RECLAMATION

Managing Water in the West

Cle Elum and Bumping Lake Dams Fish Passage Facilities Planning Report - Draft

Storage Dams Fish Passage Study
Yakima Project, Washington

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Upper Columbia Area Office

September 2008

U. S. DEPARTMENT OF THE INTERIOR

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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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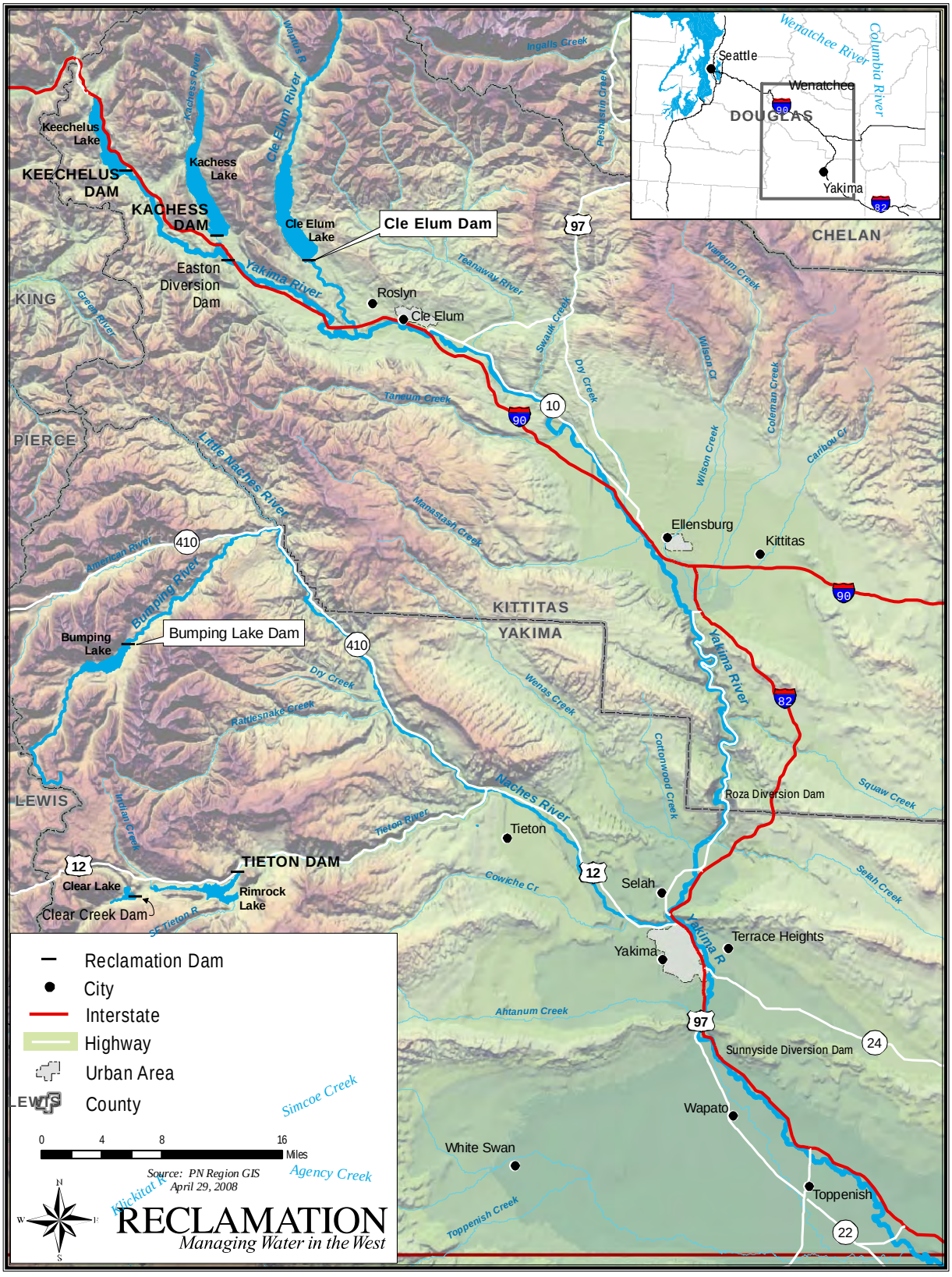

Yakima Project Storage Dams, including Cle Elum and Bumping Lake Dams

Acronyms and Abbreviations

APE	area of potential effect
BMP	best management practice
BPA	Bonneville Power Administration
Core Team	Technical Yakima Basin Storage Fish Passage Work Group
CPOM	coarse particulate organic matter
CSA	Conservation Support Area
dB	decibel
dBA	decibels on the A-weighted scale
DEC	Design, Estimating, and Construction
Ecology	Washington Department of Ecology
EDNA	Environmental Designation for Noise Abatement
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act
FCC	Federal Communications Commission
FERC	Federal Energy Regulatory Commission
fisheries co-managers	YN and WDFW
ft/s	feet per second
ft^3/s	cubic feet per second
FSR	Forest Service Road
FW	forest-watershed
FY	fiscal year
GMA	Growth Management Act
HPA	Hydraulic Project Approval
I&R	incubation and rearing
IMPLAN	Impact Analysis for Planning
ITA	Indian trust asset
KRD	Kittitas Reclamation District
m^2	square meters
MAF	million acre feet

Mitigation Agreement	*Mitigation Agreement between the USDI Bureau of Reclamation and Washington Department of Fish and Wildlife regarding Keechelus Dam Construction Issues Including Fish Passage*
MOCA	Managed Owl Conservation Area
NAAQS	National Ambient Air Quality Standard
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
N	nitrogen
NOAA Fisheries Service	National Marine Fisheries Service
NOC	Noise of Construction
NPCC	Northwest Power and Conservation Council (formerly Northwest Power Planning Council)
NRHP	National Register of Historic Places
O&M	operation and maintenance
OMR&P	operations, maintenance, replacement, and power
P&Gs	principles and guidelines
PIT	Passive Integrated Transponder
PP&L	Pacific Power & Light
PSD	Prevention of Significant Deterioration
PUD	Public Utilities District
Reclamation	Bureau of Reclamation
RED	Regional Economic Development
RM	river mile
ROD	Record of Decision
SHPO	State Historic Preservation Office
SOD	Safety of Dams
SR	State Route
Storage Study	Yakima River Basin Water Storage Feasibility Study
Study	Yakima Project Storage Dams Fish Passage Study
TOC	total organic carbon

$\mu g/m^3$	micrograms per cubic meter
USDI	U. S. Department of Interior
USFS	U. S. Forest Service
USFWS	U. S. Fish and Wildlife Service
VAC	visual absorption capability
WAAQS	Washington Ambient Air Quality Standard
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WM	Willamette Meridian
WSDOT	Washington State Department of Transportation
YKFP	Yakima/Klickitat Fisheries Project
YN	Yakama Nation
YRBWEP	Yakima River Basin Water Enhancement Project

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EXECUTIVE SUMMARY

The Bureau of Reclamation is leading a cooperative investigation with the Yakama Nation, State and Federal agencies, and others, to determine the feasibility of providing fish passage at five large storage dams of the Yakima Project -- Keechelus, Kachess, Cle Elum, Bumping Lake, and Tieton. The *Phase I Assessment* reviewed fish passage options for all five dams (Reclamation 2005 [Phase I]). This current feasibility study provides a more in-depth investigation of fish passage options at Cle Elum and Bumping Lake dams.

Background

Reclamation's commitment to study the feasibility of fish passage at these dams is documented in agreements, permits, and litigation settlements associated with the Yakima Project's Keechelus Dam Safety of Dams (SOD) construction. Early in 2001, many Yakima River basin interest groups urged Reclamation to incorporate fish passage facilities as part of the proposed reconstruction at Keechelus Dam under the SOD program. Reclamation determined that fish passage facilities could not be added under existing SOD authority. However, in the January 2002 *Record of Decision (ROD) for Keechelus Dam Modification* (Reclamation 2002), Reclamation committed to seek funding under existing authorities to conduct a feasibility study for providing fish passage at all Yakima Project storage dams. Further, Reclamation agreed to mitigation agreement terms and Hydraulic Project Approval (HPA) conditions with the Washington Department of Fish and Wildlife (WDFW) to investigate fish passage feasibility. In 2006, Reclamation and the Yakama Nation entered into a Settlement Agreement to resolve litigation, in which the parties agreed to collaborate to prepare technical plans and a planning report for fish passage at Cle Elum and Bumping Lake dams.

Reclamation collaborated with a Core Team of biologists, engineers, and other specialists from Federal, State, Tribal, and local entities to develop and evaluate fish passage alternatives. This Core Team and sub-groups met regularly throughout the Study to work through the biological, engineering, and operational issues associated with fish passage.

Study Area

The Study area lies within the Yakima River basin located in south-central Washington State. It includes Yakima, Kittitas, and Benton counties; about half of the basin lies in Yakima County. The Yakima River basin encompasses about 6,155 square miles. The Yakima Project provides irrigation water for a strip of fertile land that extends for 175 miles on both sides of the Yakima River in south-central Washington. The irrigable lands presently being served total approximately 464,000 acres. The Yakima Project storage dams are shown on the frontispiece map.

Authorities

The Tieton and Sunnyside divisions of the Yakima Project were authorized by the Secretary of the Interior on December 12, 1905, under the Reclamation Act of 1902 for the authorized purpose of irrigation. Bumping Lake Dam was constructed in 1910 and Cle Elum Dam in 1933; both under this authority.

The Yakima Project Storage Dam Fish Passage Study is conducted under the authority of the Act of December 28, 1979 (93 Stat. 1241, P. L. 96-162, Feasibility Study - Yakima River Basin Water Enhancement Project). Section 1205 of Title XII of the Yakima River Basin Water Enhancement Project Act of October 31, 1994 (P.L. 103-434, as amended, 108 Stat. 4550) authorized fish, wildlife, and recreation as additional purposes of the Yakima Project. Section 1206 of Title XII of this Act authorizes Reclamation to construct juvenile (i.e. downstream) fish passage facilities at Cle Elum Dam under a cost ceiling. Some aspects of fish passage facility construction, operation, and maintenance for the Yakima Project are also covered by the Hoover Power Plant Act of 1984.

Study Purpose and Objectives

Cle Elum and Bumping Lake dams were not equipped with fish passage facilities when constructed. Lack of fish passage at the dams blocked access to the lakes and upstream habitat for anadromous salmonids and resulted in the extirpation of one of the largest sockeye salmon runs in the Columbia River Basin from the Yakima River basin. Reclamation is examining the feasibility of providing fish passage for anadromous salmonids at these dams. Restoration of fish passage at is expected to enhance ecosystem integrity by 1) restoring sockeye populations in the Yakima River basin, 2) increasing the life history diversity, geographic distribution, and abundance of steelhead and coho and Chinook salmon, and 3) reconnecting isolated populations of Endangered Species Act (ESA)-listed bull trout.

Recommended Plan

The Core Team determined that providing juvenile and adult fish passage at the Cle Elum and Bumping Lake dams, in combination with reintroduction of anadromous salmonid species, and other actions that will achieve the ecological benefits and functions necessary to restore anadromous fish populations extirpated above the dams. There are numerous existing programs in the Yakima River basin that are improving fish habitat and utilizing hatchery supplementation to promote recovery of anadromous fish runs. Actions other than fish passage may enhance these ongoing recovery efforts but would fall short of providing the unique benefits (described in a later section) made possible by allowing passage of anadromous fish into the habitat above the dams. For these reasons, options such as operational changes were not considered to be viable alternatives and were not evaluated in this Study.

Reclamation developed a number of fish passage options for Cle Elum and Bumping Lake dams and worked extensively with the Core Team to review and identify options to study at the feasibility level. The proposed alternatives for Cle Elum and Bumping Lake dams that are identified in this report are supported by the Core Team.

Cle Elum Dam Fish Passage Facilities

Proposed fish passage facilities for Cle Elum Dam include both downstream juvenile passage and upstream adult passage. The total construction cost for the Cle Elum Dam fish passage facilities is estimated to be $96 million at January 2008 price levels. This includes field costs of $81 million and noncontract costs of $15 million. Construction of fish passage facilities would take three calendar years. The total annual operations, maintenance, replacement, and power (OMR&P) costs are estimated to be about $300,000 per year. Refer to Figure 4-5 for a site plan of the proposed fish passage facilities.

Downstream Fish Passage

The basic concept for downstream passage is to provide surface releases in enough volume to attract migrating juvenile fish to an overflow gate in the reservoir that will lead to a conduit that will safely discharge the fish downstream from the dam.

The downstream passage facilities would include a multilevel gated concrete intake structure located just above the spillway inlet channel and a conduit through the right abutment of the dam. The gates would allow release of fish passage flows at any time that the reservoir water surface is in the upper 50 feet of full pool. Downward opening gates would be used to provide surface release, or weir flow, to attract fish from the reservoir into the intake structure. The gates will provide fish passage flows in the range of 100 to 400 ft^3/s. Fish would then spill over a series of weirs and pools, depending on the water surface elevation of the reservoir, into the fish passage conduit. The fish passage conduit would be a 7-foot-diameter reinforced concrete structure 1,520 feet long. Fish would move through the conduit into the spillway stilling basin and then be able to move down river.

The proposed downstream fish passage facilities were designed to maximize passage for the majority of the season when smolts are migrating in early March to June, even in drier years. The height of the intake structure and gate elevations was selected to optimize the fish passage window without an excessive increase in costs.

Upstream Fish Passage

A trap and haul facility is proposed in lieu of a long fish ladder that would need to accommodate typical reservoir fluctuations in excess of 100 vertical feet. Trap and haul methods for upstream fish passage have been used successfully at other large dams in the Pacific Northwest. The upstream adult fish passage facility would include an angled barrier structure to guide fish to a fish ladder and a collection facility.

A 300-foot-long barrier dam angled about 55 degrees to the river flow would span the width of the Cle Elum River about 150 feet downstream from the spillway stilling basin. The barrier dam would guide fish to the fish ladder entrance on the left side of the river. Fish would swim up the ladder into the collection facility. When adequate numbers of fish are collected in the facility, they would be placed into a fish transport truck to haul fish upstream for release in the reservoir and upstream tributaries. The barrier dam and adult collection facility would be operated from early March to late December.

Bumping Lake Dam Fish Passage Facilities

Proposed fish passage facilities for Bumping Lake Dam include both downstream juvenile passage and upstream adult passage. The total construction cost for the Bumping Lake fish passage facilities is estimated to be about $27 million at January 2008 price levels. This includes field costs of $19 million and noncontract costs of $7.5 million. Construction of the fish passage facilities would take two calendar years. The total OMR&P costs are estimated to be about $150,000 per year. Refer to Figure 4-8 for a site plan of the fish passage facilities.

Downstream Fish Passage

The downstream fish passage concept is similar to that proposed at Cle Elum Dam. The proposed downstream passage facility would include a reinforced concrete intake structure and a conduit through the dam embankment. The intake structure would include two multilevel folding overshot, or tilting weir, gates set at different elevations to control passage release flows. The gates would be raised or lowered as needed to match desired outflow and reservoir levels. Fish would pass over the gates into a 20-foot-long by 20-foot-wide stilling pool that would vary from 5 to 10 feet deep and then into a conduit. The reinforced, cast-in-place concrete conduit, 230 feet long and 7 feet in diameter, would carry fish from the upstream intake structure and discharge them downstream into the river near the dam outlet works. The downstream fish passage facilities would generally be operated from early April to late June.

Upstream Fish Passage

A trap and haul system is also proposed to provide adult upstream passage at Bumping Lake Dam in lieu of a fish ladder long enough to accommodate reservoir fluctuations in excess of 30 feet. A barrier structure angled at 35 degrees to the outlet works channel would be constructed across the river to guide fish to the fish ladder entrance and into the collection facility. Fish would swim up the ladder into a holding pool. When adequate numbers of fish are collected in the facility, they would be placed into a fish transport truck to haul the fish upstream for release into the reservoir and upstream tributaries. The barrier and adult collection facility would generally be operated from early April to late November.

Benefits

Construction of fish passage facilities at Cle Elum and Bumping Lake dams and successful reintroduction of anadromous salmonids would restore much of the biological diversity and productivity that was lost when sockeye were extirpated from the upper basin and tributaries with dam construction. Restoring anadromous and resident fish to their historical habitat above the reservoirs and reintroducing sockeye would contribute to Yakama Nation ceremonial and spiritual values and would result in regional economic benefits.

Ecological Benefits

The primary purpose of providing fish passage at Cle Elum and Bumping Lake dams is to realize ecosystem and cultural benefits associated with the restoration of anadromous fish to historically occupied habitat. Since the Cle Elum River and Bumping River basins historically supported sockeye, Chinook and coho salmon, and steelhead, anadromous salmonid populations are anticipated to re-establish with installation of fish passage facilities at the dams and as active reintroduction efforts are pursued. Fish passage and anadromous fish reintroduction are expected to generate ecosystem benefits upstream of Cle Elum and Bumping Lake dams by providing additional food sources and nutrients for aquatic species, including resident and anadromous fish, as well as terrestrial animals (e.g., bears, eagles) and plants.

The infusion of marine-derived nutrients contributed by the carcasses of returning adults is fundamental to ecological functioning of the watershed and would enhance aquatic and terrestrial production, improve the overall trophic status of the ecosystem, and enhance future productivity of anadromous salmonids. The increase of marine-derived nutrients into the system would also benefit ESA-listed bull trout through increased productivity, particularly at Bumping Lake in the near-term. The return of spawning adult salmon will serve as a "nutrient pump" by transporting marine-derived nutrients to headwaters and streams where they provide an energy input into the system. Juvenile rearing salmon can feed directly on decomposing salmon carcasses or on the benthic macroinvertebrate production enhanced by the release of nutrients from the carcasses. Recent research has shown that nutrients contributed by returning adult salmon also influences productivity in the riparian zone through several physical and biological mechanisms. Restoring these nutrient cycles is a fundamental element of efforts to improve the ecological functioning of these watersheds.

Economic Benefits

Feasibility-level project cost estimates (construction and noncontract costs) were $96 million for Cle Elum Dam of which $63.8 million were expected to be incurred within the region (Yakima and Kittitas counties) and the remainder outside the region. Construction of Cle Elum Dam fish passage facilities is anticipated to provide an additional $90.6 million of

output, 937 jobs, and $35.9 million of labor income over the construction period. Output reflects the dollar value of production (sales revenues and gross receipts) from all industries in the region. Average annual OMR&P costs were estimated to generate an additional $436.7 thousand of output, five jobs, and $216.2 thousand of labor income.

Feasibility-level project cost estimates were $27 million for Bumping Lake Dam of which $13.0 million were expected to be incurred within the region (Yakima and Kittitas counties). Construction of Bumping Lake Dam fish passage facilities is anticipated to provide an additional $18.6 million of output, 196 jobs, and $7.5 million of labor income over the construction period. Average annual OMR&P costs were estimated to generate an additional $218.3 thousand of output, three jobs, and $108.1 thousand of labor income.

The increase in overall watershed productivity would be expected to provide economic benefits associated with improved recreational fisheries in the Yakima River basin, downriver, and the ocean recreational and commercial fisheries. Non-harvest recreational activities, including viewing of fish and wildlife, would also contribute to increased regional economic benefits.

Environmental Effects

Reclamation has only evaluated the effects of constructing fish passage facilities at Cle Elum and Bumping Lake dams compared to taking no action. This analysis is summarized in the table below.

Resources	No Action	Cle Elum Dam Fish Passage	Bumping Lake Dam Fish Passage
Water Quality	No change.	Temporary minor increases in turbidity and sedimentation during construction. No long-term changes.	Temporary minor increases in turbidity and sedimentation during construction. No long-term changes.
Native or Resident Fish	No change.	Temporary short-term disturbance during construction. Long-term benefit to productivity and genetic diversity from reconnection of populations above and below dam.	Temporary short-term disturbance during construction. Long-term benefit to productivity and genetic diversity from reconnection of populations above and below dam.
Vegetation	No change.	Minor temporary effect during construction.	Minor temporary effect during construction.
Wildlife	No change.	Minor disturbance near facilities during construction and operation activities.	Minor disturbance near facilities during construction and operation activities.

Resources	No Action	Cle Elum Dam Fish Passage	Bumping Lake Dam Fish Passage
Threatened and Endangered Species			
Bull trout	No change.	Temporary and minor impacts during construction due to increased turbidity and sedimentation. Species would benefit by creation of passage to upstream habitat areas.	Temporary and minor impacts during construction due to increased turbidity and sedimentation. Species would benefit by creation of passage to upstream habitat areas.
Middle Columbia River steelhead	No change.	Temporary and minor impacts during construction due to increased turbidity and sedimentation. Species would benefit from connection between upstream and downstream habitats and associated genetic exchange.	Temporary and minor impacts during construction due to increased turbidity and sedimentation. Species would benefit from connection between upstream and downstream habitats and associated genetic exchange.
Gray wolf	Not likely to be present in the construction area.	No adverse impact to habitat.	No adverse impact to habitat.
Grizzly bear	Not likely to be present in the construction area.	No adverse impact to habitat.	No adverse impact to habitat.
Marbled murrelet	Not likely to be present in the construction area.	No effect.	No effect.
Northern spotted owl	No change.	Minor effects to habitat could occur through the removal of a few mature Douglas fir or other conifers for construction of the adult collection facility and access road.	Minor effects to habitat could occur through the removal of a few mature Douglas fir or other conifers for construction of the adult collection facility and access road.
Ute ladies'-tresses	Not likely to be present in the construction area.	No effect.	No effect.
Greater sage grouse	Habitat for this species is not present in the construction areas; no impacts would occur.	Not applicable.	Not applicable.
Yellow-billed cuckoo	Not likely to be present in the construction areas and would not be impacted.	No effect.	No effect.
Basalt daisy	Not present in the constructions areas and would not be impacted.	Not applicable.	Not applicable.

Resources	No Action	Cle Elum Dam Fish Passage	Bumping Lake Dam Fish Passage
Visual Resources	Not applicable.	Minor temporary adverse effect during construction. Negligible long term effect.	Minor temporary adverse effect during construction. Negligible long term effect.
Air Quality			
Construction	Not applicable.	Slight temporary short-term effect.	Slight temporary short-term effect.
Operation	Not applicable.	No effect.	No effect.
Noise			
Construction	Not applicable.	Temporary, localized, short-term, generally limited to daytime hours.	Temporary, localized, short-term, generally limited to daytime hours.
Operation	Not applicable.	Negligible.	Negligible.
Recreation			
Construction	Not applicable.	Short term, limited in duration.	Short term, limited in duration.
Operation	Not applicable.	No effect.	No effect.
Land and Shoreline Use			
Land use conversion	Not applicable.	Not applicable.	Not applicable.
Compatibility with existing uses	Not applicable.	Compatible.	Compatible.
Consistency with relevant county land use plans and policies	Not applicable.	Likely consistent.	Likely consistent.
Utilities	No change.	No anticipated short-or long-term adverse impacts.	No anticipated short-or long-term adverse impacts.
Transportation			
Construction	Not applicable.	Slight temporary short-term adverse effect.	Moderate temporary short-term adverse effect.
Operation	No change.	Negligible effect.	Negligible effect.
Environmental Justice	No change.	No adverse effects.	No adverse effects.
Historic Resources			
Number of NHRP-eligible affected properties	Not applicable.	1 potential adverse effect.	0 no adverse effects.
Number of unknown and non-	Not applicable.	7 negligible or no adverse	8 negligible or no adverse

Resources	No Action	Cle Elum Dam Fish Passage	Bumping Lake Dam Fish Passage
NRHP eligible properties		effects.	effects.
Indian Sacred Sites			
Number of affected sites	Not applicable.	Unknown.	Unknown.
Indian Trust Assets			
Fishing rights	No change.	Potential increase in harvestable fish.	Potential increase in harvestable fish.

Findings and Recommendations

Reclamation and the Core Team found that construction of the proposed fish passage facilities in conjunction with reintroduction of anadromous salmonid species through a proposed reintroduction program will achieve the ecological benefits and functions necessary to help restore anadromous fish populations extirpated above the dams and improve resident fisheries. Reclamation has determined that the proposed downstream and upstream fish passage facilities examined in this report are technically feasible.

Reclamation will initiate the next Study phase by beginning preparation of an environment impact statement or environmental assessment of fish passage facility construction at Cle Elum Dam. Reclamation will work with the Core Team to incorporate analyses for reintroduction of anadromous salmonids into plans and environmental documents. Investigation of Bumping Lake Dam fish passage facilities will begin during construction of Cle Elum facilities.

Chapter 1 INTRODUCTION

The Bureau of Reclamation is leading a cooperative investigation with the Yakama Nation (YN), State and Federal agencies, and others, to study the feasibility of providing fish passage at five large storage dams of the Yakima Project -- Keechelus, Kachess, Cle Elum, Bumping Lake, and Tieton. The current feasibility-level study is focused on investigating fish passage at Cle Elum and Bumping Lake dams.

1.1 Location

The Study area lies within the Yakima River basin located in south-central Washington State bounded on the west by the Cascade Range, on the north by the Wenatchee Mountains, on the east by the Rattlesnake Hills, and on the south by the Horse Heaven Hills. It includes Yakima, Kittitas, and Benton counties; about half of the basin lies in and occupies most of Yakima County. The Yakima River flows southeasterly for about 215 miles from its headwaters in the Cascades east of Seattle, Washington to its confluence with the Columbia River near Richland, Washington. The Yakima River basin encompasses about 6,155 square miles. The frontispiece map depicts the general Study area and location of the Yakima Project storage dams, including Cle Elum and Bumping Lake dams.

1.2 Yakima Project

The Yakima Project provides irrigation water for a narrow strip of fertile land that extends for 175 miles on both sides of the Yakima River in south-central Washington. The irrigable lands presently being served total approximately 464,000 acres.

There are seven divisions in the Project: Storage, Kittitas, Tieton, Sunnyside, Roza, Kennewick, and Wapato. The Wapato Division is operated by the Bureau of Indian Affairs, but receives most of its water supply from the Yakima Project for irrigation of 136,000 acres of land. Over 45,000 acres not included in the seven divisions are irrigated by private interests under water supply contracts with Reclamation. Storage dams and reservoirs on the project are Bumping Lake, Clear Creek (Clear Lake), Tieton (Rimrock Lake), Cle Elum, Kachess, and Keechelus. Other project features are five diversion dams, canals, laterals, pumping plants, drains, two powerplants, and transmission lines.

1.2.1 Project Purposes

Reclamation operates the Yakima Project to achieve specific purposes: irrigation water supply, flood control, power generation, and instream flows for fish, wildlife, and recreation. Irrigation operations and flood control management have been historical priorities for reservoir operations. The Yakima Project's authorization and water rights, issued under

Washington State water law and the *1945 Consent Decree*, are statutory constraints for water resources. Reclamation must operate the Yakima River divisions and storage facilities in a manner that avoids injury to water users within this framework.

Legislation in 1994 provided that an additional purpose of the Yakima Project shall be for fish, wildlife, and recreation, but that this additional purpose "shall not impair the operation of the Yakima Project to provide water for irrigation purposes nor impact existing contracts." Since April 1995, the Yakima Project has been operated as required by the 1994 legislation to maintain target streamflows downstream from Sunnyside Diversion Dam as measured at the Yakima River near the Parker stream gage.

Hydroelectric power is produced coincidentally to other Project purposes. Reservoir storage releases are not made to meet hydroelectric power demand; sometimes incidental power generation at Project facilities is subordinated to meet instream flow requirements. Recreational needs are considered but are incidental to other Project purposes. Maximizing flood control, irrigation water delivery, and meeting streamflow needs requires continuous water management adjustments and includes many system operation considerations.

1.3 Study and Other Authorities

The Tieton and Sunnyside divisions of the Yakima Project were authorized by the Secretary of the Interior on December 12, 1905, under the Reclamation Act of 1902 for the authorized purpose of irrigation. Bumping Lake Dam was constructed in 1910 and Cle Elum Dam in 1933; both under this authority.

This Study is a feasibility investigation of fish passage for anadromous salmonids at Yakima Project storage dams. Congress authorized Reclamation to conduct a feasibility study to address the water resource needs of the Yakima River basin in the Act of December 28, 1979 (93 Stat. 1241, P. L. 96-162, Feasibility Study - Yakima River Basin Water Enhancement Project). A feasibility investigation of fish passage at the Yakima Project storage dams is one aspect of the study authorized; this Study was conducted under the authority of this Act.

Other authorities relevant to the construction, operation, and maintenance of the Yakima Project are listed below.

Hoover Power Plant Act of 1984

Congress passed the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (commonly called the Northwest Power Act) (94 Stat. 2697; 16 U.S.C. 839 note; 16 U.S.C. 839b note), creating the Northwest Power Planning Council, now known as the Northwest Power and Conservation Council (NPCC). Under this authority, the NPCC adopted a Columbia River Fish and Wildlife Program identifying actions for the protection and restoration of fish and wildlife. The Yakima River Basin Water Enhancement Project

(YRBWEP) is a Federal action to improve streamflow and fish passage conditions and is part of a comprehensive program to restore the Yakima River basin anadromous fishery resource. Phase I of YRBWEP was initiated to construct fish passage and protective facilities within the Yakima River basin in conjunction with the Bonneville Power Administration (BPA), the State of Washington, and others under the auspices of the NPCC pursuant to the Northwest Power Act.

Section 109 of the Hoover Power Plant Act of August 17, 1984 (P. L. 98-381, 98 Stat. 1340), authorizes Reclamation to design, construct, and operate fish passage facilities within the Yakima River basin that is in accordance with the NPCC's Columbia River Fish and Wildlife Program. A companion law was enacted August 22, 1984 to provide, among other things, for operations and maintenance costs related to fish facilities (P. L. 98-396, 98 Stat. 1379).

Yakima River Basin Water Enhancement Project Act of 1994

Phase II of YRBWEP focused on the conservation program of the enhancement project and was authorized by Congress in Title XII of the Yakima River Basin Water Enhancement Project Act of October 31, 1994 (P. L. 103-434, as amended, 108 Stat. 4550). Section 1205 of Title XII authorized fish, wildlife, and recreation as additional purposes of the Yakima Project. Section 1206 of Title XII authorizes Reclamation to construct juvenile fish passage facilities at Cle Elum Dam under a cost ceiling.

1.4 Study Purpose, Scope, and Objectives

Cle Elum and Bumping Lake dams are two of five major storage dams in the Yakima Project that were not equipped with fish passage facilities when constructed. Cle Elum and Bumping lakes were natural lakes turned to reservoirs by the construction of dams. Successful implementation of fish passage at these two dams could eventually lead to future detailed studies of passage at the other three dams – Kachess, Keechelus, and Tieton.

Historically, the natural lakes supported three species of salmon, steelhead (an ocean run trout), bull trout, and other resident fish important to Native Americans. Lack of passage at the dams blocked access to the lakes and upstream habitat for anadromous salmonids and resulted in the extirpation of one of the largest sockeye salmon runs in the Columbia River Basin (Section 2.2.1). Sockeye salmon are dependent on lakes for juvenile rearing. The absence of passage has also isolated local populations of bull trout and prevented the recolonization of populations diminished by natural catastrophic events.

Restoration of fish passage at Cle Elum and Bumping Lake dams is being evaluated with the objective of maximizing ecosystem integrity by restoring connectivity, biodiversity, and natural production. The extirpation of the abundant sockeye salmon and other species from the basin substantially reduced species diversity and substantially decreased the infusion of marine-derived nutrients that contributed to the overall biological productivity of the upper

basin lakes and tributaries (NPCC 2004). There have been no natural returns of marine-derived nutrients to the lakes since construction of the dams. The carcasses of returning salmon can reintroduce marine nutrients to the ecosystem that are fundamental for ecological restoration. Birds of prey and terrestrial and aquatic animals feed on salmon and steelhead carcasses. The reduction of marine-derived nutrients also affected predators, aquatic and terrestrial vegetation, and resident fisheries by reducing overall system productivity.

Construction of passage features has the potential to reconnect isolated populations of bull trout; restore life history and the genetic diversity of salmon; and increase populations of upper basin steelhead and coho and Chinook salmon. Two of the species that would benefit, bull trout and Middle Columbia River steelhead, were listed as threatened under the Endangered Species Act (ESA) in 1998 and 1999, respectively.

1.5 Study Background

Anadromous salmonids, including sockeye salmon (*Oncorhynchus nerka*), coho salmon (*O. kisutch*), Chinook salmon (*O. tshawytscha*), and steelhead (*O. mykiss*), historically occupied the four natural lakes in the Yakima River basin (Keechelus, Kachess, Cle Elum, and Bumping lakes) and their upstream tributaries, as did resident fish including bull trout (*Salvelinus confluentus*). Timber crib dams, constructed between 1904 and 1910 at the outlets of these four natural glacial lakes, blocked fish passage to tributaries upstream from the dams. Reclamation later constructed larger storage dams over the timber crib dams, beginning in 1910, as well as a fifth new dam on the Tieton River. Construction of the timber dams, followed by the larger Reclamation storage dams, eliminated access to previously productive spawning and rearing habitat for anadromous salmonids and resident fish, and inundated a considerable amount of pristine, high-quality habitat.

Several watershed assessment and planning efforts have recognized the lack of fish passage at Yakima River basin storage facilities, including Cle Elum and Bumping Lake dams, as a significant limiting factor in the recovery of salmon, steelhead, and bull trout populations in the basin. Beginning in 1983, the NPCC's Fish and Wildlife Program identified measures for restoring fish populations in the Yakima River basin. A number of studies have occurred under this program, including the Cle Elum Lake Anadromous Salmon Restoration Feasibility Study. This study, conducted from 1987 to 1993, assessed the feasibility of reestablishing sockeye salmon above Cle Elum Lake and concluded that adequate spawning habitat existed (Flagg et al. 2000). A report prepared for the Washington State Conservation Commission in 2001, pursuant to the State's Salmon Recovery Act of 1998, cited the lack of anadromous fish passage at Cle Elum and Bumping Lake dams and other major Yakima River basin storage dams as one of the most critical habitat concerns in the Yakima River basin (Haring 2001). The NPCC's *2004 Yakima Subbasin Plan* identified fish passage at both Cle Elum and Bumping Lake dams as a Tier 1 (or top level) high priority need in the basin (NPCC 2004).

Section 2.3 provides additional information about some of these studies and other related programs focused on the recovery of anadromous salmonids in the Yakima River basin.

Early in 2001, many Yakima River basin interest groups urged Reclamation to incorporate fish passage facilities as part of the proposed reconstruction at Keechelus Dam under the Safety of Dams (SOD) program. Reclamation carefully considered this issue but determined that fish passage facilities could not be added under existing SOD authority. However, in the January 2002, *Record of Decision (ROD) for Keechelus Dam Modification* (Reclamation 2002), Reclamation committed to seek funding under its existing authority (Act of December 28, 1979; 93 Stat. 1241, P.L. 96-162, Feasibility Study – Yakima River Basin Water Enhancement Project) to conduct a feasibility study for fish passage at all Yakima Project storage dams.

Subsequent to issuance of the ROD, Reclamation signed negotiated agreements and agreed to construction permit conditions, all associated with the Keechelus Dam SOD reconstruction, that have guided this feasibility investigation. These documents are summarized here and provided in Appendix A.

Mitigation Agreement - Washington Department of Fish and Wildlife and Reclamation

The *Mitigation Agreement between the USDI Bureau of Reclamation and Washington Department of Fish and Wildlife regarding Keechelus Dam Construction Issues Including Fish Passage* (Mitigation Agreement) was signed in April 2002 (Appendix A). Major provisions included:

- Conduct an assessment of fish passage, potential fish production, and sustainability at each Yakima Project storage dam and reservoir.
- Examine engineering feasibility at dams where the assessment determined fish passage was desirable and practicable.
- Negotiate with WDFW to determine alternatives to fish passage where the assessment determined it was impracticable or infeasible.
- Seek funds to ensure timely implementation of identified fish passage and alternative fish restoration measures.
- Provide interim passage (trap and haul) until fish passage facilities are constructed.

Hydraulic Project Approval (HPA)

WDFW issued the *Hydraulic Project Approval for Safety of Dams Reconstruction of Keechelus Dam* on April 17, 2002 (Appendix A). The HPA contains 65 provisions requiring compliance during and after the SOD reconstruction of Keechelus Dam. Provisions 56, 57, and 58 of the HPA contain essentially the same provisions as the Mitigation Agreement but also include specific milestone dates for completion of certain activities.

Litigation

In April 2002, the YN filed a 60-Day Notice of Intent to File a Claim under the ESA regarding the Keechelus Dam SOD reconstruction and later initiated a lawsuit. The Court rendered a judgment in favor of the United States in January 2003. Shortly thereafter, the YN appealed the Court's decision. The YN and Reclamation entered into mediation procedures which resulted in a Settlement Agreement signed in 2006 (Appendix A).

The following agreements were made:

- Reclamation agreed to use existing Congressional authority and funding to implement interim downstream fish passage measures at Cle Elum Dam until permanent fish passage is implemented or Reclamation concludes permanent passage is infeasible.

- Reclamation and the YN agreed to study and develop feasible measures, if any, for permanent downstream and upstream fish passage implementation at Cle Elum and Bumping Lake dams.

- Reclamation agreed to provide annual funding to the YN for cooperative planning activities by the YN Fisheries Resource Management Program.

- Reclamation agreed to prepare a technical plan and planning report with regard to feasibility of implementing permanent fish passage at Cle Elum and Bumping Lake dams.

- Reclamation and the YN agreed to meet to discuss whether the Technical Yakima Basin Storage Fish Passage Work Group (Core Team) should study and develop additional plans with regard to the feasibility of implementing permanent upstream and downstream fish passage at Kachess, Keechelus, and Tieton Dams in the Yakima River basin.

1.6 Study Investigations

Reclamation initiated this Study in 2002. The following summarizes previous investigations leading up to and contributing to the feasibility-level study.

1.6.1 Phase I Assessment Report

Reclamation completed a *Yakima Dams Fish Passage, Phase I Assessment Report* (Reclamation 2005 [Phase I]) that evaluated fish passage at the five Yakima Project storage dams. Based on the information developed for this assessment, Cle Elum and Bumping Lake dams were identified as the two highest priority sites for continued investigation of fish passage feasibility. Section 3.1 provides additional information about the Phase I assessment.

1.6.2 Cle Elum Dam Interim Fish Passage

In the early spring of 2005, Reclamation completed construction of an interim (temporary, experimental) downstream juvenile fish passage facility at Cle Elum Dam. Annual reports documented interim passage program results for 2006 and 2007 (Reclamation 2006; Reclamation 2008 [Interim Fish Passage]). Section 2.5 provides additional information about the program.

1.6.3 Anadromous Fish Reintroduction Plan

The fisheries co-managers (YN and WDFW) have developed a plan to reintroduce anadromous salmonids upstream from the Yakima Project dams (Reclamation 2005 [Reintroduction]; Fast and Easterbrooks 2008). The plan identifies species, goals, sequencing, and timing and is detailed in Section 2.3.3.

