, the Columbia River Valley becomes broader and much more open. The free flowing Columbia flows through the wide valley as it continues to the ocean.

There are a number of different land uses adjacent to the four reservoirs in this subregion that influence their aesthetic character. Although most of the shoreline is undeveloped and natural in appearance, there are adjacent uses such as agricultural, urban, recreational, residential, and wildlife habitat, that influence visual quality and access. A number of communities are located adjacent to the river between stretches of undeveloped lands. Among the larger communities are Pasco, Kennewick, The Dalles, Hood River, Portland, and Vancouver.

Visual and physical access to the reservoirs is plentiful from adjacent highways, towns and recreational sites. Highways are adjacent to most of the reservoirs and the free flowing lower section of the river. Viewers include travelers on the interstates and local roads that are adjacent to or cross the river, local residents, tourists, and recreational users. Due to their proximity to major population centers, reknown of the CRGNSA, abundant recreational facilities, and visual access from travel routes, projects on the lower Columbia subregion are viewed by more people than dams in any of the other subregions.

2.7.10.3 Recreation Sites and Facilities

To support the high levels of recreational use that occur in the region, an extensive system of parks and recreation sites has been developed. From river mile 125 below Bonneville Dam to river mile 350 at the upper end of Lake Wallula, approximately 75 water–related recreation sites or areas have been identified that may be impacted by operation of the Columbia system dams. These sites range from highly developed and intensively used parks with facilities to support a variety of recreational activities, to minimally improved fishing access sites and windsurfing beaches. These sites are listed in Table 2–32.

Recreation sites below Bonneville Dam down to the lower end of the Columbia River Gorge are included in the inventory because they may be directly impacted by project operations. Below the mouth of the Sandy River, the Columbia River widens and operational impacts on recreation are less significant. There are many other upland recreation sites within the study area, but they have been excluded from further analysis in this EIS because it is assumed that sites without a direct relationship to the river will not be impacted by project operations.

2.7.10.4 Managing Authorities

Corps of Engineers. The Corps is the Federal agency primarily responsible for providing recreation

facilities on lakes Bonneville, Celilo, Umatilla, and Wallula. Visitor facilities, including visitor centers, viewpoints, and fishing access sites are located at all four of the dams. The Corps also cooperates with Oregon and Washington state park departments and a variety of other local entities such as counties, cities and port districts, to build and manage a system of water–related recreation facilities, including boat ramps, swimming beaches, marinas, campgrounds, picnic areas, and interpretive sites

U.S. Forest Service. USFS is the major land management agency in the Columbia Gorge; Mount Hood and Gifford Pinchot National Forests encompass the gorge on the Oregon and Washington sides, respectively. The USFS administers 15 recreation sites within the Columbia Gorge National Scenic Area. Most of the USFS recreation areas are located at upland sites and are related to forest recreation, including campgrounds, picnic areas, trails and trailheads, viewpoints, and historic and prehistoric sites.

2.7.10.5 Special Recreation, Preservation and Natural Resource Areas

Much of the land along the mid–Columbia River adjacent to Lakes Bonneville, Celilo, Umatilla, and Wallula are dedicated natural resource preservation and management areas. These lands are managed by Federal and state agencies for natural resource values. In addition to supporting some of the developed recreation sites described above, these lands are also available for dispersed and low–density recreation activities consistent with other resource management objectives.

Columbia River Gorge National Scenic Area. In 1986, Congress created the CRGNSA. It covers 253,500 acres (102,600 hectares) along both sides of the Columbia River, encompassing Lake Bonneville and Lake Celilo up to the mouth of the Deschutes River. The CRGNSA has two primary purposes: 1) to protect and enhance the scenic, cultural, recreational, and natural resources of the Gorge, and 2) to protect and support the economy of the Gorge by encouraging growth to occur in existing urban areas.

The Scenic Area Act creates a partnership among the six counties within the Columbia River Gorge (Clark, Skamania, and Klickitat in Washington and Multnomah, Hood River, and Wasco in Oregon), a bi–state Commission, and the USFS. Each partner has important but different responsibilities in the Scenic Area. Together these agencies provide the overall coordination and management to achieve the purposes of the Act.

CRGNSA is divided into three types of management areas: Urban, General Management, and Special Management Areas. The thirteen communities in Oregon and Washington within the Scenic Area are designated as Urban Areas and are exempt from most aspects of the legislation. The Scenic Area Act allows for a variety of land uses and activities in the General Management Areas while the Special Management Areas are generally the most environmentally sensitive or scenic, and activities are more restricted. All Federal lands administered by the Corps within the CRGNSA are within the General and Urban Area zones.

The Management Plan for Special Management Areas within the CRGNSA identify the following goal pertaining to recreation:

"Ensure that all recreation development protects the scenic, cultural, and natural resources".

The plan presents recreation policies and guidelines for implementing this goal. These guidelines need to be factored into the formulation of policy and management plans for Bonneville and The Dalles Lands.

Wildlife Refuges. This category includes both federally and state managed areas which have been set aside to manage, conserve, preserve, and enhance fish and wildlife resources. These areas are generally located along the Columbia River and are especially important in the management of migratory waterfowl. These areas generally have some facilities such as access, parking, trails, and boat ramps that support generally dispersed public use consistent with fish and wildlife objectives. Most of the numerous state and Federal fish hatcheries along the

river also allow public access and provide facilities to promote and interpret their missions.

Umatilla National Wildlife Refuge, located along both sides of Lake Umatilla near its upper end, is administered by the USFWS. The refuge is managed for public use; there are several developed public access points with parking, restrooms, trails, interpretive displays, small boat ramps, and waterfowl blinds. The refuge is very popular for waterfowl hunting. Other activities include, fishing, boating, hiking, and wildlife viewing.

State Wildlife Areas and Habitat Management Areas, managed by the ODFW along the mid–Columbia River include Irrigon, Willow Creek, and McNary Management Areas. WDW management areas include Klickitat and Shillapoo. Many of these lands are licensed from the Corps, which also manages specially designated lands along all three lakes for fish and wildlife purposes.

Lands along the Oregon side of the Columbia River and north of the railroad tracks from Celilo to Boardman fall within the state's Columbia River Refuge. Washington has a corollary refuge extending from Wishram to the Klickitat County line. Hunting on these lands is controlled primarily to protect nesting waterfowl. Pierce Island is owned and managed as a natural area by the Nature Conservancy.

Wild and Scenic Rivers. The purpose of Federal and Oregon and Washington state wild and scenic rivers programs is to maintain rivers in a free flowing state, maintain and protect and enhance existing scenic/recreation values, and to make these values accessible to the public. The CRGNSA Act designated a portion of the Klickitat River as a Recreation River, and a portion of the White Salmon River as a Scenic River. Other portions of these two rivers are under study as candidates for wild and scenic river designation. The Klickitat River and the Wind River are potential Washington State Wild, Scenic, or Recreation Rivers. The Oregon Scenic Waterways Act, passed by Congress in 1989, designated segments of the Sandy, Deschutes and John Day Rivers as Federal Wild and Scenic rivers.

BLM Special Management Areas. Lands under this category include Areas of Critical Environmental Concern (ACEC), Research Natural Areas (RNA), and Outstanding Natural Areas (ONA) inventoried by the BLM. ACECs are areas where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, natural resources and systems, or to protect life and provide safety from natural hazards. RNAs contain plant communities and other natural features that are preserved for scientific and educational purposes. ONAs have unusual natural characteristics and management of recreational activities is necessary to reserve those characteristics. Special Management Areas along the mid–Columbia River include the Horn Butte Curlew Area, Governor. Tom McCall Preserve at Rowena (managed by the Nature Conservancy), Botanical and Scenic Areas within the Columbia River Gorge, the Deschutes and John Day River Canyons, and the Yakima and Columbia River Islands (Lake Wallula).

National Trails. The National Trails System Act of 1968 established a system of national, recreational, scenic, and historic trails. The Pacific Crest National Scenic Trail, which transverses the United States from Mexico to Canada passes through both National Forests in the study region and crosses over the Columbia River via Bridge of the Gods at Cascade Locks. The Lewis and Clark National Historic Trail parallels the Columbia River through the study region.

2.7.10.6 Major Activities and Use Areas

Driving for Pleasure and Sightseeing. The most popular form of recreation in the region is scenic driving. Interstate Highway 84 and the old Columbia River Scenic Highway in Oregon, and Washington State 14 provide access to majestic vistas of natural features such as forests, mountains, cliffs, rivers and streams, and waterfalls. The study region has innumerable parks, rest areas, and viewpoints available to view these scenic amenities. Multnomah Falls is the most popular visitor attraction in Oregon.

Many visitors are attracted to impressive features such as Bonneville, The Dalles, John Day, and McNary dams. Each of these project areas have

visitor centers, fish hatcheries, fish ladders, and other facilities designed to interpret project operations and purposes for visitors. An annual average of 32.6 percent of all visitors to Corps recreation sites on the mid–Columbia River participate in sightseeing (Corps NRMS data, 1987–1993).

Many historic and prehistoric features are located along the shoreline of the Columbia River, including the Lewis and Clark Trail, evidence of the Oregon Trail and early pioneer settlement, and historic engineering features such as navigation locks and the Columbia River Highway. Petroglyphs and other artifacts provide evidence of the prehistoric importance of the region. Some of these cultural resources are inundated by the Columbia River lakes. Opportunities to view these features actually increase during low water periods. However, as access to these cultural resource sites improves, so do opportunities for illegal vandalism and artifact collection.

Fishing. Fishing is the second most popular recreational activity on the lower Columbia River lakes, contributing an annual average of 21.4 percent of visitor use to Corps recreation sites (Corps NRMS data, 1987–1993). In addition to occurring at the developed recreation sites described above, fishing takes place at numerous dispersed locations throughout the study region. The Columbia River recreational fishery for anadromous species, sturgeon, and more recently, walleye is of particular importance to management of Bonneville, The Dalles, and John Day projects. Where opportunities are unique or abundant, fishing has high seasonal impacts on local economies.

The mouths of Columbia River tributary streams, including the Deschutes, John Day, White Salmon, Little White Salmon, Wind and Klickitat Rivers, and Tanner Creek are particularly important recreational fishing sites. A number of the recreation facilities identified in Table 2–32 are located adjacent to these rivers and were provided largely to promote fishing access. The tailrace areas below Bonneville, The Dalles, John Day and McNary dams are important recreational fishery sites. Facilities have been provided by the Corps at each of these project areas to provide fishing access.

Along the entire length of the four projects are numerous small lakes separated from the main stem of the river by the railroad and highway embankments. Some of these are natural lakes and sloughs, others were formed by seepage between the railroad and highway embankments and the main stem of the river. These seep lakes fluctuate with the level of the Columbia River. Recreational fisheries, particularly warm water species such as bass, have developed in these lakes and provide important fishing opportunities, especially for local residents. At some of these lakes, including Horse Thief Lake, Drano Lake, Taylor Lake, Rock Creek Park and McNary Wildlife Park, facilities have been provided to promote fishing access. In addition, boat access is available from some of the lakes to the main stem of the river, particularly those formed at the mouths of small tributary streams. These lakes provide emergency "harbors of refuge" from high wind conditions that frequently occur along the Columbia River. The majority of these lakes remain undeveloped, however.