1.6.4 Additional Analyses

Numerous technical appendices and memoranda document the analyses contributing to this feasibility-level investigation of fish passage. These are referenced in this document and key information summarized where appropriate. Many of these can be found at: http://www.usbr.gov/pn/programs/usao_misc/fishpassage/index.html or in Reclamation files and include:

- *Phase I Assessment Report,* Technical Series No. PN-YDFP-001. April 2005.
- *Stream Macroinvertebrate Surveys in the Cle Elum and Bumping River Watersheds,* Technical Series No. PN-YDFP-002. January 2005.
- *Fisheries Reintroduction Plan,* Technical Series No. PN-YDFP-003. February 2005.
- *Cle Elum Juvenile PIT Tag Fish Bypass System,* Technical Series No. PN-YDFP-004. October 2005.
- *Physical, Chemical, and Biological Characteristics of Cle Elum and Bumping Lakes,* Technical Series No. PN-YDFP-005. March 2007.
- *Coho Salmon Production Potential in the Cle Elum River Basin,* Technical Series No. PN-YDFP-007. March 2007.

- *Assessment of Sockeye Salmon Production Potential in the Cle Elum River Basin,* Technical Series No. PN-YDFP-008. March 2007.
- *Coho Salmon Production Potential in the Bumping River Basin,* Technical Series No. PN-YDFP-009. March 2007.
- *Assessment of Sockeye Salmon Production Potential in the Bumping River Basin,* Technical Series No. PN-YDFP-010. March 2007.
- *Cle Elum Dam Interim Fish Passage Operations 2006 Annual Report,* Technical Series No. PN-YDFP-011. December 2006.
- *Cle Elum and Bumping Lake Dams Fish Passage Facilities Biology Appendix,* Technical Series No. PN-YDFP-012. January 2008.
- *Cle Elum Dam Interim Fish Passage Operations 2007 Annual Report,* Technical Series No. PN-YDFP-013. May 2008.
- *Cle Elum and Bumping Lake Dams Fish Passage Facilities Designs and Estimates Appendix,* Technical Series No. PN-YDFP-006. September 2008.
- *Yakima Dams Fish Passage Study Economics Technical Memorandum,* Reclamation 2008. September 2008.

1.7 Coordination with Others

Reclamation is supported in this effort by a Core Team of biologists, engineers, and other specialists from Federal, State, and local entities. Partners include:

- Yakama Nation (YN)
- National Marine Fisheries Service (NOAA Fisheries Service)
- U.S. Fish and Wildlife Service (USFWS)
- Washington Department of Fish and Wildlife (WDFW)
- Bonneville Power Administration (BPA)
- City of Yakima
- North Yakima Conservation District
- Tri-County Water Resources Agency
- U.S. Forest Service (USFS)
- Washington Department of Agriculture
- Washington Department of Ecology (Ecology)
- Wenatchee National Forest
- Yakima Basin Joint Board
- Yakima River Basin Commodity Coalition
- Yakima-Tieton Irrigation District

The Core Team and sub-groups met (and continue to meet) on a regular basis to work through biological, engineering, and operational issues associated with fish passage at the storage dams and planning reintroduction of fish species to coincide with construction of a fish passage facility at Cle Elum Dam. The primary input to the process from non-Reclamation team members comes in the form of discussion of options, review comments on Reclamation drafted documents, and Core Team meeting attendance.

1.8 Other Related Yakima River Basin Studies and Activities

Other Yakima River basin activities or issues that are linked in various ways to the objectives of this fish passage study have been considered throughout the planning process. Following is a brief summary of the most pertinent activities.

1.8.1 Cle Elum Dam Preliminary Analysis of Fish Passage Concepts

As part of YWBWEP Title XII, Reclamation conducted an analysis of potential fish passage at Cle Elum Dam following a proposal in 1998 to raise the water surface elevation in Cle Elum Lake by 3 feet. This study entailed a preliminary analysis of potential downstream and upstream fish passage options at Cle Elum Dam (Reclamation 2000).

1.8.2 Yakima River Basin Water Enhancement Project

The YRBWEP was authorized under P.L. 103-434, of October 31, 1994, as amended by P.L. 105-62, October 13, 1997 and P.L. 106-372, October 27, 2000

This project evaluates and implements structural and nonstructural measures to increase the reliability of the irrigation water supply and enhance streamflows and fish passage for anadromous fish in the Yakima River basin. Facility modifications; implementation of water conservation measures; the purchase or lease of land, water, or water rights from willing sellers for habitat improvements and habitat restoration; and changes in operations, management, and administration may be implemented to reduce the demand on the available water supply. Two-thirds of water conserved under the Basin Conservation Program would remain instream to benefit anadromous fish. Tribal water supply systems would be improved, the Toppenish Creek Corridor enhanced, and an irrigation demonstration program would be developed for the YN to enhance Tribal economic, fish, wildlife, and cultural resources.

Specific projects completed or proposed under YRBWEP include:

- Conservation projects such as construction of re-regulation reservoirs, piping canals, and automation of canal gates by Sunnyside, Roza, Benton, Kennewick, and Union Gap irrigation districts.
- Similar conservation projects for the YN.
- Purchase of land and water to improve anadromous fish habitat and increase instream flows.

- Electrification of hydraulic pumps and/or exchange in diversion points for delivery of Kennewick Irrigation District water.
- Work in tributaries to remove fish barriers and increase instream flows.

YRBWEP is managed by Reclamation's Yakima Field Office in partnership with Ecology and various local entities such as the irrigation districts, the YN, and various basin biologists from Federal and State entities, among others.

1.8.3 Yakima River Basin Water Storage Feasibility Study

In the Act of February 20, 2003 (P. L. 108-7), Congress directed Reclamation "to conduct a feasibility study of options for additional water storage in the Yakima River basin, Washington, with emphasis on the feasibility of storage of Columbia River water in the potential Black Rock Reservoir…." Reclamation initiated the Yakima River Basin Water Storage Feasibility Study (Storage Study) in May 2003. This study addresses two potential actions:

- Diverting Columbia River water to a potential Black Rock reservoir for further transfer to irrigation entities in the Yakima River basin as an exchange supply, thereby reducing irrigation demand on Yakima River water, and improving Yakima Project stored water supplies.
- Creating additional water storage for the Yakima River basin to provide increased management flexibility of the existing water supply.

A Storage Study draft planning report/environmental impact statement was prepared to address the technical viability of Yakima River basin storage alternatives and the extent that the additional stored water supply would improve anadromous fish habitat, improve the water supply for existing proratable (junior) water users, and provide water supply for future municipal demands.

1.8.4 Grant County Public Utility District Federal Energy Regulatory Commission Application

A preliminary permit to study the development of a hydroelectric plant at Cle Elum Dam was issued by the Federal Energy Regulatory Commission (FERC) to the Public Utility District (PUD) No. 2 of Grant County, Washington in January 2007 (FERC Project No. P-12746). While conveying no rights of development, the preliminary permit is an exclusive right to study the site for up to three years while the permittee develops plans and performs studies leading to the filing of licensing documents. Additionally, the preliminary permit protects the site from competition from other potential developers.

The project, as proposed in the permit application, is a 30.2 megawatt powerplant that would be constructed alongside the existing stilling basin at the same location as Reclamation's proposed adult fish collection facility. Construction and operation of Reclamation's proposed fish passage facilities could impact the feasibility of developing the site for power production. Reclamation has met with Grant County PUD representatives to discuss the proposed hydropower project. It is Grant County PUD's responsibility to propose a facility that does not impact the location or effectiveness of the fish passage facilities.

During project licensing, the technical, environmental, economic, and financial feasibility of the power generation project would be examined by Grant County PUD and would be coordinated with Reclamation and other interested Federal, State, and local agencies. Reclamation retains authority over the site under Section 4(e) of the Federal Power Act which allows Reclamation to have full approval rights of the construction and operation of a powerplant at the dam. In addition, Reclamation requires all developers to sign separate contracts for development and operation coordination of projects located at its dams.

Chapter 2 BIOLOGICAL CONSIDERATIONS, ASSESSMENTS, AND BENEFITS OF FISH PASSAGE

This chapter provides an overview of biological information considered during the design of downstream and upstream fish passage facilities at Cle Elum and Bumping Lake dams. Reclamation and Core Team members funded or conducted a number of additional biological assessments to determine existing stream and reservoir habitat conditions and the potential to restore and sustain anadromous salmonids above the lakes. Detailed discussion of the data collection methods and analyses described in this section can be found in technical reports and the *Biology Appendix* (Reclamation 2008 [Biology Appendix]), and are referenced as appropriate.

2.1 Yakima River Basin Fisheries

Estimates of the historic abundance of the several species of salmon and steelhead in the Yakima River basin vary widely. Estimated historic abundance of spring Chinook salmon range from about 55,000 to 200,000; for summer Chinook salmon, from 86,000 to 100,000; for fall Chinook salmon, from 50,000 to 100,000; for coho salmon, from 44,000 to 150,000; for sockeye salmon, up to 211,104; and for steelhead from 24,000 to 80,000 (Yakama Nation 2001). This results in an estimated historic abundance ranging from 470,000 to 841,000 for all adult salmon and steelhead.

It is estimated that by 1900, prior to construction of the Project storage dams, the number of returning anadromous salmonid adults to the Yakima River basin had been reduced by about 90 percent, compared to historic runs (Davidson 1965, as cited in Tuck 1995). Salmon and steelhead runs continued to decline as a result of loss of habitat above the lakes and other anthropogenic activities and by 1920, only an estimated 11,000 adults returned to the Yakima River basin (USBR 1979, as cited in Tuck 1995), a reduction of more than 98 percent of the historic run (NPCC 1990).

Timber crib dams, initially constructed to enlarge four existing natural glacial lakes (Keechelus, Kachess, Cle Elum, and Bumping), blocked fish passage to tributaries upstream from the dams and contributed to the eventual extirpation of the sockeye salmon runs in the Yakima River basin by the early 20th century (Bryant and Parkhurst 1950, Davidson 1953, Fulton 1970, Mullan 1986). Reclamation later constructed larger storage dams over the timber crib dams beginning in 1910 as well as a fifth new dam on the Tieton River. None of the existing dams have fish passage facilities.

2.2 Species of Interest

2.2.1 Sockeye Salmon

Sockeye salmon (*Oncorhynchus nerka*) were extirpated from the Yakima River basin in the early 1900s. Historically, juvenile sockeye salmon reared in all of the headwaters lakes, Keechelus, Kachess, Cle Elum, and Bumping, and adults probably spawned both in the lakes and lake tributaries. Juvenile rearing is dependant upon lakes. Before construction of unladdered timber crib dams (1904-1910) at the outlets of these four lakes, the sockeye salmon run was probably larger than any other in the Columbia River Basin in terms of numerical abundance (Yakama Nation 1990), with estimated historic annual returns ranging from 150,000 to 200,000.

Except for a handful of adult fish returning in 1991, 1993, and 1995 from experimental Cle Elum Lake research releases of hatchery reared stock developed from Lake Wenatchee stock and a number of experimental releases of smolts in the 1940s, sockeye salmon have not returned to the Yakima River basin since the1920s. Present day run-timing for adult sockeye salmon at Rock Island Dam and Rocky Reach Dam on the Columbia River peaks in early-mid July, and reintroduced sockeye salmon from either Lake Wenatchee or Lake Osoyoos would likely have a similar run-timing.

Juvenile sockeye salmon rear almost exclusively in lakes, rather than their natal streams as do other Pacific salmon species. Sockeye salmon also exhibit unique spawning behavior. Some populations of adult sockeye salmon spawn in tributaries entering lakes or in lakes, while some populations spawn in rivers flowing out of the lakes, downstream from the lake outlet. Upon emergence, sockeye salmon fry in lake outlet spawning populations must migrate upstream in order to utilize the rearing habitat in the lake, whereas fry emerging from lake inlet streams must migrate downstream to the rearing habitat in the lake. The direction sockeye salmon fry migrate is genetically based and is an important consideration for fish passage and hatchery supplementation (Burgner 1991).

Most sockeye salmon rearing lakes are oligotrophic (low in nutrients), but which are sufficiently productive to support sockeye salmon. Among the lakes in the upper Columbia River Basin that support sockeye salmon populations, Lake Wenatchee is oligotrophic while Lake Osoyoos on the Okanagon River is somewhat more productive.

2.2.2 Coho Salmon

Coho salmon (*O. kisutch*) were extirpated gradually from the Yakima River basin, with the last spawning fish observed in 1977 and zero fish counted at Prosser Dam by 1984 (Haring 2001). All upper Columbia River coho salmon stocks, including those in the Yakima River, are believed to be extinct; endemic coho salmon were extirpated in the early 1980s (Berg and

Fast 2001). A coho salmon restoration program began in 1983 and has experienced some success (Yakama Nation 2004). Coho salmon are already present in the Yakima River system, principally as part of the Yakima-Klickitat Fisheries Project (YKFP) coho salmon reintroduction program.

Beginning in the 1950s and continuing through the 1970s, an extensive network of coho salmon hatcheries were constructed in the lower Columbia River. Efforts to restore coho salmon within the Yakima River basin rely largely upon releases of hatchery-produced fish. Natural reproduction of hatchery reared coho salmon, outplanted as smolts, is now occurring in the Yakima River and the Naches River. Natural reproduction is evident from the increasing occurrence of age-zero coho salmon parr (juvenile fish) in samples collected at numerous points in the basin (Yakama Nation, unpublished data, 2000). Coho salmon currently returning to the basin are a mix of hatchery stocks from outside the basin. Efforts are underway to develop a "naturalized" stock.

Currently, coho salmon enter the Yakima River in the fall with about 10 to 20 percent of the adults reaching the upper watershed between Cle Elum and Easton in November and December. Spawning occurs soon afterward; the eggs incubate over the winter and hatch in the spring. After the fry emerge from the gravel, the juveniles rear in the stream until the following spring when they outmigrate as one-year-old smolts.

2.2.3 Spring Chinook Salmon

Spring Chinook salmon (*O. tshawytscha*) are reared at the Cle Elum supplementation facility as part of the YKFP supplementation project; there is also a wild component of the population that migrates further up the Yakima River. An estimated 12 percent of the adult wild spring Chinook salmon that spawn in the upper Yakima River basin spawn in the 8-mile reach of the Cle Elum River downstream from the dam.

All Yakima River stocks of spring Chinook salmon exhibit an extensive downstream migration of pre-smolts in the late fall and early winter (Pearsons et al. 1996, Berg and Fast 2001). Most juvenile spring Chinook salmon in the Upper Yakima River basin migrate down river during the fall-winter period and overwinter in the Yakima River somewhere between Roza and Prosser dams (Berg and Fast 2001).

Adult spring Chinook salmon return to the upper mainstem Yakima River beginning in May. Adults migrate close to the area where they will spawn and find a place to hold in cover (deep water with woody debris or undercut banks or both) until they spawn in September and October. Depending on water temperature, the peak of spawning activity for spring Chinook salmon in the upper mainstem Yakima River is from September 15 to October 1 (Fast et al. 1991). Adults that spawn in the upper reaches of tributaries typically move into the tributaries by the end of June or early July when flows are still high enough for them to traverse the

lower reaches of the tributaries. Some migrating adult fish will arrive early prior to the time some streams go subsurface to make it past the parts of the streams that eventually go dry for a period of time. Variability in run timing is influenced by high and low flows. Run timing for spawning runs of all salmon and steelhead is delayed during years of high flow and accelerated in years of low flow.

2.2.4 Steelhead

Adult Middle Columbia River steelhead (*O. mykiss*) return to the upper Yakima River between September and May. Generally, adult Middle Columbia River steelhead migration into the Yakima River basin begins in late summer and peaks in late-October and again from late February or early March following a relatively inactive period during the coldest wintertime water temperatures.

Typically, steelhead spawn earlier in lower-elevation warmer waters than in higher-elevation colder waters. Overall, most spawning occurs between March through May (Hockersmith et al. 1995), although WDFW personnel have observed steelhead spawning as late as July in the Teanaway River (river mile [RM] 176.1), a tributary to the upper arm of the Yakima River. Yakima River basin steelhead are tributary spawners, with most currently spawning in the complex, multi-channel reaches of tributaries with a "moderate" gradient, about 1 to 4 percent (Berg and Fast 2001), such as Naches River and tributaries, Satus Creek, or Toppenish Creek.

Juvenile steelhead emerge from the gravel between June and August and rear in the areas near where they were spawned for 2 to 4 years before migrating to the sea. Juvenile steelhead utilize tributary and mainstem reaches throughout the Yakima River basin as rearing habitat and use faster and deeper water as they grow. Some downstream movement begins in November, but the peak of the smolt outmigration occurs between mid-April and May.

Yakima River basin steelhead are a component of the ESA-listed Middle Columbia River steelhead distinct population segment.

2.2.5 Bull Trout

Bull trout (*Salvelinus confluentus*) occurred historically throughout most of the Yakima River basin. Today, however, they are fragmented into relatively isolated populations. Although bull trout were probably never as abundant as other salmonids in the basin, due in part to their requirements for cold, clear water, they were certainly more abundant and more widely distributed than they are today (WDFW 1998).

Three bull trout life history forms are present in the Yakima River basin: adfluvial (migrate to lakes), fluvial (migrate to rivers), and resident. Adfluvial and fluvial fish reside in lakes and mainstem rivers, respectively, during part of the year. Fry and juveniles rear in their natal

streams for 1 to 4 years before migrating downstream into lakes or mainstem river systems. Adults migrate back into tributary streams to spawn, after which they return to the lake or river. The resident life-history form resides in a particular stream for its entire life cycle. Adfluvial populations occur in Cle Elum, Bumping, Kachess, Keechelus, and Rimrock lakes. A fluvial population is present in the mainstem Yakima River and Naches River. The population in the North Fork Teanaway River drainage is likely fluvial, but information on this population is limited. A resident population occurs in Ahtanum Creek (WDFW 1998).

Bull trout are late summer/early fall spawners and most spawning activity in the Yakima River basin, irrespective of life history form, occurs from early September through early October; however, spawning may occur as early as August (Deep Creek in the Bumping system) or as late as mid-October to early November (Kachess River-Mineral Creek in the Kachess system). For the migratory life history forms, the spawning migration can begin as early as mid-July (Gold Creek in the Keechelus system) when adults move upstream to hold in deep pools or it may occur just prior to spawning (Indian Creek in the Rimrock Lake system).

The primary downstream migration periods for juvenile bull trout from their natal tributaries into lakes or rivers occurs from June through November. The early summer migration appears to be in response to increased flows and may correspond with a switch in prey from invertebrates to fish, whereas the fall migration appears to be primarily in response to decreasing water temperatures and the need to find suitable overwintering habitat (Fraley and Shepard 1989; Murdoch 2002).

Fish passage facilities at Cle Elum and Bumping Lake dams would allow volitional movement of bull trout throughout the basin and reestablish connectivity with populations elsewhere in the basin. Currently, there are no plans to supplement any Yakima River basin bull trout populations because of their ESA-listed status.

2.3 Restoration Efforts

Restoration of anadromous and resident fish in the Yakima River basin are the focus of several programs managed and funded by Federal and State agencies and Tribes. These programs are currently addressing habitat improvements, changes in stream flows, reconnecting tributaries, and other actions to promote restoration. Many of these plans identify the storage dams as a limiting factor for restoration of anadromous fish. Fish passage at the Yakima River basin storage dams is essential to restore sockeye salmon to the Yakima basin. The following sections summarize some restoration and recovery programs that are related to Reclamation's efforts to provide fish passage in the Yakima River basin.

2.3.1 Columbia River Basin Fish and Wildlife Program

The NPCC was directed, pursuant to the Northwest Power Plan Act of 1980 (see Section 1.3), to prepare a regional conservation and electric power plan and to develop a fish and wildlife protection and restoration program to protect and rebuild populations affected by hydropower development in the Columbia River Basin. The NPCC adopted its Columbia River Basin Fish and Wildlife Program in 1982, which included measures to restore greatly depleted fish runs in the Yakima River basin. The primary measures for rapid implementation in the basin were installation of fish passage and protective facilities. Reclamation has been actively involved with Federal, State, Tribal, and other partners to implement these measures.

Passage at the Yakima Project storage dams was identified in the NPCC's Columbia River Fish and Wildlife Program in 1983. Measure 904(d)(6) implemented a study to determine the feasibility of re-establishing anadromous fish runs above Cle Elum Dam. The NOAA Fisheries Service conducted a multiyear study funded by the BPA between 1987 and 1993 to assess the feasibility of restoring sockeye salmon to Cle Elum Lake (Flagg et al. 2000). The NOAA Fisheries Service's study indicated that juvenile sockeye salmon released into Cle Elum Lake in the late summer-early fall successfully overwintered and were able to locate the lake outlet and outmigrate the following spring. Higher irrigation releases from Cle Elum Dam may have attracted juvenile sockeye salmon to the dam outlet. In addition, the fish survived downstream migration through the Yakima and Columbia rivers, with a few adults returning to the Yakima River in subsequent years. The study noted that adequate spawning habitat existed upstream of the lake, although the reservoir was oligotrophic and would benefit from an inlake fertilization program to increase the carrying capacity for juvenile sockeye salmon. These results encouraged the basin fisheries co-managers and others to continue to advocate upstream and downstream fish passage facilities at Yakima River basin water storage projects.

The Phase I Yakima River basin fish screening program occurred from 1983 to 1990 and corrected some juvenile fish entrainment problems at about 16 of the largest diversion dams and canals in the basin below the five major storage dams; most of these were Reclamation owned and operated facilities. In 1988, the YN submitted an application to amend the NPCC's Columbia River Basin Fish and Wildlife Program to begin preliminary design on a Phase II fish screen program for the Yakima River basin. The NPCC approved the amendment in 1989 and authorized the BPA to provide funding; BPA asked Reclamation to provide engineering and design expertise. The Phase II program aimed at correcting fish entrainment conditions at about 60 smaller diversions in the basin. Reclamation modified or rebuilt diversion structures to reduce or eliminate entrainment of juvenile outmigrants at just over half of these, beginning from fiscal year (FY) 1992 through 2006.

Recognizing that some suitable spawning and rearing habitat existed above the several Reclamation water storage dams and that access to this was totally blocked, the most recent NPCC 2004 Yakima Subbasin Plan, states

> *Kachess, Keechelus, Cle Elum, and Bumping dams block passage for sockeye and bull trout and Tieton Dam blocks passage for bull trout. A high priority objective is to restore passage to at least one dam by 2007, possibly through various fish passage options such as ladders, trap and haul, and modification of outlets for downstream passage (NPCC 2004, Executive Summary, pg 12).*

The *Supplement to the 2004 Yakima Subbasin Plan (Supplement)* identifies fish passage at Cle Elum and Bumping Lake dams as Tier 1 (or top level) high priority needs in the basin. The *Supplement* noted that the Tier 1 limiting factors have the greatest impact on the focal species in the basin and these limiting factors should be addressed first. The NPCC is currently considering recommendations for amendments to its *Columbia River Basin Fish and Wildlife Program*.

2.3.2 Yakima-Klickitat Fisheries Project

The YKFP is a joint project of the YN (lead entity) and the WDFW, and is sponsored in large part by the BPA, with oversight and guidance from the NPCC. The YKFP is among the largest and most complex fisheries management projects in the Columbia River Basin in terms of data collection and management, physical facilities, habitat enhancement and management, and experimental design and research on fisheries resources.

The YKFP is designed to use artificial propagation in an attempt to re-establish, supplement, or increase natural production and harvest opportunities of anadromous salmonids while maintaining the long-term fitness of the target population and keeping ecological and genetic impacts on non-target species within specified limits. The YKFP is also an experiment to resolve uncertainties associated with supplementation. As a "laboratory," the YKFP would help determine the role of supplementation in increasing natural production of anadromous salmonids. Both controlled experiments and basic monitoring contribute information.

Consistent with the Council's Fish and Wildlife Program (NPCC 1994; NPCC 2000; NPCC 2004), the objectives of the YKFP are to:

- Enhance existing stocks of anadromous fish in the Yakima and Klickitat river basins, while maintaining genetics and ecological resources.
- Reintroduce stocks formerly present in the basins.
- Apply the knowledge gained from supplementation throughout the Columbia River Basin.

2.3.3 Anadromous Fish Reintroduction Plan

Fisheries resources in the Yakima River basin are managed jointly by the WDFW and the YN. Concurrent with Reclamation's efforts to design interim and permanent fish passage facilities at Cle Elum and Bumping Lake dams, the Yakima River basin fisheries co-managers developed an anadromous fish reintroduction plan (Reclamation 2005 [Reintroduction]; Fast and Easterbrooks 2008) that describes the target species and outlines the sequence and timing for reintroduction of selected species above Cle Elum Dam. The reintroduction plan is consistent with the goals and objectives of the YKFP and the *2004 Yakima Subbasin Plan*.

The plan proposes a phased approach starting with coho salmon, followed by sockeye salmon, and eventually spring Chinook salmon, summer steelhead, and Pacific lamprey (*Entosphenus tridentatus*). An additional objective is to provide two-way passage for resident bull trout to restore genetic connectivity between adfluvial populations in the storage reservoirs and fluvial (riverine) bull trout that reside downstream of the dams. Sockeye salmon are the preferred species for reintroduction, but some logistical and fish culture and health and disease issues need to be resolved before sockeye salmon can be reintroduced, so coho salmon would be reintroduced initially.

The YN and WDFW have developed their reintroduction plan using species available in the near-term, mid-term, or long-term. Reintroduction was determined to be a viable and realistic approach to salmonid restoration rather than waiting for existing fish populations downstream of the dams to colonize or "pioneer" newly accessible upstream habitat using adult passage facilities. The plan suggests that it could take three or four salmon generations (15 to 20 years) or more to realize significant use of habitat above the reservoirs if fish reintroduction, especially for sockeye salmon, is not aided by human intervention. The reintroduction plan proposes to use both adult and juvenile salmon to accelerate repopulation of the habitat.

Near-Term – Coho Salmon

Near-term efforts would use hatchery coho salmon smolts and adults that are currently readily and reliably available (2008 and out years) to reestablish a localized broodstock for hatchery and natural production. Coho salmon would be used to initiate a properly functioning ecosystem by introducing marine-derived nutrients back into the Cle Elum River watershed. This would enhance the primary goal of re-establishing sockeye salmon, which utilize the lake environment for juvenile rearing. Salmon carcass "analogs" produced from surplus lower Columbia River hatchery salmon (coho or Chinook salmon) may also be purchased and used to increase ecosystem productivity and the survival and growth of juvenile salmon produced naturally from adults that are trapped, transported, and spawn upstream of the reservoirs.

Near-Term and Mid-Term – Sockeye Salmon

Sockeye salmon are the preferred species for reintroduction above Cle Elum Lake since they have been extirpated from the Yakima River basin. There are, however, logistical and fish-cultural issues that need to be addressed and overcome that would in effect prolong sockeye salmon reintroduction efforts, so their reintroduction would span both the near-term and mid-term timeframe. There are two potential donor stocks in the upper Columbia River Basin, Wenatchee and Osoyoos lakes on the Wenatchee and Okanogan rivers, respectively. Both of these stocks are wild or naturally produced populations that exhibit highly variable abundance from year-to-year. This variability makes it difficult to design a plan with firm dates for consistent and adequate numbers of fish for the reintroduction program. Currently, the near-term (next four years) outlook for the Okanogan population is an upward trend, with returning adult populations estimated between 45,000 to 55,000. The recovery efforts are expected to be cyclic while using outside sources for broodstock. The mid-term reintroduction efforts would continue to use outside sources for broodstock when available, along with adults that have returned to the Yakima River basin.

Near-Term and Mid-Term – Spring Chinook Salmon

Spring Chinook salmon are also considered a small-scale "near-term" and "mid-term" objective for reintroduction above Yakima Project storage dams. Currently, all smolts produced at the Cle Elum Supplementation and Research Facility are fully allocated to a sophisticated experimental design and cannot be used for reintroduction experiments. However, the near-term objective would use surplus eggs (90,000 to 120,000 reared to summer parr life stage with a June/July release) from supplemented hatchery egg viability and morphometric studies being conducted at the facility. Any spring Chinook salmon that voluntarily enters the adult fish trap located at the base of Cle Elum Dam would be transported and released into Cle Elum Lake (trap and haul).

Near-Term and Long-Term – Steelhead

Steelhead reintroduction above the dams would be "small-scale" in the near-term because steelhead are an existing native, wild stock that is listed as "threatened" under the ESA. The near-term strategy consists of the YN collecting steelhead kelts at the Chandler Juvenile Fish Monitoring Facility as part of their kelt reconditioning program. All adult steelhead that pass through the Roza Adult Fish Monitoring Facility are Passive Integrated Transponder (PIT)-tagged in the ventral girdle, which allows them to retain the tag for life. The "near-term" emphasis would apply to any upper Yakima River kelts that are reconditioned under this program. Reconditioned upper Yakima kelts would be spawned together as part of the kelt viability study. The progeny from these fish and the viability study would be raised to the summer parr stage and released above Cle Elum Lake. Since steelhead are listed as threatened, the near-term strategy described above of reintroducing the progeny of kelts from the viability study is expected to continue for some time.

Currently, no hatchery steelhead smolt production occurs in the Yakima River basin, so there is no available source of locally adapted hatchery smolts that could be used to accelerate steelhead reintroduction above the storage reservoirs. However, the habitat above the reservoirs is intact and underutilized; therefore, steelhead would be allowed and encouraged to expand as soon as possible into this habitat. The reintroduction of summer parr from the viabilitiy study is part of this program. Any adult steelhead that voluntarily enters the adult fish trap located at the base of Cle Elum Dam would be transported and released into Cle Elum Lake as long as the trap and haul upstream passage facility operates.

Long-Term – Pacific Lamprey

Pacific lamprey are very rare in the Yakima River subbasin and little is known about their life history, historic distribution, or current limiting factors; hence, reintroduction of this species is considered a long-term objective. The YN is currently developing a reintroduction plan for this species and is considering areas above the Yakima Project reservoirs.

2.4 Habitat Conditions

A number of activities occurred to assess the production potential of coho and sockeye salmon in new habitat that would be accessible with construction of fish passage facilities. Reclamation collected information on limnological conditions in Cle Elum Lake and Bumping Lake and on benthic macroinvertebrates in tributaries to the lake. The USFS conducted stream inventories and compiled habitat data on the tributaries above Cle Elum Lake and Bumping Lake. These efforts provided initial information on the quality and quantity of habitat accessible and usable to each of the salmonid species as well as the potential for survival and growth. Additional information can be found in the reports referenced in this section.

2.4.1 Available Upstream Habitat

In the *Phase I Assessment*, the Core Team assessed tributary habitat conditions upstream of the five Yakima Project storage reservoirs. Tributary stream length in miles up to natural or man-made barriers were obtained from various published reports and USFS stream surveys. The Core Team estimated the extent of the spawning and rearing habitat in the tributary streams using numerous environmental variables such as stream gradient, reported assessments of the quality of spawning conditions, water temperature, habitat conditions including large woody debris, and pool frequency and quality. The data were obtained from various agency reports and peer-reviewed papers. On-the-ground observations and experiences of Core Team members were also considered. Appendix B of the *Phase I Assessment* report provided a detailed discussion of the analysis and the supporting data.

Watershed above Cle Elum Lake

The assessment determined that about 29.4 miles of tributary habitat are potentially accessible upstream from Cle Elum Lake if passage at the dam were provided. Cle Elum Lake is the largest of the four reservoirs in the Yakima River basin formed from existing glacial lakes that once supported runs of anadromous salmonids. Historically, sockeye salmon used the lake for rearing and, along with coho and spring Chinook salmon, the streams above the lake for spawning (Robison 1957, Mongillo and Faulconer 1982, both as cited in Flagg et al. 2000). Resident fishes including bull trout would have had year-round access into the lake.

The lake has a large and diverse watershed with numerous tributaries, three of which (Cle Elum, Cooper, and Waptus Rivers) contain a large amount of potential spawning habitat for anadromous salmonids and bull trout (Spotts 1981, cited in Slatick and Park 2000).

Table 2-1 lists the potentially accessible stream habitat by tributary above Cle Elum Lake. Figure 2-1 shows major tributaries above Cle Elum Lake.

Table 2-1. Potentially Accessible Stream Habitat by Tributary above Cle Elum Lake.

Tributary Stream	Potentially Accessible Habitat (miles)	Comments
Cle Elum River	21.6	Steep cascades at RM 9 may impede upstream fish migration
Thorp Creek	0	Barrier cascades and high gradient in lower reach
Cooper River	0.6	Barrier falls
Waptus River	7.2	Impassable falls
Total	**29.4**	
Other tributaries to Cle Elum Lake were considered too small or steep to support migratory fish.		

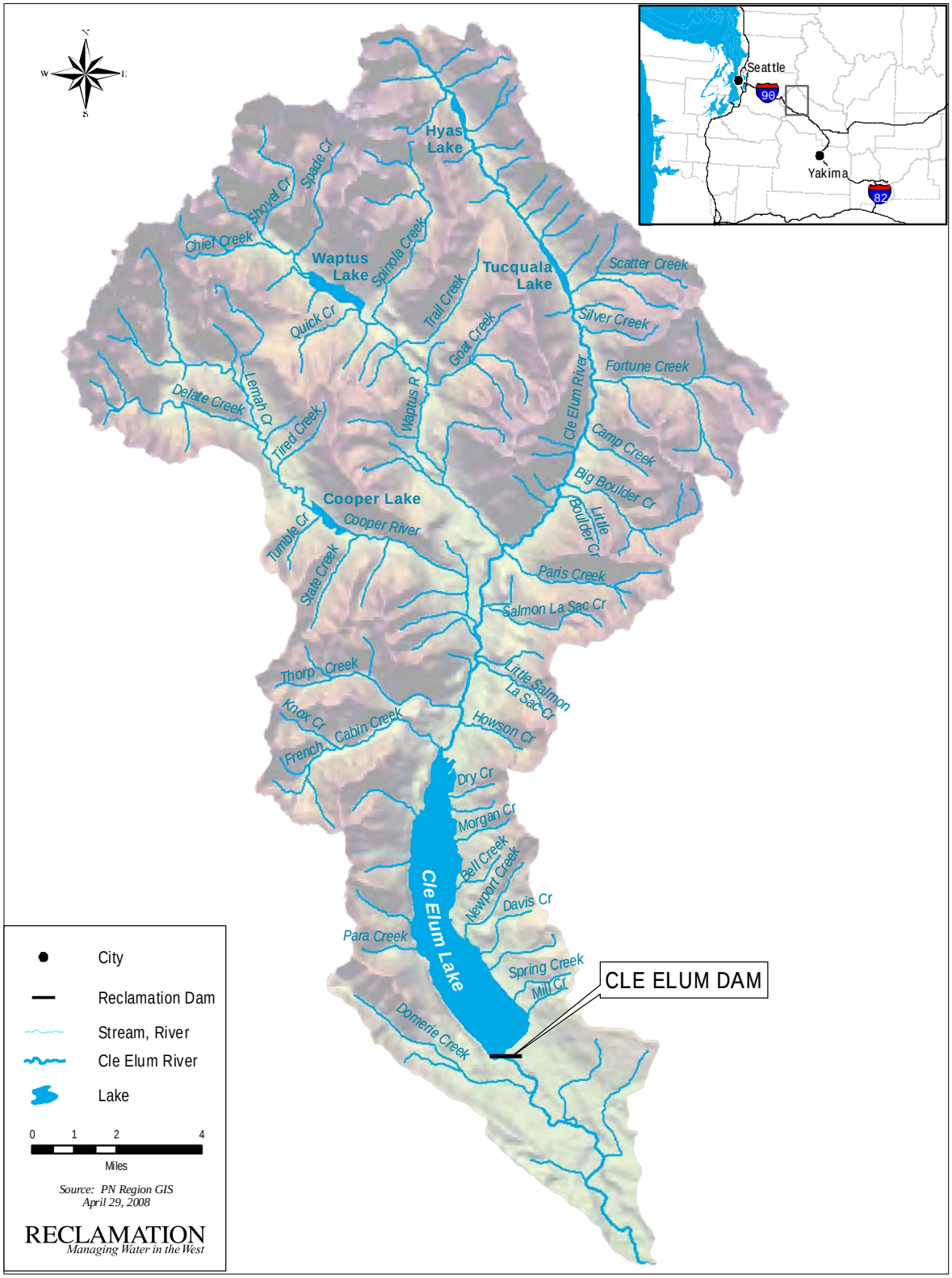

Figure 2-1. Cle Elum River Watershed above Cle Elum Lake.

Watershed above Bumping Lake

The assessment determined about 6.6 miles of tributary habitat are potentially accessible above Bumping Lake. Habitat quality in the several tributaries varies, due to differences in substrate composition, water temperatures, or riparian or stream channel conditions.

Table 2-2 lists the potentially accessible stream habitat by tributary above Bumping Lake. Figure 2-2 shows major tributaries above Bumping Lake.

Table 2-2. Potentially Accessible Stream Habitat by Tributary above Bumping Lake.

Tributary Stream	Potentially Accessible Habitat (miles)	Comments
Bumping River	1.0	Waterfall limits upstream migration (USFS 2004)
Deep Creek	5-5.6	Upper 0.5 miles goes subsurface in low water years
TOTAL	**6-6.6**	
Other tributaries to Bumping Lake were considered too small or steep to support migratory fish.		

2.4.2 Limnological Study

A limnological study of Cle Elum Lake and Bumping Lake was conducted to describe in more detail the physical, chemical, and biological conditions in the lake, to assess primary and secondary production, to determine if the present conditions would support introduced anadromous salmonids, and ultimately to determine to what extent anadromous salmonid fisheries can be restored to the basin. Information obtained in this study was used extensively in assessing sockeye salmon production potential. Reclamation collected information monthly from September 2003 to October 2005 at Cle Elum Lake and from September 2003 to October 2004 at Bumping Lake, except during the winter months. A complete description of the results can be found in Lieberman and Grabowski (2006).