Windsurfing. The reason for the growth of windsurfing in the gorge is simple, the water and wind conditions are considered ideal for the sport. This activity yearly draws hundreds of thousands of participants. Tens of thousands of spectators have witnessed professional racing events. In 1990, the economic impact of windsurfing recreation to the area was estimated at 16.5 million dollars a year (Povey, 1990).

Due to climatic and geologic conditions, the wind is nearly always blowing somewhere in the gorge. In addition, the wind blows consistently in the 20 to 35 miles per hour (40 to 60 kph) range which is the best speed for windsurfing. Also, the wind generally blows from west to east, the opposite direction of the river current. Therefore, windsurfers do not have to struggle to return to beaches from where they started.

Experienced windsurfers indicate that higher flows in the river provide better, more exciting wave conditions. They prefer using the mainstem of the Columbia River while beginners and novices make use of sheltered embayments and coves. The increasing number of windsurfers on the water has resulted in one potential safety problem; conflicts

between windsurfers and commercial tugboat/barge traffic on the river.

Also, there are relatively few sites along the river that have the necessary land–base for windsurfers and spectators and there are few access points. In Oregon, popular windsurfing sites include Cascade Locks Park, Viento State Park, "The Hook" at Hood River, Hood River Marina Park, Koberg Beach State Park, Mayer State Park, Mosier, The Dalles Riverfront Park, Celilo Park, and Biggs Junction. In Washington, popular windsurfing sites include Stevenson, Home Valley Park, "Swell City," Spring Creek Fish Hatchery, Bingen, Doug's Beach, Horsethief Lake State Park, Avery, and Maryhill State Park.

Boating. The Oregon side of the river has more facilities to support boating use than does Washington. The majority of boating use occurs in the counties in the study region with larger urban populations. The huge boating numbers for Multnomah County reflect the population of the metropolitan Portland area. However, most of the Multnomah County boating use occurs below the mouth of the Sandy River and outside of the study region. Hood River, Wasco, and Umatilla Counties also have relatively high boating use, reflecting the populations of the cities of Hood River, The Dalles, and Umatilla, respectively.

There are approximately 60 individual boat ramps along the Columbia River and associated lakes within the subregion. These facilities range from paved, multiple lane ramps with courtesy docks and other support facilities, to minimally improved gravel launch sites. There are also approximately 75 parks and marinas within the subregion with temporary, seasonal, or year–round boat moorage facilities. Most of the communities along the Columbia River have at least one municipal boat marina to support recreational boating. Boating, along with fishing, has high seasonal impacts on local economies.

The majority of boating use within the study region, (61 percent) is associated with fishing. Waterskiing is the second most popular activity, (27 percent); high winds tend to constrain this activity. Other boating activities, including sailing and cruising, make up the balance of boating use. Most boating use on all four lakes is highly localized; boaters launch from marinas and boat ramps in the vicinity of where they would like to fish or ski and within that particular area. However, a small amount of upriver and downriver cruising between lakes does occur. Recreational craft can pass through navigation locks in the dams free of charge. In 1989, 634 recreational craft locked through Bonneville Dam.

Swimming. Approximately 8 percent of visitors to recreational areas at the four lower Columbia River projects participate in swimming. Compared with other activities, swimming has the potential to be more seriously impacted by project operations than other water–related activities due to the constraints of developed swimming beaches.

Almost all swimming in the Columbia River occurs during the summer months of June, July and August when water and air temperatures warm. There are approximately 25 developed swimming beaches at parks along the Columbia River within this subregion. A certain percentage of swimming also occurs at dispersed or unimproved beaches.

2.7.10.7 Visitor Use

Table 2–33 summarizes estimated visitation to the four Corps projects for the years 1987 through 1993. The source for the majority of those data is the Corps' Natural Resource Management System (NRMS). Under NRMS, visitation estimates are collected and stored for all developed recreation sites on Federal lands administered by the Corps. Where it is available, visitation data for non–Corps sites are included into the totals.

No visitation data are currently available for the dispersed, non–site specific recreational use that occurs at all of the lakes. For this reason, visitation statistics may underestimate the total use at these projects. The visitor statistics can be used, however, to identify general trends and relationships that occur at the four lakes.

As shown, the four projects combined received an average of approximately 5.56 million visitors annually over the period from 1987 to 1991. Bonneville Dam and Lake Bonneville were the most heavily used of the three. That use reflects the close proximity of Bonneville Dam to the large urban population of the Portland/Vancouver metropolitan area and the popularity of the Bonneville Dam visitor facilities; 47 percent of the average annual visitation to Lake Bonneville is for sightseeing. Likewise, the moderately large urban population of the Tri–Cities area (Richland, Kennewick, and Pasco) directly affects visitation to Lake Wallula. Lake Umatilla and Lake Celilo are less heavily used. However, visitation to both of those projects has increased steadily and dramatically from 1987 through 1993. The increase in use probably reflects a number of factors, including the increasing population of the region, increasing interest and demand for windsurfing in the Columbia River Gorge, and designation of the gorge as a National Scenic Area.

2.7.10.8 Regional Facility Needs

The Statewide Comprehensive Outdoor Recreation Plans (SCORP) for Oregon and Washington reveal a need for additional recreation resources and facilities within the lower Columbia region. For example, the Draft Background Document for the Oregon State Parks, Columbia Gorge District (1991, Oregon State Parks and Recreation Division, Master Planning Unit) states:

"The projected future demand for recreational facilities in the gorge is virtually limitless as the population grows and interest in outdoor recreation increases. All of the sources of recreation statistics for the gorge predict a very high percentage of recreational needs growth for the area. Unfortunately, resources are limited and can only support a finite level of recreation and associated facilities. As a result, supplying the needed amount of facilities to satisfy a particular demand is often difficult, if not impossible".

South of the Columbia River in Oregon all types of boating facilities are needed, including access, ramps, transient tie–up facilities, and sewage dump stations for larger boats. Demand currently exists for additional campsites, designated trail facilities for walking, hiking, biking, and horseback riding, and for parks of all types. This demand is expected to continue through the year 2000.

North of the Columbia River in Washington the region lacks sufficient boat ramps and moorage slips, picnic sites, swimming beaches, camping areas, RV areas, and hiking trails. In addition, hunting and fishing access as well as increased opportunities for snow activities are needed. These conditions are projected to persist through the year 2000.

As noted above, windsurfing is one of the fastest growing sports in the region. Although the river and wind conditions in the Columbia River Gorge are ideal for windsurfing, only a few sites have the necessary land–based facilities for windsurfers and spectators. The Columbia Gorge Windsurfing Study, (Oregon State Parks, 1986) reported that there was only one public park in the gorge that provides adequate parking, restrooms, picnicking facilities, and areas for rigging, launching and landing the boards; and that park was often filled beyond its capacity during racing events. Some additional new facilities have been developed specifically to meet windsurfing needs. However, demand for those facilities continues to exceed supply.

Access and development of additional recreational facilities in the gorge is constrained by a number of factors. The naturally steep and rugged topography in the Columbia River Gorge limits the land base suitable for intensive use recreation sites. The highway and railroad rights–of–way on both sides of the river take up much of the developable land area or closely follow the shoreline. In many areas, those rights–of–way also prevent safe pedestrian and vehicle access to the river. In addition, there are many other conflicting uses and purposes to be considered. For example, planned expansion of Maryhill State Park in 1988 to provide facilities for windsurfing was stopped due to archeological concerns.

Table 2–32. Lower Columbia River Recreation Sites and Facilities

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
**PROJECT: MCNARY DAM/ LAKE WALLULA										
Burbank Island										
Chiawana Park and Road 54 Park	1	2				30	1			
Columbia Park	3	9				150	1	36	18	
Hat Rock State Park	1	2				180				
Hood Park	2	5				78	1	69	69	
Hover Park										
Howard Amon Park	2	4				43	1			
Leslie R. Groves Park	1	3				16				
Locust Grove Martindale						20				
Madame Doron Memorial Park	1	1				5		15		
McNary Beach Park						20				
McNary Dam	2	3				50	2			
McNary National Wildlife Refuge										
McNary Yacht Club	1	1				10				
Paco Boat Basin	1	2				5				
Peninsula Habitat Management Unit										
Sacajawea State Park	1	2				106	1			
Two Rivers Habitat Management Unit										
Two Rivers Park	2	4				3				
Walla Walla Yacht Club	1	1				5				
Warehouse Beach Rec. Area						10		20		
Warehouse Beach Sand Station Rec. Area						10		20		
Wye Park	1	2				5	1			
Yakima River Delta Wildlife Nature Area										
SUBTOTAL	20	41	0	0	0	746	8	160	87	0

Table 2–32. Lower Columbia River Recreation Facilities – CONT

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
**PROJECT: JOHN DAY DAM/LAKE UMATILLA										
Arlington Park	1	2	10	200		8				
Boardman Park	1	2				12	1	63	31	
Crow Butte State Park	1	2	10	150		20		50	50	
Irrigon Park	1	2				14	1			
LePage Park	1	2		200		23		30		
Unatilla Marina and Park	1	4	40	500				5		
Philippi Park			10	200		20		20		
Plymouth Park	1	2	3			15	1	32	32	
Quesnel Park	1	1				5		20		
Railroad Island		2				5				
Rock Creek Park	1	2				12		12		
Roosevelt Park	1	2	5	50		8		10		
Sundale Park	1	1				3				
Umatilla National Wildlife Refuge	1	1								
Nugent Park	1	1				15	1			
Willow Creek										
Alderdale Park										
SUBTOTAL	13	26	78	1300	0	160	4	242	113	
**PROJECT: THE DALLES LOCK & DAM/LAKE CELILO										
Celilo Park	1	2				36				
Hess Park						4				
Horsetheif Lake	2	2				27		25		
Maryhill Park	1	2				10	1	50	25	
Seufert Visitor Area										
Slearfish Lake		1				3				
Biggs Park										
Cliffs Area	1	1				5	1	10		
Avery Park	1	1				3				
Deschutes State Park	1	2				25		34		
Rufus	1	1				48				
SUBTOTAL	8	12	0	0	0	161	2	119	25	0