The limnological study indicated that both Cle Elum Lake and Bumping Lake are relatively unproductive oligotrophic lakes with low nutrient levels, chlorophyll *a* concentrations, phytoplankton biovolume, zooplankton densities, and total organic carbon concentrations similar to other lakes that support viable sockeye salmon populations. After salmon are reintroduced and established above Cle Elum and Bumping Lake dams, marine-derived

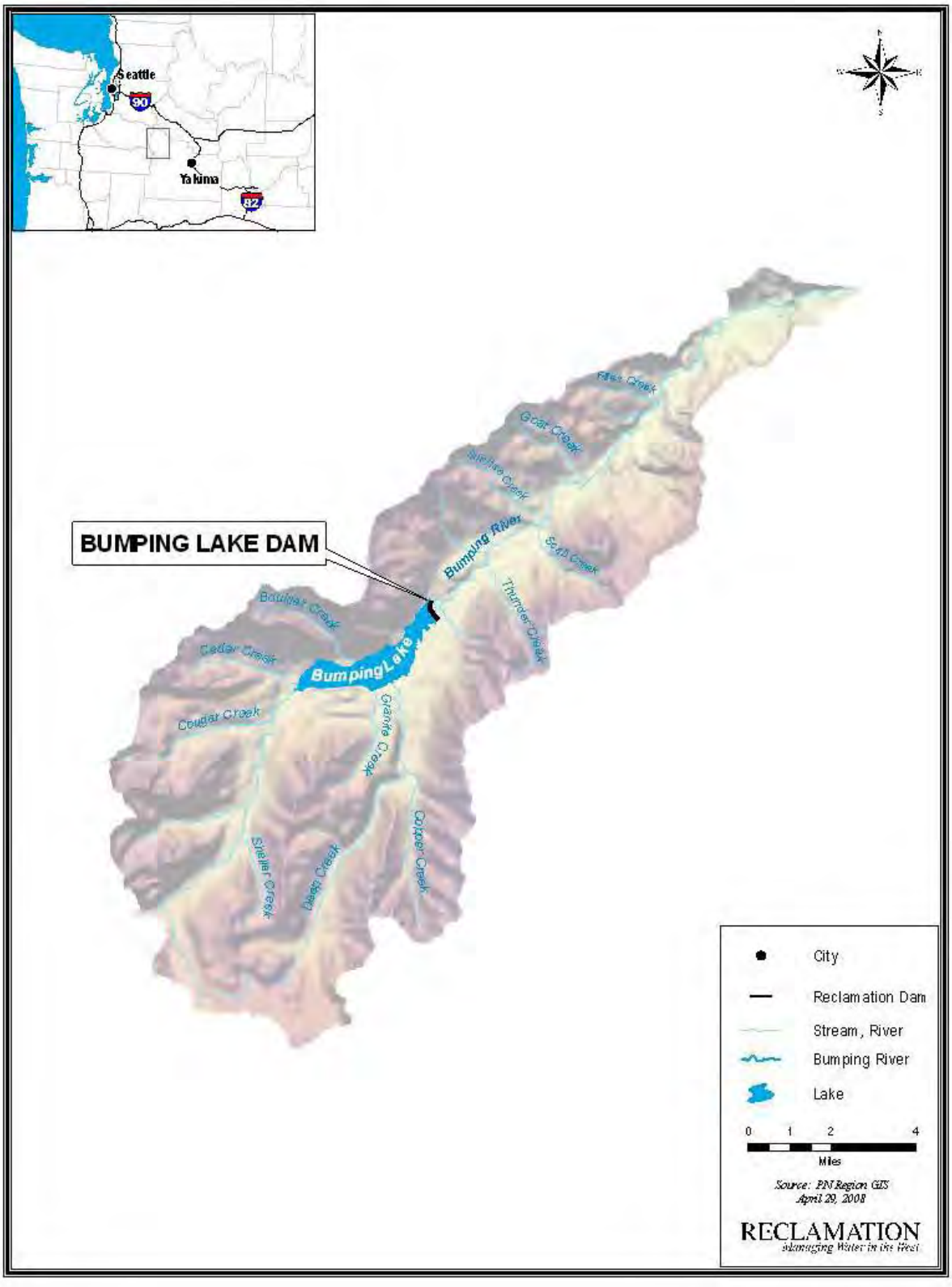

Figure 2-2. Bumping River Watershed above Bumping Lake.

nutrients from the returning adults are expected to increase river and lake productivity and benefit the ecosystem. Nutrient enrichment of the lakes is a potential short-term method to increase both algal and zooplankton production to improve juvenile fish survival until productivity increases from the infusion of marine-derived nutrients from returning adult salmon. The results of the study also indicate that the range of water temperatures in the lakes would be suitable for the diel vertical migrations of juvenile sockeye salmon.

2.4.3 Macroinvertebrate Survey

Reclamation biologists conducted a benthic macroinvertebrate survey at 21 sites in September 2003 and 2004 to assess species composition and standing crop in the watershed above Cle Elum Lake and Bumping Lake. Additional sampling occurred in March/April 2004 above Cle Elum Lake as sites above Bumping Lake were difficult to access. The abundance and types of aquatic macroinvertebrates associated with the watershed helped in determining the capability of anadromous salmonids to develop self-sustaining populations above the dams. Macroinvertebrate data provided information on habitat quality and information on the potential for survival and growth of juvenile anadromous salmonids. Growth rates of salmonids are often linked to food availability and increased food may result in increased growth rates and ultimately higher survival. Differences in the ability of streams to produce salmonids are often related to food availability rather than physical habitat. Complete details of the survey are reported by Nelson (2005).

The study concluded that macroinvertebrate standing crops in the watersheds above Cle Elum and Bumping Lake reservoirs were low and likely related to regional geology and water quality (e.g., low alkalinity). The standing crop was slightly higher in the Bumping Lake watershed with functional-feeding groups and physical attributes indicating high coarse-particulate-organic-matter (CPOM) retention. The data suggested low retention of CPOM in the Cle Elum watershed. To take full advantage of fish passage at Cle Elum Dam, it may be necessary to increase retentiveness of organic matter in the watershed above the reservoir. Increased retentiveness would also allow for full utilization of salmon carcasses in the system and their contribution of marine-derived nutrients to the ecosystem. Goals to achieve increased CPOM and macroinvertebrate standing crop are achievable (see example of Laitung et al., 2002) and would likely contribute to the success of an anadromous fish passage program.

2.4.4 Other Stream Surveys

Stream surveys conducted by USFS staff biologists from as early as 1991 to current, for the purpose of ongoing habitat assessments, were available. The USFS also collected additional water temperature information in the Cle Elum River at eight locations in July through October 2004, to supplement earlier information. In 2003, the Washington Conservation Corps sampled reaches of the Cle Elum River for bed composition for the USFS. The USFS also surveyed Deep Creek, a tributary to Bumping Lake, from July through October 2005 to

collect physical habitat information. The results of these data collection activities are described in the *Biological Appendix* (Reclamation 2008 [Biology Appendix]).

These data supplemented by the limnological and invertebrate information described earlier, formed the basis for estimating the amount of spawning habitat for coho and sockeye salmon and juvenile rearing habitat for coho salmon, to assess production potential in both watersheds.

2.5 Interim Juvenile Fish Passage at Cle Elum Dam

Juvenile coho salmon were used to test whether smolts could locate and use an interim juvenile bypass facility constructed on the spillway of Cle Elum Dam. Juvenile coho salmon successfully used the interim bypass facility during releases in 2006 and 2007. The preliminary tests of the interim facility indicate the basic concept proposed for downstream passage would work effectively to move fish downstream.

In the early spring of 2005, Reclamation completed construction of the interim (temporary, experimental) downstream juvenile fish passage facility at Cle Elum Dam. The passage features include a stop-logged overflow section and plunge pool installed in the second radial gate bay from the left side of the spillway and a temporary plywood and lumber framed flume built on the existing spillway. Two PIT tag detectors were installed in the flume. Annual reports document interim passage program results (Reclamation 2006 and Reclamation 2008 [Interim Fish Passage]).

Low reservoir levels in 2005 caused by drought conditions precluded the planned release of 10,000 PIT-tagged coho salmon smolts into the reservoir. Instead, many of the fish were released in April at several points downstream from Cle Elum Dam; some fish were held back and used to test the efficiency of the PIT-tag detectors in the interim juvenile fish passage facility. The YN released 3,000 PIT-tagged coho salmon parr into the Cle Elum River near Tucquala Lake 12.9 miles upstream of Cle Elum Reservoir in August 2005. The purpose of this release was to test rearing and overwintering survival, and outmigration in the spring of 2006.

In 2006, YN biologists released about 10,000 PIT-tagged coho salmon smolts into the reservoir from a net pen located about ½-mile upstream from the spillway. They also released about 1,000 PIT-tagged coho salmon smolts downstream from the dam as controls and another 1,000 fish directly into the passage facility to check efficiency of the PIT-tag detectors. About 3,000 PIT-tagged coho salmon parr were again released into the Cle Elum River near Tucquala Lake.

Even though the period of operation in 2006 was late in the season and of relatively short duration, 617 PIT-tagged coho salmon smolts were recorded passing through the interim

juvenile passage facility. Thirty of these fish were from the group of 3,000 coho salmon parr released in the summer of 2005 at Tucquala Lake. The remaining fish were from the group of 10,000 coho salmon smolts released into the reservoir in late May 2006.

In 2007, YN biologists again released about 10,000 PIT-tagged coho salmon smolts into the reservoir. The PIT tag detectors counted 3,450 of the smolts as they passed through the juvenile passage facility. In addition, another 954 fish from the 2006 releases were counted as they passed through the facility in 2007. This indicated that almost 10 percent of the tagged smolts that were released in 2006 survived and overwintered in the lake. This was an unexpected and encouraging development. Many of the smolts were also detected at downstream locations as they migrated out to sea. About 800 tagged smolts were used to test the efficiency of the PIT-tag detectors, and about 200 fish were used to assess condition and survival of fish after passing through the facility. Several PIT-tagged coho salmon adults from previous year releases were detected as they returned to the Yakima River system in 2007. Nine adults were detected at Prosser Dam.

The fisheries co-managers plan to release PIT-tagged juvenile coho salmon again in 2008, with about 6,000 smolts released from net pens near the dam and about 6,000 smolts released near the upper end of the reservoir to assess whether fish released at the upper end of the reservoir are able to locate the outlet and successfully outmigrate.

2.6 Potential Benefits of Fish Passage

Constructing fish passage facilities at Yakima Project storage dams in combination with successful reintroduction of anadromous salmonids would restore in large part the biological diversity and productivity lost when fish were extirpated from the upper basin lakes and tributaries, resulting in significant ecosystem and cultural benefits. As the reintroduced fish populations build over time, economic benefits would be realized from potential recreational fisheries in the Yakima River basin and contributions to downriver or ocean recreational and commercial fisheries. An analysis of regional economic benefits associated with potential improvements in the recreational and commercial fisheries is provided in Section 6.17.

2.6.1 Ecosystem Benefits

The reintroduction of anadromous salmonids, particularly coho salmon and sockeye salmon, into historically occupied habitat upstream from Cle Elum and Bumping Lake dams is expected to have substantial beneficial effects on stream, lake, and terrestrial ecosystems. Since the Cle Elum River and Bumping River basins supported coho and sockeye salmon historically, it is likely that over time anadromous salmonid populations would be re-established as fish passage facilities are installed at the dams. The characteristics of the lakes are similar to other lakes in the Pacific Northwest, Canada, and Alaska that support viable

sockeye salmon populations. Returning adult salmon from restored populations are expected to contribute marine-derived nutrients to the system and increase river and lake productivity over time. This would benefit resident fish as well.

The infusion of marine-derived nutrients contributed by the carcasses of returning adults is fundamental to ecological restoration of the watershed and is expected to enhance aquatic and terrestrial production, improve the overall trophic status of the ecosystem, and enhance productivity for future production of anadromous salmonids.

The increase of marine-derived nutrients into the system would also benefit ESA-listed bull trout through increased productivity. Further, passage facilities would provide an opportunity for greater connectivity among bull trout populations in the upper basin. Genetically-isolated "adfluvial" (lake-dwelling) bull trout in Bumping Lake will benefit from reconnection of the population with downstream "fluvial" (river-dwelling) bull trout in the Bumping and Naches rivers. Reproductive exchange of genes between the two populations via the Bumping Lake Dam upstream and downstream fish passage facilities should help boost recovery of this ESA-listed species. These populations were originally connected prior to construction of the dams.

High-elevation lakes that support sockeye salmon production are often oligotrophic, as is the case with Cle Elum and Bumping lakes. Recent studies using stable isotopes of nitrogen (N) have shown that the annual pulse of marine-derived nutrients from salmon carcasses historically provided substantial energy input into the aquatic ecosystem (e.g., Mathisen et al. 1988, Kline et al. 1990, Bilby et al. 1996) and terrestrial ecosystems. Studies of sediments in various lakes have shown that concentrations of marine isotopes of N have declined when anadromous salmonids were reduced in numbers by fishing activities or blocked from formerly accessible spawning and rearing habitats by dams or water diversions. Some studies estimate that the concentration of marine-derived nutrients currently being returned to inland watersheds in Washington, Oregon, and California has declined to 6 to 7 percent of historical levels (Gresh et al. 2000). In another study (Flagg et al. 2000), phosphorus concentrations in the sediments of Cle Elum Lake decreased to about 19 percent of that prior to the construction on the outlet of the original lake of a timber crib dam that blocked anadromous fish passage after about 1910. Studies have shown that up to 40 percent of the carbon in a coho salmon smolt can come from nutrients derived from decaying carcasses of the previous generation of salmon.

Returning and spawning adult salmon serve as a "nutrient pump" by transporting marine-derived nutrients to tributaries where they provide an energy input into the system. Salmon accumulate greater than 95 percent of their biomass in the ocean, so they can return substantial amounts of nutrients with their corresponding energy content to their natal stream ecosystem. Salmon carcasses provide an organic source of nutrients more directly biologically available to rearing juvenile salmon and benthic macroinvertebrates. This

enhances and benefits benthic macroinvertebrate production by providing a direct food source or by increasing the algal food base for invertebrates. Decomposition of the spawned out carcasses releases nutrients to the algae. Juvenile rearing salmon can feed directly on decomposing salmon carcasses or on the benthic macroinvertebrate production enhanced by the nutrients.

These nutrients furthermore enhance productivity at various trophic levels within aquatic food webs, but they may also fertilize riparian vegetation. Recent research has shown that nutrients contributed by returning adult salmon also influences productivity in the riparian zone through several physical and biological mechanisms. For example, the consumption of salmon by terrestrial piscivores such as birds, mammals, and insects, transfers some of the marine-derived nutrients to riparian and terrestrial areas where it influences growth of vegetation (Helfield and Naiman manuscript submitted). Increased growth of riparian zone vegetation may provide increased shading of the streams that would have an effect on stream water temperature. Over time, the nutrient contribution could result in a greater amount of large woody debris to the stream that would increase stream channel complexity and fish rearing habitat.

2.6.2 Salmon Production Potential

Reclamation estimated the production potential for coho and sockeye salmon that could be supported by the suitable habitat upstream from Cle Elum Lake and Bumping Lake. These estimates are based on available physical and biological data for lake and tributary habitat conditions. The production estimates assisted in determining the improved harvest opportunities as well as the overall ecosystem benefits associated with construction of the fish passage facilities and implementation of a reintroduction plan.

Coho Salmon Production Potential

The estimate of production potential for coho salmon was based on substantial stream survey information from the Wenatchee National Forest, Cle Elum Ranger District staff biologists, literature values for redd size and fecundity, information from an existing coho salmon supplementation program in the Yakima River basin, and additional information on habitat characteristics and limiting factors from various sources. The methods used and the results obtained are described in Reclamation (2007 [Cle Elum Coho]) for Cle Elum River basin coho salmon and Reclamation (2007 [Bumping Coho]) for Bumping River basin coho salmon; the following summarizes the analysis results.

Cle Elum River Basin

The analysis estimated that the Cle Elum River upstream from the lake had 159,160 square meters (m^2) of suitable spawning substrate for coho salmon that could support about 15,000 spawning pairs and produce about 596,817 smolts. This is a maximum estimate and is unlikely to be achieved. An assessment of stream habitat used for overwintering by juvenile

coho salmon estimated that about 30,818 smolts could be produced, with the number of returning adults ranging up to about 1,851. A return of 1,588 adult coho salmon to the upper Cle Elum River was determined to be a reasonable estimate, since recent returns to the Yakima River counted at Prosser Dam were as high as 6,138 adults in 2000 (Yakama Nation 2004).

Bumping Lake River Basin

The analysis estimated that upstream from Bumping Lake there are 18,218 m^2 of suitable spawning substrate for coho salmon that could support about 1,822 spawning pairs and produce about 68,364 smolts. This is a maximum estimate and is not likely to be achieved. An assessment of stream habitat used by juvenile coho salmon for overwintering estimated that about 7,458 smolts could be produced, with the number of returning adults ranging up to about 447. A return of 410 adult coho salmon to the Bumping River was determined to be a reasonable estimate, based on a range of assumptions and recent returns to the Yakima River counted at Prosser Dam described above.

Sockeye Salmon Production Potential

Estimates of sockeye salmon spawning habitat in the upper Cle Elum River and some tributaries and above Bumping Lake were made similarly to that described for coho salmon. Spawning sockeye salmon generally use less area for a redd than do coho salmon, so the available habitat would support more spawning sockeye salmon. Sockeye salmon juveniles rear in lakes rather than in streams. Details of the methods used and the results obtained are described in Reclamation (2007 [Cle Elum Sockeye]) for Cle Elum sockeye salmon and Reclamation (2007 [Bumping Sockeye]) for Bumping Lake sockeye salmon; the following summarizes the analysis results.

Cle Elum River Basin

The analysis estimated that the Cle Elum River upstream from the lake had 159,160 m^2 of suitable spawning substrate for sockeye salmon that could accommodate about 22,737 spawning pairs, based on average redd size and area defended. The estimated smolt production using several lake-based methods under average conditions ranged from about 409,023 to about 2,907,365, sufficient to eventually produce an adult return of 30,000 to 50,000 sockeye salmon to Cle Elum Lake.

Bumping River Basin

The analysis estimated that the available spawning habitat could accommodate about 2,602 spawning pairs of sockeye salmon, based on the average redd size and area defended. The estimated sockeye salmon smolt production using several lake-based methods under average conditions ranged from about 57,353 to 865,897, sufficient to eventually produce an adult return of 10,000 to 17,000 adult sockeye salmon to Bumping Lake.

Chapter 3 PLAN FORMULATION

Reclamation considered a number of different fish passage options at Cle Elum and Bumping Lake dams. Plan formulation has been an iterative process relying heavily upon the professional expertise and judgment of biologists, engineers, hydrologists, and other team members. Through a collaborative process with the Core Team, the concepts, costs, and perceived benefits of each plan were discussed and decisions made as to which plans should be pursued in detail. The engineers developed conceptual layouts and cost estimates for alternative plans that could provide passage through differing ranges of reservoir pool elevations and differing lengths of fish passage time. The biologists estimated general increases in fish populations associated with passage into currently unoccupied habitat in the Yakima River basin. The plan discussed in this document has been reviewed and is supported by the Core Team.

3.1 Prioritization of Sites

Reclamation completed a *Phase I Assessment* in 2003 (Reclamation 2005 [Phase I]) at the five Yakima Project storage dam sites. The purpose of this assessment was to consolidate and document existing habitat information, evaluate preliminary passage concepts, and prepare appraisal-level cost estimates for passage options. Initial efforts were directed towards the evaluation of the technical feasibility of providing fish passage at Keechelus Dam in light of the SOD reconstruction activities. It was concluded that the Keechelus SOD work would not preclude fish passage options nor increase the cost of constructing fish passage in the future.

During the *Phase I Assessment*, Reclamation determined that there are a range of options and opportunities for providing fish passage and potentially reestablishing populations of anadromous salmonids in tributaries above all five storage reservoirs. The assessment concluded that some form of upstream and downstream passage for anadromous salmonids and bull trout connectivity is technically possible at all five Yakima Project storage dams. However, construction of fish passage facilities would be much more expensive at some dams, in relation to available habitat, than at others. Further, the amount and quality of tributary habitat upstream from the reservoirs varied.

Based on information developed for the *Phase I Assessment*, Cle Elum and Bumping Lake dams were identified as the two highest priority sites for continued investigation of fish passage feasibility. These two reservoirs present substantially different opportunities for developing fish passage concepts. The rationale for selecting these sites is explained below.

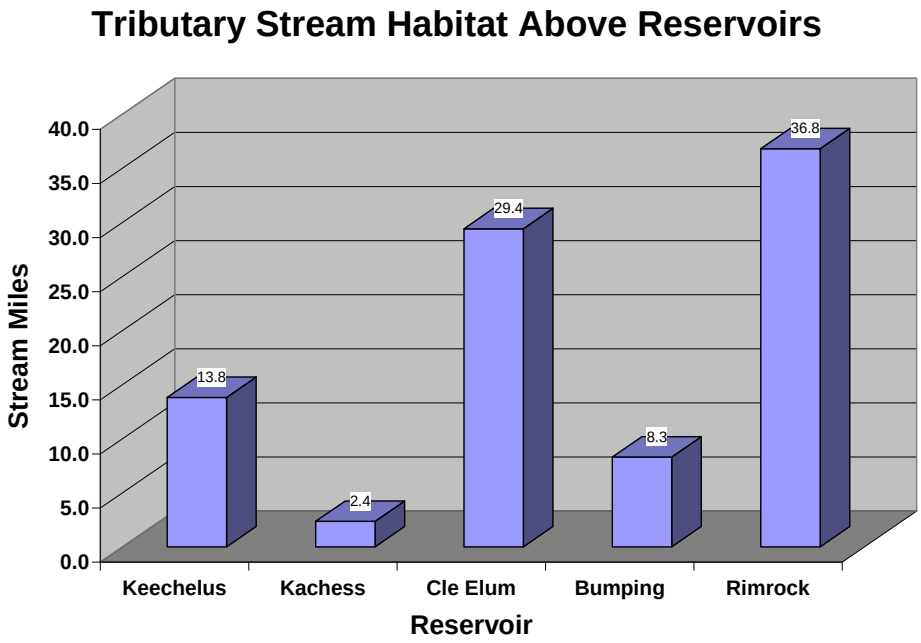

Figure 3-1. Miles of Tributary Stream Habitat Above Reservoirs.

Cle Elum is the largest reservoir in the Yakima River basin, and has a substantial amount of tributary and mainstem habitat upstream from the reservoir (see Figure 3-1). The habitat is generally in good condition and some is pristine, since much of the watershed lies within the Alpine Lakes Wilderness Area. Considerable research has been completed on the Cle Elum watershed, especially in relation to the restoration of sockeye salmon. The investment required to provide permanent passage in relation to the miles of habitat available is among the lowest of any of the reservoirs in the basin. The YRBWEP Act of 1994 (Title XII, PL 103-434) authorized construction of permanent downstream passage facilities at Cle Elum Dam. For this reason, if proven feasible, the downstream passage features could be implemented more quickly than passage at the other dams.

Bumping Lake is a smaller dam and reservoir and smaller watershed. Tributary habitat quantity is about one-fifth of that above Cle Elum Lake (Figure 3-1). However, the small reservoir size in relation to the watershed runoff allows considerable flexibility in operations. The low dam height should also result in less expensive fish passage features, although the cost per mile of habitat made accessible may be higher than at Cle Elum Dam.

A substantial tributary habitat exists upstream from Rimrock Lake. However, downstream passage at Tieton Dam was determined to be difficult due to its large height and location within a narrow rock canyon.

3.2 Interim Downstream Fish Passage

An interim downstream fish passage facility was constructed at Cle Elum Dam in early spring of 2005 and was an integral part of the feasibility study (see Section 2.5). The most promising (and most cost effective) concepts involve volitional movement of fish with minimal operational requirements. The operation of the interim fish passage facility, coupled with the release of PIT-tagged juvenile coho salmon in the lake and upper river, assisted in evaluating fish movement and behavior in the reservoirs and tributaries, and thus, the feasibility of passage. Installation of temporary experimental passage facilities confirmed that fish can find the entrances to the passage facilities and will volitionally move through them.

3.3 Biological Assessments

Reclamation and the Core Team conducted a number of biological assessments in 2003 through 2007, described in the previous chapter and documented in a *Biology Appendix* (Reclamation 2008 [Biology Appendix]) and other technical reports. This information assisted the fisheries co-managers in developing goals and objectives for reintroduction and in developing estimates of the capability of establishing self-sustaining populations of anadromous salmonids above Cle Elum and Bumping Lake dams. It also helped to quantify potential benefits.

Reintroduction of anadromous fish is essential to achieve the ecosystem objectives and other benefits described in Section 2.6. Concurrent with the engineering design of fish passage facilities, the fisheries co-managers developed an anadromous salmonid reintroduction plan to guide reintroduction efforts above Cle Elum Dam (Reclamation 2005 [Reintroduction]; Fast and Easterbrooks 2008). This plan was first issued in February 2005 to assist in the design of interim fish passage facilities at Cle Elum Dam. The plan was updated in 2008 to incorporate additional data generated by modeled analyses and by data collected during interim downstream passage in previous years. Section 2.3.3 described the reintroduction plan's goals and objectives.

3.4 Alternative Plans

The Core Team believes that juvenile and adult fish passage is the only alternative for Cle Elum and Bumping Lake dams that will achieve the ecological benefits and function needed to restore anadromous fish populations in the Yakima River basin or lead to successful reintroduction of species, such as sockeye salmon, that have been extirpated from the basin. Numerous existing Yakima River basin programs currently address habitat improvements, changes in stream flows, reconnecting tributaries, and other actions to promote restoration (these were described in the previous chapter). Alternatives to fish passage at the dams could aid in these ongoing efforts but would fall short of providing the unique benefits gained by

allowing passage of anadromous fish into the habitat above the dams. Successful passage and reintroduction of anadromous fish species would bring very important marine-derived nutrients into the headwaters area of tributaries above the dams, thereby benefiting both aquatic and terrestrial wildlife throughout the basin. Fish passage at the dam would also connect isolated populations of bull trout.

The only other alternative to fish passage considered for this planning study is the "No Action" alternative. Dam removal and major operational changes were not considered to be viable alternatives and were not evaluated. A basic study assumption and constraint is that fish passage operations at the dams must be consistent with other Project operations and not impact existing water delivery contracts, flood control, or instream flow requirements.

3.4.1 Recommended Plan

A number of physical, hydrological, and biological considerations were involved in the development of downstream and upstream fish passage designs. The biological considerations included the species targeted for passage, the periods when fish passage is required, and other issues presented earlier in this report. In 2006, Reclamation's engineers began detailed engineering studies to evaluate the feasibility of providing fish passage at Cle Elum and Bumping Lake dams. The engineering concepts explored in the *Phase I assessment* were developed in further detail and reviewed with the Core Team. The Core Team discussed the advantages and disadvantages of the various concepts and selected the downstream and upstream fish passage concepts for Reclamation's engineers to develop feasibility-level designs, cost estimates, and schedules. Throughout the feasibility-level design process, Reclamation engineers reviewed iterations of the design and design criteria (i.e., timing of upstream and downstream fish passage, passage design flows, sizing criteria for holding ponds, pipe velocities) with the Core Team. Adjustments were made to the designs based on these discussions. Engineering design, cost estimates, and schedules for the recommended plan are provided in Chapters 4 and 5.

Downstream Passage

The challenge of providing downstream passage at the dams is to be able to provide passage at critical times when fish are migrating downstream. The basic downstream passage concept evaluated would provide surface releases of sufficient volume to attract migrating juvenile fish to an overflow gate leading to a conduit and safely discharging the fish downstream. The fish would enter the fish passage system under their own volition rather than being collected and handled and then transferred downstream. This basic concept, although differing in detail and scope, is proposed at both Cle Elum and Bumping Lake dams.

Sections 4.2.1 and 4.3.1 provide additional information about the recommended downstream fish passage features at Cle Elum and Bumping Lake dams, respectively.

Upstream Passage

Upstream trap and haul facilities are proposed at both sites in lieu of fish ladders that would need to accommodate reservoir fluctuations in excess of 100 vertical feet at Cle Elum Lake and 30 feet at Bumping Lake. Trap and haul methods for upstream fish passage have been used successfully at other large dams in the Pacific Northwest. Adult trap and haul features at both sites are similar but vary in scope and detail. Each site would include an angled barrier structure across the river to lead fish into the collection facility. The adult migrants would move volitionally along the barrier structure, into a fish ladder entrance, and up the ladder into a holding area. Fish would be transported by tank truck to the reservoir or upstream tributaries to spawn. The collection facility would also provide an opportunity for biologists to collect information from the returning adults.

Sections 4.2.2 and 4.3.2 provide additional information about the recommended upstream fish passage features at Cle Elum and Bumping Lake dams, respectively.

3.4.2 No Action

Under the "no action" alternative, Reclamation would not modify Cle Elum or Bumping Lake dams or their features to include fish passage facilities. In accordance with the *Mitigation Agreement*, Reclamation would work with WDFW and YN to identify an as yet undetermined alternative to permanent fish passage.

3.5 Risk Assessment

Reclamation's SOD program uses a risk assessment technique as a primary tool to ensure that Reclamation dams are operated in a manner that minimizes risks to downstream human populations. Reclamation policy requires a risk analysis before any modification to a dam or any of its features occurs or before a potentially significant change in operation of a reservoir is proposed. Reclamation conducted risk assessments to analyze potential changes in risk of failure associated with modification to Cle Elum and Bumping Lake dams and their features from the addition of the fish passage facilities (see Reclamation 2007 [Cle Elum Risks] and Reclamation 2007 [Bumping Risks]).

The analysis concluded that the proposed modifications for fish passage pose very small to minimal additional risks, assuming all construction and design assumptions are implemented.

The magnitude of the risks are below guidelines levels. The recommended plan described in this Study reflects the assumptions used in the risk assessment. The assessment did not consider risks associated with construction of the facilities, but evaluated potential risks assuming the facilities were in place.

3.6 Design, Estimating, and Construction Review

A Design, Estimating, and Construction (DEC) review of draft feasibility-level design and costs estimates for the recommended fish passage plan occurred in December 2007 (Reclamation 2008 [DEC Review]). A DEC review consists of an oversight review by an independent expert team convened by Reclamation to ensure that cost estimates are appropriate, that there are no major technical flaws, and that project risks and uncertainties are identified and addressed. Reclamation made some modifications to the feasibility grade designs and cost estimates to address recommendations from the DEC review. These revisions are reflected in the designs and cost estimates presented in Chapters 4 and 5 in this report.

Chapter 4 PROPOSED FISH PASSAGE FACILITIES

The following sections describe the recommended plan to construct upstream and downstream fish passage facilities at Cle Elum and Bumping Lake dams. An overview of the existing facilities is also provided. The *Design and Estimates Appendix* (Reclamation 2008 [Designs Appendix]) provides detailed descriptions and drawings of the facilities proposed.

4.1 Existing Facilities

The Yakima Project has five major storage reservoirs (Clear Lake is a minor facility) with a total storage capacity of a little over 1 million acre feet (MAF); total yearly runoff passing through the storage reservoir system averages 1.71 MAF. Table 4-1 summarizes the system storage capacity and average annual runoff for these Project storage facilities.

Table 4-1. System Storage Capacity and Average Annual Runoff on September 30.

Reservoir	Drainage area ($mi.^2$)	Capacity (acre-feet)	Avg. Annual Runoff (acre-feet)	Ratio of Avg. Runoff to Capacity	September 30 Historical Storage (acre-feet)		
					Minimum	Average	Maximum
Keechelus	54.7	157,800	244,764	1.5:1	4,800	40,500	126,900
Kachess	63.6	239,000	213,398	0.9:1	20,100	107,200	227,200
Cle Elum	203.0	436,900	672,200	1.5:1	12,900	118,000	359,500
Bumping	70.7	33,970	209,492	6.2:1	2,400	7,900	24,600
Rimrock	187.0	198,000	367,966	1.8:1	200	74,500	145,100
System	579.0	1,065,400	1,707,820	1.6:1	51,700	357,500	660,200
Period of Record = 1920-1999							

4.1.1 Cle Elum Dam and Reservoir

Cle Elum Dam was completed in 1933 and is located at the lower end of a natural lake at RM 8.2 on the Cle Elum River, 8 miles northwest of the city of Cle Elum, Washington. The earthfill dam includes the main Cle Elum Dam, a dike adjacent to the left abutment of the dam, and three small saddle dikes. The dam has a maximum structural height of 165 feet and a crest length of 1,800 feet including the main dike. The earthfill dam forms a reservoir with a capacity of 436,900 acre-feet, with 427,930 acre-feet available for use. Cle Elum Reservoir has the largest storage capacity and average annual runoff in the Yakima River basin.

Cle Elum Dam is equipped with a gated spillway (sill elevation 2223.00) with capacity of 40,000 cubic feet per second (ft^3/s) at reservoir elevation 2240. The spillway consists of radial gates and a concrete-lined open channel in the right abutment. The outlet works consist of a gated control tower and a reinforced concrete conduit through the right abutment of the dam.

4.1.2 Bumping Lake Dam and Reservoir

Bumping Lake Dam is located at the lower end of a natural lake at RM 17 on the Bumping River, about 29 miles northwest of the town of Naches, Washington. The earthfill dam was completed in 1910 and forms a reservoir with a total capacity of 33,970 acre-feet, with 31,220 acre-feet available for use. The dam has a maximum structural height of 61 feet and a crest length of 2,925 feet. The average annual runoff at Bumping Lake is much more than the reservoir's capacity, which allows the reservoir to fill every year.

The spillway consists of an uncontrolled concrete ogee crest (elevation 3426.20) and concrete-lined channel connected to a timber chute that discharges spillway flows to the river. The spillway is capable of passing 3,400 ft^3/s at a reservoir water level of 3429 feet. The outlet works consist of a gate tower and concrete conduit at the base of the dam.

4.1.3 Project Operations

The five Project reservoirs are operated in a coordinated manner to provide for the needs of the system as a whole. The releases from each reservoir are balanced to meet system-wide irrigation and water demands in conjunction with natural runoff and return flow available in the basin. No single reservoir is designated to supply the needs of one particular area, irrigation district, or Project division. The major storage facilities store runoff during the winter and spring/summer seasons. This water is released later during low-flow periods in the summer and fall seasons for irrigation.

Operational releases at Cle Elum and Bumping Lake dams are affected by the presence of Chinook salmon redds in the Cle Elum River and Bumping River, respectively, downstream of the dams. About 12 percent of the spring Chinook salmon redds in the Upper Yakima River basin were found in the Cle Elum River in recent years, while about 50 percent of the redds were found in the Yakima River reach upstream from the mouth of the Cle Elum River to Easton Diversion Dam. The presence of redds downstream results in conflicting needs for the operational releases from the reservoirs.

Reclamation makes efforts to reduce impacts of Project operations on the fishery resources and to provide for appropriate water flows, while at the same time providing water for irrigation purposes. Reclamation implements three atypical operational strategies beginning

in late August each year. These are "Flip-Flop," "Mini Flip-Flop," and "KRD Canal Bypass" and are described below. Each of these operational schemes is designed to balance the need for irrigation water delivery with the protection of spring Chinook salmon redds in the upper arm of the Yakima River above Roza Dam.

Flip-Flop – Flip-Flop operation meets Lower Yakima basin irrigation demands (below the confluence of the Naches River) primarily from upper mainstem Yakima River (above Roza Dam) storage during the summer months and then reduces flows in the upper mainstem Yakima River during the latter part of the irrigation season. Late-season Lower Yakima basin demands are then met primarily from Rimrock Lake on the Naches River arm. The purpose of the Flip-Flop operation is to encourage spring Chinook salmon in the upper mainstem Yakima River above Roza Dam to spawn at lower river stage levels. This minimizes the river flows (and storage releases) required to keep the redds watered and protected during the subsequent incubation period (November through March).

Mini Flip-Flop – In years of sufficient water supply, heavier releases are made from Keechelus during June, July, and August to meet upper mainstem Yakima River above Roza Dam demands; Keechelus releases are reduced in September and October to provide suitable spawning flow in the Yakima River reach from Keechelus to the upper end of Lake Easton. This minimizes the river flows (and Keechelus storage releases) required to keep the redds watered and protected during the subsequent incubation period (November through March).

Kittitas Reclamation District (KRD) Canal Bypass – The operation uses storage upstream from Easton Diversion Dam to supply some of the irrigation diversion demand in the lower Kittitas/Ellensburg valley, Roza Irrigation District, and flow demands below Roza Diversion Dam while maintaining target spawning flows in the Easton reach of the Yakima River. Flows are bypassed through the KRD canal beginning about September 1 and continuing to about mid-October when KRD's irrigation season ends. This allows the target flow below Easton Diversion Dam (about 200 ft^3/s) to be maintained while releases from Keechelus Lake and Kachess Lake totaling about 1,450 ft^3/s are continued for downstream demand.

Cle Elum Dam and Reservoir Operations

Cle Elum Lake is operated to meet irrigation demands, flood control, and instream flows for fish. The prime flood control season extends from mid-November through mid-June. Cle Elum Lake regulates about 20 percent of the entire runoff above Parker gage (RM 103.7). With the largest storage capacity in the Yakima River basin, it is the main resource for meeting the large irrigation demands in the lower Yakima River basin.

Cle Elum releases are greatest in July and August in order to meet most of the Lower Yakima River basin diversion demands during these months. Late season irrigation demands (mid-September) are met primarily from Rimrock Lake. The 3,200 ft^3/s summer release from Cle Elum is reduced during the Flip-Flop operation to a minimum flow range of 200 to 300 ft^3/s to support both spawning and irrigation demands on the Upper Yakima River basin system. This allows Reclamation to meet a target flow range (200 to 300 ft^3/s) in the Cle Elum River during winter for spring Chinook salmon incubation and early rearing. Average monthly releases at Cle Elum Dam for the mean, maximum, minimum, and 93 percent and 7 percent exceedances are shown in Figure 4-1 for the 1981 to 2007 period of record. The 5 percent and 95 percent exceedance flows for reservoir releases are 2,946 ft^3/s and 103 ft^3/s, respectively.

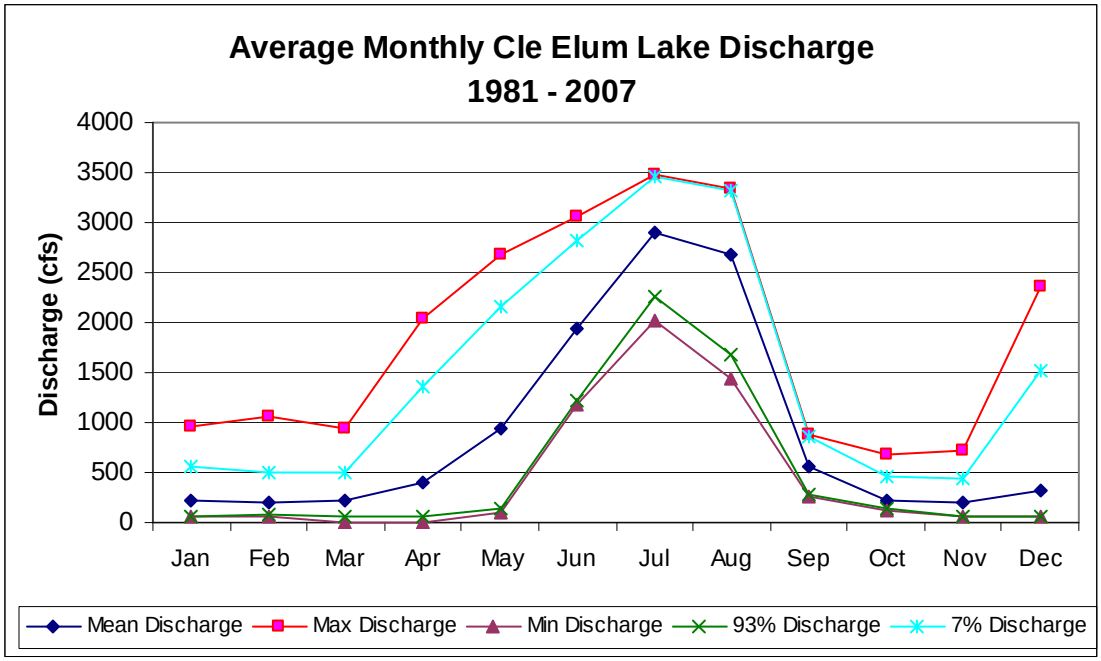

Figure 4-1. Average Monthly Cle Elum Lake Discharge.

The reservoir typically reaches its lowest elevation in September or October when the irrigation season ends. In the winter months, water is released to meet downstream demands and to maintain flood control space. In the spring, water is stored in the reservoir to regulate downstream flows for flood control and to store water for irrigation demands later in the year. The highest reservoir elevations generally occur in the May to July period depending on the annual water supply. Full pool is at elevation 2240 feet. Figure 4-2 shows the average monthly reservoir elevations for mean, maximum, minimum, and 93 and 7 percent exceedances for the 1981 to 2007 period of record.