Table 2–32. Lower Columbia River Recreation Facilities – CONT

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
**PROJECT: BONNEVILLE DAM/LAKE BONNEVILLE										
Wind River Boat River	1	2	0	0	0	0	0	0	0	0
Bonneville Dam Visitor Center	0	0	0	0	0	0	0	0	0	0
Rock Creek Park	0	0	0	0	0	0	0	0	0	0
Bonneville Hatchery	0	0	0	0	0	0	0	0	0	0
Overlook Park	0	0	0	0	0	0	0	0	0	0
Bingen Boat Basin	1	3	25	300	0	12	0	0	0	0
Crates Point	0	0	0	0	0	0	0	0	0	0
Doug's Beach	0	0	0	0	0	6	0	0	0	0
Drano Lake	1	1	0	0	0	0	0	0	0	0
Hood River Boat Basin & Marina	1	3	0	0	0	0	0	0	0	0
Hood Vista Sail Park	0	0	0	0	0	0	0	0	0	0
Koberg Beach State Wayside	0	0	0	0	0	6	0	0	0	0
Mayer State Park	1	3	0	0	0	26	0	0	0	0
Memaloose State Park	0	0	0	0	0	1	1	110	43	0
Rowland Lake Boat Ramp	1	2	0	0	0	0	0	0	0	0
Spring Creek Fish Hatchery	0	0	0	0	0	0	0	0	0	0
The Dalles Boat Basin	1	3	0	900	0	0	0	0	0	0
Viento State Park	0	0	0	0	0	19	0	75	0	0
Bonneville Dam WA Shore Visitor Fac.	0	0	0	0	0	10	0	0	0	0
SUBTOTAL	7	18	25	1200	0	80	1	185	43	0
**PROJECT: COLUMBIA RIVER BELOW BONNEVILLE DAM										
Barsteads Landing	1	1	0	200	0	0	0	0	0	0
Beacon Rock State Park	1	3	0	200	0	70	0	30	0	0
Benson Park	0	0	0	0	0	105	0	0	0	0
Coverts Landing	1	1	0	0	0	0	0	0	0	0
Dalton Point	1	1	0	0	0	0	0	0	0	0
Hankens Landing	1	1	0	300	0	0	0	0	0	0
Multnomah County Park	4	2	10	120	5	100	5	200	45	8

Table 2–32. Lower Columbia River Recreation Facilities – CONT

SITE NAME	BOAT RAMPS	BOAT LAUNCH LANES	BOAT MOOR SPACES	BOAT MOOR FEET	MOOR BUOYS	PICNIC SITES	PICNIC SITES GROUP	CAMP SITES INDIV	CAMP SITES HOOKUP	CAMP SITES GROUP
Corbett Launch Ramp	1	1	0	0	0	0	0	0	0	0
Sandy River	2	1	5	30	2	40	4	100	5	5
Rooster Rock State Park	1	2	0	0	1	229	0	0	0	0
SUBTOTAL	13	13	15	850	8	544	9	230	50	13
TOTAL	**60**	**109**	**143**	**3350**	**8**	**1688**	**24**	**936**	**298**	**13**

Table 2–33. Lower Columbia River Visitation Summary, 1987–1993

MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
McNARY LOCK & DAM / LAKE WALLULA								
Corps of Engineers Recreation Sites1/								
Jan	n/a	n/a	89.5	112.9	100.4	92.4	81.1	95.3
Feb	n/a	n/a	123.9	91.6	80.3	123.1	106.0	105.0
Mar	n/a	n/a	160.5	255.1	258.4	171.4	212.6	211.6
Apr	n/a	n/a	206.3	246.2	345.0	302.4	278.8	275.7
May	n/a	n/a	265.2	228.0	322.4	330.4	436.5	316.5
Jun	n/a	n/a	387.1	316.5	411.5	377.5	495.7	397.7
Jul	n/a	n/a	467.7	407.4	560.6	485.4	505.8	485.4
Aug	n/a	n/a	349.8	588.3	393.0	440.3	430.0	440.3
Sep	n/a	n/a	300.9	208.6	290.5	250.4	350.9	280.3
Oct	n/a	n/a	147.0	142.1	139.0	191.3	167.5	157.4
Nov	n/a	n/a	141.9	112.2	102.7	96.8	117.0	114.1
Dec	n/a	n/a	107.7	70.1	93.4	94.8	94.3	92.1
Project Total	**n/a**	**n/a**	**2747.5**	**2779.0**	**3097.2**	**2956.2**	**3276.2**	**2971.2**
JOHN DAY LOCK & DAM / LAKE UMATILLA								
Corps of Engineers Recreation Sites1/								
Jan	43.7	77.6	74.5	103.3	98.6	56.9	56.6	73.0
Feb	67.4	100.9	100.7	93.8	72.7	80.2	61.9	82.5
Mar	210.2	165.8	133.5	123.0	197.6	126.5	73.5	147.2
Apr	263.0	271.8	230.9	176.8	200.6	164.0	105.3	201.8
May	311.0	334.2	133.5	227.9	270.4	198.4	140.7	230.9
Jun	276.3	363.4	246.2	270.6	296.9	264.0	203.8	274.5
Jul	322.4	353.2	364.2	310.3	312.4	315.8	228.4	315.2

Table 2–33. Lower Columbia River Visitation Summary, 1987–1993 – CONT.

MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
JOHN DAY LOCK & DAM / LAKE UMATILLA – CONT								
Corps of Engineers Recreation Sites1/ – CONT								
Aug	342.9	322.9	363.1	414.2	379.3	333.1	239.1	342.1
Sep	279.3	263.9	306.4	366.4	317.0	292.5	174.1	285.7
Oct	223.1	192.4	253.0	253.0	229.0	197.8	156.7	215.0
Nov	102.4	113.8	122.2	122.2	107.2	128.3	94.5	112.9
Dec	76.6	91.0	79.3	79.3	77.7	100.3	61.8	80.9
Corps Subtotal	**2518.3**	**2650.9**	**2407.5**	**2540.8**	**2559.4**	**2257.8**	**1596.5**	**2361.6**
Umatilla NWR 6/								
	n/a	n/a	138.0	n/a	n/a	n/a	n/a	138.0
Project Total								**2499.6**
THE DALLES LOCK & DAM / LAKE CELILO								
Corps of Engineers Recreation Sites1/								
Jan	13.0	35.4	74.5	103.3	98.6	27.5	21.0	53.3
Feb	27.6	51.5	100.7	93.8	72.7	49.1	30.0	60.8
Mar	60.3	86.0	133.5	123.0	197.5	43.5	37.5	97.3
Apr	125.9	106.0	230.9	176.8	200.6	67.6	73.5	140.2
May	154.9	171.7	133.5	227.9	270.2	73.8	59.9	156.0
Jun	160.1	172.6	246.2	270.6	296.9	99.1	97.5	191.9
Jul	149.0	214.3	610.6	310.3	312.4	136.6	117.2	264.3
Aug	140.1	178.3	363.1	414.2	379.3	172.3	114.6	251.7
Sep	146.2	157.7	306.4	366.4	317.0	151.5	92.7	219.7
Oct	95.4	102.4	253.0	229.5	197.8	133.7	80.3	156.0
Nov	74.1	51.2	122.2	107.2	128.3	61.9	46.1	84.4
Dec	40.6	33.7	79.3	77.7	100.3	50.5	33.0	59.3
Corps Subtotal	**1187.2**	**1360.8**	**2653.9**	**2500.7**	**2571.6**	**1067.1**	**803.3**	**1734.9**
Other Recreation Sites								
Deschutes Rec. Area 2/	121.5	135.7	130.0	141.3	130.8	135.0	111.5	
Heritage Landing /2	102.6	118.2	113.2	139.8	107.2	132.1	113.5	
Misc. Windsurf Sites 3/	n/a	n/a	23.0	21.0	n/a	n/a	10.5	
Subtotal	**224.1**	**253.9**	**266.2**	**302.1**	**238.0**	**267.1**	**235.5**	
Project Total	**1411.3**	**1614.7**	**2920.1**	**2802.8**	**2809.6**	**1334.2**	**1038.8**	

Table 2–33. Lower Columbia River Visitation Summary, 1987–1993 – CONT.

MONTH	VISITOR–DAYS (in 1,000's)							
	1993	1992	1991	1990	1989	1988	1987	AVG
BONNEVILLE LOCK & DAM / LAKE BONNEVILLE								
Corps of Engineers Recreation Sites1/								
Jan	43.3	53.2	37.7	58.2	73.9	67.6	44.8	54.1
Feb	43.8	55.7	90.8	51.1	52.3	85.5	195.7	82.1
Mar	93.8	113.0	159.2	114.1	98.0	106.3	116.4	114.4
Apr	171.7	167.2	145.3	181.8	171.0	173.6	227.9	176.9
May	279.2	231.7	253.4	304.8	255.5	263.1	259.0	263.8
Jun	441.6	427.7	311.2	507.4	420.4	306.1	266.7	383.0
Jul	557.4	435.4	453.7	558.9	483.0	403.5	371.7	466.2
Aug	457.8	366.7	657.4	597.9	631.1	405.6	740.0	550.9
Sep	308.0	278.8	331.1	359.0	457.0	355.2	303.0	341.7
Oct	248.2	175.1	173.3	210.6	195.4	195.3	237.9	205.1
Nov	141.9	78.5	100.2	105.0	99.3	99.2	161.3	112.2
Dec	63.6	54.0	50.7	76.9	52.9	52.9	106.7	65.4
Corps Subtotal	**2850.3**	**2437.0**	**2764.0**	**3125.7**	**2989.8**	**2513.9**	**3031.1**	**2816.0**
Oregon State Parks								
Viento St. Pk. 2/	198.8	192.9	163.3	136.7	135.3	123.0	143.7	
Mayer St. Pk. 2/	115.5	139.3	114.4	89.5	125.7	57.9	125.3	
State Parks Subtotal	**314.3**	**332.2**	**277. 7**	**226.2**	**261.0**	**180.9**	**269.0**	
Other Recreation Sites								
Dalles Riverfront 3/	n/a	n/a	n/a	270.2	n/a	n/a	n/a	
Hood River Marina 4/	n/a	n/a	n/a	115.2	n/a	n/a	n/a	
Cascade Locks Park 5/	n/a	n/a	n/a	274.7	n/a	n/a	n/a	
Koberg Wayside 2/	n/a	n/a	n/a	82.2	n/a	n/a	n/a	
Spring Cr. Hatchery 7/	n/a	n/a	n/a	315.0	n/a	n/a	n/a	
Misc. Windsrf Sites 8/	n/a	n/a	n/a	49.0	n/a	n/a	25.0	
Other Sites Subtotal	**n/a**	**n/a**	**n/a**	**1558.7**	**n/a**	**n/a**	**25.0**	
PROJECT TOTAL	**3164.6**	**2769.2**	**3041.7**	**4910.6**	**3250.8**	**2694.8**	**3325.1**	

SOURCES

1/ U.S. Army Corps of Engineers, Portland District. Portland, Oregon
2/ Oregon State Parks and Recreation Department, Salem, Oregon
3/ Port of The Dalles, The Dalles, Oregon
4/ Port of Hood River, Hood River, Oregon
5/ Port of Cascade Locks, Cascade Locks, Oregon
6/ U.S. Fish and Wildlife Service, Umatilla NWR
7/ U.S. Fish and Wildlife Service, Spring Creek Hatchery, White Salmon, Washington
8/ Estimated from data presented in "Columbia River Gorge Windsurf Economics: 1990 Season" David Povey, 1990. University of Oregon, Community Planning Workshop.

CHAPTER 3

RECREATION ANALYSIS PROCEDURES AND METHODOLOGY

3.1 INTRODUCTION

The general objectives and functions of the RWG were previously described in section 1.1. This chapter describes and documents the quantitative methods that were developed and applied to calculate recreation participation impacts for the final EIS. The primary analytical objective throughout the course of the SOR study was to identify and evaluate the potential effects of changes in system operations on recreational use patterns in the Columbia River Basin (Basin), including predicted direct, indirect, and cumulative impacts of alternatives. A secondary goal was to estimate changes in net social welfare attributable to changes in mainstem hydrosystem operations. Such effects are manifested by how outdoor recreationist's behavior, preferences, and willingness to pay change as operation of the Federal Columbia River Power System (FCRPS) varies over time.