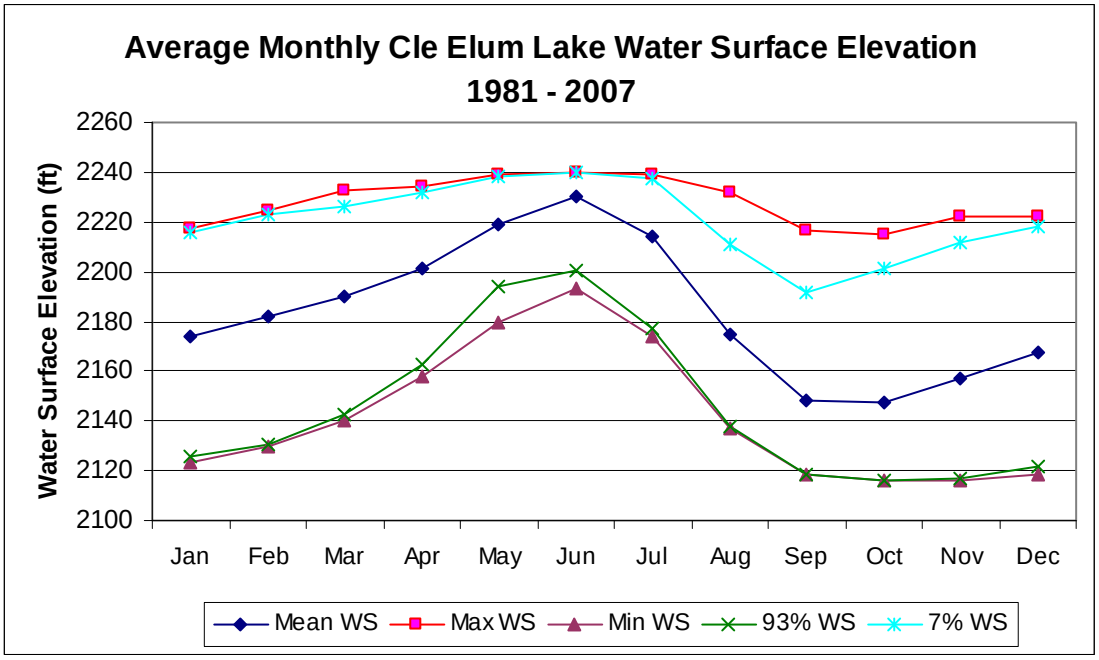

Figure 4-2. Average Monthly Cle Elum Lake Water Surface Elevation.

In order to perform maintenance on the outlet works gates, the upstream guard gates must be closed. To perform work in the outlet conduit, the main gates must be closed. Either action allows no flow into the river downstream. Therefore, the required maintenance on the main gates is attempted only when the lake is above spillway crest (elevation 2223); otherwise, pumping is necessary to maintain downstream flows. Maintenance of the guard gates must be done when the reservoir is below elevation 2120.5 or lower than the top of the outlet intake structure and would require pumping. The ramping rate for operations is 2 inches per hour as measured at the first gage downstream from the dam. (The proposed fish passage facility could provide an auxiliary outlet.)

Bumping Lake Dam and Reservoir Operations

Bumping Lake Dam is operated to supplement irrigation demands, flood control, and instream flows for fish. Bumping Lake is normally operated in the flood control mode during the spring/summer period, except for extreme water-short years (or multiple short years in a row). Depending on the timing of the runoff, the reservoir can be brought up to full pool a number of times each year. The facility is used to supplement water supply for demands in the upper Naches River during summer months. Heavy drawdown of storage for summer irrigation demand normally starts in August and continues into early September.

During the early-September to late-October spawning period, the reservoir's outflows are kept under 200 ft^3/s in order to minimize the required releases from storage for the winter

incubation and rearing (I&R) period. During the winter I&R period, natural inflow to Bumping Lake often drops below 35 ft^3/s. Supplementation from the end-of-season storage is required to provide winter minimum target flows. During the winter I&R period–and depending on earlier spawning flows–instream flows downstream from Bumping Lake Dam are kept within a target range of 200 ft^3/s to the minimum natural inflow. The instream flows during this period are variable depending on the results of redd surveys. Average monthly releases at Bumping Dam for the mean, maximum, minimum, and 93 percent and 7 percent exceedances are shown in Figure 4-3 for the 1981 to 2007 period of record.

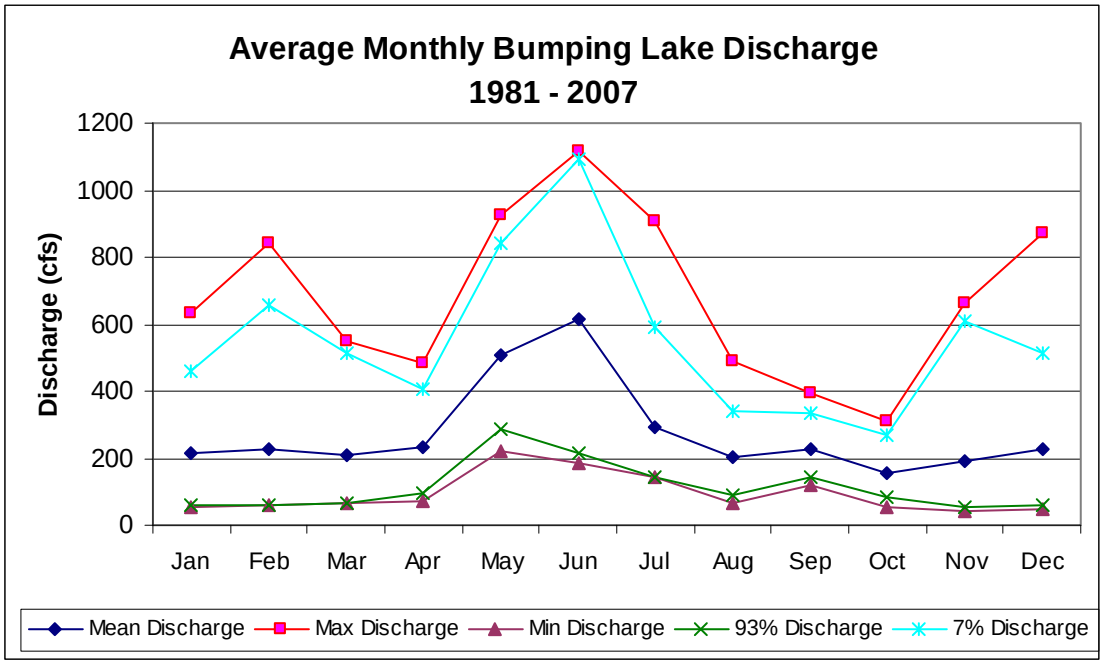

Figure 4-3. Average Monthly Bumping Lake Discharge.

The reservoir typically reaches its lowest elevation after the end of the irrigation season and can remain low from October through December. Bumping Lake is not used as a carryover facility, but is operated to provide 10,000 acre-feet of end-of-season storage (3403.55) needed to maintain winter incubation flows. In extreme water-short years the end-of-season storage target is reduced to the range of 6,000 to 9,000 acre-feet (3398.16 feet to 3402.27). In the winter months, water is released to meet downstream targets and to maintain flood control space. In the spring, water is stored in the reservoir to regulate downstream flows for flood control and to store water for irrigation demands later in the year. The highest reservoir elevations generally occur in the May to August period depending on the annual water supply. Full pool is at elevation 3426.20. Figure 4-4 shows the average monthly reservoir elevations for mean, maximum, minimum, and 93 and 7 percent exceedances for the 1981 to 2007 period of record.

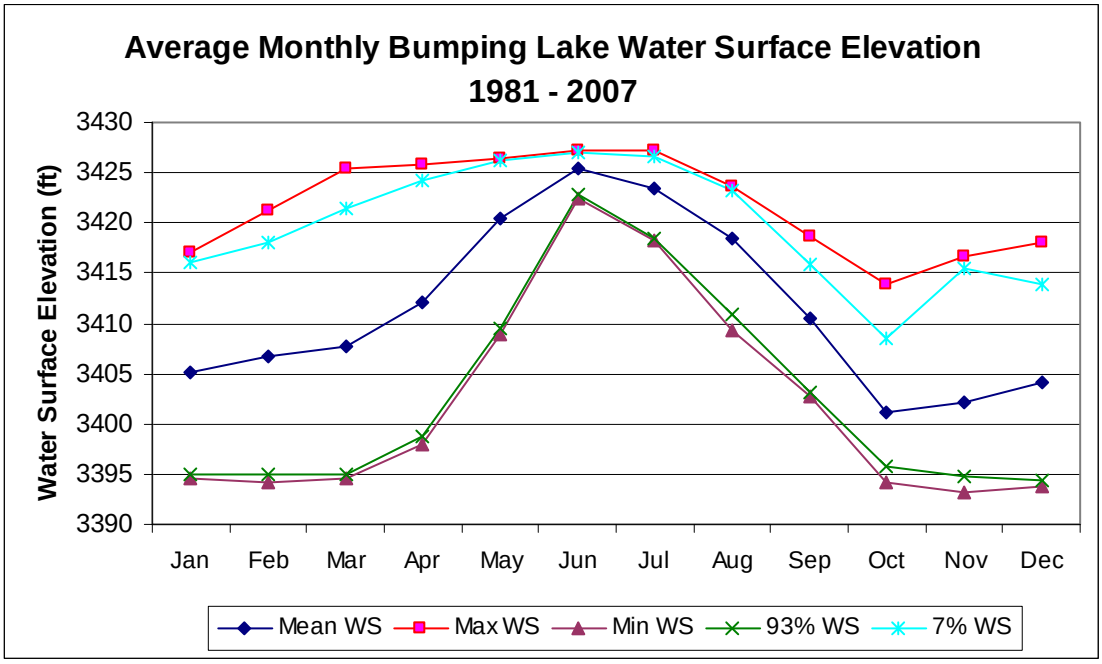

Figure 4-4. Average Monthly Bumping Lake Water Surface Elevation.

In order to perform maintenance on the outlet works gates, the upstream guard gates must be closed. To perform work in the outlet conduit, the main gates must be closed. Either action allows no flow into the river downstream. Therefore, the required maintenance on the main gates is attempted only when the lake is above spillway crest (elevation 3426.20); otherwise, pumping is necessary to maintain downstream flows. Maintenance of the guard gates must be done at lower pool elevations with the use of stoplogs and pumping. The ramping rate for operations is 2 inches per hour as measured at the first gage downstream from the dam. (The proposed fish passage facility could provide an auxiliary outlet.)

4.2 Cle Elum Dam Fish Passage Facilities

Proposed fish passage facilities include both downstream juvenile passage and upstream adult passage. Figure 4-5 shows the site plan for upstream and downstream fish passage facilities.

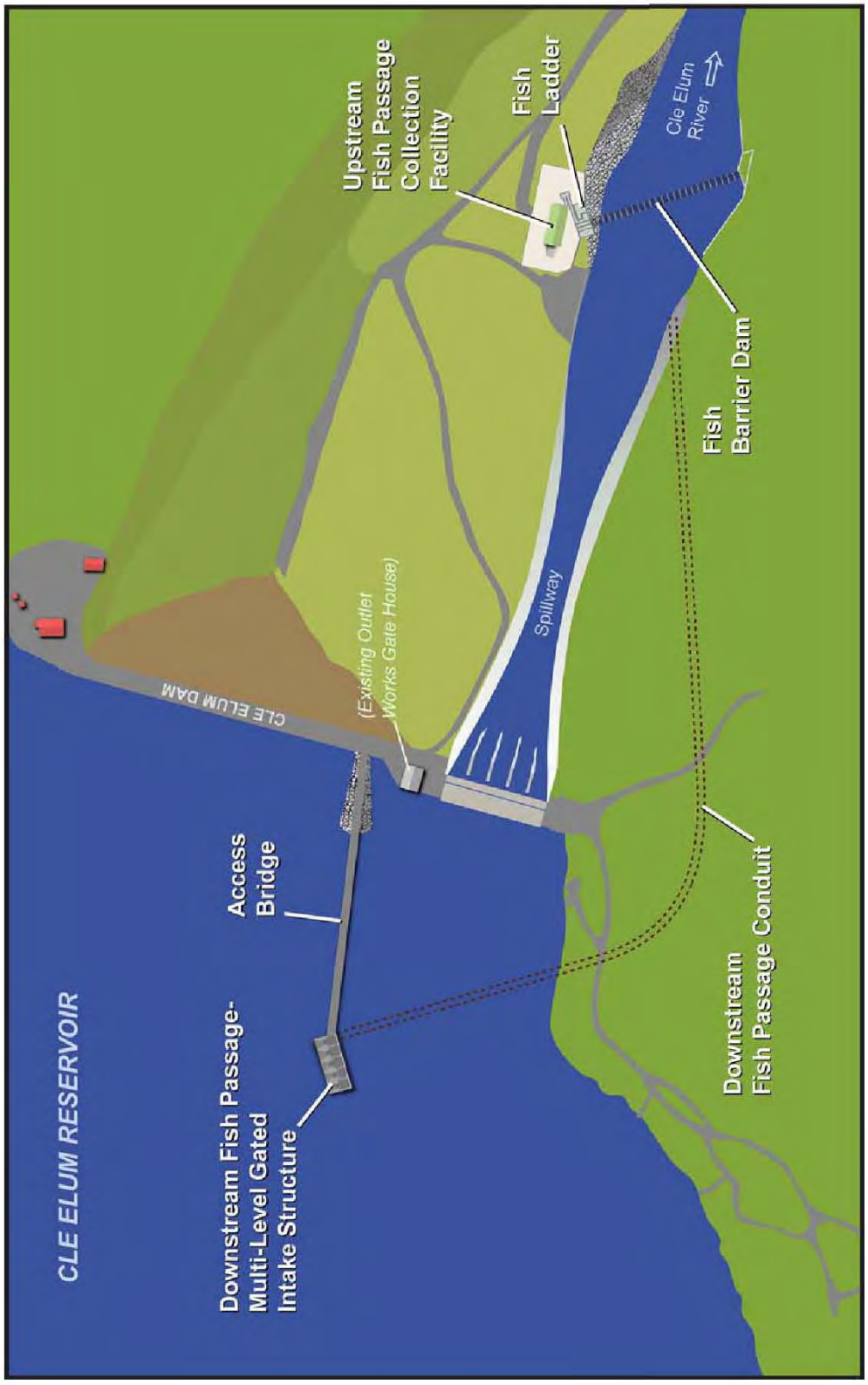

Figure 4-5. Cle Elum Dam Upstream and Downstream Fish Passage Facilities.

4.2.1 Downstream Fish Passage

The basic concept for downstream passage is to provide surface releases in enough volume to attract migrating juvenile fish to an overflow gate that would lead to a conduit that would safely discharge the fish downstream. The fish would enter the fish passage system under their own volition rather than being collected and handled and then transferred downstream. The downstream passage facilities would include a multilevel gated intake structure and a 7-foot-diameter conduit through the right abutment of the dam that would discharge fish flows into the spillway stilling basin.

The proposed new juvenile passage intake structure would be located about 500 feet upstream from the existing outlet works gate house, just above the spillway inlet channel. All land required for construction and operation of the proposed downstream fish passage features is Federally owned and falls within the Wenatchee National Forest.

Intake Structure

The intake structure would consist of a rectangular concrete tower with multilevel intake gates. The gates would allow release of fish passage flows at any time that the reservoir water surface is in the upper 50 feet of the pool. Downward opening gates would be used to provide surface release, or weir flow, to attract fish from the reservoir into the intake structure. Fish would then spill over a series of weirs and pools depending on the water surface elevation of the reservoir. The pools would be deep enough to provide sufficient energy dissipation to protect the fish. The drop structure concept would control the potential drop at all times and would also permit open channel flow in the outlet conduit.

The intake structure would be located upstream from the spillway inlet channel to avoid excavating and maintaining a deep channel leading to the intake structure. The structure is oriented to minimize excavation. The excavated area would be backfilled to the original ground contours.

A trashrack with 1-foot bar spacing would be placed on the upstream side of the gates. Juvenile fish would easily pass through the trashrack openings, but larger debris would be blocked from entering the structure. The plan includes an automated trashrake system to handle debris that accumulates on the trash rack.

Special ramped and converging entrance approaches would be used to gradually increase the approach velocity and provide a smooth transition for the fish as they pass from the reservoir pool over the gates and into the passage facility. Each of the five drop bays are 20 feet long by 20 feet wide and 20 feet deep with inflow controlled by 8-foot-wide by 16-foot-high roller gates, with the exception of the bottom gate which is 8 feet wide by 8 feet high.

Access to the intake structure would be provided by a 16-foot-wide by 370-foot-long bridge extending from the crest of the dam. Figure 4-6 provides a section view of the intake structure.

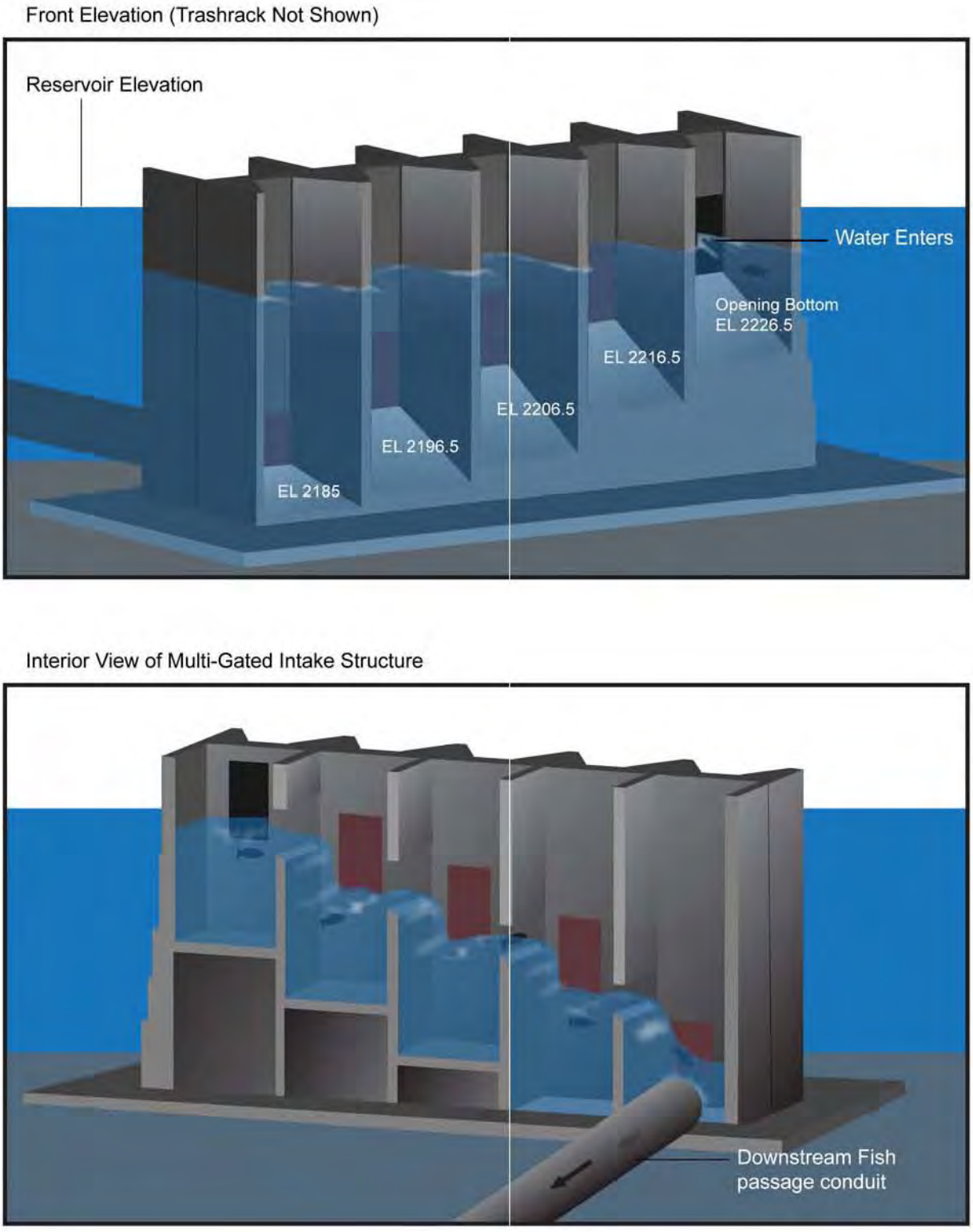

Figure 4-6. Cle Elum Intake Structure.

Fish Passage Conduit

A reinforced concrete conduit would carry passage flows from the upstream intake structure to be discharged into the spillway stilling basin. The concrete conduit would be cast-in-place using cut and cover methods. The depth of cut would vary from 75 feet to 20 feet with a 15-foot-wide working space at the invert and 3:1 side slopes. The excavation for the conduit around the right abutment of the dam would be through native ground with no excavation through dam embankment materials. The cut and cover method of installation would eliminate the uncertainties connected with tunneling.

The 1,520-foot-long conduit would have an inside diameter of 7 feet, and a minimum wall thickness of 21 inches. The outside of the conduit would be formed in a horseshoe shape with rounded top. The conduit would be non-pressurized and would have an open channel flow capacity of about 400 ft^3/s with a maximum velocity of about 12 feet per second (ft/s).

The fish passage conduit would discharge at the base of the spillway into the spillway stilling basin. The downstream fish passage conduit would have no effect on spillway capacity and no changes would be required to the operation of the spillway.

Operations

The goal is to obtain downstream fish passage covering as much of the fish passage season from early March to the end of June as possible, during which time most of the smolts are expected to migrate out of the system. Previous research investigations at Cle Elum Dam by NOAA Fisheries Service concluded that “a smolt bypass system configured for maximal smolt passage would probably need to operate at elevations of around 33 feet below the current spilldeck” (Flagg et al. 2000). The multilevel gates proposed in the feasibility design for the permanent downstream passage facility at Cle Elum Dam would provide passage through a wider range of reservoir elevations (in the top 50 feet of the reservoir). This would allow passage earlier in the season (when fish are ready to migrate but the reservoir is filling and well below spillway crest elevation). It would also allow passage during more of the years when the reservoir doesn't completely fill. When pool levels are above elevation 2190, the fish passage system also could serve as an auxiliary outlet which might benefit maintenance or repair crews working on the main outlet works.

Reservoir operational patterns during the last 25 years were used to evaluate the effectiveness of the proposed fish passage design. The hydrology information was used to determine the length of time that the proposed juvenile fish passage facilities would be functional at different structure depths and gate configurations for critical fish passage windows. The height of the intake structure and gate elevations were selected to optimize the fish passage window without an excessive increase in costs.

The proposed facilities would allow a surface spill from reservoir elevation 2190 to maximum pool elevation 2240. Analysis of HYDROMET records from 1934 to 2004 shows that Cle Elum Reservoir was above elevation 2190 in early March in about 61 percent of the years. The pool elevation was above 2190 by early April in 73 percent of the years and by early May in about 90 percent of the years. Analysis of current reservoir operations from 1981 through 2007 shows similar results (see Figure 4-7). Even in a very low water year (minimum elevation in Figure 4-7), downstream passage would be available over a six-week period at some time during the March – June window.

The juvenile passage facilities are designed to make surface releases of fish passage flows in the range of 100 to 400 ft^3/s. These releases would be made whenever reservoir levels are between elevations 2190 and 2240. Minimum flows downstream from Cle Elum Dam are usually kept at about 200 ft^3/s to protect Chinook salmon redds in the Cle Elum River. The dam operating staff must maintain a minimum discharge of 100 ft^3/s through the existing outlet gates to prevent potential cavitation from lower releases. So, at times, there would only be another 100 ft^3/s available to operate the juvenile fish passage facilities. As reservoir releases are increased to meet downstream irrigation demands, the juvenile fish passage releases would be increased from 100 ft^3/s to 400 ft^3/s. The total outflow from the reservoir would vary from 200 ft^3/s to 500 ft^3/s. As downstream demands increase above 500 ft^3/s, the additional releases would be made from the existing outlet works while maintaining 400 ft^3/s through the juvenile fish passage facility. The construction of the downstream fish passage facility would allow maintenance to occur on the outlet works when the reservoir elevation is below the spillway crest, but above elevation 2190, without requiring pumping.

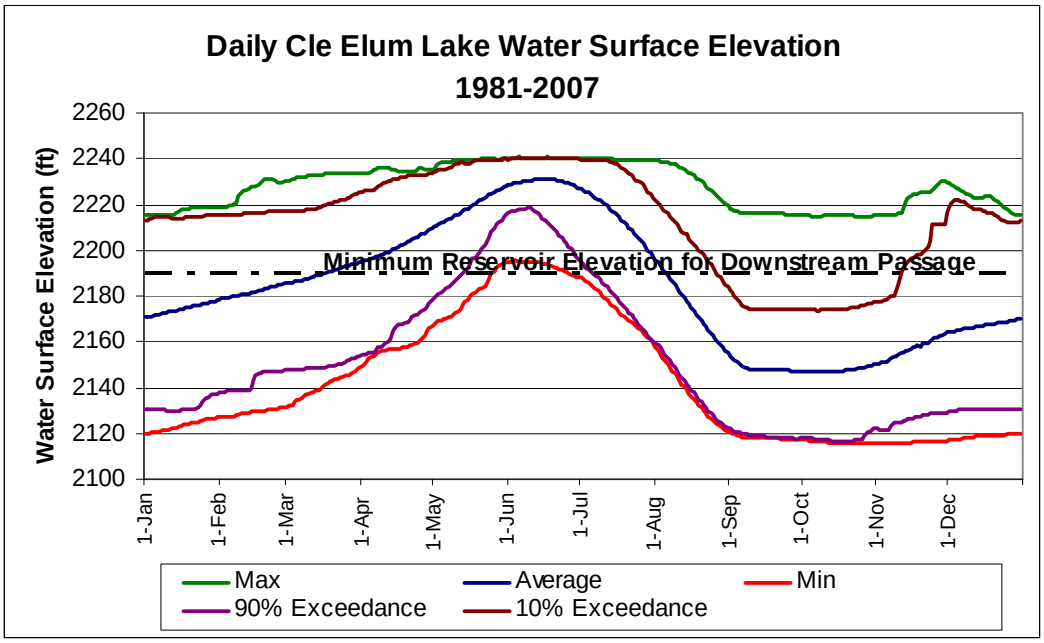

Figure 4-7. Daily Cle Elum Lake Elevations for 1981 to 2007 Period, showing the minimum elevation for downstream passage.

4.2.2 Upstream Fish Passage

An upstream trap and haul facility is proposed in lieu of a fish ladder that would need to accommodate reservoir fluctuations in excess of 100 feet at Cle Elum Dam. The upstream adult fish passage facilities would include a barrier structure, a fish ladder, and a collection facility. The collection facility would also provide an opportunity for biologists to collect information from the returning adults. Figure 4-5 shows the site plan for the upstream trap and haul facility.

The barrier structure and collection facility would be located about 150 feet downstream from the spillway stilling basin. The collection facility would be located on the left side of the river.

Barrier Dam

A vertical drop hydraulic barrier about 300 feet long controlled by overshot weir gates would span the width of the Cle Elum River just downstream from the spillway stilling basin and the juvenile fish passage conduit outlet (described previously in this section). The barrier would be oriented at an angle of about 55 degrees to the river flow and would serve as a directional device to guide adult migrating fish to the fish ladder entrance on the left side of the river. The barrier also would provide hydraulic head to deliver operational water to the collection facility. When the collection facility is not in use, the barrier gates would be in their fully-down position.

The variable-crest barrier was chosen to provide enhanced operation and flood conveyance ability. It would use a vertical hydraulic drop of 10 to 12 feet to prevent upstream passage beyond the collection facility. Tailwater elevations at the spillway stilling basin would be raised by 10 to 12 feet during operation of the barrier. This increase in the tailwater elevation at the base of the spillway would not impact spillway operations. The discharge capacity of the outlet works at higher flows would be reduced by the higher water surface elevation on the end of the outlet works. The loss in outlet works discharge capacity is offset by the additional discharge capacity of up to 400 ft^3/s from the downstream passage conduit. If additional outlet works discharge capacity is required, the barrier gates would need to be lowered to reduce the water surface elevation at the end of the outlet works. In major flood control releases, the barrier gates would be lowered as needed to avoid overtopping the stilling basin walls.

If the downstream passage system is in operation at the same time that the barrier gates are in the raised position, the juvenile fish migrating downstream that are discharged from the downstream passage conduit would enter the pool upstream from the barrier gates. The fish would then spill over the barrier gates to continue downstream migration.

The barrier would be used to create attraction flow to guide fish to the collection facility and to create the hydraulic head for the auxiliary system attraction flow. The auxiliary system would be sized for a maximum flow of 180 ft^3/s to be used as attraction flow.

Adult Collection Facility

The proposed adult collection facility design would be similar to the existing collection facility found at Roza Diversion Dam on the Yakima River. Fish would be attracted to swim into the ladder entrance by the auxiliary water flow. Up to 6 ft^3/s would flow down the fish ladder into the ladder entrance. Fish would swim up the ladder into the adult fish collection facility. When adequate numbers of fish are collected in the facility, they would be placed into a fish transport truck which would deliver them to upstream locations in-and-around the reservoir watershed. The holding pool, fish lock, handling and sorting facilities, and office would be enclosed in a building. An existing access road northeast of the site would be improved to provide access for construction and operation of the collection facility.

Operation

The barrier and adult collection facility would be operated from early March to late December. Peak upstream movement of adult salmon would be expected from June through November.

The barrier gates would be fully-upright during normal operations. The barrier gates would start dropping when river flows reach about 6,500 ft^3/s to avoid exceeding water surface elevation 2130 in the spillway stilling basin. The gates would each have differential sensors and actuators that would lower each gate in sequence starting at the left side of the river. This sequence would provide the most attraction flow to the collection facility.

Adult fish moving into the collection facility would be detained for a short time in a holding area. Biologists would selectively measure, weigh, examine, take scale and other samples, and mark the fish. Fish would then be transported in trucks and released in the reservoir or upstream tributaries.

4.2.3 Construction Access

Access for construction of the downstream passage features and portions of the upstream barrier would be from the right side of the dam using a new county road and bridge across the Cle Elum River anticipated to be in-place by 2010. No easements would be needed for use of this road, but special permits would be required for movement of large construction equipment. The right bank access road includes about 4.5 to 5 miles of paved road and 2 miles of unimproved gravel road. Most of the paved road is located on resort property that is being developed for condominiums, homes, golf courses, etc.

An existing two-lane paved road connecting to Highway 903 provides access to the left abutment of the dam. A narrow gravel access road departs the paved road about 1,800 feet east of the dam and would be improved to provide access for construction vehicles to the fish collection site and left side of the barrier dam. Road improvements would include about 2,600 feet of widening and grade improvement and about 1,000 feet of new road alignment at a 10 percent grade. The access road would later be used for operation and maintenance of the collection facility.

Construction of the right side of the barrier dam would require access on the right side of the river using the same access road as used for the downstream passage facilities. In addition, about 550 feet of new access road would be constructed at a 10 percent grade from the existing road down to the barrier.

4.3 Bumping Lake Dam Fish Passage Facilities

Proposed fish passage facilities include both downstream juvenile passage and upstream adult passage. Figure 4-8**Error! Reference source not found.** shows the site plan for these fish passage facilities.

All land in and around Bumping Lake Dam and Reservoir is withdrawn and Federally owned. The lands are administered by the Snoqualmie National Forest.

4.3.1 Downstream Fish Passage

The downstream fish passage concept is similar to that proposed at Cle Elum Dam except that there is more operational flexibility at Bumping Lake. The downstream passage facility at Bumping Lake would have two multilevel 10-foot-wide overflow gates and a conduit through the dam. These gates could also serve as an auxiliary outlet when the main outlet works has to be shut down for maintenance or repairs. This would provide a significant benefit to operation and maintenance crews.

Intake Structure

The reinforced concrete intake structure would include two folding overshot or tilting weir gates set at different elevations to control passage release flows. The gates would be raised or lowered as needed to match desired outflow and reservoir levels. Each gate would be 10-foot-wide by 12-foot-high. Flow over the gate would pass into a 20-foot-long by 20 foot-wide stilling pool section that would reduce energy to acceptable levels for juvenile fish. The depth of water in the stilling pool would vary from 5 to 10 feet for flows from 100 to 300 ft^3/s. When the reservoir pool elevation is at the spillway crest, the maximum hydraulic drop over the fish passage gate to the stilling pool water surface would be 10 feet or less.

Passage releases of 300 ft^3/s could be made at reservoir pool elevation 3411 or higher. The intake structure would butt up to the existing embankment with the structure deck at elevation

3430. The structure includes a trashrack with 12-inch bar spacing. The trashrack would be cleaned manually by raking from the top of the deck or from a trolley mounted access platform on the front of the trashrack. A short pedestrian access bridge would connect the structure deck to the crest of the dam.

Fish Passage Conduit

A reinforced, cast-in-place concrete conduit would carry passage flows from the upstream intake structure to be discharged downstream into the dam outlet works. The 230-foot-long conduit would have an inside diameter of 7 feet, and a minimum wall thickness of 18 inches, and would be formed in a horseshoe shape with a rounded top and an open flume transition on the downstream end. The maximum open channel flow capacity would be 400 ft^3/s, but normal releases would be from 100 ft^3/s to 300 ft^3/s. The normal depth of flow in the conduit at a discharge of 300 ft^3/s would be 4.5 feet with a velocity of about 12 ft/s.

A 10-foot transition would connect the conduit to a 5-foot-wide chute that would drop 7.7 feet in a distance of 20 feet and would discharge to the receiving pool. The maximum velocity down the chute and discharging into the pool would vary between 24 and 21 ft/s and would be discharged horizontally just above the receiving pool tailwater elevation. A 6-foot-deep plunge pool would be excavated at the outfall structure.

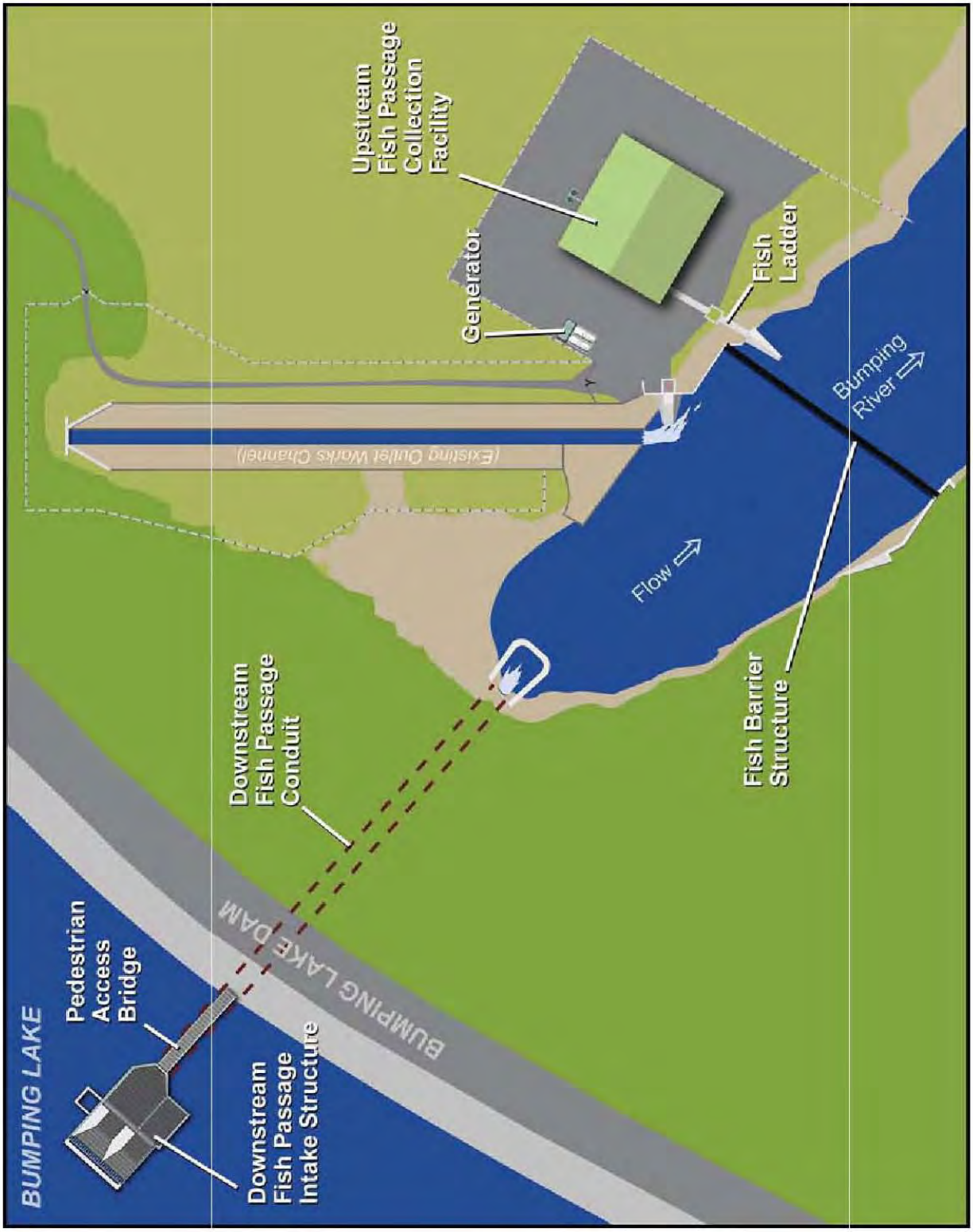

Figure 4-8. Bumping Lake Dam Upstream and Downstream Fish Passage Facilities.

An open cut with 3:1 side slopes and bottom width of about 18 feet would be excavated through the existing dam embankment. This would result in a temporary breach of the existing embankment 260 feet wide at the top of the dam. Proper backfill with appropriate filter zones and materials would minimize the potential for seepage or piping. The excavated dam embankment would be replaced with a new zoned embankment that includes a 20-foot-wide impervious core section. Much of the excavated material from the dam would be reused. The existing seepage stability berms would be replaced in-kind to eliminate any piping or seepage concerns.

Operation

The downstream passage facilities would generally be operated from early April to late June depending on reservoir conditions. Downstream juvenile fish passage flows in the range of 100 to 300 ft^3/s would be discharged into the existing outlet works outfall pool. These releases would be made whenever reservoir levels are between elevations 3411 and 3426 (spillway crest elevation is 3426.2). Figure 4-9 shows daily Bumping Lake elevations for the minimum, average, maximum, and at the 10 and 90 percent exceedance for the 1981 to 2007 period. The minimum elevation allowing downstream fish passage is 3411 which is not met until mid-May in the drier years (minimum and 90 percent exceedance in Figure 4-9) under historic operations.

Operations at Bumping Lake, however, might be modified to accommodate downstream fish passage earlier in the season. Bumping Lake's small reservoir size compared to reservoir inflows provides flexibility to accommodate the changes needed to provide good downstream passage at the site. A number of factors would be considered in determining the operational pattern at any given time, including the water supply, flood control guidelines, downstream flow requirements, fish migration needs, dam safety requirements, and other factors. Generally, as conditions allow, the reservoir pool would be raised to operate between elevations 3411 and 3426 during critical downstream migration periods. At pool elevations above 3411, the major portion (up to 300 ft^3/s) of reservoir releases would be made through the fish passage facilities, supplemented by releases from the main outlet works as needed.

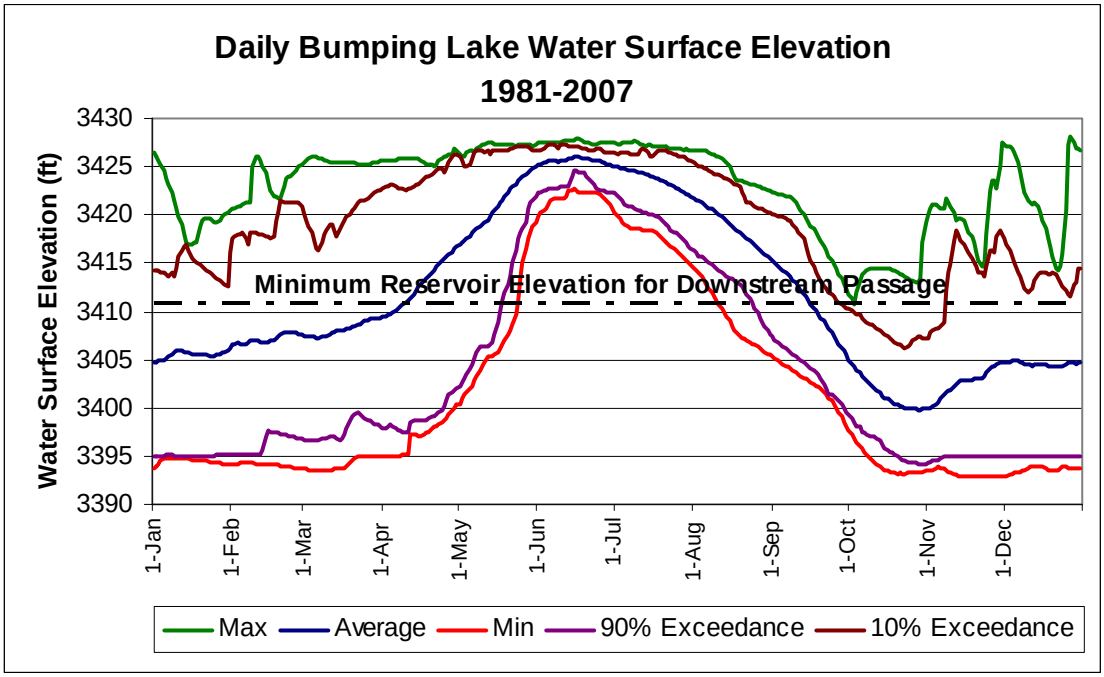

Figure 4-9. Daily Bumping Lake Elevations for 1981 to 2007 period, showing minimum elevation for downstream fish passage.

4.3.2 Upstream Fish Passage

Upstream fish passage facilities involve a trap and haul system. Adult fish migrating upstream would be attracted by reservoir releases from the outlet works. A barrier structure would be placed across the river just downstream from the outlet works channel to block fish from further upstream movement and direct them to the collection facility.

Barrier Structure

The barrier structure would have a series of 13 picketed vertical panels to effectively block adult fish while having minimal backwatering effects on the outlet works channel. The panels would be removable if necessary to meet freezing conditions or for maintenance of the facility. Each panel would be about 10 feet wide by 5 feet high. An operating deck at elevation 3396 would provide access to the picket panels. The barrier would be located with its axis at about 35 degrees to the outlet works channel.

The outlet works flow would attract adult fish and the barrier would direct the fish toward the ladder entrance which would be located immediately adjacent to the left end of the barrier. Approach velocity at the picketed barrier would be less than 1 ft/s at a flow of 400 ft^3/s. The barrier pickets would extend 2 feet above the maximum design water surface. Two V-shaped openings would be provided in the picket panels on the right side of the barrier to allow downstream passage of adult fish if necessary. The V-shaped opening would prevent upstream movement of adults.

Adult Collection Facility

The proposed adult collection facility design would be similar to the existing collection facility found at Roza Diversion Dam on the Yakima River. Fish would swim up the ladder into the holding pool. When adequate numbers of fish are collected in the facility, they would be placed into a fish transport truck which would deliver them to upstream locations in the reservoir and upstream tributaries.

The holding pool, fish lock, handling and sorting facilities, and office would be enclosed in a building. An existing access road that leads from the dam spillway would be used for access to the collection facility.

The water supply system to the fish ladder allows for both gravity and pumped flow with the two sources manifolded together at the collection facility. A 16-inch gravity supply pipeline with screened intake would be attached to the side of the juvenile passage intake structure. The pipe would be embedded in the bottom of the concrete horseshoe conduit section and would deliver water to the trap and haul facility downstream.

Operation

The barrier and adult collection facility would generally be operated from early April to late November. Water to supply the adult collection facility is delivered by pipeline from the reservoir at the downstream passage intake structure to the flume and holding pond at the adult collection facility. A reservoir water surface elevation of approximately 3,419, or above, would be needed to deliver water by gravity flow to the flume and elevation 3,412, or above, for gravity delivery to the holding pool at the adult collection facility. The reservoir pool is typically in this elevation range, or higher, from about May through August in an average water year. The collection facility water supply would only need to be pumped during the time the reservoir is below these elevations, typically in April and September through November in an average water year.

4.3.3 Construction Access

The only existing access to cabins located on the north shore of the reservoir and to the spillway and left side of the dam is across the dam crest. A temporary access road or a cofferdam wide enough to accommodate local vehicles and operation and maintenance (O&M) traffic would be needed during construction. Existing access roads would be adequate for local access and O&M activities once the project is complete.

4.3.4 Power

Bumping Lake is a remote site with no connection to the power grid. Power to operate the existing outlet gates is provided by an on-site generator. The fish passage facility would

include a new 50-kilowatt propane generator located at the adult collection facility. This generator would provide power to operate all the pumps, gates, gantries, and other electrical needs of the upstream passage features. Power to operate the folding gates at the downstream passage facility would be provided by connecting to the existing generator. These gates could also be operated by a solar panel or by connecting to the new generator at the adult collection facility.

4.4 Operation and Maintenance

Both upstream and downstream fish passage operations would be transparent to other Project demands and would not impact existing water delivery contracts or flood control operations. However, normal operations at Cle Elum and Bumping Lake dams might be modified to accommodate downstream fish passage during critical migration times. A number of factors would be considered in determining the operational pattern at any given time, including the water supply, flood control guidelines, downstream flow requirements, fish migration needs, dam safety requirements, and other factors.

Day-to-day operation of the fish passage facilities would be a shared responsibility between Reclamation and the YN. Reclamation's Yakima Project O&M staff would operate the juvenile downstream passage facilities and the upstream barrier structure. YN biological staff would operate the adult collection facilities and would also carry out the supplementation, monitoring, and research activities that are associated with the fisheries reintroduction program.

All fish passage features would be integrated into the existing maintenance program of the Yakima Project. Reclamation would maintain all of the passage facilities using Yakima Project maintenance staff. The additional workload required for the fish passage O&M activities would be accomplished by using a combination of existing staff, seasonal temporary staff, and permanent new staff.

4.5 Post-Construction Monitoring Program

A robust post-construction monitoring program would be developed and implemented by the YN and WDFW as part of the Master Plan for reintroduction of anadromous salmonids above the dams. Details of this monitoring program would not be available until the Master Plan is completed.

Chapter 5 CONSTRUCTION COST ESTIMATES AND SCHEDULE

The plans and cost estimates displayed in this report are intended to be used to evaluate the feasibility of constructing and operating fish passage facilities at Cle Elum and Bumping Lake dams. The estimates are suitable for requesting construction fund appropriations from Congress. Cost estimates provided for Project construction are comprised of field costs and noncontract costs, and annual operating costs are comprised of operation, maintenance, replacement, and power (OMR&P).

5.1 Construction Costs

The project construction cost is made up of two components:

- **Field costs** (construction contract costs) which include the direct contract cost of materials and services to construct project facilities and construction contract costs and contingencies.
- **Noncontract costs** which include facilitating services, investigations, developing designs and specifications, construction engineering and supervision, and environmental compliances.

5.1.1 Field Costs (Construction Contract Costs)

The Pacific Northwest Region Design Group prepared preliminary layouts and conceptual drawings for all major project features. Detailed structural designs were not prepared, but the layouts and drawings were sufficiently defined to allow development of approximate quantities for each kind or class of material and labor needed for construction. Quantities for all major construction items (i.e., earthwork, concrete, piping, gates) were calculated from the drawings. Reclamation's Technical Service Center developed unit prices and prepared the construction cost estimates based on the drawings, plans, and quantity estimates prepared by the Pacific Northwest Region.

Allowances for Minor Undefined Items and Estimating Uncertainties

At the feasibility stage of project investigation, it is not practical to identify all items associated with construction of a project. The cost estimates include a separate line item to account for the cost of these minor undefined items of work. Unlisted items provide a contingency for minor design changes and for minor pay items that have not been itemized but that would have some influence on the total cost. A 15 percent allowance for these unlisted items is included in the estimates based on the estimator's professional judgment.

The cost estimates also include a 25 percent contingency to cover minor differences in actual and estimated quantities, unforeseeable difficulties at the site, changed site conditions, possible minor changes in plans, and other uncertainties.

5.1.2 Noncontract Costs

Noncontract costs are those associated with work or services that support a project. Noncontract costs include post-authorization investigations, project management costs, collection of design data, preparation of final designs and specifications including Value Engineering studies, permits and environmental compliance costs, construction engineering, contract administration, and other related costs. Estimates for the labor, equipment, materials, and supplies needed for these different activities were developed jointly between the Pacific Northwest Region and the Technical Service Center based on experience at projects of similar scope and complexity. The Technical Service Center developed the costs for post-authorization investigations, data collection, and final design. All other noncontract costs were developed by the Pacific Northwest Region.

5.1.3 QA/QC (Quality Assurance/Quality Control)

Preliminary conceptual drawings of project features were reviewed by representatives of several Groups within the Civil Engineering Services, Geotechnical Services, Infrastructure Services, and Water Resources Services divisions of the Technical Service Center. The Technical Service Center also conducted a SOD Risk Analysis of the proposed features. A DEC Oversight Review of the plans and cost estimates was completed under the direction of the Senior Advisor, DEC, and was approved by the Director, Technical Resources.

5.2 Cost Estimates

The *Designs & Estimates Appendix* (Reclamation 2008 [Designs Appendix]) contains detailed construction cost estimates for Cle Elum and Bumping Lake dams fish passage facilities. The following disclaimer should be included with any document that contains or references the cost estimates found in this report.

> Reclamation has provided the enclosed cost estimate as a resource for use in discussions among interested parties evaluating this specific project, activity, concept, issue, etc. Presentation of this estimate does not in and of itself imply Reclamation's support for moving forward with the effort. When appropriate, Reclamation specifically will articulate support for further action through other means, such as a report containing recommendations.

5.2.1 Cle Elum Dam Fish Passage Facilities

Project Cost Estimates

The total construction cost for the Cle Elum Dam fish passage facilities is estimated to be $96 million at January 2008 price levels. This includes field costs of $81 million and noncontract costs of $15 million. Table 5-1 provides a summary of the project cost estimates.

Table 5-1. Project Cost Estimates for Fish Passage Facilities at Cle Elum Dam.

Description		Subtotal	Total
Cle Elum Downstream Passage Facility			
Roads and Road Structures	$2,260,000		
Dams	$31,700,000		
Waterway Structures	$26,000,000		
		$60,000,000*	
Cle Elum Dam Upstream Fish Passage Facility			
Structures and Improvements	$5,730,000		
Road and Road Structures	$1,200,000		
Waterway Structures	$13,700,000		
Pumps and Prime Movers	$170,000		
Accessory Electrical Equipment	$82,000		
		$21,000,000*	
Total Field Costs			$81,000,000*
Noncontract Costs			
Data Collection and Final Designs	$7,900,000		
Construction Engineering and Inspection	$5,700,000		
NEPA,ESA, Permits & Contract Administration	$910,000		
Total Noncontract Costs			$15,000,000*
TOTAL CONSTRUCTION COST			**$96,000,000***

January 2008 price levels
Indexes are from Reclamation, *Construction Cost Trends 1977 = 100*
* Totals rounded to the nearest $100,000 or $1 million using guidelines in Reclamation's *Cost Estimating Handbook* (March 1998).

Annual OMR&P Estimate

The total annual OMR&P costs for Cle Elum Dam fish passage features are estimated to be about $300,000 per year. O&M staff account for about 84 percent of the total. Equipment, supplies, electrical power, and special maintenance items account for the other 16 percent. A breakdown of the OMR&P costs can be found in the *Designs & Estimates Appendix*.

5.2.2 Bumping Lake Dam Fish Passage Facilities

Project Cost Estimates

The total construction cost for the Bumping Lake Dam fish passage facilities is estimated to be about $27 million at January 2008 price levels. This includes field costs of $19 million and noncontract costs of $7.5 million. Table 5-2 provides a summary of the project cost estimates.

Table 5-2. Project Cost Estimates for Fish Passage at Bumping Lake Dam.

Description		Subtotal	Total
Bumping Lake Dam Downstream Passage Facility			
Roads and Road Structures	$310,000		
Dams	$7,700,000		
Waterway Structures	$3,700,000		
		$12,000,000*	
Bumping Lake Dam Upstream Fish Passage Facility			
Structures and Improvements	$3,640,000		
Waterway Structures	$2,470,000		
Pumps and Prime Movers	$270,000		
Accessory Electrical Equipment	$280,000		
		$6,700,000*	
Total Field Costs			$19,000,000*
Noncontract Costs			
Data Collection and Final Design	$3,100,000		
Construction Engineering and Inspection	$4,000,000		
NEPA,ESA, Permits & Contract Administration	$370,000		
Total Noncontract Costs			$7,500,000*
TOTAL CONSTRUCTION COST			**$27,000,000***

January 2008 price levels
Indexes are from Reclamation, *Construction Cost Trends 1977 = 100*
* Totals rounded to the nearest $100,000 or $1 million using guidelines in Reclamation's *Cost Estimating Handbook* (March 1998).

Annual OMR&P Estimate

The total annual OMR&P costs for Bumping Lake Dam fish passage features are estimated to be about $150,000 per year. O&M staff account for about 84 percent of the total. Equipment, supplies, electrical power, and special maintenance items account for the other 16 percent. A breakdown of the OMR&P costs can be found in the *Designs & Estimates Appendix*.

5.3 Project Control Schedule

After completion of the Commissioner's Final Planning Report and National Environmental Policy Act (NEPA) compliance, Reclamation would collect design data and conduct advanced planning studies (including Value Engineering studies). This would be followed with preparation of final designs and specifications including Value Engineering studies.

Tables 5-3 and 5-4 provide the Project Control Schedules showing the anticipated implementation schedule and funds required by fiscal year for Cle Elum and Bumping Lake dams. Construction of all fish passage facilities at Cle Elum Dam would take three calendar years (over four fiscal years) to complete. Construction of all fish passage facilities at Bumping Lake Dam would take two calendar years (over three fiscal years).

Table 5-3. Cle Elum Dam Fish Passage Facilities - Project Control Schedule.

Cle Elum Dam - Fish Passage Facilities
Yakima Project, Washington
Project Control Schedule

Item	Jan. 2008 Cost	FY2009	FY 2010	FY 2011	FY 2012	FY 2013	Construction FY 2014	Construction FY 2015	Construction FY 2016	Construction FY 2017	Total
Liaison & Coordination	$260,000	$41,000	$43,000	$45,000	$47,000	$48,000	$21,000	$22,000	$23,000	$24,000	$314,000
Environmental Compliance & Permitting	$470,000	$200,000	$207,000	$36,000	$37,000	$39,000					$519,000
Realty Specialist	$26,000				$31,000						$31,000
Contract Administration - Pre Award	$60,000						$77,000				$77,000
Contract Administration - Post Award	$96,000						$31,000	$32,000	$34,000	$35,000	$132,000
Design Data Collection and Hydraulic Model Study	$2,000,000			$2,290,000							$2,290,000
Final Design	$5,800,000				$3,460,000	$3,600,000					$7,060,000
VE Studies	$100,000			$110,000							$110,000
Construction Management	$5,700,000						$1,840,000	$1,910,000	$1,990,000	$2,070,000	$7,810,000
Subtotal - Total Non Contract Costs (Rounded)	$15,000,000										
Construction (Field Cost)	$81,000,000						$5,500,000	$41,500,000	$35,400,000	$29,800,000	$112,200,000
Total Project Cost	**$96,000,000**										
Total Funding Needs by Fiscal Year		**$241,000**	**$250,000**	**$2,500,000**	**$3,600,000**	**$3,700,000**	**$7,500,000**	**$43,500,000**	**$37,400,000**	**$31,900,000**	**$130,500,000**

Assumptions:
1. One contract and specifications will be issued for the construction
2. Construction will span 3 calendar years (4 FY)
3. Design will occur over 2 FY
4. All costs are indexed to mid-point of FY assuming a 4% rate of inflation.
5. Costs for Liaison & Coordination activities are assumed to occur 75% during pre-construction and 25% during construction.

Table 5-4. Bumping Lake Dam Fish Passage Facilities - Project Control Schedule.

Bumping Lake Dam - Fish Passage Facilities
Yakima Project, Washington
Project Control Schedule

Item	Jan. 2008 Cost	FY2015	FY 2016	FY 2017	FY 2018	FY 2019	Construction FY 2020	Construction FY 2021	Construction FY 2022	Total
Liaison & Coordination	$158,000	$32,000	$33,000	$34,000	$36,000	$37,000	$22,000	$22,000	$23,000	$239,000
Environmental Compliance & Permitting	$106,000	$71,000	$74,000							$145,000
Realty Specialist	$13,000				$20,000					$20,000
Contract Administration - Pre Award	$34,000						$56,000			$56,000
Contract Administration - Post Award	$60,000						$33,000	$34,000	$35,000	$102,000
Design Data Collection	$810,000			$1,180,000						$1,180,000
Final Design	$2,200,000				$1,660,000	$1,730,000				$3,390,000
VE Studies	$100,000			$150,000						$150,000
Construction Management	$4,000,000						$2,180,000	$2,260,000	$2,360,000	$8,800,000
Subtotal - Total Non Contract Costs (Rounded)	$7,500,000									
Construction (Field Cost)	$19,000,000						$7,300,000	$15,300,000	$9,700,000	$32,300,000
Total Project Cost	**$27,000,000**									
Total Funding Needs by Fiscal Year		**$103,000**	**$107,000**	**$1,400,000**	**$1,700,000**	**$1,800,000**	**$9,600,000**	**$17,600,000**	**$12,100,000**	**$44,400,000**

Assumptions:
1. One contract and specifications will be issued for the construction
2. Construction will span 2 calendar years (3 FY)
3. Design will occur over 2 FY
4. All costs are indexed to mid-point of FY assuming a 4% rate of inflation.
5. Costs for Liaison & Coordination activities are assumed to occur 75% during pre-construction and 25% during construction.

Chapter 6 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment and evaluates the environmental consequences of construction and operation of the adult and juvenile fish passage facilities. The level and depth of the analysis corresponds to the context and intensity of the impacts anticipated for each environmental component. Environmental consequences, impacts, and effects are synonymous in this document.

The resource discussions are divided into two sections. The first section describes the affected environment and provides information about current resource conditions within that environment. The second section then presents the environmental consequences. The environmental impacts of each alternative are compared against the impacts that would occur under the No Action alternative. Some discussions are arranged by resource category or area, while others are arranged by activity or alternative.

The resources presented in this chapter are:

- Water Quality
- Fish
- Vegetation
- Wildlife
- Threatened and Endangered Species
- Visual Resources
- Climate/Air Quality
- Noise
- Recreation
- Land and Shoreline Use
- Utilities
- Transportation
- Environmental Justice
- Historic Resources
- Indian Sacred Sites
- Indian Trust Assets
- Socioeconomics

Only impacts associated with the construction of the fish passage facilities are described in this chapter. The impacts and benefits with an associated anadromous salmonid reintroduction plan were not considered in these analyses. Construction and operation of the fish passage facilities would be transparent to other project demands and would not impact existing water rights, water delivery contracts, or flood control operations. Therefore, this report does not include discussions on water rights, water resources, irrigation and agriculture, and hydropower resources. The impact analysis assesses construction impacts to the various resources assuming the current range of Project operations remain unchanged.

Construction activities would be confined to a relatively small area near the outlet of Cle Elum and Bumping Lake dams, and in the Cle Elum and Bumping rivers immediately downstream from the dams. The area of potential effect (APE) includes the lands adjacent to the dam and reservoir and roads used to access the facility as shown in Figure 6-1 for Cle Elum and Figure 6-2 for Bumping Lake.

Figure 6-1. Cle Elum Area of Potential Effect.

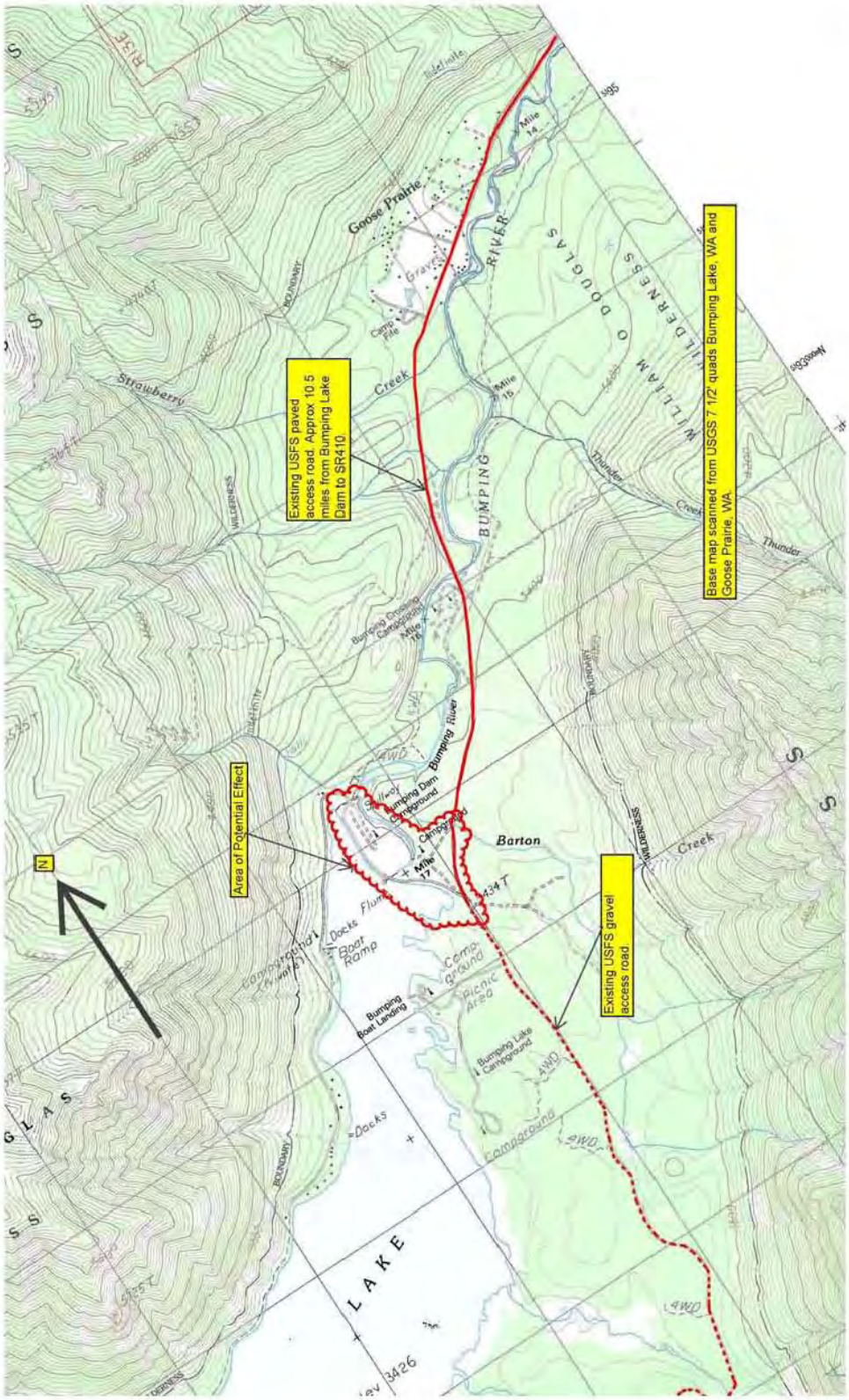

Figure 6-2. Bumping Lake Area of Potential Effect.

6.1 Water Quality

6.1.1 Affected Environment

Two segments of the Cle Elum River are on Washington State's 303(d) list of impaired waters for temperature: one section immediately upstream of Cle Elum Lake, and a section from the dam downstream (Ecology 2007). There is a small section of the Bumping River that appears on the State's 303(d) list of impaired waters for temperature. It extends from the confluence with the Naches River upstream approximately ¼-mile (Ecology 2007).

Bumping Lake is a relatively small irrigation storage reservoir. Annual water level fluctuation and the rapid flushing rate reduce primary and secondary production, resulting in an oligotrophic reservoir (Reclamation 2005 [Phase I]). The lake has low levels of dissolved constituents and algal nutrients. Dissolved oxygen concentration is high. Algal productivity is low, and the water is highly transparent with an average secchi depth of 8.9 m. (USFS 2007 [Wenatchee]; Reclamation 1994; Reclamation 2005 [Phase I]; Reclamation 2008 [Biology Appendix]).

Limnological studies were conducted on both Cle Elum and Bumping lakes to determine if the lakes are productive enough to support plankton necessary for rearing juvenile sockeye salmon (Reclamation 2007 [Limnology]; Mongillo and Faulconer 1982). While the lakes are considered to be oligotrophic, they support kokanee reproduction (landlocked form of sockeye salmon), and are considered to have adequate water quality to support reintroduction of sockeye salmon (Reclamation 2005 [Reintroduction]). Their major limiting factors are low nutrient levels, chlorophyll *a* concentrations, phytoplankton and zooplankton populations, and total organic carbon (TOC) concentrations. Nutrient enrichment of the lakes is considered a potential method to increase these parameters to support reintroduced populations of anadromous fish (Reclamation 2005 [Reintroduction]).

6.1.2 Environmental Consequences

All of the excavation for the juvenile passage intake structures for both Cle Elum and Bumping lakes is located in the drawdown zone of the reservoirs behind cofferdams. Excavation for the intake structure and placement of cofferdams would be done in the dry during normal reservoir drawdown effectively isolating the construction activities within the dewatered cofferdams. Very little sedimentation or turbidity would result as cofferdam removal would also occur in the dry during reservoir drawdown.

Construction of the adult fish barriers would be done in two phases for both Cle Elum and Bumping Lake by installing a cofferdam spanning one half the width of the river, completing construction of that portion of the barrier, removing the cofferdam, then repeating for the

remaining half of the river. The cofferdams would consist of large sandbags and gravel. The cofferdam itself is the primary mitigation measure ensuring that turbidity and sedimentation from construction activities do not adversely affect aquatic life. A relatively minor amount of sedimentation would occur during the installation of the cofferdam. Effects of the turbidity from placing the sandbags and gravel are not anticipated to extend more than 200 feet downstream of the site during the 5-day construction period. Some turbidity and sedimentation would also occur during the 5-day cofferdam removal period.

Temporary minor increases in turbidity and sedimentation would occur during construction of the adult upstream collection and transportation facilities. Some disturbance of the streambanks would occur as the fish ladder is constructed. Stockpile and staging areas would be isolated with a containment berm or physical structure to reduce erosion and sediment impacts to reservoir and river water quality. Access roads may increase some sediment input to the rivers during precipitation events.

No long-term changes would occur to the overall good water quality present in the Cle Elum Lake and Bumping Lake project areas. The sections of the Cle Elum River and the Bumping River that are on the 303(d) list of impaired waters would not be changed as a result of implementing the proposed actions.

Contracts for construction of the fish passage facilities would include standard language to protect water quality during construction. The contractor would be required to keep all heavy equipment clean and free of grease, hydraulic oil, and other contaminants. The contractor would also be required to prepare and implement a spill prevention, control, and containment plan and develop and implement a temporary erosion and sediment control plan. Appropriate measures for handling and storing construction materials, fuels, and solvents would also be implemented.

6.2 Fish

6.2.1 Affected Environment

Native resident (non anadromous) fish species present in Cle Elum and Bumping lakes include kokanee (*Oncorhynchus nerka*), mountain (*Prosopium williamsoni*) and pygmy whitefish (*Prosopium coulteri*); cutthroat (*Oncorhynchus clarki*) and rainbow trout (*Oncorhynchus mykiss*); longnose (*Rhinichthys cataractae*), leopard (*Rhinichthys falcatus*) and speckled dace (*Rhinichthys osculus*); chiselmouth (*Acrocheilus alutaceus*), redside shiner (*Richardsonius balteatus*), peamouth (*Mylocheilus caurinus*), northern pikeminnow (*Ptychocheilus oregonensis*); largescale (*Catostomus macrocheilus*), mountain (*Catostomus platyrhynchus*) and bridgelip suckers (*Catostomus columbianus*); burbot (*Lota lota*), three-spine stickleback (*Gasterostreus aculeatus*); as well as Paiute (*Cottus beldingi*), torrent (*Cottus rhotheus*) and mottled sculpins (*Cottus bairdi*). Introduced resident species include brown (*Salmo trutta*), brook (*Salvelinus fontinalis*), and lake trout (*Salvelinus namaycush*).

Cle Elum and Bumping Lake dams were constructed without fish passage facilities, resulting in the extirpation of four anadromous fish species - sockeye salmon (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*), spring Chinook salmon (*Oncorhynchus tshawytscha*), and steelhead (*Oncorhynchus mykiss*) above the passage barriers (Bryant and Parkhurst 1950; Davidson 1953; Fulton 1970; Mullan 1986). Pacific lamprey (*Lampretra tridentata*) and western brook lamprey (*Lampetra richardsoni*) were also eliminated above these dams. The lack of passage has also isolated local populations of bull trout, reducing or eliminating interconnectedness and the exchange of genetic material among populations, and preventing the recolonization of populations diminished by catastrophic natural events. There are no provisions at these storage dams for safe downstream passage of fish.

Cle Elum Lake Fish Operations

Refer to Section 4.1.3 for a summary of Cle Elum Dam operations.

Bumping Lake Fish Operations

Refer to Section 4.1.3 for a summary of Bumping Lake Dam operations.

6.2.2 Environmental Consequences

Construction activities would be confined to a relatively small area near the outlet of the Cle Elum and Bumping Lake dams, and in the Cle Elum and Bumping rivers immediately downstream from the dams. Heavy equipment use during construction creates the risk for accidental spills of fuel, lubricants, hydraulic fluid, and similar contaminants into the riparian zone or water resulting in death or injury of aquatic organisms. Discharge of construction water used for vehicle washing, concrete washout, pumping for work area isolation cofferdams, and other purposes can carry sediments and a variety of contaminants to the riparian area and stream. Similarly, use of treated wood in or over flowing water to build any type of structure at the construction site can introduce toxic compounds directly into the stream during cutting or abrasion, or by leaching. Concrete, concrete leachate, grout, and other uncured concrete substances are deleterious and highly toxic to fish and other aquatic organisms. Implementation of best management practices (BMPs) during construction would reduce potential impacts to the fish communities in the lakes and in the rivers. Cofferdams for the juvenile passage intake structure would be constructed in the dry during reservoir drawdown eliminating the potential for fish injury or mortality. Work activities would be isolated inside the cofferdams also eliminating the potential for injury or mortality of fish or other aquatic organisms.

The facilities would be constructed over a period of three years allowing flow releases for salmon spawning, incubation, and rearing to continue unchanged.

Permanent habitat impacts above the dams would include the replacement of lake bed habitat in the footprint of the juvenile passage intake structure. In the case of Cle Elum, this is approximately 17,500 square feet (175 feet x 100 feet), and for Bumping Lake, this is approximately 3,600 square feet (60 feet x 60 feet). This is marginal fish habitat as it lies in the drawdown zone of the reservoirs and is very small in relation to the overall size of the lakes.

A 300-foot angled adult fish barrier would be installed about 150 feet below the dentate of the stilling basin at Cle Elum. The barrier would be built in two stages; with one-half being constructed first followed by the second half. The proposed schedule for Cle Elum is to begin the right side cofferdam August 23 to 28th, complete construction of the barrier behind the dewatered cofferdam, then remove the cofferdam from April 24 to 29 the following spring. This proposed construction schedule falls partially within Washington's allowable in-water work period for the Cle Elum River (July 15 through August 31). Installation of the cofferdam for the second half of the adult barrier is proposed to begin April 30 through May 15, with removal proposed for September 14 through 18.

The barrier on the Bumping River would be 130 feet long and would also be constructed in two phases. Construction of the left side cofferdam is proposed for August 29 through September 3. It would be removed in mid November and construction for the right side cofferdam would begin May 1 of the next year. The cofferdam would be removed after construction of the barrier around June 12. Removal of the cofferdam as proposed is likely to be outside the in-work period for the Bumping River of July 15 through August 15.

Permits for work outside the state's in-water work periods would depend on review and approval by WDFW, USFWS, and NOAA Fisheries Service. Disturbances to the river outside of the recommended in-water work period generally is problematic as there may be steelhead redds present during the spring and early summer and spring Chinook redds during the fall extending into winter. However, the cofferdams are the primary mitigation measures employed for work that has to be done in the water – as well as allowing construction to proceed in the dry. Cofferdams eliminate the adverse impacts that could result from direct contact of the stream or lake with construction activities. The primary impact is the short term increase in sedimentation and turbidity as the channel is disturbed during placement and removal of the cofferdams as well as the permanent removal of streambed habitat in the footprint of the barrier itself. Additionally any short-term increases in turbidity and sedimentation effect is reduced because only one-half of the channel is being worked on at a given time, allowing the other half of the channel to remain relatively undisturbed.

There would be no change in operations at either Cle Elum or Bumping Lake as a result of construction, or of operations of the adult fish collection facility or the juvenile fish collection facilities.

Permanent loss of some habitat below the dams would result from installation of the adult fish barriers. For Cle Elum the footprint of the barrier covers about 13,200 square feet (300 feet x 44 feet.) and for Bumping Lake the footprint covers about 3,900 square feet (130 feet. x 30 feet).

Figure 6-3. Immediately downstream of Cle Elum Lake Dam - the vicinity where the barrier dam would be constructed.

Implementation of BMPs would reduce adverse impacts that may occur. To perform any concrete-related work, the contractor would be required to completely isolate all construction areas from water prior to the start of any work. In addition, the contractor would be required to take measures to prevent the incidence of concrete coming in contact with a stream or lake for a minimum of 24 hours after the work has been completed to ensure that the concrete has fully cured.

Contractors would be required to treat all construction discharge water (e.g., concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) as follows:

- Design, build, and maintain facilities to collect and treat all construction discharge water, including any contaminated water produced by drilling, using the best available technology applicable to site conditions.

- Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals, and other pollutants likely to be present.

- Prevent pollutants from contacting any wetland or the 2-year floodplain, including green concrete, contaminated water, silt, welding slag, sandblasting abrasive, or grout that has been cured less than 24 hours.

Figure 6-4. Pool immediately downstream of Bumping Lake Dam - the site of the adult collection facility and the barrier dam.

6.3 Vegetation

6.3.1 Affected Environment

Several plant communities occur in the Cle Elum and Bumping lakes project areas; however, mixed conifer stands are the most common in the vicinity of the proposed construction activities. On the east side of Cle Elum Dam in the vicinity of the proposed stockpile and staging areas, the habitat is characterized by young stands of ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) with an understory of bitterbrush (*Purshia tridentata*) and kinnikinnick (*Arctostaphylos uva-ursi*). The downstream area in the area of the proposed adult collection facility is characterized by mostly mid-aged Douglas fir with some ponderosa pine and lodgepole pine (*Pinus contorta*). There are some black cottonwoods on the shoreline of the river.

On the bench at the south end of the Bumping Lake Dam, the overstory consists predominantly of lodgepole pine with a relatively open understory of western hemlock (*Tsuga*

heterophylla), western larch (*Larix occidentalis*), western red cedar (*Thuja plicata*), and Engelmann spruce (*Picea engelmannii*). The shrub and herb layers include red alpine blueberry (*Vaccinium scoparium*), wild rose (*Rosa spp*), Oregon grape (*Mahonia nervosa*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), and pipsissewa (*Chimaphila maculata*). At the north end of the dam, the forest overstory includes Douglas fir, western larch, lodgepole pine, western white pine (*Pinus monticola*), and black cottonwood (*Populus trichocarpa*), with an understory of grand fir (*Abies grandis*), western redcedar, and Engelmann spruce. The shrub layer includes red-osier dogwood (*Comus stolonifera*), mountain alder (*Alnus viridis*), Douglas maple (*Acer Glabrum var douglasii*), kinnikinnick *(Arctostaphylos uva-ursi*), pachistima (*Pachistima mysinites*), and snowberry (*Symphoricarpos albus*). The herb layer includes species such as vanilla leaf (*Achlys triphyilla*), Oregon grape, twinflower, and strawberry (*Fragaria spp.*).

6.3.2 Environmental Consequences

Cle Elum Lake

Table 6-1 summarizes the habitat lost temporarily during construction and permanently. About 17,500 square feet of drawdown zone habitat (disturbed lakebed) would be permanently replaced by the juvenile passage intake structure. The fish passage conduit would initially disturb about 640,000 square feet of second growth forest adjacent to the spillway. The permanent footprint of the conduit would replace about 7,600 square feet of habitat.

There would be a temporary loss of vegetation of about 200,000 square feet in the staging and stockpile areas for both the juvenile passage intake facility on the lake shore (Figure 6-5) and the adult collection facility on the Cle Elum River downstream of the dam (Figure 6-6). Stockpiled material would be removed and the area revegetated when construction is completed.

The adult collection facility including the fish ladder, loading slab, building, fish lock and holding pool would permanently replace about 23,700 square feet of riparian and second growth Douglas fir, pine, and cottonwood habitat (Figure 6-7).

About 2,600 feet of existing access roads would be widened and drains added. This would mostly affect already disturbed areas adjacent to the roads. A new access road would be constructed adjacent to the right side of the adult fish barrier. This would pass through a heavily used camping-recreation area and would permanently disturb 550 linear feet.

Figure 6-5. Typical habitat of young Douglas fir, ponderosa pine, and bitterbrush in the vicinity of the proposed staging and stockpile area for the juvenile fish collection facility on the west side of the dam.

Figure 6-6. Habitat in the area proposed for the adult collection facility. Most of the facility is located in the natural opening, but some mature Douglas fir and ponderosa pine would likely be removed.

Figure 6-7. Some riparian vegetation would be removed for construction of the adult collection facility.

Table 6-1. Habitat losses associated with Cle Elum Lake construction of fish passage facilities.