This chapter proceeds with a brief discussion of the recreational concerns and issues that shaped the decision to develop an analytical model needed to quantify changes in recreation participation (trips) and welfare (monetary values) within the Basin in section 3.2. A generalized conceptual framework underlying recreation demand modeling is suggested in section 3.3. The methodology and analyses developed to calculate recreation impacts for the different phases of SOR leading to the final EIS are reviewed in section 3.4. Section 3.5 provides the rationale for transitioning from the modeling approach used in the draft EIS to a theoretically more rigorous recreation demand and non–market valuation model applied in the final EIS. The methodology and theoretical construct underlying the final EIS recreation demand (participation) model is summarized in section 3.6 (Appendix J–1 presents a detailed description of the methodology and theoretical construct underlying the models, including the basinwide recreation survey upon which the models are based). Finally, a description of the reliability, limitations, and assumptions associated with the recreation visitation data that were used to calibrate the final recreation demand model is provided in section 3.7.

3.2 PUBLIC ISSUES AND CONCERNS

Throughout the SOR public scoping process, several issues were raised pertaining to the effects of FCRPS hydropower system operations on the quantity and quality of outdoor recreation opportunities at Columbia River federal and non–federal hydro projects. Readers should refer to section 1.3 for a description of site–specific public issues that were raised about recreation resources in the Basin. It was recognized that any recreation impact modeling effort needed to adequately capture and reflect these public concerns and opinions since outdoor recreation is extremely important to local economies and the quality of life throughout the Pacific Northwest. There are innumerable forms of water and land based leisure activities available at many different projects and, within a project, at many different sites. The Basin's abundant and diverse outdoor recreation opportunities continue to be used more intensively and frequently by an expanding regional population; the demand for high–quality outdoor recreation experiences is expected to continue climbing into the next century.

Most of the issues surfaced by the public concern the deleterious effect of water releases and reservoir drawdowns during peak recreation seasons. Severe reservoir drawdowns render boat launching ramps and marina facilities unusable, eliminate shore access, and can dramatically alter the natural scenery and aesthetic value of storage and run–of–river projects. Excessive or inadequate water releases from Federal hydro projects can also influence the

quality of recreation experiences in downstream river reaches by altering instream flows. Such changes in streamflow can adversely impact those river users who engage in fishing, power boating, and white-water float boating activities among others. Similarly, radical fluctuations in daily and weekly system operations can disrupt popular recreation activities that are typically not affected under normal operating conditions, such as wind surfing in the Columbia Gorge National Recreation Area or float boating in the Hells Canyon National Recreation Area.

It was clear from public commentary that any change in FCRPS operations that causes reservoir elevations and in-river flows to fluctuate severely is perceived to have a significant negative effect on the quantity and quality of recreational activities available on the Columbia River. These insights, particularly the direct relationship between recreation use and changes in hydrological conditions, were especially important information used to help formulate a conceptual framework for the recreation impact assessment models developed for the draft and final EIS.

3.3 CONCEPTUAL FRAMEWORK

Decision analysis procedures were applied and used to translate these public concerns into a conceptual framework to model the recreation and social welfare effects of alternative SOSs. Recreation demand (participation) models are conceptually needed because outdoor recreation is very popular and valuable in the region, a Basin-wide recreation demand model was previously lacking in the region, and changes in Columbia River recreation participation rates and recreational social welfare (monetary) values could not be easily quantified. A theoretically correct and properly specified recreation model statistically explains how recreation participation (and values) at the numerous projects and sites, and in activities throughout the Basin, changes under various FCRPS operating conditions. Recreation demand models estimated statistically are based on the economic theory of recreation demand and accepted non-market valuation techniques. New empirical research techniques which had not previously been attempted in the Basin were needed to estimate and apply such a theoretical recreation demand model to the SOR.

The primary inputs into a fully-integrated recreation demand model and their conceptual linkeage to recreational user behavioral responses (outputs) are presented in Figure 3-1. This diagram shows the relationship between the physical, chemical, and biological components of a hydrologic system, the different forms of recreation activities available to participants, and the resultant effects which are to be measured. The recreation model is driven by reservoir lake elevations and streamflows. Fluctuations in lake hydrology and riverine flows alter the suitability of recreational opportunities in terms of access, aesthetics, safety, and water quality. Changes in hydrologic conditions impact the productivity of biological resources at various levels of the trophic food chain extant in fluvial and lacustrine systems. The diversity and composition of fish and wildlife populations vary in abundance and distribution in direct response to such changes in biological trophic relationships. The quality and quantity of recreational experiences for such activities as fishing, boating, and camping are influenced directly by these variations in resource abundance (i.e., fishing catch rates) and system hydrologic conditions. Such effects on recreation are measured as a change in recreation participation rates, expressed as visitor or recreation days. The final measure of impacts (visitor days) can be translated into monetary terms to quantify the non-market value of various recreational activities.

3.4 ANALYTICAL SCOPE FOR DRAFT EIS

3.4.1 Model Development

Recreation pilot simulation models were developed and applied in the first phase of SOR leading up to the Draft EIS issued in 1994. The underlying methodology applied in this initial pilot model development phase is described in Columbia System Operation Review Screening Analysis: Description and Conclusions (SOR, 1992). These initial pilot models were a first-cut analytical tool used to quantitatively estimate impacts on recreation resources under various system operating strategies.

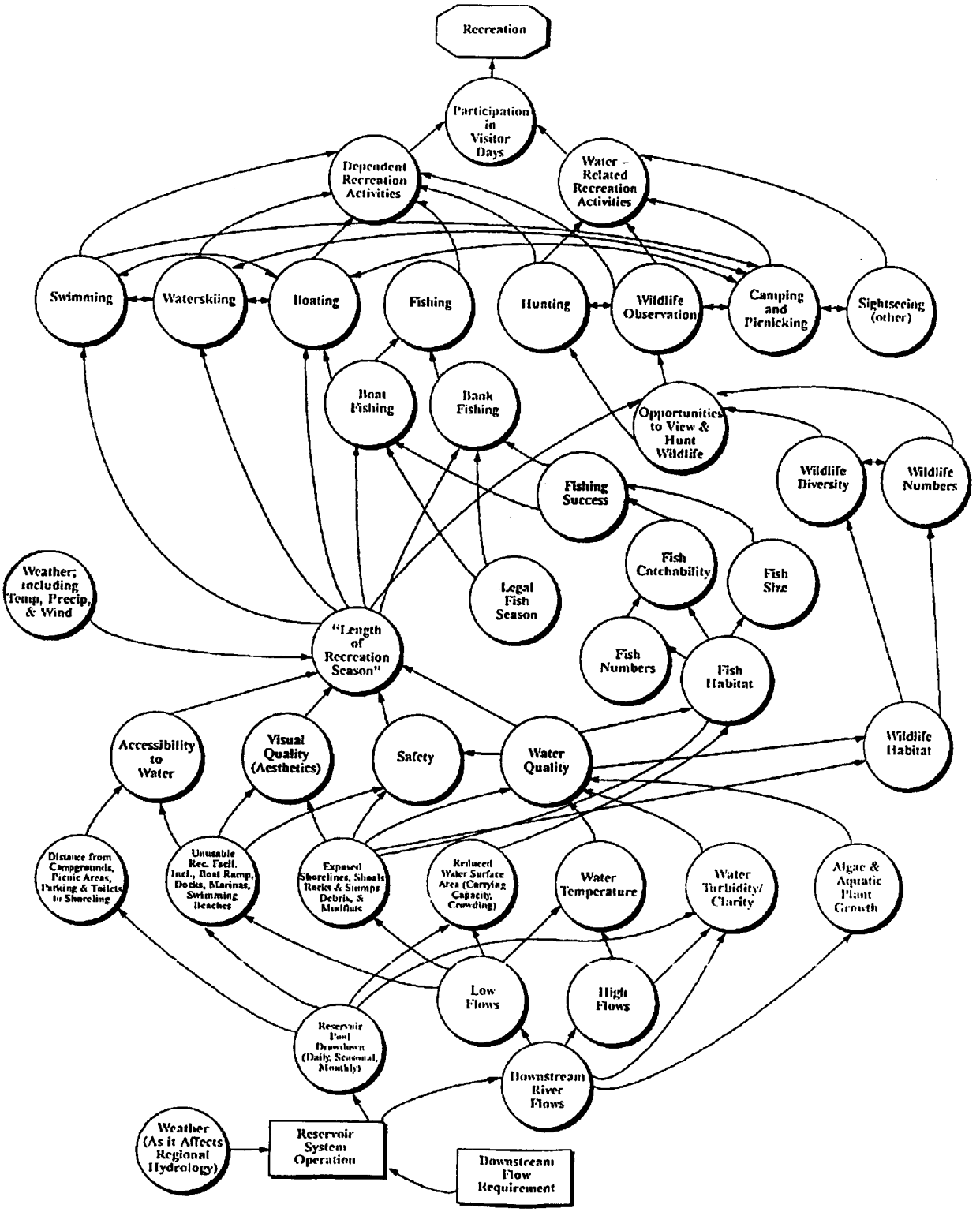


Figure 3–1. Conceptual Framework for Recreation Impact Assessment Models

Pilot models were initially constructed for a representative sample of Federal projects which were thought to best characterize the recreation effects that could be expected from altering system operations. It was not necessary to develop models for every Federal project to satisfy the requirements of pilot and screening analysis. Rather, a representative subset of projects were selected to facilitate analyses of the 91 screening alternatives that were analyzed in phase 1. This analytical scope adequately characterized the range of preliminary impacts that were expected to occur as a result of altering system operations.

Pilot recreation models were initially developed for three federal storage projects: Dworshak, Libby, and Grand Coulee. These models were based on existing visitation data sources and professional judgment of recreational professionals in the region. A fourth storage model, Hungry Horse, was adapted from a statistical contingent valuation model estimated from recreational user survey data collected on-site (Ben-Zvi 1990). These storage projects are very popular recreation areas that are geographically dispersed throughout the Basin and are considered to attract a representative sample of recreationists throughout the region. In addition, the Corps and Reclamation maintain good historical databases on recreation usage, facilities, and lake elevations at these reservoirs, another factor that influenced the decision to develop initial pilot models for these projects.

Free-flowing river stretches were not included in the initial pilot modeling efforts. Data on recreational activities on free-flowing river reaches that are or could be affected by Federal dam operations (i.e. Clearwater River below Dworshak, Kootenai River below Libby, Flathead River below Hungry Horse, and Snake River Hells Canyon National Recreation Area) were unavailable at the time pilot analysis was completed. In addition, the hydroregulation outputs for screening alternatives provided end-of-month pool elevations and flows, but not hourly or daily fluctuations in streamflows. At this time, it was felt that an end-of-month streamflow model would not adequately characterize impacts on water-dependant river recreation activities.