Feature	Location	Amount (approx)	Type	Duration
Juvenile Passage Intake Structure	500 ft.upstream of existing outlet works gate house	17,500 sq.ft. (175 x 100 ft)	Drawdown zone	Permanent
Fish Passage Conduit (construction)	From upstream of intake structure to spillway stilling basin	640,000 sq.ft. (400 x 1600 ft)	Second growth forest – Douglas fir/pondarosa pine	Temporary
Fish Passage Conduit	" " "	7,600 sq.ft. (50 x 1520 ft)	" " "	Permanent
Adult Trap & Haul Facilities:				
- Adult Barrier with flip top cofferdam (construction)	Immediately downstream of stilling basin	106,400 sq.ft. (280 x 380 ft)	Riverine & Riparian	Temporary
-Adult Barrier Dam (final footprint)	" " "	13,000 sq.ft. (298 x 44 ft)	Riverine	Permanent

Feature	Location	Amount (approx)	Type	Duration
Adult Collection Facility (ladder, loading slab, bldg.fish lock, holding pool)	Downstream of dam adjacent to spillway	23,700 sq.ft. (210x110 + 10x60)	Riparian & second growth Douglas fir, pine & cottonwood	Permanent
Staging & stockpile areas	Near juvenile passage intake upstream of dam & near adult trap & haul facilities downstream of dam	200,000 sq.ft.	Second growth Douglas fir, pine & cottonwood forest	Temporary
Access Roads – existing (widening & grade improvement & culverts)	Throughout project (see figure 7-1)	2,600 ft. (linear)	Disturbed areas adjacent to existing roads	Permanent
Access roads - new	Access to right side of adult fish barrier	550 ft (linear)	Disturbed areas used for camping in Douglas fir & pine forest	Permanent

Bumping Lake

Temporary and permanent habitat losses in Bumping Lake and Bumping River are summarized in Table 6-2. Construction of the juvenile fish passage intake structure would result in the temporary disturbance of about 13,200 square feet of lakebed substrate in the drawdown zone. About 3,600 square feet of lakebed habitat would be permanently replaced by the facility.

The adult collection facility (Figure 6-7) including the fish ladder, loading slab, building, fish lock, and holding pool would permanently replace about 19,600 square feet of riparian and second growth Douglas fir habitat. An old growth stand of western redcedar is very close to the northeast side of the facility and would need to be protected from construction-related damage and losses as it is in critical spotted owl habitat. The fish passage conduit would be constructed in the dam embankment, across a disturbed area at the foot of the dam and into the river, resulting in the permanent loss of a small stand of trees and riparian vegetation (Figure 6-8 and Figure 6-9).

Staging and stockpile areas would temporarily disturb about 200,000 square feet in two areas - in an as yet unspecified area on the adjacent lakeshore in second growth Douglas fir habitat for the juvenile collection facility; and in the flat disturbed area at the foot of the dam for the

adult collection facility. The area at the foot of the dam is heavily disturbed with little vegetation (Figure 6-8); however, the stockpile area for the juvenile fish passage intake structure could remove second growth forest habitat depending on the exact location.

Existing roads would be used for project construction for the most part. Crossing the dam may require a temporary access road or cofferdam wide enough for local vehicles and O&M traffic during construction. Activities associated with the dam crossing are likely to be in already-disturbed areas with little existing vegetation.

Disturbance of riparian vegetation would be minimized during construction of the adult collection facilities and barrier dams. Riparian vegetation destroyed should be counted and recorded as to species composition. Riparian plantings at a ratio of 6:1 for each species lost should occur for all losses occurring downstream of the dams for the adult collection facilities. Native plant species appropriate for riparian areas should be used and should be planted by hand tools or non-invasive mechanical methods. Staging and stockpile areas located outside the riparian corridor should be revegetated using a hydro mulch or geotextile material with native grass and forb seeds. The old growth western redcedar stand located downstream of Bumping Lake Dam should be flagged by a qualified forester or biologist and protected from disturbance. Every effort should also be made to avoid destroying other mature conifers in the area, removing only the amount required to place the adult collection facility, access road, and appurtenant features.

Table 6-2. Habitat losses associated with Bumping Lake construction of fish passage facilities.

Feature	Location	Amount (approx)	Type	Duration
Juvenile passage intake structure (construction - cofferdam)	340 ft. south & east of existing outlet works	13,200 sq.ft. (240 x 55 ft)	Drawdown zone	Temporary
Juvenile passage intake structure	340 ft. south & east of existing outlet works	3600 sq.ft. (60 x 60 ft)	Drawdown zone	Permanent
Fish passage conduit	From upstream of intake structure to spillway stilling basin	3,450 sq.ft (230 x 15 ft)	- Dam embankment (little or no veg. or wildlife value) – 90% - Trees & shrubs adj to spillway pool removed – 10%	Permanent
Adult Trap & Haul Facilities:				

Feature	Location	Amount (approx)	Type	Duration
- Adult Barrier with flip top cofferdam (construction)	Immediately downstream of stilling basin	37,800 sq.ft. (210 x 180 ft) - area of river with cofferdams	Riverine & Riparian	Temporary
-Adult Barrier Dam (final footprint)	" " "	3,900 sq.ft. (130 x 30 ft)	Riverine	Permanent
Adult Collection Facility (ladder, loading slab, bldg.fish lock, holding pool)	Downstream of dam adjacent to spillway	19,600 sq.ft. (140x140)	Riparian – 90% Old growth western redcedar - 10%	Permanent
Staging & stockpile areas	At foot of dam	200,000 sq.ft.	Disturbed area – little vegetation present	Temporary
Access roads – a temporary access road or cofferdam wide enough for local vehicles & O&M traffic needed during construction.	Across dam	Not specified	Disturbed areas adjacent to existing roads	Temporary

Figure 6-8. The staging and stockpile area for the Bumping Lake adult collection facility is in an already disturbed area below the dam.

Figure 6-9. This small clump of trees would be removed during construction of the Bumping Lake juvenile transport pipe.

Figure 6-10. Small stand of old growth western redcedar that would need to be protected.

6.4 Wildlife

6.4.1 Affected Environment

The Cle Elum Lake and Bumping Lake areas support a variety of terrestrial mammals. The areas are used both summer and winter by elk and deer, though winter use is marginal due to snow depths. Mountain goats occur on American Ridge, adjacent to Bumping Lake, and on Nelson Ridge to the south. Other large mammals that may occur in the vicinity of Cle Elum Lake and Bumping Lake include elk (*Cervus Canadensis*), deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), coyote (*Canus latrans*), red fox (*Vulpes vulpes*), cougar (*Puma concolor*), bobcat (*Lynx rufus*), and marten (*Martes martes*). Aquatic mammals that may occur in the area include beaver (*Castor Canadensis*), river otter (*Lontra Canadensis*), muskrat (*Ondatra zibethicus*), and mink (*Neovison vison*). Small mammals in the project area likely include snowshoe hare (*Lepus americanus*), northern flying squirrel (*Glaucomys sabrinus*), golden-mantled ground squirrel (*Spermophilus lateralis*), Douglas squirrel (*Tamiasciurus douglasii*), yellow-bellied marmot (*Marmota flaviventris*), bushy-tailed woodrat (*Neotoma cinerea*), yellow pine chipmunk (*Tamias amoenus*), vagrant (*Sorex vagrens*) and water shrew (*Sorex alaskanus*), and deer mice (*Peromyscus maniculatus*).

Reptiles and amphibians likely occurring in the project vicinity include Cascades frog (*Rana cascadae*), Pacific tree frog (*Hyla regilla*), western toad (*Bufo boreas*), northern long-toed salamander (*Ambystoma macrodactylum*), western skink (*Eumeces skiltonianus*), northern alligator lizard (*Elgaria coerulea*), rubber boa (*Charina bottae*), and garter snake (*Thamnophis sirtalis*).

There is some waterfowl production associated with wetlands fringing both lakes, primarily mallard (*Anas platyrhynchos*) and green-wing teal (*Anas carolinensis*). Cavity-nesting ducks that may occur in the area include wood duck (*Aix sponsa*), Barrows goldeneye (*Bucephala islandica*), common (*Mergus merganser*) and hooded mergansers (*Lophodytes cucullatus*), and bufflehead (*Bucephala albeola*). A number of raptors may occur in the vicinity of the project.

The bald eagle, a former threatened species that was officially delisted by the USFWS in 2007 (72 FR 37346), winters in the Yakima River basin and may be found along the Cle Elum and Bumping rivers from about October 31 through March 31. Other raptors that may occur in the project vicinity include goshawk (*Accipiter gentilis*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), osprey (*Pandion haliaetus*), golden eagle (*Aquila chrysaetos*), pygmy owl (*Glaucidium passerinum*), saw whet owl (*Aegolius acadicus*), and northern spotted owl (also listed as threatened). Many other bird species have been observed in the vicinity of Cle Elum and Bumping lakes.

6.4.2 Environmental Consequences

Wildlife would temporarily be disturbed or displaced during construction activities for the three-year duration of the projects. Some losses to individuals may occur if there is not sufficient unoccupied habitat in the adjacent areas during construction. This is offset somewhat by the relatively small areas disturbed. All of the disturbed areas would be revegetated. Table 6-1 and Table 6-2 in the Vegetation section list the estimated amount and type of habitats lost temporarily and permanently for Cle Elum and Bumping lakes. Human activities associated with the operation of the juvenile passage intake structures, the adult collection facilities, as well as operation of the trap and haul trucks would increase in the project areas and may result in some long term disturbance to wildlife, as well as slight increase in mortality risks from vehicle collisions.

Cle Elum Lake

A minor amount of habitat consisting of young Douglas fir, ponderosa pine, and bitterbrush on the west side of Cle Elum Dam would be temporarily replaced by a stockpile and staging area (about 200,000 square feet - Table 6-1). The stockpiled material would be replaced in the excavation for the juvenile passage intake facility and the area reseeded. The juvenile passage intake structure would permanently replace about 17,500 square feet of drawdown zone lakebed habitat (Table 6-1). This would have little impact on wildlife. The fish passage conduit would temporarily disturb about 640,000 square feet of Douglas fir, black cottonwood, lodgepole pine, and chokecherry along with the dirt roadway adjacent to the existing spillway facilities. Most of this area would be revegetated, with about 7,600 square feet being permanently replaced by the conduit structure (Table 6-1). The adult collection facility downstream adjacent to the Cle Elum River would permanently eliminate about 23,700 square feet of riparian and second growth Douglas fir, black cottonwood, lodgepole pine, and chokecherry (Table 6-1). About 2,600 feet of existing access roads would be upgraded and 550 feet of new road would be constructed, resulting in some habitat losses.

Bumping Lake

Staging and stockpile areas would temporarily disturb about 200,000 square feet in two areas - in an as yet unspecified area on the adjacent lakeshore in second growth Douglas fir habitat for the juvenile passage intake facility; and in the flat disturbed area at the foot of the dam for the adult collection facility. The area at the foot of the dam is heavily disturbed with little vegetation and is of minimal value for wildlife; however, the stockpile area for the juvenile fish passage intake structure could remove second growth forest habitat depending on the exact location, temporarily adversely affecting species such as deer and elk. This area would be revegetated after construction of the project is completed. The juvenile passage intake structure would permanently replace about 3,600 square feet of drawdown zone habitat, but

this is of little value to wildlife. The adult collection facility would permanently replace about 19,600 square feet of riparian habitat. The facility footprint is adjacent to a stand of old growth western redcedar. Construction activities may adversely impact this stand and the species dependent on old growth unless specific protection measures are implemented.

Existing roads would be used for project construction for the most part. Crossing the dam may require a temporary access road or cofferdam wide enough for local vehicles and O&M traffic during construction. Activities associated with the dam crossing are likely to be in already-disturbed areas with little existing vegetation. Little impact would occur to wildlife.

6.5 Threatened and Endangered Species

6.5.1 Affected Environment

A list of endangered and threatened species listed under the ESA and candidate species was obtained from the USFWS for Kittitas County (Cle Elum Lake vicinity) and Yakima County (Bumping Lake vicinity) (USFWS 2007 [Website]). The listed species are the same for both proposed project areas. A list of anadromous fish species listed under the ESA was obtained from NOAA Fisheries Service (NOAA Fisheries 2007). Table 6-3 lists these species.

Table 6-3. Federally Listed Endangered, Threatened, and Candidate Species that may Occur in Kittitas County and Yakima County.

Species	Scientific name	Federal Status*
Bull trout	*Salvelinus confluentus* – Columbia River distinct population segment	T, CH
Steelhead	*Oncorhyncus mykiss* Middle Columbia River distinct population segment	T, CH
Gray wolf	*Canus lupus*	E
Grizzly bear	*Ursus arctos horribilis*	T
Marbled murrelet	*Brachyramphus marmoratus*	T
Northern spotted owl	*Strix occidentalis caurina*	T, CH
Ute ladies'-tresses	*Spiranthes diluvialis*	T
Fisher	*Martes pennati* West Coast distinct population segment	C
Greater sage grouse	*Centrocercus urophasianus* Columbia Basin distinct population segment	C
Yellow-billed cuckoo	*Coccyzus americanus*	C
Basalt daisy	*Erigeron basalticus*	C

*E = Endangered; T = Threatened; C = Candidate; CH = Critical habitat has been designated for this species

Bull trout

In June 1998, the USFWS listed the Columbia River basin "distinct population segment" of bull trout as threatened under the ESA (63 FR 31647). USFWS identified eight subpopulations in the Yakima River basin, which include isolated populations in Cle Elum Lake and Bumping Lake. The Cle Elum population appears to be very low while redd counts indicate the Bumping Lake population is relatively stable. Bull trout require cold, clear water with stable channels and adequate cover (Thurow 1987, Ziller 1992). Critical habitat for the bull trout was designated in 2005 and includes the Cle Elum and Bumping rivers (70 FR 56212).

Steelhead

The steelhead population in the Yakima River basin is a component of the Middle Columbia River steelhead distinct population segment that was listed as threatened in 1999 (64 FR 14517). Four genetically distinct spawning populations of wild steelhead have been identified in the Yakima River basin, one of which spawns in the upper Yakima River and its tributaries (Phelps et al. 2000). Critical habitat was designated for the Middle Columbia River steelhead including the Cle Elum River downstream of Cle Elum Lake and the Bumping River downstream of Bumping Lake (70 FR 52630).

Gray wolf

The gray wolf is a wide-ranging carnivore, using a variety of habitats. Their primary prey are deer and elk. Historic habitat for this species occurs in the proposed project areas; however, there have been no confirmed recent sightings in the Cle Elum Lake area or the Bumping Lake area. Wolves tend to move away from areas where road densities exceed 1.0 mile per square miles (Mech et al. 1988, Mech and Boitani, 2003). The project areas both have fairly high road densities which reduce the likelihood of these species occurring on a regular basis.

Grizzly bear

Grizzly bears are wide-ranging and feed on roots, berries, ants, grubs, carrion, small mammals, and ungulates. Suitable habitat existed in the Cle Elum Lake and Bumping Lake areas historically, but fairly high road densities, development, and increased human use have decreased the quality of the habitat in these areas. This species is an unlikely, but possible visitor to or inhabitant of the area.

Marbled murrelet

The marbled murrelet is a small seabird that forages in marine environments and nests in older forests within 55 miles of marine environments. Marbled murrelet nesting begins in mid-late March and extends until the end of August (Hamer 1995). Nesting habitat is in old-

growth and mature coniferous forests, with multi-layered canopies, a high composition of low elevation conifer trees, on the lower two-thirds of forested slopes, with moderate gradients. Tree species where nests were located included mountain and western hemlock, Douglas-fir, Sitka spruce, western redcedar, and Pacific silver fir. Loss of nesting habitat and poor reproductive success in the habitat that remains are major factors in the decline of marbled murrelet populations (USFWS 1997). Loss of nesting habitat is largely attributed to commercial timber harvest and forest management practices. A portion of the Wenatchee National Forest is located within daily flying distance (55 miles) of marine environments in the Puget Sound (USFS 1997). However there are no confirmed nesting sites in the Wenatchee Forest (USFS 2006). It is unlikely that this species nests near Cle Elum or Bumping Lake dams.

Northern spotted owl

The northern spotted owl was listed as a threatened species by the USFWS in 1990, primarily due to widespread habitat loss and inadequate protective mechanisms. Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001) and protection from predators.

The northern half of Cle Elum Lake lies within a proposed Managed Owl Conservation Area (MOCA) and the southern half lies within a proposed Conservation Support Area (CSA) as discussed in the 2007 Draft Recovery Plan. Bumping Lake lies entirely within a proposed MOCA (USFWS 2007 [Recovery Plan]). MOCA represent areas that contain or would develop habitat considered essential for spotted owl recovery. Management of these key areas to support stable or increasing spotted owl populations is the heart of the recovery strategy. CSAs are existing land-use allocations that benefit spotted owls and are intended to support the MOCAs.

Ute ladies'-tresses

Ute ladies'-tresses was listed as a threatened species by the USFWS in 1992 due to habitat loss or modification, small population size, and low reproductive rate (USFWS 1992). This species is found on alluvial banks, point bars, floodplains, or oxbows associated with perennial streams. They are also found in seasonally flooded river terraces, subirrigated or spring-fed abandoned stream channels and valleys, and lakeshores. It has also been found

along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside barrow pits, reservoirs, and other human-modified wetlands. This species occurs from 720 to 1,830 feet in elevation in Washington State (Fertig et al. 2005).

Ute ladies'-tresses was first discovered in Washington Lake in Okanogan County in 1997. It was also found near the Chief Joseph Dam in Chelan County (USFWS 2007 [Coordination Act Report]). Currently, no other populations of this species are known in Washington. At present, there are no known populations of Ute ladies'-tresses within the project areas at Cle Elum Lake or Bumping Lake (Washington Natural Heritage Program 2008).

Fisher

The fisher is a medium-size mammalian carnivore that feeds on a variety of small to medium sized mammals and birds and carrion. It inhabits dense coniferous forest with extensive and continuous canopy. It uses riparian areas and ridgelines as movement corridors. Fisher populations have declined because of over-trapping, predator control, and habitat alteration. The presence of this species in the proposed project areas at Cle Elum and Bumping lakes have not been confirmed, though there are several sightings on record in the Naches District (USFS 2006).

Greater sage grouse

While sagebrush habitats required for this species exist in the lower elevations of Yakima and Kittitas counties, this very specific habitat type does not exist in the project areas. Therefore, this species is not likely to occur in the project areas nor would it be affected by any of the proposed actions (Connelly et al. 2004).

Yellow-billed cuckoo

WDFW (2004) does not list this species for Kittitas and Yakima counties as a priority for conservation and management as the habitat in this area is generally unsuitable for Yellow-billed cuckoo.

Basalt daisy

This species grows in basalt cliffs on canyon walls along the Yakima River Canyon and Selah Creek, a tributary of the Yakima River, at elevations of 1,250 to 1,500 feet. It is not likely this species would occur in the Cle Elum Lake or Bumping Lake project areas.

6.5.2 Environmental Consequences

Bull Trout

Construction of the cofferdams for the adult fish barrier has the highest potential to increase sedimentation and turbidity that may potentially adversely impact bull trout. The duration of

this potential impact would extend for approximately 20 days (5 days for installation of each half of the barriers and 5 days for removal of each barrier). This initial planning anticipates installation and subsequent removal of the cofferdams for Cle Elum Lake to occur during late August, late April-early May, and mid-September; and for Bumping Lake to occur during late August-early September, mid-November, early May, and mid-June. Constructing the fish barriers in two stages would help offset any temporary increases in sedimentation and turbidity by leaving half the channel undisturbed, allowing fish to escape to the undisturbed portion of the channel. It is not anticipated that the increases in sedimentation and turbidity would extend more than 200 ft downstream.

Timing of the in-water work would extend outside Washington State's designated in-water work period of July 15 through August 31 for the Cle Elum River and July 15 through August 15 for the Bumping River; and can overlap critical life stages of the bull trout. Specific use of the habitat immediately below Cle Elum and Bumping Lake dams by bull trout is not known at this time. Surveys should be completed to determine if bull trout are spawning or rearing in these areas.

Implementation of construction best management practices, along with working closely with WDFW and USFWS to develop construction schedules that minimize adverse impacts to bull trout and allow construction to proceed efficiently, would minimize temporary construction impacts on bull trout. In the long term, these temporary impacts would be offset by the creation of passage that would allow access to upstream habitat areas. It would also be important to ensure that adult collection facilities are designed to accommodate adult bull trout.

Middle Columbia River Steelhead

As with bull trout discussed above, installation and removal of the cofferdams for the adult fish barriers have the highest potential to increase sedimentation and turbidity that may potentially adversely impact steelhead. The duration of this potential impact would extend for approximately 20 days (5 days for installation of each half of the barriers and 5 days for removal of the barriers). This initial planning anticipates installation and subsequent removal of the cofferdams for Cle Elum Lake to occur during late August, late April-early May, and mid-September; and for Bumping Lake to occur during late August-early September, mid-November, early May, and mid-June. Constructing the fish barriers in two stages would help offset any temporary increases in sedimentation and turbidity by leaving half the channel undisturbed, allowing fish to escape to the undisturbed portion of the channel. It is not anticipated that the increases in sedimentation and turbidity would extend more than 200 ft downstream.

Timing of the in-water work would extend outside Washington State's designated in-water work period of July 15 through August 31 for the Cle Elum River and July 15 through August

15 for the Bumping River; and can overlap critical life stages of steelhead. Steelhead are likely to spawn in suitable habitat potentially affected by construction activities. Surveys should be completed to determine if steelhead are spawning or rearing in the areas that could potentially be affected by cofferdam installation and removal.

Implementation of construction best management practices, along with working closely with WDFS, USFWS, and NOAA Fisheries Service to develop construction schedules that minimize adverse impacts to steelhead and allow construction to proceed efficiently, would minimize temporary construction impacts. In the long term, these temporary impacts would be offset by the creation of passage that would allow access to upstream habitat areas.

Gray Wolf

This species is not likely to be present in the construction area. Habitat for this species would not be adversely impacted.

Grizzly Bear

This species is not likely to be present in the construction area. Habitat for this species would not be adversely impacted.

Marbled Murrelet

This species is not likely to be present in the construction area and would not be impacted.

Northern Spotted Owl

The construction area in the Cle Elum Dam vicinity lies within the CSA for northern spotted owl. The construction area in the Bumping Dam vicinity lies entirely with the MOCA. Minor effects to the habitat could occur through the removal of a few mature Douglas fir or other conifers for construction of the adult collection facilities and access roads. There is a stand of old growth western redcedar adjacent to or overlapping with the footprint of the adult collection facility on the Bumping River. The footprint of the facility has been adjusted to minimize this overlap since the initial planning efforts, but potential for adversely impacting a small portion of this habitat remains.

Ute Ladies'-tresses

This species is not likely to be present in the construction areas and would not be impacted.

Greater sage grouse

Habitat for this species is not present in the construction areas and no impacts would occur.

Yellow-billed cuckoo

This species is not likely to be present in the construction areas and would not be impacted.

Basalt daisy

This species is not present in the construction areas and would not be impacted.

6.6 Visual Resources

6.6.1 Affected Environment

Both Cle Elum Lake and Bumping Lake provide visitors a place to enjoy the beauty of nature. However many activities that take place at these locations, such as recreation, timber harvesting, residential development, or road construction, have the potential to disturb the surface of the landscape and impact scenic values. Visual Resource Management (VRM) is a system for minimizing the visual impacts of surface-disturbing activities and maintaining scenic values for both present and future generations.

Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape.

The lands around Cle Elum and Bumping Lake dams and reservoirs are within the Wenatchee National Forest and are managed by the Forest Service according to its *1990 Land and Resource Management Plan* (Forest Plan) (USFS 1990). The management direction for the scenic resource of viewsheds containing Cle Elum and Bumping Lake dams and reservoirs are described in terms of Visual Quality Objective (VQO), Variety Class, Sensitivity Level, and Distance Zone. These terms are from the *Visual Management System* (USFS 1974) and the National Forest Landscape Management handbooks. The visual quality objectives for Cle Elum Lake and Bumping Lake are shown in Table 6-4. (Jackson 2008)

Table 6-4. Forest Plan Visual Quality Objectives by Management Area.

Viewshed	Wenatchee National Forest Land Allocation, VQO
Cle Elum Lake	Scenic Travel 1 (ST-1)- Retention VQO
Bumping lake	Scenic Travel 1 (ST-1) - Retention VQO

In 1995, the Forest Service adopted a new method of scenery management, called Landscape Aesthetics. The method is described in detail in *Landscape Aesthetics, A Handbook for Scenery Management* (USFS1995). This method includes new terminology for scenery management, but corresponds to, and incorporates the terms and direction found in the Forest

Plan. In Landscape Aesthetics, Scenic Integrity corresponds to VQOs. Scenic Integrity is a measure of the degree to which a landscape is visually perceived to be "complete." The following paragraphs explain the integration of the two terms (Jackson 2008).

Scenic integrity is the amount of human caused deviation in form, line, color, and texture of a landscape. Scenic integrity serves as a frame of reference for measuring scenic integrity levels based on the valued attributes of the existing landscape character being viewed. The degrees of integrity vary from very high to very low. The following table displays the five scenic integrity levels and conditions associated with each level (Jackson 2008).

Table 6-5. Scenic Integrity Levels and Conditions.

Scenic Integrity Level	Condition
Very High (Preservation VQO)	Unaltered
High (Retention VQO)	Appears Unaltered
Moderate (Partial Retention VQO)	Slightly Altered
Low (Modification VQO)	Moderately Altered
Very Low (Maximum Modification)	Heavily Altered

In areas designated Retention VQO, all foreground landscapes shall have the visitor perception of natural appearing and will have high scenic integrity. High scenic integrity refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident (USFS 1995). This classification applies to the lands around Cle Elum and Bumping Lake dams and reservoirs (Jackson 2008).

6.6.2 Environmental Consequences

The landscape type where the proposed actions occur typically is one of the more difficult to blend or design compatible facilities due to the resulting low visual absorption capability (VAC) (BCMoF 1994). VAC is an estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality. The capacity to absorb development is primarily dependent on vegetation cover, landform, and existing structures.

Lake and reservoir shorelines generally have a low visual absorption capacity due to the availability of uninterrupted views across water. However, a major factor influencing visual absorption capacity is the level of visual contrast between the proposed new development and the existing elements in that landscape. If, for example, a visually prominent industrial development already exists, then the capacity of that section of landscape to visually absorb an additional section of industrial development is higher than a similar section of landscape

that has a natural undeveloped visual character. Therefore, the existence of Cle Elum and Bumping Lake dams and their related structures will increase the capacity of the landscape to visually absorb new visual intrusions related to implementing fish passage. Distance is also a strong influence on potential visual impact as the proportion of the total view from a particular location that is taken up by an implemented project decreases with distance.

The visibility assessment involved determining situations from which the project alternatives could potentially be visible and a field inspection to determine the extent of potential visibility. Summaries of the visibility of the construction and implementation of fish passage at Cle Elum and Bumping Lake are presented in the following tables:

Table 6-6. Summary of Visibility during Construction - Cle Elum Lake.

Time period, location	Visible Items	Viewpoint	Likely Period of View
Above dam, on or adjacent to reservoir	Construction activities, heavy equipment, cofferdam, etc.	Highway 903, east of the dam and north, through trees, generally half a mile or greater	A minutes or less depending on speed of travel and distance from dam
		Reservoir, shoreline, campgrounds, generally unobstructed, a thousand feet or more	Several minutes or more depending on level of interest in construction activities and distance from the dam
		Residences, east of the dam and north, adjacent to or overlooking the reservoir, portions through trees, portions unobstructed, generally a half mile or greater	Variable depending on level of interest in construction activities and distance from the dam
Below dam	Construction activities, heavy equipment, excavation, cofferdam, etc.	Highway 903, east of the dam and south, through trees, generally a half mile or greater, generally not visible	Potentially a few seconds, if visible
		New County Road, south of the dam, through trees, not visible	None
		Riverbank, south of the dam, through trees, from areas publicly accessible during construction, generally two thousand feet or more, generally not visible	Variable depending on level of interest in construction activities and distance from the dam, if visible

Table 6-7. Summary of Visibility after Construction - Cle Elum Lake.

Location	Newly constructed items	Viewpoint	Items Viewed
Above dam, on or adjacent to reservoir	Additional intake structure and access bridge for downstream fish passage	Highway 903, east of the dam and north, through trees, generally half a mile or greater	The intake structure and access bridge will blend with the existing dam features and be indistinguishable from them
		Reservoir, shoreline, campgrounds, generally unobstructed, a thousand feet or more	
		Residences, east of the dam and north, adjacent to or overlooking the reservoir, portions through trees, portions unobstructed, generally a half mile or greater	
Below dam	Additional outlet for downstream fish passage; barrier, power lines on wooden poles, fish ladder, and fish handling facility (building, parking lot) for upstream fish passage	Highway 903, east of the dam and south, through trees, generally a half mile or greater, generally not visible	None
		New County Road, south of the dam, through trees, not visible	None
		Riverbank, south of the dam, through trees, from areas publicly accessible, generally several hundred feet or more, limited visibility	Barrier potentially visible from portions of the riverbank accessible to the public

Table 6-8. Summary of Visibility during Construction - Bumping Lake Dam.

Location	Visible Items	Viewpoint	Likely Period of View
Above dam, on or adjacent to reservoir	Construction activities, heavy equipment, cofferdam, etc.	Bumping Lake Road (Forest Road 1800) • east of the dam and south, through trees, generally five hundred feet or more	• A few minutes or less depending on speed of travel and distance from dam
		• across the dam, unobstructed view	• Several minutes or less depending on speed of travel
		• west of the dam and south, through trees, generally two thousand feet or more	• A few minutes or less depending on speed of travel and distance from dam
		Reservoir, shoreline, marina, boat launch, campgrounds, south of the dam, generally a thousand feet or more	Several minutes or more depending on level of interest in construction activities and distance from the dam
		Residences adjacent to or overlooking the reservoir, west side of the dam and south, generally two thousand feet or more	Variable depending on level of interest in construction activities and distance from the dam
Below dam	Construction activities, heavy equipment, excavation, cofferdam, etc.	Bumping Lake Road (Forest Road 1800) • east of the dam, through trees, a few hundred feet or more	• a few minutes or less depending on speed of travel and distance from dam
		• across the dam, unobstructed view	• several minutes or less depending on speed of travel
		Riverbank, north of the dam, through trees, from areas publicly accessible during construction, generally several hundred feet or more, generally not visible	Variable depending on level of interest in construction activities and distance from the dam
		Recreation areas, residences, north of the dam, through trees, generally a thousand feet or more, limited visibility	Variable depending on level of interest in construction activities and distance from the dam

Table 6-9. Summary of Visibility after Construction - Bumping Lake Dam.

Location	Newly constructed items	Viewpoint	Items Viewed
Above dam, on or adjacent to reservoir	Additional intake structure and access bridge for downstream fish passage	Bumping Lake Road (Forest Road 1800) • east of the dam and south, through trees, generally five hundred feet or more • across the dam, unobstructed view • west of the dam and south, through trees, generally two thousand feet or more	Newly constructed items will blend with the existing dam features and be indistinguishable from them
		Reservoir, shoreline, marina, boat launch, campgrounds, south of the dam, generally a thousand feet or more	
		Residences adjacent to or overlooking the reservoir, west side of the dam and south, generally two thousand feet or more	
Below dam	Additional outlet for downstream fish passage; barrier, fish ladder, and fish handling facility (building, parking lot) for upstream fish passage	Bumping Lake Road (Forest Road 1800) • east of the dam, through trees, a few hundred feet or more • across the dam, unobstructed view	The top of the fish handling facility building may be visible
		Riverbank, north of the dam, through trees, from areas publicly accessible, generally several hundred feet or more, generally not visible	None
		Recreation areas, residences, north of the dam, through trees, generally a thousand feet or more, limited visibility	None

Potential adverse visual impacts associated with construction of fish passage facilities at Cle Elum and Bumping Lake dams will be short-term, minor, localized, and temporary.

Disturbed areas below both dams will be contoured to blend with adjacent areas to the extent practicable and revegetated with appropriate native plant species as described in other sections of this document. The old growth western redcedar stand and mature conifers in the area located downstream of Bumping Lake Dam will be protected from disturbance to the extent possible. The visual impact of the fish handling facility buildings will be reduced by using the appropriate paint color to blend with the natural landscape character. Consultation with the landscape architect for the Okanogan-Wenatchee National Forest in advance of preparing final designs will assure the fish passage facilities and the restoration of the lands disturbed for their construction will meet the High Scenic Integrity Level (Retention VQO) to the extent practicable in concert with engineering specifications.

6.7 Climate/Air Quality

Existing Federal and State air quality regulations were reviewed for the preparation of this section. Air quality is generally assessed in terms of whether or not concentrations of air pollutants are higher or lower than National Ambient Air Quality Standards (NAAQS) established to protect human health and welfare. Agencies with jurisdiction over ambient air quality in Washington include the U.S. Environmental Protection Agency (EPA), Ecology, and local clean air authorities. These agencies establish regulations governing the concentrations of pollutants in the ambient air, visible emissions, and contaminant emissions from air pollution sources. Unless the State or local jurisdiction has adopted more stringent standards, the EPA standards apply. Based on monitoring information collected over a period of years, Ecology and EPA agencies designate regions as “attainment” or “non-attainment” areas for particular air pollutants called “criteria” pollutants. Attainment status is therefore a measure of whether or not air quality in an area complies with the relevant NAAQS for six criteria air pollutants: carbon monoxide, sulfur dioxide, particulate matter, ground level ozone, lead, and nitrogen dioxide. Under Federal and State clean air rules, there are special requirements in non-attainment and maintenance areas to ensure that proposed projects do not cause or contribute to existing air quality problems. These “conformity rules” require analysis to demonstrate compliance with existing air quality control plans and programs.

The two most common permits associated with industrial activity emitting regulated air pollutants are Notice of Construction (NOC) approvals and Prevention of Significant Deterioration (PSD) permits. The proposed project would not be required to go through this type of permitting process because the fish passage structures have no regulated air emissions during operation.

Mobile air emission sources (such as construction equipment and maintenance pickups) are regulated separately under the Federal Clean Air Act, including vehicle inspection and

maintenance programs, and are not included when determining if a source must go through permitting. According to WAC 173-400-300, fugitive air emissions are emissions that "do not and which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening." These emissions include fugitive dust from unpaved roads, construction sites, and tilled land. Fugitive emissions are considered in determining the level of air permitting required only for a certain subset of sources, not including this type of proposed project. However, pursuant to WAC 173-400-040(8)(a) "The owner or operator of a source of fugitive dust shall take reasonable precautions to prevent fugitive dust from becoming airborne and shall maintain and operate the source to minimize emissions." Projects that require earthwork or otherwise have the potential to create fugitive dust are required to utilize BMPs to control dust at the project site.

6.7.1 Affected Environment

Cle Elum Lake and Dam

Existing land uses in the project area consist primarily of timberlands and low-density residential development. Therefore, sources of existing air pollutants in the project area are limited to vehicle emissions. This means that ambient air quality in the study area meets the National and Washington Ambient Air Quality Standards (NAAQS/WAAQS). Ecology has established air pollution monitoring stations throughout the state; however, no operating air quality monitoring stations for carbon monoxide or ozone are located in Kittitas County. PM_{10}[1] is monitored in Ellensburg, the largest urban area in Kittitas County, which is approximately 30 miles southeast of the project site. PM_{10} levels monitored in Ellensburg in 2002 reached a maximum concentration of 77 micrograms per cubic meter ($\mu g/m^3$) on January 23, 2002, below the NAAQS/WAAQS for PM10 of 150 $\mu g/m^3$.

Bumping Lake

Bumping Lake is located within Yakima County about 60 miles from Yakima. The Yakima Regional Clean Air Authority has primary air quality jurisdiction within Yakima County and ensures that NAAQS set by EPA and State standards set by Ecology are attained and maintained within the county. Few sources of pollutants exist within the area and any existing sources are minor.

6.7.2 Environmental Consequences

Air quality impacts associated with constructing the proposed facilities would be minimal. The primary type of air pollution during construction would be combustible pollutants from equipment exhaust and fugitive dust particles from disturbed soils becoming airborne. Any

[1] PM – particulate matter, 10 – particles of 10 micrometers or less

adverse impacts from combustible pollutants and fugitive dust (PM_{10}) would be temporary in nature and minor. Such short-term emissions from construction sites are exempt from air quality permitting requirements. Construction emissions would vary from day to day and activity to activity depending on the timing and intensity of construction with each activity having its own potential to release emissions. Construction activities that can produce dust (PM10) emissions include excavation, earthwork, trenching, vehicle and truck travel over unpaved roads, blowing wind over disturbed areas, and tail-pipe exhaust being emitted from vehicles and equipment. Compliance with all applicable emission standards and BMPs would reduce potential impacts to less than significant levels. No adverse air quality impacts are anticipated with the operation of the fish passage facilities.

6.8 Noise

Noise can be defined as unwanted sound. However, sound is measurable, whereas noise is subjective. The relationship between measurable sound and human irritation is the key to evaluating noise impact. There are several ways to measure noise, depending on the source of the noise, the receiver, and the reason for the noise measurement.

The challenge to evaluating noise impact lies in determining what amount and what kind of sound constitutes noise. The vast majority of people exposed to noise are not in danger of direct physical harm. However, research on the effects of noise has led to several generally accepted conclusions (CWEC 2003):

- The effects of sound are cumulative. Therefore, the duration of exposure must be included in any evaluation of noise.
- Noise can interfere with outdoor activities and other communication.
- Noise can disturb sleep, TV/radio listening, and relaxation.
- When community noise levels have reached sufficient intensity, community wide objection to the noise will likely occur.

Research has also found that individual responses to noise are difficult to predict. Some people are annoyed by perceptible noise events, while others show little concern over the most disruptive events. However, it is possible to predict the responses of large groups of people – i.e. communities. Consequently, community response, not individual response, has emerged as the prime index of noise measurement (CWEC 2003).

A decibel (dB) is the unit used to describe the amplitude of sound. Noise levels are stated in terms of decibels on the A-weighted scale (dBA). This scale reflects the response of the human ear by filtering out some of the noise in the low- and high-frequency ranges that the ear does not detect well. The A-weighted scale is used in most noise ordinances and standards.

The dBA scale is logarithmic. Therefore, individual dBA ratings for different sources cannot be added directly to calculate the sound level for combined sources. For example, two sources, each producing 50 dBA will, when added logarithmically, produce a combined noise level of 53 dBA.

6.8.1 Affected Environment

Noise Standards and Regulations

State, county, and local noise regulations specify standards that restrict both the level and duration of noise measured at any given point. The maximum permissible environmental noise levels depend on the land use of the property that contains the noise source (i.e., industrial, commercial, or residential) and the land use of the property receiving the noise.

Cle Elum Lake and Dam lies within Kittitas County and Bumping Lake lies within Yakima County. Only Yakima County has noise regulations; however, the proposed activities associated with the fish passage structure at Bumping Lake would not be regulated by Yakima County Ordinances. This is because sounds originating from construction or refuse remove equipment and sounds from any forest harvesting activities (land clearing) are exempt. Therefore, for both Cle Elum Lake and Bumping Lake, the Washington State regulations would apply to the project. The Washington Administrative Code (WAC) 173-60 establishes limits on the levels and duration of noise crossing property boundaries (WAC 2008). Allowable maximum sound levels depend on the zoning of the noise source and the zoning of the receiving property. WAC 173-60-040 establishes maximum permissible environmental noise levels. These levels are based on the Environmental Designation for Noise Abatement (EDNA), which is defined as an area or zone (environment) within which maximum permissible noise levels are established. There are three EDNA designations (WAC 173-60-030), which generally correspond to residential, commercial/recreational, and industrial/agricultural uses:

• Class A: Lands where people reside and sleep (such as residential);

• Class B: Lands requiring protection against noise interference with speech (such as commercial/recreational);

• Class C: Lands where economic activities are of such a nature that higher noise levels are anticipated (such as industrial/agricultural).

For the purpose of this analysis, noise-sensitive areas in the project vicinity include Class A and Class C EDNA.

Table 6-10 summarizes the maximum permissible levels applicable to noise received at noise-sensitive areas (Class A EDNA) and at industrial/agricultural areas (Class C EDNA) from an industrial facility (Class C EDNA).

Table 6-10. Maximum Allowable Noise Levels.

	Environmental Designation of Noise Abatement of Receiving Property		
Environmental Designation for Noise Abatement of Noise Source	**Class A (dBA)**	**Class B (dBA)**	**Class C (dBA)**
Class A (residential/recreational)	55	57	60
Class B (commercial)	57	60	65
Class C (industrial)	60	65	70

Source: WAC 173-60-040

WAC 173-60-050 identifies noise sources or activities that are exempt from the noise limits described in the above table:

- Sounds created by traffic on public roads;
- Sounds created by warning devices (i.e. back-up alarms); and
- Sounds from blasting and from construction equipment are exempt from the standards during the day (7:00 a.m. to 10:00 pm weekdays and from 9:00 a.m. to 10:00 pm on weekends) in rural and residential districts.

Although not regulated, construction noise can be significant. Most construction noise comes from equipment. Noise levels of typical construction equipment at 50 feet from the source of the noise are shown in Table 6-11.

Table 6-11. Construction Equipment Noise Ranges.

Equipment	Examples	Noise Level (dBA) at 50 ft
Earth Moving	Compactors, loaders, backhoes, tractors, graders, pavers	73 to 96
Materials Handling	Concrete mixers and pumps, cranes, derricks	74 to 88
Stationary	Pumps, compressors, generators	69 to 87
Hauling	Trucks	83 to 94
Impact Equipment	Pile drivers	95 to 106
Impact Tools	Jackhammers, rock drills, pneumatic wrenches	81 to 98

Source: EPA 1971

Depending on the activity, peak noise levels from equipment shown in Table 6-11 would range from 69 to 106 dBA at 50 feet from the source; however, noise levels decrease with distance from the source at a rate of approximately 6 to 7.5 dBA per doubled distance, and noise levels received further from construction activities would be lower than those listed in Table 6-11. For example, at 200 feet from the noise source, noise levels from construction equipment would range from 57 to 94 dBA.

Existing Noise Sources and Levels

Both Cle Elum Lake and Bumping Lake are located in relatively remote forested areas that are sparsely populated. Sensitive noise receptors at Cle Elum Lake include several parcels of private land with houses or cabins located below (southeast) and across (northeast) the lake from the dam. The closest residences are about 4,000 feet from the dam construction area. Recreational boaters and river anglers may also be found in proximity to the project area.

Sensitive noise receptors at Bumping Lake include the Bumping Campground (located across open water from the project site and within a quarter mile), the Bumping Lake Marina (located across open water from the project site and within a half mile), and a summer home tract consisting of approximately 14 residences under lease from the USFS (located across open water from the project site and within a half mile). Recreational boaters and river anglers may also be found in proximity to the project area.

Typical background noise levels in coniferous recreational settings range from 35 to 45 dBA in the summer daytime and 30 to 35 dBA in the winter daytime (USFS 2007 [White Pass]). Current sound levels at both Cle Elum Lake and Bumping Lake are not uncharacteristic for the type of land uses found there as vegetation and winter snow pack absorb human caused noise. The exception to this is noise at the lakeshore or on the lake surface. At these locations, noise tends to amplify and travel farther due to a lack of features to serve as sound barriers or to absorb sound.

6.8.2 Environmental Consequences

Noise associated with excavation, construction, and material hauling would be the most noticeable impacts associated with the proposed actions at both Cle Elum Lake and Bumping Lake. The construction schedule is shown in Table 6-12.

Table 6-12. Construction Schedule.

Construction Season	Construction Period and Work Shifts	
Cle Elum Dam		
First	April 15 to November 30	
	April 15 to September 1	6 days / week, 1 shift / day
	September 1 to November 30	7 days / week, 2 shifts / day
Second	April 15 to November 15	
	April 15 to August 1	6 days / week, 1 shift / day
	August 1 to November 15	7 days / week, 1 shift / day
Third	April 15 to November 15	
	April 15 to August 1	6 days / week, 1 shift / day
	August 1 to November 15	7 days / week, 1 shift / day

Construction Season	Construction Period and Work Shifts	
Bumping Lake Dam		
First	May 1 through November 30	
	May 1 through July 14	6 days / week, 1 ten hour shift / day
	July 15 through November 30	7 days / week, 1 ten hour shift / day
Second	May 1 through November 30	
	May 1 through July 14	6 days / week, 1 ten hour shift / day
	July 15 through November 30	7 days / week, 1 ten hour shift / day

Noise impacts will occur seven months each year of the three year construction period at Cle Elum. Construction at Bumping Lake will occur six months each year of the planned two year construction period. The increase in noise will be temporary, localized, short-term, and generally limited to daytime hours. Construction noise is exempt from regulation under the WAC if conducted within the hours specified within the Code. Due to the expanse of open water and portions of the project occurring within the lakes, the use of sound barriers would be cost prohibited and technically difficult.

No adverse noise impacts are expected from operation of the fish passage facilities at either dam.

6.9 Recreation

6.9.1 Affected Environment

The proposed project areas, Cle Elum Lake and Bumping Lake, are located within the Yakima River basin. Recreation settings within the basin vary from designated wilderness areas to urban greenways. Recreation features within the Yakima River basin are mainly situated in roaded natural settings. Both Bumping Lake and Cle Elum Lake can be characterized as being in a roaded natural setting.

The Washington State Interagency Committee for Outdoor Recreation surveys indicate that the number one preferred recreation setting is water-oriented. Public demand for access to rivers, streams, and reservoirs continues to increase yearly. Recreationists are attracted to the Yakima River basin by the quality of the scenery, water, and recreation opportunities. Primary recreation activities include fishing the reservoirs and rivers for cold water sport species, whitewater boating and kayaking, motorized boating, and other related activities such as camping, hiking, picnicking, and wildlife viewing. Other popular activities enjoyed by recreationists in the area include berry gathering, mushroom picking, bird watching, swimming, sunbathing, hunting, rock climbing, gold panning, and photography (USFS 1996).

Cle Elum Lake

Cle Elum Lake is on the Cle Elum River which drains into the Yakima River. With approximately 4,750 acres at full pool, the lake provides opportunities for boating, camping, fishing, picnicking, and swimming. Surrounded by the Wenatchee National Forest with areas of private land, recreational facilities in the area are managed by the Forest Service out of its Cle Elum Ranger District Office located in Cle Elum.

Visitor-use data for individual recreation sites within the National Forest are not available due to the expense of collecting these data. However, empirical evidence indicates that recreational use of Cle Elum Lake is very high. Picnic sites and campgrounds are close to or exceeding capacities on summer weekends and exceed capacity on holiday weekends. Recreation demand slows during the week but can reach 50-to-75 percent capacity depending on the weather (Reclamation 2007 [Recreation]).

Developed Recreation

The Forest Service manages 25 campgrounds in the Cle Elum District. Wish Poosh and the Cle Elum River campgrounds are the closest to the project area, although not in close proximity. Wish Poosh Campground is approximately 4 miles from Cle Elum Dam and Cle Elum River is approximately 8 miles.

Dispersed Recreation

Dispersed recreational use in the area increases as water levels in Cle Elum Lake become lower during the summer. This is largely due to increased dispersed camping opportunities and added access along emerging shorelines. Public use such as off-highway vehicle riding also increases as mud flats develop and additional areas can be accessed. Additionally, as the developed campsites in the area become full, many campers are left with little choice but to camp in dispersed areas. As a result, areas along Cle Elum Lake and the Cle Elum River are extremely popular for dispersed camping.

Winter Recreation

Cross country skiing and snowmobiling are popular winter sports in the Cle Elum Lake area. Snowshoeing and dog sledding are also pursued but to a lesser degree. Parking is the greatest limiting factor for winter recreation. Funding for plowing parking areas in most years has been limited.

Bumping Lake

Bumping Lake is surrounded by the Wenatchee National Forest and for visitors to the area the lake is usually their primary destination. Bumping Lake is literally “the end of the road” (USFS 1998). The Bumping River Road (Forest Road 1800) is the primary travel route and provides year round paved access to Bumping Lake. Forest Road 1800 parallels the Bumping River for over 10 miles before reaching the lake. In addition to providing access to the lake,

the road also provides access for a marina, several developed campsites, boat launch sites, Bumping Lake summer homes, and the Bumping Trailhead on the west shore. Visitors attracted to the area are seeking minimally developed campgrounds or dispersed camping areas, driving for pleasure, or engaged in hunting or viewing of wildlife.

Developed Recreation

Developed recreation facilities managed by the Forest Service within the region surrounding the project area include three campgrounds and one marina adjacent to Bumping Lake (Upper Bumping Lake Campground, Bumping Lake Campground, Lower Bumping Lake Campground; Bumping Lake Marina). Additional campgrounds are downstream of Bumping Lake Dam along Forest Road 1800 in close proximity to the Bumping River including Cougar Flats, Soda Springs, and Cedar Springs.

Limited Developed/Dispersed Sites

Granite Lake, Deep Creek campground, Deep Creek horse camp, Bumping Crossing, and Barton Creek are classified by the Forest Service as limited development sites. Located immediately downstream of Bumping Lake Dam, Bumping Crossing and Barton Creek were formerly developed campgrounds with all facilities except vault toilets removed in the early 1980's as part of a maintenance reduction program. Both areas still receive heavy dispersed use.

There are roughly 80 well-used dispersed camping areas outside Wilderness inventoried by the Forest Service in the Bumping Watershed Area (USFS 1998). The heaviest use sites lie adjacent to the lakeshore. Additionally, dispersed campsites are emerging in boat-in areas, inaccessible by car. Although this type of use is not heavy, it is increasing in amount and is important to the Forest Service due to its uniqueness within the region.

Lake Recreation

Bumping Lake is popular with boaters from May through Labor Day weekend, when the reservoir's depth is lowered. There are two boat launch areas. Bumping Lake Marina is managed under a Forest Service Special Use permit and a boat launch facility is available there. Additionally, the Bumping Campground has a concrete ramp recently reconstructed to improve boating access.

Bumping Lake produces good kokanee fishing for 6- to 9-inch fish starting in mid-May, with a generous kokanee limit. Fishing for rainbow trout is considered fair with most fish caught being in the 8- to 11-inch range. There are no seasonal closures on Bumping Lake so fishing is available year-round.

Hikers in the area find fair fishing for rainbow, eastern brook, and cutthroat trout above Bumping Reservoir. Below the reservoir, there is fair fishing for wild rainbows, plus whitefish during the special whitefish-only winter season. Fish generally range from 6 to 12 inches. Selective gear rules are in effect for the river below Bumping Lake (WDFW 2007).

Trailheads

Forest Road 1800 provides access to twelve trailheads within the Bumping Lake drainage that service trails leading into the William O. Douglas Wilderness.

Recreation Special Uses

There are 62 recreation residences within five tracts in the Bumping Lake area. Recreation residences are privately-owned, limited-use cabins in national forests under 20-year special use permits. Recreation residence tracts were first authorized in 1915 to encourage recreation within national forests. Many of the cabins have been used by the same family for generations. Recreation residence tracts within the Bumping Lake area include Bumping Lake (14 homes), Edgewater tract (13 homes), American Forks (21 homes), and Hawks Nest (4 homes).

Other Special Uses authorized by the Forest Service include a permit issued to Chinook Pass Outfitters for a base camp at the junction of Highway 410 and the Bumping River Road and a staging area near Barton Creek. The Bumping Marina (on the northwest corner of Bumping Lake) has a resort permit and offers camping as well as boat rental and launching. There are also several unpatented mining claims in the Bumping Lake drainage with one claim being active.

Snow Based Recreation

Snow comes early and stays late in the Bumping Lake area. Winter recreation activities center on roaded access. The Bumping River Road is maintained year-round with a parking lot maintained for winter recreation use at Bumping Lake. Snowmobiles, cross country skiers, snowshoers, and dog teams are the most frequent users of the area in the winter. A 5-mile-long cross country ski trail is maintained near the northeastern corner of Bumping Lake. Additionally, the lake bottom is commonly used for cross country skiing and snowmobiling although there are no groomed snowmobile trails in the area. Some snowmobile use is associated with the recreational residences also.

6.9.2 Environmental Consequences

Cle Elum Lake and Dam

One of the primary effects on recreation users with implementation of the proposed project will be disruption caused by construction traffic. All construction traffic accessing the site

will be using State Highway 903 which is the main recreational access to Cle Elum Lake and beyond. Since a high percentage of recreation users in the area originate from communities within the region, a public communication strategy utilizing community media such as newspapers, local television, and radio will be effective in preparing recreation users for possible construction related delays, traffic slowdowns associated with slow moving construction equipment, increased dust and noise, and potential road congestion. This will be particularly critical prior to high use weekends or when recreation activity is expected to increase.

The proposed road alignment for access to the right abutment has the potential to disrupt the solitude of anglers, hikers, and dispersed campers within sight and sound of the roadway. However, this should not be significant as recreational use within this area is low to moderate. To preclude any major changes to the character of the landscape due to increased public use and access, and the need to impose a recreational management scheme to previously unmanaged lands, this and any other newly established roads or roads which are not presently used by recreationists and are not needed for future O&M of the facilities will be closed at the end of the construction use and largely obliterated.

Lake users within sight and sound of the construction area will also experience negative consequences to their recreational experience. The magnitude of the impact will be directly related to the distance located from the project area. Lake users will be able to travel to areas of the lake where disruption to their recreational experience will be minimal; therefore, this disruption is of minor consequence.

Upon closing newly established construction roads no longer needed and restoring stockpile sites to their original character, impacts to the recreational resources should be minimal and of short duration, limited to the three summer construction seasons.

Bumping Lake

Impacts to the users of recreational resources within the Bumping Lake area will occur during two construction seasons and be similar to those experienced around Cle Elum Lake. Since there is only one road in and out of the Bumping Lake area, construction traffic impacts can be expected to effect recreation users in the area. Trailhead access may be impacted by traffic associated with construction activities. Traffic delays, road congestion, increased noise and dust, as well as an increase in traffic accidents resulting from frustrated drivers can be anticipated. Traffic-related impacts to campers using campgrounds along the roadway can also be anticipated.

Noise can be a major disruption to campers seeking relaxation and solitude amidst a natural setting. There is also potential for conflicts with recreationists at the Bumping Campground located within ½ mile of Bumping Lake Dam. There is a possibility noise from construction activities could be heard from the Wilderness, but the noise should be of limited duration and intensity.

Lake users within sight and sound of the construction area will also experience negative consequences to their recreational experience. The magnitude of the impact will be directly related to the distance located from the project area. Lake users will be able to travel to areas of the lake where disruption to their recreational experience will be minimal therefore this disruption will be short term, limited in duration, and of minor consequence.

6.10 Land and Shoreline Use

6.10.1 Affected Environment

Cle Elum Lake and Dam

Kittitas County has addressed land use planning and has adopted zoning which identifies allowed land uses designed to be compatible with the planning goals for particular areas within the county. Kittitas County's Comprehensive Plan Land Use Map provides the groundwork for zoning designations. The Comprehensive Plan Land Use map depicts the planned land use conditions throughout the County (e.g., Rural), whereas zoning regulates the type of allowed land uses as established in the Kittitas County Code. Together, the County Comprehensive Plan and Zoning Code guide development throughout Kittitas County including Cle Elum Lake and the proposed project area. The lands surrounding Cle Elum Lake and the planning area are zoned Rural and Commercial Forest. The development of fish passage structures and support facilities are compatible with the Commercial Forest and Rural zone use goals as set by Kittitas County.

Bumping Lake

Land use and land use planning in Yakima County is directed by the May 1997, *Plan 2015 - A Blueprint for Yakima County Progress*. This plan was developed to comply with planning goals established in Washington's 1990 Growth Management Act (GMA). The main goals of Plan 2015 include ensuring present and future residents are not burdened by a heavy financial burden including provisions to protect agricultural, forest, mineral, and open space resources for future generations (Yakima County 1997, 1998).

Yakima County's *Plan 2015* Comprehensive Plan Land Use Map provides the groundwork for zoning designations. The Comprehensive Plan Land Use map depicts the planned land use conditions throughout the County (e.g., Rural), whereas zoning regulates the type of allowed land uses as established in the Yakima County Code (Title 15, Zoning). Together, the County Comprehensive Plan and Zoning Code guide development throughout Yakima County including Bumping Lake and the proposed project area.

Yakima County's Plan 2015 generally divides existing land use within the County into three major land use categories identified in the 1990 Washington State GMA. These categories

are: urban, rural, and resource. The Plan 2015 accordingly establishes goals and policies based on each of the three land use categories to guide future land use decisions in Yakima County. The project area around Bumping Lake is zoned Forest Watershed. The development of fish passage structures and support facilities are compatible with the Forest Watershed zone use goals as set by Yakima County.

6.10.2 Environmental Consequences

Due to the small size of the APE from implementation of the proposed actions, there would be no land use conversion or land converted from a current to another use. There are no anticipated problems relating to nonconformance with County zoning; however, consultation with county officials during final design will confirm conformance with County ordinances.

6.11 Utilities

6.11.1 Affected Environment

Cle Elum

Electric Power

Electric power within Kittitas County is provided by the Kittitas County PUD and Puget Sound Energy. Puget Sound Energy delivers power to the left end of Cle Elum Dam with a 12.5 Kilovolt (kV) line. Each of the two 7200 Volt legs feeds a 7200/4160 Volt, 75 Kilovolt Amps (kVA) transformer, open delta. This provides a 3-phase, 4160 Volt, 100 kVA feed to a transformer that steps down to 240 Volt, 3-phase power at the dam. There is also a 30 Kilowatt (kW), 240 volt, 3-phase backup generator at the dam.

Telecommunications

Area providers include Fair Point Communications and Qwest.

Bumping Lake

Electric Power

Most of Yakima County is served by Pacific Power & Light (PP&L). However, electric power service is not available currently at Bumping Lake Dam because of the remoteness of the area. Power to operate the existing outlet gates is provided by an on-site generator.

Telecommunications

Advanced telecommunication services are available in Yakima County through Qwest, Sprint, and EMBARQ Communications. Companies offering long-distance and/or cellular services include US Cellular, Verizon, AT&T, Sprint, Clearwire, Charter Communications, and EMBARQ Communications.

6.11.2 Environmental Consequences

The contractor at each site will need to obtain electrical power, phone service, and construction water. Sources of power and water that may be available near the site will be identified during final design.

6.12 Transportation

6.12.1 Affected Environment

Cle Elum Lake

Cle Elum Lake and Dam and the proposed project area would have two access points. The left and right abutments would be accessed by different roads. The left abutment would be accessed from the south by SR 903 and County Road 25010 (Cle Elum Lake Dam Road). SR 903 runs from Cle Elum to Roslyn and continues toward Cle Elum Lake, terminating at the Wenatchee National Forest boundary. The length of SR 903 is 10.1 miles. There are approximately 20 side roads which feed off of SR 903 from outside of Cle Elum to the National Forest boundary. These side roads serve numerous tracts of private and commercial properties. Traffic volume data for SR 903 is shown in Table 6-13.

Table 6-13. Average Daily Traffic Volume – State Route 903 Mainline State Route 970 to Forest Boundary (source WSDOT 2006).

State Route	Milepost	Location	2003	2004	2005	2006
903	000.00	After Jct SR 970 Begin Route	2,700*	2,800	2,800	2,600
903	000.21	After Jct SR 903 Wye Conn	5,500*	5,500	5,600	5,300*
903	001.19	After Jct Yakima Ave	7,000	7,100	7,300*	7,300
903	001.90	After Jct Pennsylvania Ave	8,300	8,300*	8,400	8,400
903	004.20	After Jct Bullfrog Rd	--	4,800*	4,800	4,800
903	006.06	After Jct Alaska Ave	2,200	2,400	2,400*	2,400
903	008.11	After Jct Morrel Rd	--	--	1,500*	1,500
903	010.06	National Forest Boundary End Route	1,200	1,200	990*	990

-- no data
* based on actual count

State Route 903 is classified by the State of Washington as a Class 3 roadway. Class 3 roads are defined as highways that carry moderate traffic volumes at moderate travel speeds for medium and short travel distances providing for intercity, intra-city, and intercommunity travel needs. Highways in this class are typically distinguished by planned restrictive medians and minimum distances between public and private connections.

County Road 25010, Cle Elum Lake Dam Road, is classified by Kittitas County as a Rural Local Access Road (class 9). This is a classification that is given to roads which provide direct access to adjoining properties within a neighborhood. Rural Local Access roads constitute all rural mileage not classified as principal arterial, minor arterial, major collector, or minor collector mileage. Traffic volume for this portion of the county road system is not available.

The right abutment would be accessed from Bull Frog Road. Bull Frog Road is operated and maintained by Kittitas County and is classified as a Rural Major Collector Road, Class 7. Rural Major Collector (Class 07) roads serve the county seat and are roads not on an arterial route. This class of road may also serve larger towns not directly served by the higher systems. Additionally this class of road may serve other traffic generators of equivalent intra-county importance, such as consolidated schools, shipping points, county parks, and important mining and agricultural areas. Rural Major Collector Roads may also link these places with nearby larger towns or cities or with routes of higher classification; and serve the more important intra-county travel corridors.

Present plans for accessing the right abutment also include the construction of new roadway. According to County Ordinances, all new road construction in Kittitas County must be done in accordance with the current edition of Washington State Department of Transportation (WSDOT's) Standard Specifications for Road & Bridge Construction. Additionally, Kittitas County road standards state the minimum requirements for road construction in the county. According to RCW 46.44.041, the maximum legal load on state highways is 105,500 pounds. Kittitas County has adopted the state's schedules of permits and fees for overweight vehicles as set forth in RCW 46.44 for all county roads. Design of any newly constructed roads or newly opened roadways should be completed in accordance with State and County standards and ordinances.

Bumping Lake

FSR 1800 provides the only access into the Bumping Watershed including Bumping Lake Dam. The first 10.9 miles, from State Highway 410 to Bumping Lake Dam, is classified by the USFS as a Long Term, Constant Service, Arterial facility that is maintained to Level 5 standards by Yakima County. Level 5 roads are generally defined as roads that provide a high degree of user comfort and convenience and are normally double lane and paved, or aggregate surfaced with dust abatement. FSR 1800, on this segment is double lane with an asphalt surface.

The remaining 6.1 miles, continuing past Bumping Lake Dam is a Collector road maintained by the Forest Service to Maintenance Level 3 standards. Maintenance Level 3 is typically assigned to roads open and maintained for travel by a prudent driver in a standard passenger

car. User comfort and convenience are not considered priorities however. This segment of the road is a Long Term, Constant Service facility that is single lane with turnouts and has native surface with a few areas of pit run rock (USFS 1998).

The Bumping Lake Road is accessed by SR 410 which extends from west of Yakima to the Tacoma area. Jurisdictions managing the road have long-recognized the spectacular natural scenery surrounding SR 410. In 1930, a 75-mile-long section of the highway was designated the Mather Memorial Parkway and Chinook Scenic Byway. In 1998, it was designated an All-American Road. These designations confirmed that the highway is nationally significant, contains one-of-a-kind features that do not exist elsewhere, and provides an exceptional traveling experience. The National Park Service has the responsibility to preserve the historic aspects of the park and highway. The following table portrays traffic volume from 2002 through 2005 for SR 410 before the Bumping Lake Road intersection and after the Bumping Lake Road intersection.

Table 6-14. Average Daily Traffic Volume, State Route 410 (source WSTDOT 2006).

State Route	Milepost	Location	2002	2003	2004	2005
410	088.46	Before Junction Bumping River Rd	720	* 700	770	* 760
410	088.46	After Junction Bumping River Rd	830	* 810	960	* 950

* Based on Actual Count

6.12.2 Environmental Consequences

This section evaluates potential transportation impacts that could result from the proposed projects at Cle Elum and Bumping lakes. Types of direct transportation impacts include the potential for the project to exceed legal roadway load and weight limits, accident or navigational hazards, and degradation of roadway conditions. For the proposed projects, the primary concerns are the potential transportation-related impacts attributable to vehicle trips (both trucks and automobiles). These trips would be associated with construction, O&M, and existing and new gravel access roads. Indirect impacts are not anticipated because the project is not expected to substantially induce regional growth to the extent that would result in significant changes to offsite traffic.

Construction Impacts

Project construction would take place over the period of three years, largely occurring during the summer seasons. It is anticipated that most of the employees would travel to the worksites from within a 50-mile radius. The roadway network discussed above would be the primary roadways used by construction vehicles traveling to and from the project site. For the Cle Elum Lake project, most workers and construction traffic would come from Cle Elum or

Ellensburg and would access the site via SR 903. It would be important that project managers carefully analyze and coordinate construction traffic impacts in the vicinity of Bull Frog Road accessing the right abutment for the Cle Elum Lake portion of the proposed actions because of the rapid growth in this area. For the Bumping Lake project, SR 410 and FSR 1800 would be the primary access route to the site, and would likely receive the greatest impact from construction vehicles and workers. It is anticipated that the majority of the construction workforce traffic would originate in Yakima and the surrounding area.

Construction-related traffic would consist of deliveries of project equipment and construction materials (such as concrete and steel) by truck. Truck deliveries are anticipated to occur between 8 a.m. and 4:30 p.m. on weekdays. These truck deliveries would include:

- Major equipment (e.g., tower sections, nacelles, blades)
- Gravel for site access roads, O&M facility area, and substation
- Water trucks to wet the road during compaction and for dust control
- Construction equipment delivery and pickup
- Concrete and reinforcing steel
- Mechanical equipment
- Electrical equipment and material (transformers, cable, etc.)
- Miscellaneous steel, roofing, and siding
- Construction consumables
- Contractor mobilization and demobilization

At this stage of the project planning there is not enough information available to estimate the number of trucks and load trips which would be traveling to the project areas. As material quantities become known and other project details are developed, an analysis of the number of trips, the current Level of Service for the impacted roadways and intersections, and the anticipated changes to the Level of Service should be conducted.

Construction vehicles would not use private roadways used by residents who live in or visit the project area. However, given the potential volume of truck trips generated during construction, the additional vehicular and construction traffic attributable to the project could temporarily increase the risk of accidents in the project area. The risk of accidents would be greatest along routes where construction vehicles would share the roadway with other vehicles.

Diesel fuel and gasoline are the only potentially hazardous materials that would be hauled and used in significant quantities during project construction. It can be anticipated that contractors would use fuel trucks to refill construction vehicles and equipment onsite. The fuel trucks would be properly licensed and would incorporate features in equipment and operation such as automatic shut-off devices to prevent accidental spills.

6.13 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental justice in Minority Populations and Low-Income Populations," dated February 11, 1994, requires agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities as well as the equity of the distribution of the benefits and risks. Environmental Justice addresses the fair treatment of people of all races and incomes with respect to actions affecting the environment. Fair treatment implies that no group should bear a disproportionate share of negative impacts.

6.13.1 Affected Environment

Cle Elum Dam and Reservoir

Kittitas County Census Tract 9751 which includes the area around Cle Elum Dam and Reservoir was selected for the immediate study area. Table 6-15 provides the numbers and percentages of population for seven racial categories (White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Some Other Race, and Two or More Races), the total racial minority population, and the Hispanic or Latino population, a minority ethnic group for the Cle Elum study area, Kittitas County, and the State of Washington. Table 6-16 provides income, poverty, unemployment, and housing information for the same geographic area.

Table 6-15. Race and Ethnicity.

	Study Area		Kittitas County		State of Washington	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total population	5,397	100.0	33,362	100.0	5,894,121	100
One race	5,312	98.4	32,704	98.0	5,680,602	96.4
White	5,159	95.6	30,617	91.8	4,821,823	84.9
Black or African American	23	0.4	236	0.7	190,267	3.3
American Indian and Alaska Native	58	1.1	303	0.9	93,301	1.6
Asian	26	0.5	731	2.2	322,335	5.6
Native Hawaiian and Other Pacific Islander	9	0.2	49	0.1	23,953	0.4
Some other race	37	0.7	768	2.3	228,923	4.0
Two or more races	85	1.6	658	2.0	213,519	3.6
Racial Minority	238	4.4	2,745	8.2	1,072,298	18.2
Hispanic or Latino (of any race)	122	2.3	1,668	5.0	441,509	7.5
Minority[2]	--	5.9	--	10.6	--	21.1

Source: USCB 2000

[2] Nonwhite not Hispanic or Latino plus Hispanic or Latino

In comparison to the State of Washington and Kittitas County, the local study area has a smaller percentage of total racial minority and ethnic (Hispanic or Latino) populations.

Additional potentially affected minority populations include members of the YN and downstream Indian tribes. While Census data are available for recognized Indian reservations, specific data for Tribal members are not. Tribal members may be affected regardless of whether or not they reside on their reservations.

Table 6-16. Income, poverty, unemployment, and housing.

	Study Area	Kittitas County	Washington
Income			
Median family income	$47,902	$46,057	$53,760
Per capita income	$23,503	$18,928	$22,973
Percent below poverty level			
Families	7.7	10.5	7.3
Individuals	11.4	19.6	10.6
Percent unemployed	6.8	9.1	6.2
Percent of Housing			
1.01 or more occupants per room	3.0	3.1	5.1
Lacking complete plumbing facilities	0.8	0.8	0.5

Source: USCB 2000

Low-income populations are identified by several socioeconomic characteristics. As categorized by the 2000 Census, specific characteristics include income (median family and per capita), percentage of the population below poverty (families and individuals), unemployment rates and substandard housing.

Median family income for the Study area is greater than the County, but less than the State. The Study area has per capita income higher than the County and the State. Compared to the State, the Study area and Kittitas County have greater percentages of families and individuals below the poverty level.

Other measures of low-income, such as unemployment and substandard housing, also characterize demographic data in relation to environmental justice. The 2000 unemployment rates for the Study area and Kittitas County were higher than the State's 6.2 percent rate. Substandard housing units are overcrowded and lack complete plumbing facilities. The percentage of occupied housing units with 1.01 or more occupants per room in the Study area and County was lower than the percentage for the State. The percentage of housing units lacking complete plumbing facilities in the Study area and County was greater than the State.

Bumping Lake Dam and Reservoir

Yakima County Census Tract 30 which includes the area around Bumping Lake Dam and Reservoir was selected for the immediate study area. Table 6-17 provides race and ethnicity data for the Bumping Lake study area, Yakima County, and the State of Washington. Table 6-18 provides income, poverty, unemployment, and housing information for the same geographic areas.

Table 6-17.Race and Ethnicity.

	Census Tract 30		Yakima County		State of Washington	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total population	8,065	100.0	222,581	100.0	5,894,121	100.0
One race	7,874	97.6	214,830	96.5	5,680,602	96.4
White	7,327	90.8	146,005	65.6	4,821,823	84.9
Black or African American	23	0.3	2,157	1	190,267	3.39
American Indian and Alaska Native	70	0.9	9,966	4.5	93,301	1.6
Asian	27	0.3	2124	1	322,335	5.7
Native Hawaiian and Other Pacific Islander	5	0.1	203	0.1	23,953	0.4
Some other race	422	5.2	54375	24.4	228923	4.0
Two or more races	191	2.4	7751	3.5	213519	3.6
Racial Minority	738	9.2	76,576	34.4	1,072,298	18.2
Hispanic or Latino (of any race)	731	9.1	79,905	35.9	441,509	7.5
Minority[3]	--	12.2	--	43.5	--	21.1

Source: USCB 2000

The local study area has a smaller percentage of total racial minority and ethnic (Hispanic or Latino) populations in comparison to the State of Washington and Yakima County.

Additional potentially affected minority populations include members of the YN and downstream Indian tribes. While Census data are available for recognized Indian reservations, specific data for tribal members are not. Tribal members may be affected regardless of whether or not they reside on their reservations.

Table 6-18. Income, poverty, unemployment, and housing.

	Census Tract 30	Yakima County	Washington
Income			
Median family income	$47,612	$39,746	$53,760
Per capita income	$17,758	$15,606	$22,973
Percent below poverty level			
Families	7.1	14.8	7.3
Individuals	9.4	19.7	10.6
Percent unemployed	4.3	11.1	6.2
Percent of Housing			
1.01 or more occupants per room	4.4	14.2	5.1
Lacking complete plumbing facilities	0.9	0.8	0.5

Source: USCB 2000

[3] Nonwhite not Hispanic or Latino plus Hispanic or Latino

Several socioeconomic characteristics can be used to identify low-income populations. Specific characteristics from the 2000 Census include income (median family and per capita), percentage of the population below poverty (families and individuals), unemployment rates, and substandard housing.

Median family income and per capita income for the study area are greater than the County but less than the State. The study area has lower percentages of families and individuals below the poverty level compared to Yakima County and the State.

Other measures of low-income, such as unemployment and substandard housing, also characterize demographic data in relation to environmental justice. The 2000 percentage unemployed in the study area, 4.3 percent, was less than the County's 11.1 percent and the State's 6.2 percent. Substandard housing units are overcrowded and lack complete plumbing facilities. The percentage of occupied housing units with 1.01 or more occupants per room in the study area was lower than the percentage for the County and the State. The percentage of housing units lacking complete plumbing facilities in the study area was greater than the County and the State.

6.13.2 Environmental Consequences

Construction of the alternatives would most directly impact those living, recreating, or pursuing other activities in the immediate study areas.

The following issues are evaluated to determine potential impacts:

- Are affected resources used by minority or low-income populations?
- Are minority or low-income populations disproportionately subject to adverse environmental, human health, or economic impacts?
- Do the resources affected by the project support subsistence living?

Environmental justice issues are focused on environmental impacts on natural resources (and associated human health impacts) and potential socioeconomic impacts. Environmental resources potentially used by minority groups in the study area are primarily aquatic related resources. Members of the YN and other tribes outside the immediate study area may currently use these resources and would be expected to do so in the future. They may use these resources disproportionately to the total population. The subsistence level of use of renewable natural resources (such as fish, wildlife, and vegetation) by the YN or other tribes in the construction areas and downstream has not been quantified.

The immediate study areas potentially affected by implementation of the alternatives have lower percentages of minority and low-income populations than Yakima and Kittitas counties or the State of Washington. There would be no disproportionate adverse impact to those populations; everyone in the area, especially nearest the construction areas would be equally affected.

Other than minor construction impacts that are temporary, no adverse impacts to aquatic related resources have been identified. No adverse human health impacts for any human population have been identified. Thus, this alternative would not have an adverse environmental justice impact.

6.14 Historic Resources

Historic resources, the remains of past human activity, are finite, nonrenewable, and often fragile. These resources encompass a broad range and can include specific places associated with traditional ceremonies; artifacts, structures, objects, or buildings and landscapes associated with a period of time, a person, or historic movements. Federal agencies are required to identify and evaluate the significance of historic resources located within the APE of any Federal undertaking.

Federal agencies' responsibility to consider and protect historic resources is based on a number of Federal laws and regulations. In particular, the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations for Section 106, set out the requirements and process to identify and evaluate historic resources, assess effects to these resources, and mitigate effects to significant resources which occur as a result of the agency's permitted undertaking. Under Section 110 of the NHPA, the responsibility of the Federal agency that owns or formally manages land includes identifying and managing the historic resources on that land, even when there is no new undertaking.

6.14.1 Affected Environment

Historical Overview

Approved in 1905 as Reclamation's thirteenth project, operation of the Yakima Project depended on the construction of storage reservoirs at the headwaters of the Yakima River and its major tributaries. That same year, Reclamation identified five feasible reservoir sites. Ranked in order of capacity and importance, they were Cle Elum, Kachess, Keechelus, Bumping Lake, and McAllister Meadows (Rimrock.) All but Rimrock were located on natural lakes. Later, another site was approved at Clear Lake on the north fork of the Tieton River west of Yakima.

The first of the Storage Division reservoirs built was at Bumping Lake, located on the headwaters of Bumping River, a main tributary of the Naches River, about 30 miles west of Yakima. Although the site had been explored as a potential storage facility as early as 1894, it was not until the early 1900s that Reclamation engineers investigated the area. After the construction of a construction road and camp, work commenced on Bumping Lake Dam in 1909 (remnants of the camp, a recorded historic resource, still exist).

Construction of Cle Elum Dam would be the last major storage facility constructed by Reclamation on the Yakima Project. It is located on the Cle Elum River about 8 miles northwest of Cle Elum, near the coal mining (and Hollywood) town of Roslyn. As early as 1905, Reclamation engineers deemed Cle Elum's large volume as necessary to the project's success. In 1905, Union Gap Irrigation Company built a timber crib dam which was subsequently destroyed. In 1907, Reclamation constructed a small crib and rockfill dam to bring initial storage to 26,000 acre-feet. Over the next twenty years, limited work such as reservoir clearing took place at the site until the mid-1930s, when full-scale construction of the 165-foot-high earth and rockfill structure commenced. Completed in 1933, the new dam (and four earthen dike system) increased storage to 356,000 acre-feet—the Yakima Project's largest storage facility in terms of volume. A 1,050 foot-long concrete-lined spillway is located on the dam's south abutment. Uncontrolled at first, in 1936 Reclamation installed five 37- by 17-foot radial gates in the spillway to help boost the reservoir's capacity to 436,900 acre-feet. The original design included gates that were installed three years later.

Known Historic Resources

Known historic resources in the APE and the level of survey conducted to date are described here. The majority of these sites have not been evaluated for eligibility in the National Register of Historic Places (NRHP). Clearly, the list is incomplete for areas in which no or limited identification efforts have taken place.

APEs for the staging and installation of upstream and downstream fish passages for both facilities are compact (see Figure 6-1 and Figure 6-2). For Bumping Lake, the tentative APE is limited to an area consisting of a roughly elongated, irregular oval that comprises the entire dam, both spillway areas, a narrow section of the lake next to the dam's upstream side, a larger area near the dam's southeast end, and a small length of FSR 1800. As such, the Bumping Lake APE is confined to small parts of two adjacent land sections, the northwest ¼ of Section 23 and the southwest ¼ of Section 14, both T.16N, R.12E, Willamette Meridian (WM).

The Cle Elum APE includes the dam, a small area of the lake immediate adjacent to the dam's upstream side (for the intake structure), the spillway and land adjacent to the spillway on the south side, stilling basin, and an elongated, finger-shaped area of land immediately north of and adjacent to Cle Elum River extending southeast from the dam to an old foot bridge, including the left bank access road. Cle Elum's revised APE is confined to the northern halves of two adjacent land sections: Secs. 10 and 11 of T.20 N, R.14E, WM.