The pilot recreation models were structured to simulate the effect of changes in FCRPS operations. EXCEL spreadsheet models for each sample project were constructed to estimate how variations in reservoir pool levels affect participation rates in various forms of outdoor recreation activities. These pilot models estimated participation (use) effects for the following four common recreational activities: fishing, boating, camping/picknicking, and swimming. Impacts on all forms of recreation available at these reservoirs were not estimated; therefore, the visitation numbers generated by the pilot models underestate total recreation participation at these projects. These recreational activities, however, accounted for the largest percentage of visitation occurring at these four reservoirs and represented the most important component of the public's overall recreation experience. Alternatively, the Hungry Horse model that was adapted did not distinguish by activity, rather it generated an aggregate estimate of impacts across all types of recreation activities.

3.4.2 Methodological Assumptions

The methodological structure of the initial pilot models was based on a simple relationship between lake elevation and expected participation (usage) in each recreation activity. Drawdowns in lake levels are known to produce undesirable physical effects that adversely impact a user's ability to recreate at a reservoir, such as exposing mud flats, rendering boat ramps unusable, limiting shore access, and impairing overall lake aesthetics. Consequently, use (visitation) in a particular recreation activity was assumed to decline in direct response to, and correlate with, reductions in reservoir elevations. Such "break-point" relationships were established or adopted (i.e., Hungry Horse) for each recreational activity at each project. Break-points are points at which the relationship between an elevation and recreation usage are quantified. At each each break-point, a percentage reduction in visitation was estimated and established at various lake elevations as they dropped from full pool. Figure 3-2, for example,

Degree of Recreational Impact at Varying Operational Ranges (Break Points) (i.e., Timing of Reservoir Fluctuation/Downstream Flow)					
Pool Elev.	**1290 ft.**	**1285.0 ft.**	**1280.0 ft.**	**1250.0 ft.**	**1234.0 ft.**
Description	**Maximum Pool**	**Intermediate Pool**	**Lower Intermediate Pool**	**Low Pool**	**Minimum Operating Pool**
General Comments	Full pool not optimum as debris lodged at high water line is refloated and becomes a problem to boaters. More sandy beaches available with minor drawdown. Optimum pool is 1288 ft.	Drawdown is five feet from full, debris is stranded at high pool, swimming beaches are impacted, natural beaches are exposed.	Drawdown 10.0 ft. is at lower end of historic summer fluctuation. Major negative impacts begin to occur.	Drawdown 40.0 ft. below full pool. All recreation facilities and marina service severely impacted.	Drawdown 56 ft. from full pool. Most water based facilities are out of service.
Boating (all types)	All boat ramps and docks are fully usable. Floating debris is a deterrent to boating **Boating Use: 95%**	All boat facilities available; shoreline beaches exposed. **Boating Use: 100%**	Three small launch ramps inoperable; all other boating facilities usable. Some minor inconvenience at launching and parking sites. **Boating Use: 85%**	Launch lanes are reduced by more than half. Most docks out of service. One major marina is out of business. **Boating Use: 50%**	Only four narrow launch ramps in service. Docks and marina services unavailable. **Boating Use: 15%**
Fishing (boat or shore)	Floating debris is a minor deterrent to fishing. All facilities usable. **Fishing Use: 95%**	Minimum debris on water surface; shoreline easily accessible; all facilities available. **Fishing Use: 100%**	Lake access is impacted for shore and boat anglers. **Fishing Use: 85%**	Water access severely hampered for boat and shore anglers. Resident fish stocks diminished. **Fishing Use: 50%**	Lake access very difficult. Negative impacts on resident fish populations. Marinas are inoperable. **Fishing Use: 10%**
Camping/ Picnicking	All water–related recreation facilities are fully usable. Some minor detriment due to floating debris and not as many sandy beaches. **Camping/Picnicking Use: 100%**	All facilities operable; lakeshore easily accessible from camping and day use areas. **Camping/Picnicking Use: 100%**	Water surface is farther away from developed camping and picnicking areas. Negative effect on aesthetics. **Camping/Picnicking Use: 90%**	Water surface long distance from camping and picnic facilities. Aesthetics adversely affected by large drawdown band. **Camping/Picnicking Use: 60%**	Long distance from camping and day use facilities to lake. No developed swim areas in service. Poor aesthetic quality. Few boating facilities. **Camping/Picnicking Use: 50%**
Swimming	All designated swimming areas fully usable. **Swimming Use: 90%**	Some swim hazards at developed swim areas. Shallow water under swim floats hazardous to divers. Swim areas within boom floats diminished. **Swimming Use: 75%**	Designated swimming areas are greatly diminished in size; swim platforms unusable. Long distance from turf and shaded areas to water surface. **Swimming Use: 25%**	All developed swimming areas are exposed and essentially unusable. **Swimming Use: 0%**	All developed swim areas are unusable and high and dry. **Swimming Use: 0%**

Figure 3–2. Grand Coulee/Lake Roosevelt Break Points

shows that at Grand Coulee a drawdown of 5 feet is assumed to reduce participation in boating activities by 5 percent from historical visitation levels. Similarly, a 10–foot drawdown is assumed to reduce boating usage by 15 percent. The activity break–points were quantified in this way for all of the projects.

In general, the physical break–points were estimated based on the best professional judgment and knowledge of RWG members, resource managers, and recreation planners familiar with the project areas. The assumptions, justification, rationale, and data used to develop recreation activity break–point relationships for these four project areas are documented in the Screening Analysis (SOR, 1992).

Such break point relationships were translated into linear curves, where the percent reduction in visitation is a function of variable lake levels as they progressively decline from full (SOR, 1992, 1994). This basic methodological structure of the pilot models was also applied to estimate recreation impacts for the draft EIS. The pilot models measured effects on recreation activities by estimating from these break–point curves gains or losses in recreation visitation or participation rates, expressed in visitor days (or hours), in response to changes in end–of–month lake elevations. Monthly lake elevations were based on outputs generated by SOR hydrological simulation models. The total annual impact on recreation usage by project was computed as the sum of the monthly changes in visitation for each recreational activity.

3.4.3 Sensitivity and Probability Analysis

Sensitivity analysis was carried out to explain which variables impact the value measure (i.e., total visitor hours, or days, at each reservoir) most significantly. Each parameter in the model was varied around a range of high and low values, and was then entered into the Decision Analysis Sensitivity software program to test the resulting change in visitation. The larger the spread or deviation in the value measure (i.e. visitor hours or days), the more sensitive the input variable is in explaining a change in visitation. These variables were ranked according to their level of importance in "tornado" diagrams that were generated by the Decision Analysis software package. An example of a tornado diagram for the Dworshak pilot model is shown in Figure 3–3. From the sensitivity analyses, the variables considered most important for modeling purposes were hydrologic conditions and break–point/activity relationship curves for each recreation activity (SOR, 1992).

Those input variables that explained the largest variation in visitation were selected for the subsequent probability analyses of alternatives evaluated in the screening phase of SOR. The Supertree software program generates a decision tree to calculate the expected value (weighted average) of all possible outcomes defined by the tree structure. Each branch of a decision tree is assigned a certain probability of occurrence in order to execute the probability analysis (SOR, 1992). An example of a Supertree probability analysis performed on the Dworshak pilot model is provided in Figure 3–4. The output is: 1) a cumulative probability distribution that plots the likelihood that participation will be less than or equal to a certain number of visitor hours (days) for three alternatives evaluated simultaneously, and 2) the expected value of recreation visitation at the project. From the Dworshak probability distribution, it can be concluded, for example, that the FLOW alternative analyzed in this instance affects visitation much more significantly than the STORAGE and BASE alternatives. That is, for every probability level, the expected value of visitation is much higher under BASE and STORAGE than under the FLOW alternative.

3.4.4 Screening Analysis

The four recreation models developed during the pilot phase were executed to analyze 91 hydrological alternatives evaluated during the SOR screening phase. Each pilot model was structured to capture the effect of uncertainty in break–point relationships (i.e. changes in use given variable water conditions) and the variability in hydrological conditions using the Supertree software. The uncertainty in break–point relationships was reflected by establishing a "high" and "low" range of values around the original break–points which establish a point estimate for percentage of visitation at a particular lake

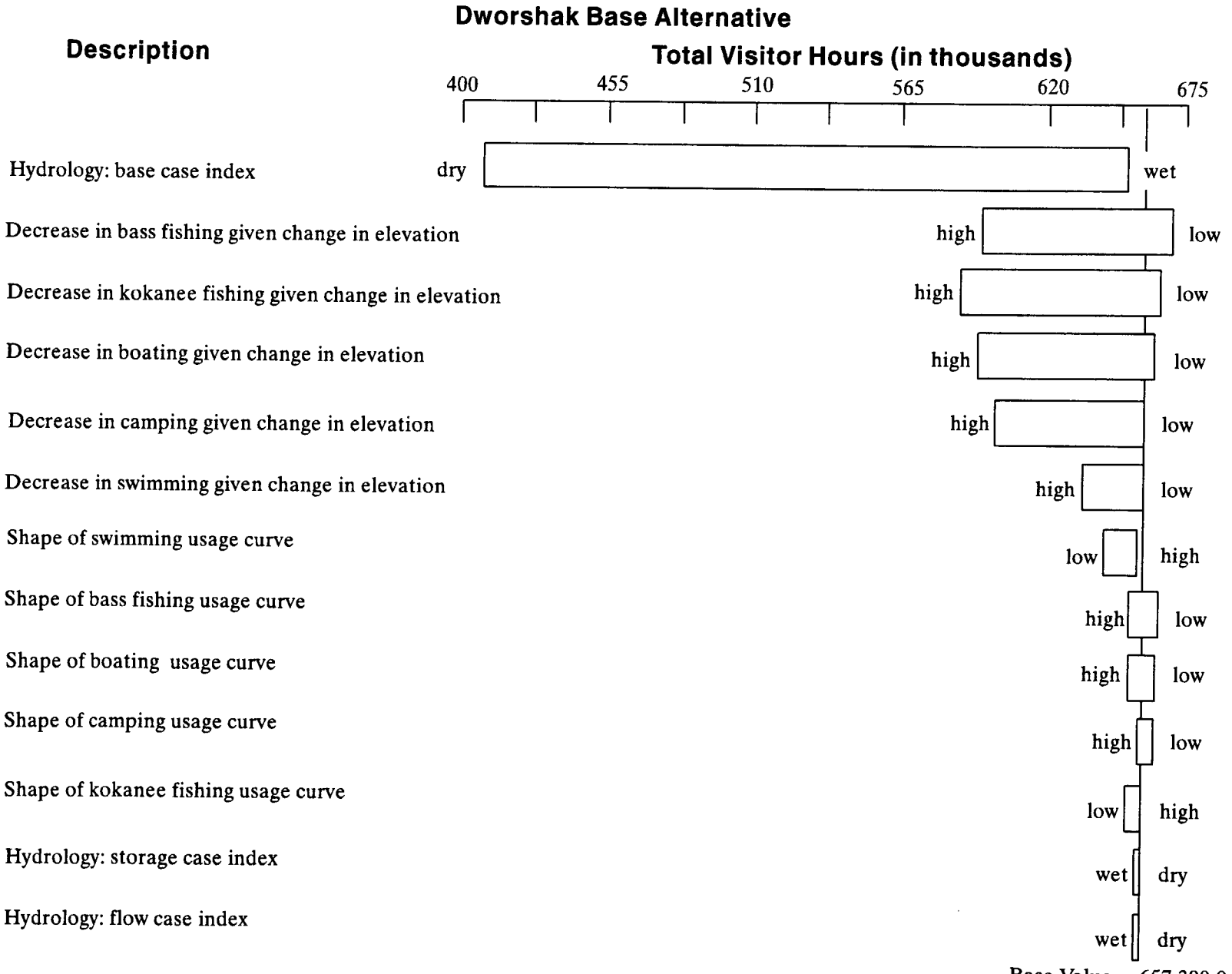


Figure 3–3. Example of Recreation Sensitivity Analysis and "Tornado" Diagram at Dworshak Reservoir under a Base Case Scenario

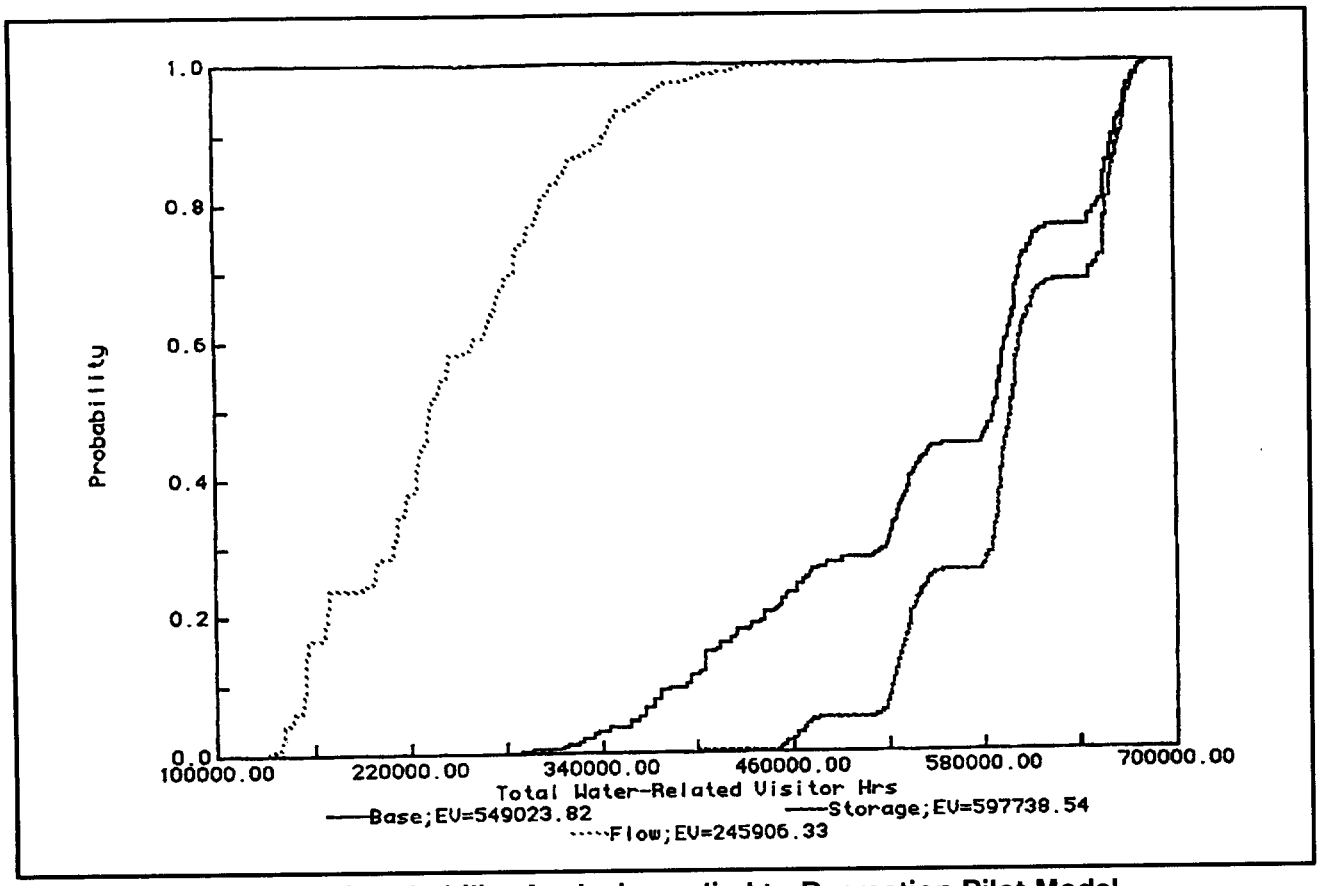


Figure 3–4. Example of Probability Analysis applied to Recreation Pilot Model

elevation. High, mid–range, and low activity break–points curves were assigned a probability of 5 percent, 95 percent, and 5 percent, respectively, to conduct the probability analyses.

The primary output of each Supertree probability run was the expected value of recreation–hours or days, summed across all four recreation activities, for each of four reservoir projects –– Dworshak, Libby, Grand Coulee, and Hungry Horse. The expected value of recreation–hours or days was ranked against two base cases to compare the effects of the alternatives evaluated in screening. The recreational impacts for 91 screening alternatives are provided in Screening Analysis (SOR, 1992).

3.4.5 Full–scale Analyses for Draft EIS

The recreation pilot models developed for screening were considered to be preliminary analytical tools and were not specified to explain with statistical confidence changes in recreational demand and value as a function of system hydrological conditions. The pilot modeling approach was, however, a constructive first–step attempt at developing an analytical tool needed to estimate Basin–wide recreation impacts. By incorporating uncertainty in parameter estimates, the pilot models were capable of generating reliable measures of gains or losses in recreation use under varying hydrological conditions. At the time the draft EIS was completed, the pilot model was considered to be the best tool available to analyze the quantitative effects of alternative SOSs on Basin recreational resources. Consequently, the methodological approach developed in screening was also applied to conduct full–scale analysis for the draft EIS.

Full–scale analyses focused on all 14 Federal projects being evaluated under SOR (see section 1.4.1.). Recreation impact assessment models (IAM) were

developed for each Federal project inextricably linked to the operation of the FCRPS. In addition, IAMs were constructed for three free-flowing river reaches that are affected by changes in Federal system operations. These include: 1) the Clearwater River below Dworshak Dam, 2) Kootenai River below Libby Dam, and 3) the Columbia River in Canada, below Keenleyside and Brilliant dams to the international boundary.

The Streamflow IAMs were developed, despite the limitations imposed by the availability of average monthly streamflows, to serve as a proxy for the range of impacts that could be expected to occur on free-flowing reaches of the Columbia River. Because of severe data limitations, quantitative models were not developed to estimate indirect effects on non-Federal project areas (e.g. mid-Columbia Public Utility District dams) and other nationally renowned or important free-flowing river recreation areas on the Snake River and tributaries to the Columbia River, such as Hells Canyon National Recreation Area and the Flathead River below Hungry Horse Dam.

Quantitative analyses were complemented with an extensive qualitative evaluation of the direct and indirect effects of each SOS. The results of the full-scale IAMs, combined with professional knowledge of the characteristics of project areas, sites, and recreational attributes, were used to quantitatively and qualitatively estimate effects on Basin recreation participation and quality. Technical Exhibit C describes the detailed modeling methodology used to conduct pilot and full-scale analyses for the draft EIS.

The full-scale IAMs were designed to estimate use by recreational activity for each of 14 Federal storage and run-of-river projects. As in pilot analysis, the primary recreational activities that accounted for the majority of the recreation use occurring on an annual basis were incorporated into each IAM model. For all storage and run-of-river projects, four activities were modeled: boating, fishing, swimming, and camping/picnicking. A fifth recreation activity, windsurfing, was also included in the models developed for the Bonneville and The Dalles projects, since it is an extremely popular activity in the Columbia River Gorge National Recreation Area.

The full-scale IAM generated an estimate of recreation participation (visitation) rates, measured in recreation days, for the most important water-dependent recreational activities available in each project area. Recreation days, instead of recreation-hours, was selected as the primary value measure for calculating effects because it was the value measure used to monetize the value of public outdoor recreation in the Basin. From information gained during the pilot phase, the full-scale models were executed using variables for hydrology, including the 50-year streamflow record, and break-point/activity curves developed for each recreation activity. The Supertree software program was used to produce the final value measure, the expected value of recreation days, in order to evaluate the effects of alternative SOS's in the draft EIS.

3.5 TRANSITION FROM DRAFT TO FINAL EIS MODEL

The RWG convened a workshop in February 1991 to allow scientists to review and critique the recreation pilot modeling concept that was developed for screening and which was ultimately carried forward to conduct full-scale analysis for the draft EIS. The conclusions of this workshop helped guide, shape, and design the research program which was undertaken to expand upon and enhance the initial IAM capability. The most important conclusion of the workshop was that the validity of the break-point curves was questioned because evidence of users actual response to changes in lake elevations and streamflows was absent. Although the lake elevation (streamflow)/activity relationships may approximate reality, for the most part they are not based upon empirical user behavioral response (demand) curves. Other important limitations of the draft EIS modeling approach were: (1) it did not correlate visitation to fishing and hunting success as it may be influenced by the effects of alternative SOSs on fish and wildlife populations; and (2) it did not address shifts in participation across substitutes in the region under the alternative SOSs.

To remedy these concerns, the RWG determined that recreation user surveys should be conducted at a number of Federal projects to enhance the predictability and credibility of the SOR recreation IAMs applied in the draft EIS. To this end, a comprehensive study plan was developed to improve upon the draft EIS analytical tools and to accomplish the following objectives for the final EIS : 1) implement visitor use surveys throughout the Columbia River Basin; 2) apply a Contingent Valuation Method (CVM) to elicit the public's participation and economic valuation response to changes in lake elevations and/or streamflows; 3) estimate contingent valuation and participation user responses to alternative hydrologic conditions; and 4) develop a simulation model that will statistically predict changes in recreation demand and social welfare values under various hydrological (pool levels and streamflow rates), substitution, resource quality, and social, demographic, and economic conditions in the Basin.

The first phase of this long–term research plan was implemented by conducting an initial (phase I) recreation survey in the Basin during April 1993, as described in section 2.4. The survey was designed to obtain basic information about the patterns of water–related recreation use in the region (RCG/ Hagler Bailly, Inc. 1993). The RCG (1993) phase I survey also recommended that specific empirical modeling approaches, the CVM and contingent behavior elicitation format, be implemented to provide defensible estimates of economic value and changes in visitation rates (demand) as pool elevations or flow rates vary at the projects under study and elsewhere in the Basin. In addition, the phase I survey information was used to develop sampling strategies in order to conduct a comprehensive regional CVM survey of recreation users in phase II of the research plan.

Following the phase I survey, several focus group meetings were convened in September 1993 to begin to test the feasibility of conducting a Basinwide CVM/contingent behavior survey of recreational users and to design the phase II sampling plan. Focus group participants were provided with several examples of potential survey questions to determine whether or not the contingent behavior and CVM elicitation questions were understandable and free of bias problems that can occur in traditional CVM surveys. The responses generated by the focus group participants were evaluated to determine whether unbiased contingent behavior and valuation responses could be provided by respondents. Based on the outcome of these focus group discussions, and further pre–testing of the survey instrument in October 1993, it was concluded that the CVM/contingent behavior approach should not be administered as originally planned. A revised approach, the Travel Cost/Contingent Behavior (TC/CB) survey format, was instead adopted to model Columbia River Basin recreation in phase II of the research (see Appendix j–1, Chapter 3).

The Phase II survey of Columbia River Basin recreationists was carried out in fall 1993 and designed to provide data parameters needed for the TC/CB modeling task. The TC/CB statistical estimation tasks and development of a basin–wide simulation demand model were subsequently completed and incorporated into the final EIS. The associated simulation modeling results were used to predict changes in recreation participation for the final set of SOSs and replace the quantitative estimates provided in the draft EIS. In particular, the recreation model was designed to meet the RWG's fundamental objectives to: 1) predict how frequently individuals take trips to each of several Federal projects under existing and hypothetical water levels or streamflows as manifested by each SOS, and 2) predict recreation values for these trips, and subsequently predict changes in those values as water levels or streamflows at the projects change. Chapter 4 of this appendix presents the quantitative estimates of changes in trip taking behavior resulting from changes in FCRPS operating alternatives (SOSs) . The monetized non–market values of these changes in visitation to Federal hydro projects are presented in Appendix O (Economic and Social Impacts).

3.6 FINAL EIS RECREATION DEMAND MODEL

3.6.1 General Theory

This section briefly outlines the important theoretical features of the TC/CB modeling approach developed for the final EIS. The specific details of the phase II research effort, including survey design, data collection, theoretical construct, empirical issues, econometric estimating procedures and simulation model development are presented in Appendix J–1.

TC can be used, along with a contingent behavior participation model, to estimate the effects of changes in pool elevations and flow rates at recreation sites for Federal projects on individual economic value and participation. As stated in the economics literature, the CVM/CB technique was developed in recent years to measure users willingness–to–pay (WTP) for an improvement in, or prevent the further loss of, the quality of natural resource commodities that do not have established market prices. It is, along with the TC and Hedonic methods, a tool for estimating the non–market value and demand for such natural resources as fish, wildlife, recreation, water quality and air quality.

The TC/CB method is used in the final EIS to estimate the effects of changes in, for example, reservoir operating policies for Federal hydro projects in the Basin on recreational participation at these projects and on the monetary benefits derived by the users of these sites. TC/CB modeling requires both actual behavioral data on individual recreation trips and behavioral responses to hypothetical changes in an system operations, such as changed pool elevations or streamflows outside the range experienced by individuals recreating at Federal projects. The TC/CB approach generates demand models of recreation trips. The benefits of a change in an operating policy to, for example, increase water levels at one or more Federal projects may be estimated from the TC/CB demand functions.

The TC/CB model predicts the destinations and frequency of water–based recreation trips taken by an individual to both Federal projects and other substitute sites as a function of travel costs incurred, social and economic characteristics of an individual, and the qualitative characteristics of the recreation site. A TC model that fails to include substitute sites typically results in biased estimates of the benefits of recreation, unless there are no good substitutes for the recreation sites being considered. Data on the number of trips that an individual takes to the waters in his/her region were collected using the phase II mail survey questionnaire. Four regions in the Northwest were defined based on existing origin–destination data collected at the Federal projects. The generalized version of the TC demand equation can be written as:

(5) $$Qij = f(Pij, Z, Si, Wj, Wk)$$

where,

- Q = number of trips by an individual i to project j,
- P = a vector of the implicit prices of the trips from an individual's origin i to various destinations j,
- Z = a vector of other time–varying variables,
- S = a vector of individual social, economic and demographic characteristics,
- W = the water level for the own project j,
- Wk = a vector of alternative water levels k that may affect demand for own project j,
- i = 1,. . .,I an index denoting the individual to whom the equation applies,
- j = 1,. . .,J an index denoting the project for which projections will be made using the equation

3.6.2 Actual Behavior Model

The TC demand model whose parameters are to be estimated is a model of an individual's actual recreation trip–taking behavior. The unit of measurement is a recreation "trip." A recreation trip is defined as the activity of leaving from home, for any length of time, for the primary purpose of engaging in recreation. That is, an individual visiting the local creek for 2 hours or traveling to a distant lake 100 miles away from their residence is taking only 1 trip irrespective of time and distance to the site.

The phase II recreation survey collected data on the individual's actual trips taken to Federal projects

during the 1993 water–based recreation season. Recreators were asked whether they have taken any water–based recreation trips to waters, including lakes and rivers, in the Basin both in and outside their region. Survey respondents are also asked several questions to determine the costs to the individual of a typical trip to one of the projects. This cost information is used to construct "implicit prices" for trips, which can be viewed in the same way as market prices for goods: as recreation prices increase, individuals switch to closer sites, or take fewer trips.

An individual's demand for a particular water, project, or recreation site also is a function of the characteristics of that water. Qualitative site characteristics have long been used to help explain the demand for a recreation site (Greig, 1983; Morey, 1981). Many characteristics such as surface acreage, flow rates, water levels, fish catch rates, type of bank vegetation, and availability of boat ramps have been shown to be important variables that explain or influence recreation demand, but this importance varies according to the user's type of recreation. Finally, the demand for trips is influenced by various social, demographic and economic characteristics, such as age, sex, marital status, and income. The exact set of variables included in the above vectors may vary from project demand equation to equation and the rationale for their development are discussed at length in Appendix J–1. TC recreation demand models for water–based recreation in the Pacific Northwest were estimated using the trip, characteristics (for sites and individuals), and cost data for each individual in the phase II survey sample. The parameters of the travel cost recreation model were estimated by carefully considering very complex mathematical, econometric, and statistical estimating procedures using a sample of cross–sectional data such as collected in the phase II survey.

3.6.3 Contingent Behavior Model

The parameters of the TC model may also be estimated using information about "contingent" trips. These "contingent behavior" responses are the stated number of trips that a recreator says s/he will take under a hypothetical set of changes in system operations. Contingent behavior responses are needed to explain behavior in response to conditions outside the bounds of conditions that correspond to actual ones. That is, several of the SOSs under consideration in the SOR have not been experienced by recreators in the Basin. Models of actual behavior may not do a particularly good job of explaining and predicting recreation trips and value under widely different conditions than the ones actually experienced.

Contingent behavior modeling applications to recreation demand are growing rapidly, and the concept is well–grounded in economic theory (Cameron 1990; Englin and Cameron 1993). The approach used in the phase II survey depicted hypothetical conditions through computer enhanced photographs of two different water levels (at reservoirs) or flow rates (streams and rivers) at three to four projects in the region. The two different water levels/flow rates reflected conditions for the summer of 1993 and for a hypothetical period, with a lower or higher water level/flow rate. Each respondent looked at these pictures and was asked how many more or fewer trips s/he would have taken to the different projects if the water levels had changed to those depicted in the photographs representing hypothetical conditions.

Contingent behavior responses were tested to be sure that they are consistent with logic and the economic theory that explains recreation participation and site allocation. For example, if an angler states that s/he will take 14 more trips per year if water levels double at a close site, it is necessary to test to see whether this number of new trips is highly improbable given his or her preferences, as revealed from actual behavior. Income constrains individuals from taking more trips than they can afford, and preferences that illustrate that the angler wants variety in species and across waters will limit the number of trips to the same water that we expect to observe.

3.6.4 Predicting Future Demand

Once the parameters for the TC model shown in equation 5 are estimated, it can be used to predict trip–taking behavior under a wide variety of scenarios. Scenarios, represented by each SOS, will vary

primarily according to changes in site characteristics, including water elevations and flow rates. Trips to specific sites are estimated for each individual in the sample, first, under base conditions. Next, the site characteristics are altered to fit a specific scenario and the model is used to predict the change in the number of trips to each site. The difference in the number of trips and the distribution of trips to destinations reflects the impact of the scenario on recreation participation and is expressed in terms of total recreation days expended at a particular project. This process is repeated for every individual in the sample and these results are then "blown up" or extrapolated to the population as a whole, using population weights. Changes in the size and socioeconomic characteristics of the population over time can also be taken into account by systematically changing the values of individual characteristics variables in the model. The simulated results of each SOS and the associated estimates of recreation days spent at each Federal project are presented in Chapter 4 of this appendix.

3.6.5 Estimating Recreation Values

Changes in the welfare of recreators are defined in terms of an individual's maximum willingness to pay (WTP) to prevent conditions from becoming worse. The difference between an individual's maximum WTP and the amount s/he actually has to pay for a change in conditions is known as consumer's surplus and is the economist's preferred measure of net benefits. Recreation TC demand models reveal the consumer's surplus without asking the individual any direct question about his or her WTP (See Technical Appendix O, Economics and Social Impacts, for a more complete discussion). Put simply, the consumer surplus measure is derived from the travel cost demand equation by mathematical integration over the change in conditions.

Without the contingent behavior questions discussed above, the recreation TC demand model estimated for the final EIS will reveal the total consumers surplus for recreation in the Basin. By combining contingent behavior responses the impacts of water elevations and flows to changes or consumer surplus could be estimated. Using this approach along with actual behavioral responses, the net benefits from preventing water level decreases at any of the Federal projects can be estimated. The associated consumer surplus estimates of value by SOS are presented in Appendix O (Economics and Social Impacts).

3.7 DATA SOURCES AND ASSUMPTIONS

The draft EIS IAM and final EIS recreation demand model estimate gains or losses in recreation visitation rates, expressed as recreation or visitor days, under each SOS. The accuracy of these effects depends, of course, upon the quality of the recreation data that are integrated into the models. Seven years of monthly visitation data for each project, collected from 1987–1993, was the primary input used in the draft recreation demand models. The data were supplied by federal, state, and local agencies with primary recreation management responsibility at the respective projects. The primary source of data for the impact assessment models used for the final report was the recreational user survey performed in 1993. Historic visitation data from 1992 and 1993 was used to aggregate and calibrate the final models.

3.7.1 Corps of Engineers

The primary source of visitation data for Federal projects administered by the Corps is the Natural Resource Management System (NRMS) database maintained by the Corps District offices. Corps visitation data supplied to NRMS is usually collected through a combination of actual vehicle count and visitor surveys. The NRMS database supplied annual recreation visitation data over the last five complete years of record (1987–1993) for each Corps project. Average annual visitation was computed for each project using NRMS records. For sites where less than five years of record are available, the most recent year(s) of data was used as a proxy for average annual use.

NRMS data were also used to determine the percent of total visitation by specific recreation activity and the percent of activity participation by month for each project area, referred to as load factors in the NRMS. The NRMS maintains this information for nine sets of unique activities: camping, picnicking, boating, fishing, hunting, sightseeing, waterskiing, swimming and other activities.

The NRMS visitor data for the most part includes water dependent and water–related recreation activities at developed sites. It also may include some "dispersed use" which is an additive number used to account for those visitors who gain access to Corps projects outside developed recreation areas and are not included in traditional visitation counting methods.

The term "visitor" as used in this analysis is equal to the term "visit." A visitor means the entry of one person into a recreation area or site to carry on one or more recreation activities. Average annual visitor days by activity were determined by multiplying the average percent of total participation by activity times average days per visit by activity. The total equals average annual visitor days of recreation use at the project area.

3.7.1.1 Libby Reservoir/Kootenai River

NRMS data includes only the small portion of the recreation facilities that are located on administrative lands at Libby and lands immediately downstream also under Corps jurisdiction. This includes the downstream segments of the Kootenai River. The NRMS data are based on a visitor survey that was conducted in 1985. A weighting factor was derived from the survey results to establish final visitation figures. In addition to NRMS data sources, two years of visitation data were also available for the Canadian parks on the north half of the reservoir.

Visitation data does not include the six major parks that are administered by the USFS. The data collected by the USFS was not reliable enough to be accurately used in the evaluation. Visitors to the three private resort/marinas on the reservoir are likewise not included. Therefore, the Corps' visitation data supplied for full–scale modeling purpose under estimates the total number of visitors that historically come to the reservoir.

3.7.1.2 Albeni Falls Dam/Lake Pend Oreille

NRMS includes all of the recreation facilities that are located on the lake and lands that are administered by the Corps. This also includes land administered by Idaho Department of Fish and Game under lease from the Corps. The last visitor survey was conducted in 1985, and from the results, a weighting factor was determined to establish final visitation figures.

At least one year of data were available for the six USFS sites, for Sandpoint City Beach, and for Farragut State Park. Visitation to private facilities is not normally collected and is not included in the visitation figures. There are nine private lakefront resorts, local hotels and motels, and 2,289 lakefront parcels (Bonners County County Tax Office, 1991) that surround the lake. Consequently, the visitation numbers used in full–scale modeling will underestimate the total visitation that occurs at the lake.

3.7.1.3 Chief Joesph Dam/Rufus Woods Lake

NRMS includes all of the recreation facilities that are located on the lake and administrative lands that are under Corps jurisdiction. This also includes park lands administered by Washington Sate Parks under lease from the Corps. The last time that a visitor survey was conducted was in 1990, and from the results, a weighting factor was determined to establish final visitation figures.

3.7.1.4 Dworshak Reservoir

The visitation data for Dworshak Reservoir on the Middle Fork of the Clearwater River includes water–dependent and water–related recreation activities. Only visitation to developed recreation sites with direct access to the shoreline are included in the database. The NRMS data base includes all of the recreation facilities and sites operated by the Corps of Engineers and Idaho State Parks on Dworshak.

NRMS visitation data for 1987 was incomplete, with visitation available in "visitor hours," but not in "visitors." To convert data to the appropriate unit of measure for 1987 the ratio of visitors to visitor hours for a known month and year were calculated. The resulting multiplier was then applied to the available 1987 visitor hours for the same month. The result of this calculation is the estimated 1987 visitors (recreation days).

3.7.1.5 Lower Snake River and McNary Projects

The visitation data for lakes on the lower Snake River (Lake Sacajawea, Lake West, Lake Bryan, and Lower Granite Lake) and Lake Wallula (McNary project) on the Columbia River include water–dependent and water–related recreation activities. Only visitation to developed recreation sites with direct access to the shoreline are included in the database. The NRMS database includes all of the recreation facilities and sites operated by the Corps, Washington State Parks, and local government agencies on the lower Snake River and that portion of the Columbia River included in Lake Wallula.

In four cases the visitation data was incomplete or unavailable for several or all months of particular years, and it was necessary to use two different methods to create data that serves as a proxy for visitation in the missing periods. For Lake Wallula, the July and August 1988 estimated visitation was estimated by averaging the available four years of monthly data to fill in those two missing months. July through December 1988 visitation for Lake Bryan and Lower Granite Lake, and July through December 1988 and all of 1987 at Lake West; was incomplete; visitation was available in "visitor hours," but not in "visitors." To convert data to the appropriate unit of measure for these areas, the ratio of visitors to visitor hours for a known month and year were calculated. The resulting multiplier was then applied to the available visitor hours for the same month. The result of this calculation is the estimated visitors for the missing months.

3.7.1.6 Lower Columbia River Projects

John Day Dam/Lake Umatilla. Only developed recreation sites with direct access to the river are included in the NRMS database. Other upland recreation sites near the river but without direct access to it have been excluded.

Supplemental data were obtained for Umatilla National Wildlife Refuge, administered by the U.S. Fish and Wildlife Service. The Corps' NRMS data also includes some "general reservoir " visitor use that occurs at undeveloped recreation sites on Lake Umatilla. There do not appear to be any significant gaps in visitor use for the project area.

The Dalles Dam/Lake Celilo. The visitor data for Lake Celilo includes water–dependent and water–related recreation activities. Only those developed recreation sites with direct access to the river are included in the database. Numerous other upland recreation sites in the Columbia River Gorge National Scenic Area without direct access to the river have been excluded.

NRMS includes all of the recreation facilities that are located on The Dalles Lock and Dam Project lands that are administered by the Corps and by Washington State Parks (under lease from the Corps). Supplemental data were obtained for recreation sites administered by Oregon State Parks, the only other recreation management agency on Lake Celilo. The Corps NRMS data also includes some "reservoir general" visitor use occurring at undeveloped recreation sites on Lake Celilo.

Because of the importance of windsurfing in the Columbia River Gorge, use of undeveloped but heavily used windsurf sites was estimated from data collected in a 1990 study on the economic importance of windsurfing in the Columbia River Gorge (Povey, 1990). Of the 231,600 estimated windsurfing visits in 1990, approximately 30 percent of the use occurred in the three sub–areas of The Dalles project area (the remaining 70 percent was on Lake Bonneville). Of that, an estimated 70 percent occurred at developed recreation sites for which visitor data is collected. The estimated remaining 30 percent occurred at undeveloped sites for which no specific data is kept (i.e., Rufus, Biggs).

At least one year of visitor data was available for almost all of the developed recreation sites on Lake Celilo; there do not appear to be any significant gaps in visitor use for the project area. No recent visitor use surveys have been completed for The Dalles project. Therefore, average days per visit for the project are based on national averages at Corps projects.

Bonneville Dam/Lake Bonneville. The NRMS visitor data excludes numerous other upland recreation sites in the Columbia River Gorge National Scenic Area without direct access to this section of the river. NRMS includes all of the recreation facilities that are located on Bonneville Lock and Dam Project lands that are administered by the Corps. Supplemental data was obtained for recreation sites administered by other agencies, including the U.S. Fish and Wildlife Service, Oregon State Parks, and several local port districts. The NRMS data also includes some "general reservoir" visitor use occurring at undeveloped recreation sites on Lake Bonneville.

Windsurfing recreation data were estimated from Povey (1990). Of the 231,600 estimated windsurfing visits in 1990, approximately 70 percent of the use occurred in the three sub-areas of the Bonneville Project area (the remaining 30 percent was on Lake Celilo). Of that, an estimated 70 percent occurred at developed recreation sites for which visitor data is collected. The estimated remaining 30 percent occurred at undeveloped sites for which no specific data is kept (i.e., Bob's Beach, Stevenson, Swell City, Mosier, and Doug's Beach). Average percent of total use for windsurfing was based on a comparison of total project visitation with windsurfing visitation presented in Povey (1990). Average use per visit for windsurfing was a professional estimate of 3.4 hours.

3.7.2 Bureau of Reclamation/National Park Service/U.S. Forest Service

3.7.2.1 Hungry Horse Dam/Reservoir

Reclamation supplied monthly visitation data from 1987 to 1993. These recreation use data are collected by the USFS, Hungry Horse Ranger Station, and are based on campground receipts and recreation use observations at the location. Due to staff limitations and the size of the district, the recreation use data are not extremely accurate. Moreover, recreation data are not collected by activity.

3.7.2.2 Grand Coulee Dam/Lake Roosevelt

The National Park Service (NPS) at Coulee Dam National Recreation Area collects most visitor data using traffic counters. The counters are located on park roads that receive little or no local use that is unrelated to recreation visits. Traffic counts are reduced by the number of vehicle trips attributable to employees of the concessionaires and the NPS. The NPS uses a multiplier of average number of vehicle occupants to determine the number of visitors to the park. In addition to traffic counts, the concessionaires provide accurate counts of houseboat rentals, which includes the total number of people in each party.

The NPS also makes actual counts of the numbers of boat trailers at launch ramps, which translates into a reasonably accurate figure for total numbers of boat launches. Camping figures are acquired by actual count of the numbers of tents and recreational vehicles at the campgrounds. All figures are collected and tallied on a monthly basis.

Figures given for the portions of Lake Roosevelt within the two Indian reservations are estimates made by the recreation staff of the Spokane and Colville Confederated Tribes. These estimates are the best figures available. These figures account for a small percentage of the total recreation use at Lake Roosevelt.

3.7.3 Mid Columbia Public Utility District River Projects

The main source of visitation data for mid-Columbia PUD projects is a combination of data collected by Washington State Parks and the data collected by the PUDs. The data includes all of the recreation facilities that are located on the lakes and lands that are administered by either the State of Washington or the PUDs. This also includes land administered by Washington Department of Fish and Game.

Average annual visitation was obtained over the last five complete years of record (1987-1991). Visitation is based on actual vehicle counts. At least one year of visitor data was available for the PUD sites, and for the Washington State Parks sites. For the

sites where less than five years of record was available, the most recent year of data was used as a proxy for average annual use.

3.7.4 Clearwater River Below Dworshak Dam

The visitation data for the Clearwater River from below the Orofino bridge to the upper end of Lower Granite Lake includes water–dependent and water–related recreation activities. The source of base–line visitation data for the Clearwater River is a Clearwater River Recreation Study (Krumpe, 1987), covering the period September 1986 through August 1987. Therefore, one year of data is being used as a proxy for historical average use. Although it is considered by some to be dated, the (Krumpe, 1987) study provides valid recreation use estimates for the lower Clearwater River. There is no other visitation/use data available for the Clearwater that has the degree of accuracy and validity found in this study.

The Clearwater River Recreation Study surveyed and estimated visitation on six river segments. Two of the six segments are above Orofino on the main fork of the Clearwater. These segments would not be impacted by changes in operation of Dworshak Dam, therefore visitation estimates from the upper two segments (Kooskia to river mile 59 and river mile 59 to Orofino bridge) of the Krumpe study are not included in the use estimates input to the full–scale IAM.

3.7.5 Hells Canyon National Recreation Area

The USFS, Hells Canyon National Area Field Office, maintains an historical database on recreation use for floatboat and powerboat recreationists. Both commercial and private recreation use data are collected. The data provides information which reflects general trends in overall use patterns rather that an exact count of yearly river users. The figures provided in table 2.28 represent private and commercial float and powerboat use during the regulated season, which runs from about the end of May to September 15.

3.7.6 Columbia River – Hugh Keenlyside Dam to International Boundary

A seven–year time series of annual visitation data is not available for recreation use on the Canadian stretch of the Columbia River between the Keenleyside Dam and the International Boundary. Boat and shore fishing estimates were accurately collected in a creel census conducted in the 1990/91 season (British Columbia Hydro, 1991).

Annual visitation data for swimming, non–motorized boating, and sightseeing were not available. The numbers used in modeling analysis were gleaned from a 1984 recreation and tourism survey (Stephenson, 1984) in combination with the 1990/91 creel census survey data collected for the river system. The fishing data generated in the 1990/91 study was divided by the numbers for fishing generated in the Stephenson (1984) survey to estimate a percentage or ratio. The numbers for swimming, non–motorized boating and sightseeing generated by Stephenson (1984) were then multiplied by the above percentage to give estimates used in full–scale analysis.