Cle Elum Lake

For Cle Elum, class I survey revealed nine recorded cultural resources within or immediately adjacent to the APE (see Table 6-19). Class I surveys involve a literature search to get an idea of what exists, where it exists, and eligibility; this differs from class II and III surveys, which

involve on-site digging and sampling. The SHPO has their recorded surveys on a GIS database, which streamlined the research process. There are no recorded cultural resources where the intensive downhill passage construction is proposed immediately next to the spillway and its adjacent staging area. On the north side of the river and dam there are a couple long, linear historic resources connected to the water histories of Roslyn and Cle Elum. One is KT-2146, the 7+ mile long fragmented Cle Elum Historic Water Line Complex, which has been determined not eligible, and the other is KT-2147, the 5+ mile long historic Roslyn Historic Water Line Complex, whose steel bridge that crosses the Cle Elum River is National Register eligible. However, this bridge is well southeast of the APE, and should not be an issue with construction or access.

A prehistoric site located near the downstream passage intake structure is FS-1492, where a Clovis-like projectile point was discovered in 1984 by Floyd Fulle of Kirkland, WA, during an unusually low drawdown year. Found on a terrace on the southwest side of the lake about 100-200 meters from the dam's southwest abutment, an intensive shoreline inspection four years later revealed no further materials. Furthermore, the water level of Cle Elum Lake has not dropped enough since 1984 to expose that particular terrace. With recent Clovis finds in East Wenatchee, however, a Clovis site at Cle Elum is plausible. The NRHP eligibility of this site is unknown.

One linear historic site that cuts through the APE is KT-2165, which is the remnant of an old historic telephone line. Approximately 1,000 feet long, it consists of white doughnut shaped insulators attached to ponderosa pines with wrapped wire. The feature runs from the old Roslyn waterline bridge into private land, across one access road slated for improvement.

In 1983, the Washington State Historic Preservation Office (SHPO's) Office of Archeology and Historic Preservation prepared a draft National Register nomination form for Cle Elum Dam, based on a drawdown and shoreline survey conducted by contractors in the 1970s. Unlike Bumping Lake Dam, however, there has been no Historic American Engineering Record follow-up and no formal determination of eligibility. Over the last few years, buildings associated with the dam have been removed, so the site's integrity has been compromised.

Table 6-19. Recorded Cultural Resources: Cle Elum Lake APE.

Site Number	Short Description	Elevation (Feet above sea level)	Within APE?	Eligibility	Misc.
FS-01482	Mudstone flakes and cobble scatter	2180	Adjacent	Unknown	In drawdown zone, extensive disturbance
FS-01492	Cle Elum Clovis Point	2200	Yes	Unknown	Not at site, removed, could be others under reservoir drawdown zone
45-KT-2146	Cle Elum Historic Water Line Complex	2050-300	Yes	Not Eligible	Long linear feature that runs through APE
45-KT-2147	Roslyn Water Line Complex	2050-300	Yes	Yes (water line bridge only)	Long linear feature that runs thru APE
45-KT-2153	Ed's Doll Head Scatter	2240	Adjacent	Not Eligible	Historic garbage, inc a doll's head
45-KT-2157	Lunchbox Refuse Scatter	2140	Other side of river fm APE	unknown	Yet another historic trash dump
45-KT-2158	Attention Refuse Scatter	2160	adjacent	Unknown	Historic trash dump adjacent to road intended for const trucks
45-KT-2162	Bridge abutment #1—West Side	2130	Adjacent	Unknown	Remnants of historic bridge abutment across the river from APE
45-KT-2165	Telephone Line	2120-160	Yes	unknown	

Bumping Lake

On July 16, 2007, a class I survey of recorded cultural resources in both APEs was conducted at the Washington SHPO in Olympia.

With Bumping Lake, a total of eleven recorded cultural resource sites exist within, or immediately adjacent to, the APE (see Table 6-20). Additionally, there are three sites that exist out of the APE, but may be connected culturally with the sites adjacent or within. By far the largest site in the APE (more a related collection of smaller sites) is WF-400, where the historic remains of the Bumping Lake Dam construction site are located. It is in an 80-acre polygon-shaped area where the Forest Service road intersects with the dam access road at the base of the dam's southeast end, and contains assorted historic refuse, remnants of household furnishings, and building foundations. Within WF-400 is WF-211, a collection of large, dome-shaped bread ovens made of stones and mortar with iron doors. Also in the area is YA-517, another historic campsite located at the base of the dam in the campground. This site, consisting of fire-cracked rock related to a hearth or oven, has been extensively disturbed by the dam's construction and the campground's maintenance, and is not NRHP eligible. The NRHP eligibility of WF-400 and -211, recorded by the USFS in 1989, is unknown.

Another recorded site within the APE—and within WF-400—is FS-1503, the remnant(s) of an old historic telephone line. A long, linear feature otherwise known as "Nelson's Insulators," it starts near the American Forks Guard Station and runs 15 miles along Deep Creek and Bumping River and about 15 miles to an old bunkhouse at Copper City, and cuts directly through the APE. It consists mostly of old insulators, pegs, and leftover wire on larch and pine trees (the USFS removed most of the wire in the 1960s and 1970s because they viewed it as a safety hazard.) It is not National Register eligible.

There are no recorded sites on the north end of the APE near the spillway and flume. The lack of recorded sites in this location, however, does not preclude the possibility that they do not exist.

In 1990, Reclamation sponsored the creation of a draft Historic American Engineering Record document (number WA-30), which determined that Bumping Lake dam was eligible for inclusion in the National Register of Historic Places. This study arose from the repairs Reclamation performed to the dam's channel outlet.

Table 6-20. Recorded Cultural Resources, Bumping Lake APE.

Site #	Short Description	Elevation (Feet above sea level)	Within APE?	Eligibility	Misc
WF-211	Bumping Lake large dome shaped bread ovens	3440	Yes	Unknown	
WF-400	Bumping Dam construction camp, 1911-1919	3440	Yes	Unknown	
FS-1496	Bumping Lake can scatter	3434	Adjacent	Not Eligible	
FS-1503	Nelson's Insulators, part of historic BL telephone line, linear feature	3280-3920	Yes	Not Eligible	
45-YA-168	Bumping Lake Narrows	3400	No	Unevaluated	Site inundated upon dam construction
45-YA-517	Bumping Lake Campground Site, extensive construction disturbance	3421	Yes	Not eligible	Site abuts dam
45-YA-518	Bumping Lake Campground Site	3421	No	Not eligible	
45-YA-519	Unknown	3421	No	Unknown	Prob connected to YA-518
45-YA-520	Old Bumping Lake Lithics	3421	Adjacent	Unknown	
45-YA-521	Unnamed (flakes, cherts)	3418	Yes	Unknown	In drawdown zone
45-YA-522	BL Knoll Site (poss hunting camp or special purpose site)	3409	Yes	unknown	In drawdown zone adj to former river channel

6.14.2 Environmental Consequences

Extensive construction disturbance over time has occurred within the Cle Elum and Bumping Lake APEs. For Cle Elum, the only NRHP-eligible site within the APE proper is 45-KT-2147 (see Table 6-18). As currently planned, since construction activities would avoid the water line bridge, the only eligible feature, no adverse effects would occur so mitigation would not be necessary. For the seven unknown and non-NHRP properties, because of extensive previous construction disturbance, there would be negligible or no adverse affects. For Bumping Lake, since there are no NHRP-eligible properties, there would be no adverse impacts. Because of the extensive disturbances in the area during previous construction activities, impacts to the non-NHRP properties would be negligible (see Table 6-19).

Reclamation's policy is to seek to avoid impacts to historic resources whenever possible. If an action is planned that could adversely affect an NHRP-eligible archeological, historical, or traditional cultural property site, then Reclamation would investigate options to avoid the site. If avoidance is not possible, protective or mitigative measures would be developed and considered. Cultural resources management actions would be planned and implemented consistent with consultation requirements defined in 36 CFR 800, using methods consistent with the Secretary of the Interior's Standards and Guidelines (see also 7.15.2)

If mitigation is necessary, Reclamation, working in coordination with other involved agencies, the YN and other Tribal authorities, the Washington SHPO, and the Advisory Council on Historic Preservation, would develop an all-inclusive programmatic agreement that would detail any requirements needed to mitigate and resolve adverse effects to eligible cultural resources that may result from the construction and operation of fish passages at these and all Yakima Project facilities.

Mitigation under any finalized construction plan would occur for NRHP-eligible cultural resources that could be adversely affected by construction operations, including the improvement of access roads and staging areas. For Cle Elum, NRHP eligible sites within the APE include 45-KT-1363 and 45-KT-2147 (see Table 6-19). Of the two, 45-KT-1363 would be the most sensitive, due to its status as a native camping hunting and camping site. With 45-KT-2147, as long as construction activities avoid the water line bridge, mitigation would not be necessary. For Bumping Lake, most recorded cultural resources within the APE are not eligible, and have already been subjected to extensive disturbance during previous construction activities.

6.15 Indian Sacred Sites

Executive Order 13007, Indian Sacred Sites (May 24, 1996), directs executive branch agencies to accommodate access to, and ceremonial use of, Indian Sacred Sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites on Federal lands. The agencies are further directed to ensure reasonable notice is

provided for proposed land actions or policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. The Executive Order defines a sacred site as a "specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion."

6.15.1 Affected Environment

Reclamation has not consulted with the Washington SHPO and local tribes regarding potential cultural resource and sacred site issues. Local tribes include the federally acknowledged Confederated Tribes and Bands of the YN, Confederated Tribes of the Colville Reservation, Snoqualmie Tribes, and the nonfederally acknowledged Wanapum Tribe.

6.15.2 Environmental Consequences

Once construction plans have been finalized, Reclamation would consult with the Washington SHPO and local tribes including Snoqualmie and Wanapum, regarding potential cultural resource and sacred site issues, especially how to approach resources and sites that may exist but have not been found and recorded. Since fish passage construction is a cooperative effort between Reclamation and the YN, it is recommended that consultations begin with this tribe as soon as possible.

6.16 Indian Trust Assets

Indian trust assets (ITAs) are legal interests in property held in trust by the United States for Indian tribes or individuals. Examples of things that may be trust assets are lands, minerals, hunting and fishing rights, and water rights. The United States has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and Executive Orders, which are sometimes further interpreted through court decisions and regulations. This trust responsibility requires Reclamation to take all actions reasonably necessary to protect trust assets.

6.16.1 Affected Environment

The ITAs of concern for this action are fishing rights.

6.16.2 Environmental Consequences

Installation and operation of fish passage facilities would be expected to increase harvestable anadromous fish that would facilitate the exercising of Tribal fishing rights by members of area Tribes. It would also contribute to maintaining or increasing subsistence fishing.

Overall, ITAs would benefit from implementation of any of the action alternatives; no long-term adverse environmental impacts would occur.

6.17 Socioeconomics

The socioeconomic analyses developed for this study are comprised solely of a Regional Economic Development (RED) impact analysis which focuses on estimating economic impacts to study the region's local economy stemming from three primary areas: 1) up-front construction costs, 2) annual OMR&P costs, and 3) annual sport fishing recreation expenditures. Note that by evaluating economic impacts across the entire study period, as opposed to only the construction period, this analysis measures a broader range of impacts than the rest of the analyses in this chapter which focus only on construction period effects.

Changes in costs and expenditures occurring within the region were measured compared to the No Action Alternative. The RED analysis includes the initial or direct impact on the primary affected industries, and the secondary impacts (multiplier effects) resulting from those industries providing inputs to the directly affected industries (indirect effects) as well as household spending of income earned by those employed in the directly or indirectly impacted sectors of the economy (induced effects).

The study area or "region" was selected based on the location of the proposed fish passage facilities and the economic interaction between neighboring counties within the area. Cle Elum Dam and Reservoir is located within Kittitas County. Bumping Lake Dam and Reservoir is located in Yakima County. The assumption was made that Yakima and Kittitas Counties are economically linked; therefore, the region was defined as both Yakima and Kittitas counties of Washington State.

Regional economic activity can be measured in a variety of ways. This analysis focuses on three commonly applied measures of regional economic impact: 1) output, 2) employment, and 3) labor income. Output reflects the dollar value of production (sales revenues and gross receipts) from all industries in the region. Labor income is a measure of employee compensation (wages and benefits) plus income for self-employed individuals. Employment measures the number of jobs in a particular sector, both full-time and part-time.

The regional economic impact analysis involves running estimates of in-region costs and recreational expenditures through a regional economic impact model generated specifically for the study area. The IMPLAN (IMpact, Analysis, for PLANning) model was selected for this analysis. IMPLAN is a commonly applied input-output modeling system that estimates the effects of economic changes within a region. More detailed information on the RED impact analysis compared to what is presented below can be found in the Yakima Fish Passage Study Economics Technical Repport (Reclamation, 2008).

6.17.1 Affected Environment

Table 6-21 displays the latest "current" output, employment, and labor income information as generated by the IMPLAN model based on 2004 data for the combined economy of Kittitas and Yakima counties for fourteen major sectors. In 2004, these two counties generated $12.6 billion in output, 134.5 thousand jobs, and $4.4 billion in labor income.

The IMPLAN model includes 509 sectors which were aggregated into fourteen primary sectors for display purposes. While the ranking of the five most important sectors within Kittitas and Yakima counties economy vary based on the regional economic measure considered, the following major economic sectors consistently fell within the top five: 1) agriculture, forestry, and fisheries; 2) manufacturing; 3) retail trade; 4) services; and 5) Federal, State, and local government. Looking at the employment measure, these five sectors represent about 83 percent of the total employment within the region in 2004.

In addition to providing some detail on the current makeup of the regional economy, this current condition information was used to evaluate the magnitude of estimated regional economic impacts. While economic impacts for the No Action Alternative were not specifically estimated, these estimates of current conditions were assumed to be "close enough" to the No Action Alternative to provide a useful comparative perspective.

Table 6-21. Baseline Data for Kittitas and Yakima Counties - Output, Employment, and Labor Income.

IMPLAN Model: Yakima Fish Passage_Kittitas & Yakima.iap						Base Year: 2004	
		Industry				Labor	
IMPLAN		Output	% of	Employment	% of	Income	% of
Industry #s	Industry	(Million $)	Total	(Jobs)	Total	(Million $)	Total
1-18	Agriculture, Forestry, & Fisheries	1,689.235	13.45	26,193	19.47	626.014	14.29
19-29	Mining	1.891	0.02	17	0.01	0.643	0.01
30-32	Utilities	111.834	0.89	226	0.17	20.175	0.46
33-45	Construction	650.321	5.18	6,147	4.57	257.398	5.88
46-389	Manufacturing	2,806.953	22.35	9,537	7.09	434.830	9.93
390	Wholesale Trade	601.510	4.79	5,373	3.99	226.148	5.16
391-400	Transportation & Warehousing	382.527	3.05	4,261	3.17	170.289	3.89
401-412	Retail Trade	787.549	6.27	12,681	9.43	318.007	7.26
413-424	Information	358.231	2.85	1,975	1.47	83.952	1.92
425-430	Finance & Insurance	385.816	3.07	2,538	1.89	113.214	2.59
431-436	Real Estate, Rental, & Leasing	346.029	2.76	2,706	2.01	70.190	1.60
437-494	Services	2,507.039	19.96	41,655	30.97	1,104.959	25.23
495-506	Federal, State, and Local Government	1,313.388	10.46	21,214	15.77	953.728	21.78
507-509	Other	617.146	4.91	0	0.00	0.000	0.00
	Totals:	12,559.468		134,520		4,379.548	

6.17.2 Environmental Consequences

Construction of fish passage facilities at Cle Elum and Bumping Lake dams combined with reintroduction of anadromous fish is expected to generate economic impacts within the two-county region as a result of in-region costs and expenditures for construction, OMR&P, and sport fishing.

Up-Front Impacts from Construction Costs:

Total in-region construction costs for the fish passage facilities at Cle Elum and Bumping Lake dams were developed by Reclamation cost engineers. These in-region costs were separated into various construction sectors and run through the IMPLAN model. Results are presented in tables 6-22 and 6-23.

Cle Elum Dam

Total costs of construction of fish passage facilities at Cle Elum Dam was estimated at $96.4 million of which $63.8 million was expected to be incurred within the region. These in-region construction costs were estimated to generate an additional $90.6 million of output, 937 jobs, and $35.9 million of labor income over the 4-year construction period as shown in Table 6-22. While the overall impact of this in-region construction activity was estimated to be relatively small (less than a 1 percent change in total economic activity as compared to current conditions), certain sectors of the economy (e.g., the construction sectors) are expected to temporarily experience sizable positive impacts.

Bumping Lake Dam

Total costs of construction of fish passage facilities at Bumping Lake Dam was estimated at $26.5 million of which $13.0 million was expected to be incurred within the region. These in-region construction costs were estimated to generate an additional $18.6 million of output, 196 jobs, and $7.5 million of labor income over the 3 year construction period as shown in Table 6-23. While the overall impact of this in-region construction activity was estimated to be relatively small (less than a 1 percent change in total economic activity as compared to current conditions), certain sectors of the economy (e.g., the construction sectors) are expected to experience temporary sizable positive impacts.

Table 6-22. Cle Elum Dam Fish Passage Facilities - Construction Costs Output, Employment, & Labor Income Impact.

Base Year:	2004				% Change[1,2]
					from
IMPLAN		Industry	Employment	Total Labor	Current
Industry #s	Industry	Output ($)	(Jobs)	Income ($)	Conditions[3]
1-18	Agriculture, Forestry, & Fisheries	412,800	6	116,700	0.02
19-29	Mining	100	0	0	0.01
30-32	Utilities	337,400	1	59,400	0.29
33-45	Construction	60,071,500	600	25,519,700	242.16
46-389	Manufacturing	1,783,600	7	334,800	0.08
390	Wholesale Trade	2,499,100	22	939,600	0.42
391-400	Transportation & Warehousing	1,389,200	14	600,300	0.35
401-412	Retail Trade	3,716,800	62	1,479,500	1.74
413-424	Information	1,032,800	5	218,800	0.26
425-430	Finance & Insurance	1,728,600	11	481,500	0.43
431-436	Real Estate, Rental, & Leasing	1,744,500	12	357,200	0.51
437-494	Services	11,939,500	193	5,507,300	5.16
495-506	Federal, State, and Local Government	1,054,100	6	307,300	0.03
507-509	Other	2,918,800	0	0	n/a
	Totals:	90,628,800	937	35,922,300	0.82

Footnotes: 1) Note that current conditions estimates are in millions of dollars (M$), whereas impact estimates are in dollars ($).
2) The percent change across impact measures is consistent.
3) See Affected Environment section for current conditions estimates.

Table 6-23. Bumping Lake Dam Fish Passage Facilities - Construction Costs Output, Employment, & Labor Income Impact.

Base Year:	2004				% Change[1, 2]
					From
IMPLAN		Industry	Employment	Total Labor	Current
Industry #s	Industry	Output ($)	(Jobs)	Income ($)	Conditions[3]
1-18	Agriculture, Forestry, & Fisheries	87,687	1	24,818	0.00
19-29	Mining	16	0	5	0.00
30-32	Utilities	70,065	0	12,358	0.06
33-45	Construction	12,245,929	125	5,322,204	38.16
46-389	Manufacturing	382,874	2	72,931	0.02
390	Wholesale Trade	505,154	5	189,921	0.08
391-400	Transportation & Warehousing	260,299	3	114,675	0.07
401-412	Retail Trade	782,604	13	311,413	0.37
413-424	Information	216,617	1	45,833	0.05
425-430	Finance & Insurance	354,278	2	98,667	0.09
431-436	Real Estate, Rental, & Leasing	352,917	2	71,992	0.10
437-494	Services	2,497,020	41	1,155,931	1.08
495-506	Federal, State, and Local Government	219,970	1	64,051	0.01
507-509	Other	608,159	0	0	n/a
	Totals:	18,583,588	196	7,484,799	0.17

Footnotes: 1) Note that current conditions estimates are in millions of dollars (M$), whereas impact estimates are in dollars ($).
2) The percent change across impact measures is consistent.
3) See Affected Environment section for current conditions estimates.

Annual Impacts from OMR&P Costs

As opposed to the up-front temporary nature of construction impacts, annual OMR&P impacts are expected to occur for as long as the proposed project is in operation. The operations, maintenance, and power costs for Cle Elum and Bumping Lake dams fish passage would generally be incurred annually; whereas replacement costs would generally be incurred periodically (e.g., once every 10 or 20 years). Instead of treating the relatively small replacement element separately, the decision was made to run the entire OMR&P cost through the IMPLAN model's "Other Maintenance and Repair" sector.

Cle Elum Dam

The average annual OMR&P costs for the Cle Elum Dam fish passage facilities are estimated at $300,000. All of these costs are assumed to occur in-region. These in-region OMR&P costs were estimated to generate an additional $436.7 thousand of output, five jobs, and $216.2 thousand of labor income on average annually. The impact of these in-region OMR&P costs on the overall economy and, specifically, on the Other Maintenance and Repair sector was estimated to be relatively small.

Bumping Lake Dam

The average annual OMR&P costs for the Bumping Lake Dam fish passage facilities was estimated at $150,000. All of these costs were assumed to occur with the region. These in-region OMR&P costs were estimated to generate an additional $218.3 thousand of output, three jobs, and $108.1 thousand of labor income on average annually. The impact of these in-region OMR&P costs on the overall economy and, specifically, on the Other Maintenance and Repair sector was estimated to be relatively small.

Annual Impacts from Sport Fishing Expenditures

High and low estimates of commercial, sport, and ceremonial and subsistence harvests were developed by study team biologists for coho and sockeye salmon in the ocean, Columbia River, and Yakima River. The focus of the fishing related regional economic impact analysis is exclusively on Yakima River sport fishing for two reasons: 1) the Yakima River reflects the only fishing area geographically located within the two county region, and 2) the Yakima River tribal ceremonial and subsistence harvests, although incurred within the region, do not generate economic impacts because they do not involve market transactions.

To estimate Yakima River sport fishing regional economic impacts, in-region recreational expenditures by alternative were first developed. In-region expenditures were calculated by applying estimates of expenditures per visit to estimates of visits by alternative. It is typically assumed that the majority of impacts stem from the expenditures of recreators residing outside the region. Local recreators are generally assumed to spend their money within the region

regardless of the alternative selected and would therefore generate little additional regional economic activity. As a result, the sport fishing regional analysis focuses on in-region expenditures by non-local recreators.

In-region fishing expenditure information per visit by non-local recreators was obtained from a recreation survey conducted in 2006 and 2007 in the Yakima River Basin (Aukerman, Haas, & Associates 2008). High and low estimates of additional non-local visitation by alternative as compared to the No Action Alternative were developed on an average annual basis. The change in average annual visitation was derived by multiplying the high and low changes in harvest by an estimate of the average number of sport fishing trips taken per sport fish caught as obtained from the WA Department of Fish and Game. This estimate ot total visitation was then multiplied by an estimate of the percentage of Yakima River recreation visitation taken by nonlocals, thereby resulting in high and low nonlocal fishing visitation estimates. Finally, multiplying the high and low end change in non-local fishing visitation by the non-local recreator in-region expenditures per fishing trip by expenditure category provides high and low end estimates of the change in non-local recreator in-region expenditures by expenditure category for subsequent input into the IMPLAN model.

Cle Elum Dam

The total change in non-local recreator in-region expenditures summed across expenditure categories equals $1,135.2 thousand for the high-end estimate and $454.0 thousand for the low-end estimate. For the high-end fish harvest scenario, the in-region sport fishing expenditures were estimated to generate an additional $837.1 thousand of output, 12 jobs, and $252.2 thousand of labor income on average annually. For the low-end fish harvest scenario, the in-region sport fishing expenditures were estimated to generate an additional $334.8 thousand of output, five jobs, and $100.8 thousand of labor income on average annually. The impact of these additional in-region sport fishing expenditures on the overall economy and, specifically, on the directly impacted sectors was estimated to be relatively small.

Bumping Lake Dam

The total change in nonlocal recreator in-region expenditures summed across expenditure categories equals $136.7 thousand for the high end estimate and $45.6 thousand for the low end estimate. For the high-end fish harvest scenario, the in-region sport fishing expenditures were estimated to generate an additional $100.8 thousand of output, two jobs, and $30.4 thousand of labor income on average annually. For the low-end fish harvest scenario, the in-region sport fishing expenditures were estimated to generate an additional $33.6 thousand of output, one job, and $10.1 thousand of labor income on average annually. The impact of these additional in-region sport fishing expenditures on the overall economy and, specifically, on the directly impacted sectors was estimated to be relatively small.

Chapter 7 FINDINGS AND RECOMMENDATIONS

Reclamation has completed an engineering feasibility-level investigation of proposed upstream and downstream fish passage facilities at Cle Elum and Bumping Lake dams to provide passage for anadromous fish. This draft planning report documents the data collected, analyses conducted, and the feasibility-level engineering designs and cost estimates completed.

7.1 Findings

Reclamation and the Core Team found that construction of the proposed fish passage facilities in conjunction with reintroduction of anadromous salmonid species through a proposed reintroduction program is a vitally important component, along with other activities in the basin, to achieve the ecological benefits and functions necessary to restore anadromous fish populations extirpated above the dams. Analyses conducted during this study indicate that suitable salmonid spawning habitat and juvenile rearing habitat are available above Cle Elum and Bumping Lake dams. A reintroduction program would use juvenile and adult salmon to accelerate repopulation of habitat made accessible with fish passage facility construction. Fish passage facilities would eventually allow anadromous salmonids to expand their range into historically occupied habitat and reduce dependence on reintroduction. Fish passage would also allow reproductively isolated bull trout populations above and below the dams to reconnect, particularly in the Bumping River watershed in the near-term, thus expanding genetic diversity and improving population resiliency. Overall watershed productivity would be improved through infusion of marine-derived nutrients from returning adults, stimulating both aquatic and terrestrial production.

Improved river and lake productivity, including increased smolt production and increased adult returns, would result in economic benefits associated with increased recreational and commercial harvest of anadromous and resident fish. The increase in overall watershed productivity would also be expected to provide economic benefits associated with non-harvest recreational activities including viewing of fish and wildlife (e.g. spawning salmon and bull trout, bald eagles, and river otters and other riparian-associated wildlife). Restoring anadromous fish to their historical range and reintroducing fish species would enhance YN ceremonial and spiritual values.

Reclamation has determined that the proposed downstream and upstream fish passage facilities at Cle Elum and Bumping Lake dams are technically feasible. Fish passage facility operations would be consistent with other Project operations and would not impact existing water delivery contracts, flood control, or instream requirements. However, minor operational changes under some circumstances might improve juvenile fish passage windows at some facilities and will be considered during final engineering design.

Feasibility-level project cost estimates (construction and noncontract costs) were $96 million for Cle Elum Dam of which $63.8 million were expected to be incurred within the region (Yakima and Kittitas counties) and the remainder outside the region. Construction of Cle Elum Dam fish passage facilities was anticipated to provide an additional $90.6 million of output, 937 jobs, and $35.9 million of labor income over the construction period. Output reflects the dollar value of production (sales revenues and gross receipts) from all industries in the region. Average annual OMR&P costs were estimated to generate an additional $436.7 thousand of output, five jobs, and $216.2 thousand of labor income.

Feasibility-level project cost estimates were $27 million for Bumping Lake Dam of which $13.0 million were expected to be incurred within the region (Yakima and Kittitas counties). Construction of Bumping Lake Dam fish passage facilities was anticipated to provide an additional $18.6 million of output, 196 jobs, and $7.5 million of labor income over the construction period. Average annual OMR&P costs were estimated to generate an additional $218.3 thousand of output, three jobs, and $108.1 thousand of labor income.

7.2 Recommendations

Based on a finding of technical feasibility and the preliminary ecological and Tribal spiritual benefits described in this draft planning report, Reclamation has decided to initiate the next study phase for the Cle Elum Dam fish passage facilities. Reclamation will continue to collaborate and coordinate with the Core Team. Reclamation will begin environmental compliance activities and commence the next step of engineering investigations for the Cle Elum Dam facilities.

Reclamation will begin activities to comply with the NEPA, preparing an environmental impact statement or environmental assessment of fish passage facility construction at Cle Elum Dam. Reclamation will work with the Core Team to ensure that appropriate analyses are conducted to assess, describe, and quantify the ecological benefits from implementation of an anadromous salmonid reintroduction plan by the Yakima River basin fisheries co-managers.

Reclamation will prepare a final planning report when completing NEPA compliance activities and issue a Record of Decision identifying the selected alternative. The final planning report, upon certification by Reclamation, will be provided to the Commissioner, the Secretary of Interior, and Congress to support funding requests for construction of fish passage facilities.

Investigation of the Bumping Lake Dam fish passage facilities is anticipated to begin in FY2015, pending appropriations, when construction of Cle Elum Dam fish passage facilities is ongoing.

7.2.1 Engineering Studies

Reclamation will begin the next phase of engineering investigations for Cle Elum Dam in FY2011, pending appropriations, which will include collecting additional data and conducting analyses needed to complete engineering designs and plans. Immediate steps include conducting a Value Engineering study, which will entail a review by an independent technical team to determine if there are more cost effective ways of constructing the alternatives examined in this report or other less expensive fish passage options that would meet the study objectives.

Reclamation's dam safety program requires that a risk analysis be conducted before any dam feature or operation is modified to ensure that dams are operated in a manner that minimizes risks to downstream populations. A risk assessment with the fish passage facilities completed was conducted. Reclamation will complete an assessment of risks that might occur during construction of the proposed fish passage facilities before final engineering design occurs.

Survey data would be collected and geologic and subsurface investigations conducted to verify the materials and properties expected to be encountered during construction. Reclamation would prepare final engineering designs, construction drawings, and specifications in collaboration with the Core Team.

7.2.2 Reviews, Approvals, and Permits

To implement a selected fish passage plan, Reclamation would apply for various permits, take certain actions, and comply with various laws, regulations, and Executive Orders. The following is a partial list of major permits, actions, and laws that Reclamation must consider before implementing a selected alternative:

- National Environmental Policy Act
- Endangered Species Act
- Indian Trust Assets
- National Historic Preservation Act
- Executive Order 11988: Floodplain Management
- Executive Order 11990: Protection of Wetlands
- Executive Order 12898: Environmental Justice
- Executive Order 13007: Indian Sacred Sites
- Section 401 Permit, Clean Water Act
- Section 402 Permit, National Pollutant Discharge Elimination System, Clean Water Act
- Section 404 Permit, Clean Water Act
- State Environmental Policy Act
- Washington Department of Natural Resources Permit
- Hydraulic Project Approval

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Appendix A

AGREEMENTS AND PERMITS

MITIGATION AGREEMENT BETWEEN THE USDI BUREAU OF RECLAMATION AND WASHINGTON DEPARTMENT OF FISH AND WILDLIFE REGARDING KEECHELUS DAM CONSTRUCTION ISSUES INCLUDING FISH PASSAGE.

This Mitigation Agreement ("Agreement") is made between the Washington State Department of Fish and Wildlife, hereinafter referred to as WDFW, and the USDOI Bureau of Reclamation, hereinafter referred to as Reclamation. For purposes of this Agreement, the above entities are referred to collectively as "the Parties." The terms of this Agreement shall be binding upon the respective successors or assigns of each Party.

WHEREAS the U.S. Department of Interior Bureau of Reclamation ("Reclamation") and the Washington Department of Fish and Wildlife ("WDFW") share a common objective to protect, maintain and enhance water, fish and wildlife resources, and they recognize their mutual desire to continue a long-standing working relationship;

WHEREAS Congress established that the purposes of the Federal Yakima Project include fish, wildlife and recreation and that the existing storage rights of the project include storage for the purposes of fish, wildlife and recreation (Public Law 103-434, Title XII Yakima River Basin Water Enhancement Project - Sec 1205(e) Operation of Yakima Project);

WHEREAS Congress established that said storage for the purposes of fish, wildlife and recreation shall not impair the operation of the Yakima Project to provide water for irrigation purposes nor impact existing contracts (Public Law 103-434, Title XII Yakima River Basin Water Enhancement Project - Sec 1205(e) Operation of Yakima Project);

WHEREAS The Washington State law requires that a dam or other obstruction shall be provided with a durable and efficient fishway approved by the director of WDFW and that the fishway shall be maintained in an effective condition and continuously supplied with sufficient water to freely pass fish (RCW 77.55.060);

WHEREAS Reclamation and WDFW agree that Reclamation's authorities in the Yakima Basin provide for a broad range of fish enhancement activities including such things as barrier removal, screening of diversions and restoration of instream flows on both the mainstem river and tributaries, within proscribed limits;

WHEREAS Reclamation and WDFW agree that restoring fish passage at man-made barriers is, in nearly all cases, biologically preferable for conserving, restoring and enhancing indigenous fish species; and

WHEREAS the parties agree that moving forward expeditiously with repairs to Keechelus Dam is in the public interest to protect public safety and provide necessary

water for project purposes.

THEREFORE the parties agree to work collaboratively to carry out their respective responsibilities and agree as follows:

I. Commitments of WDFW:

WDFW Agrees:

1) To issue a Hydraulic Project Approval (HPA) for the proposed Safety of Dams reconstruction of Keechelus Dam as soon as possible. The HPA shall incorporate the provisions of this agreement.

2) To provide technical support to Reclamation so that the fisheries objectives of this agreement may be met.

II. Commitments by the United States of America

Reclamation Agrees:

1) To abide by the provisions of the HPA.

2) To immediately conduct an assessment of fish passage at all Yakima Project storage reservoirs in the Yakima River Basin as outlined in the HPA for the Keechelus Safety of Dams Modification Project. The assessment shall include consideration of the potential fish production and likelihood of sustainability above each dam using a mutually acceptable assessment tool. Where fish passage is determined to be desirable and practicable, based upon the results of this assessment, Reclamation shall examine engineering feasibility. Where fish passage is determined to be impracticable or infeasible, Reclamation shall negotiate with WDFW to provide an alternative to fish passage, consistent with state law.

3) To seek appropriate funding to ensure timely implementation of: a) fish passage facilities, where passage is determined to be desirable and practicable by the project-wide passage assessment (item 2 above), and b) alternative fish restoration measures for locations where fish passage is determined by the project-wide assessment to be biologically beneficial but impractical or infeasible.

4) Until construction of fish passage facilities at each of the Yakima Project storage reservoirs where fish passage has been determined as necessary as per item 2 above, and such fish passage facilities are in operation, to provide interim fish passage (e.g. trap and haul program) in collaboration with WDFW at each of those reservoirs.

5) To restore fish passage for salmonids from Lake Keechelus into Cold Creek, in collaboration with WDFW, as an interim measure to address fish passage concerns at Keechelus Dam and construction-related impacts of the Safety of Dams project. Reclamation shall do this in concert with the reconstruction of Keechelus Dam and ensure that conditions suitable for adult passage into Cold Creek from the reservoir are restored.

6) To develop a formal process involving regularly scheduled meetings to occur no less than biannually to ensure that there is ample opportunity for input by the fish management agencies (WDFW, National Marine Fisheries Service, US Fish and Wildlife Service and the Yakama Nation) into decisions concerning fish enhancement measures implemented by Reclamation under its various authorities in the Yakima River basin.

7) To ensure that construction materials for major Reclamation projects (including Safety of Dams projects) are sourced from sites not in the geomorphic flood plain of the Yakima River, or tributaries, whenever practicable.

8) To ensure that the proposed Safety of Dams reconstruction-related actions at Keechelus Dam will not result in significant additional costs for retrofitting fish passage facilities at Keechelus Dam nor require future significant modification of the portions of the dam being reconstructed as part of the SOD work.

9) To ensure that the functions of the large (approximately 300 acres) wetland complex below the toe of Keechelus Dam are not impaired. This wetland is the source of water for three different water courses, at least two of which are fish-bearing streams, which flow into a river side channel complex below Keechelus Dam. Reclamation shall mitigate for unavoidable impacts to this wetland as outlined in the Final Environmental Impact Statement (FEIS) for the Keechelus Dam Safety of Dams Modification (September 2001). If for some reason the land acquisition outlined in the FEIS cannot be accomplished, alternative mitigation strategies shall be developed in cooperation with the WDFW and others.

III. DISPUTE RESOLUTION

1) In the event that a dispute between the parties should arise, the parties shall make every effort to informally resolve the matter. Should a dispute arise, the aggrieved party shall send the other parties written notice of the issue in dispute, which shall state the aggrieved party's preferred resolution to the matter. Nothing shall prevent the parties from using any other remedy otherwise available to them if informal dispute resolution does not work; provided, however, that no party shall engage in self-help without first notifying the other parties of its intended act(s) and providing reasonable time for the other parties to respond.

2) Each Party shall have all remedies otherwise available in equity or at law to enforce the terms of this agreement, including specific performance and injunctive relief. No party shall be liable in damages to any other Party or other person for any breach of this agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this agreement, or any other cause of action arising from this agreement.

IV. MODIFICATION OF AGREEMENT

This agreement may only be modified upon written agreement of the parties.

V. SAVINGS CLAUSE

Nothing herein shall prevent, waive or diminish the right or authority of WDFW to use any statutory or other remedy available to enforce the provisions of this agreement. Nothing herein shall prevent, waive or diminish the right or authority of WDFW to protect populations of fish, or any other aquatic life in Lake Keechelus, theYakima River or tributaries to the fullest extent allowed by law, nor shall this preclude the WDFW from using any statutory or other remedy available concerning or relating to these fish. Nothing contained in this agreement is intended to unlawfully limit the authority or responsibility of the Department of Fish and Wildlife to invoke penalties or otherwise fulfill its responsibilities as a public agency.

VI. GENERAL PROVISIONS

1) Nothing herein shall or shall be construed to obligate Reclamation to expend or involve the United States of America in any contract or other obligation for the future payment of money in excess of appropriations authorized by law and administratively allocated for the purposes and projects contemplated hereunder.

2) No member of, or delegate to Congress or resident Commissioner, shall be admitted to any share or part of this Agreement or to any benefit that may arise out of it.

3) The parties agree to comply with all federal statues relating to nondiscrimination, including but not limited to: Title VII of the Civil Rights Act of 1964, as amended which prohibits discrimination on the basis of race, color, religion, sex or national origin; Title IX of the Education amendments of 1972, as amended, which prohibits discrimination on the basis of sex; the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990, as amended, which prohibit discrimination on the basis of disability: the Age Discrimination in Employment Act of 1976, as amended, which prohibits discrimination based on age against those who are at least 40 years of age; and the Equal Pay Act of 1963.

4) The Agreement shall become effective on the date of last signature hereto and

extended until terminated. Either party may formally request modification of the agreement.

5) Nothing in this Agreement shall, or shall be construed to alter or affect the authorities, rights or obligations of the parties under existing law or regulations.

THE UNITED STATES OF AMERICA

By: Eric Glover
Dated: 4/8, 2002

Eric Glover
Area Manager
Bureau of Reclamation

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

By: Jeff Tayer
Dated: 4/4-08-, 2002

Jeff Tayer, Regional Director
Department of Fish and Wildlife

HYDRAULIC PROJECT APPROVAL

RCW 77.55.100 - appeal pursuant to Chapter 34.05 RCW

State of Washington
Department of Fish and Wildlife
Region 3 Office
1701 South 24th Avenue
Yakima, Washington 98902-5720

DATE OF ISSUE: April 17, 2002

LOG NUMBER: 00-E1998-01

PERMITTEE

USDI Bureau of Reclamation
Upper Columbia Area Office
ATTENTION: David Kaumheimer
1917 Marsh Road
Yakima, Washington 98901
(509) 575-5848 ext. 232
Fax: (509) 454-5650

AUTHORIZED AGENT OR CONTRACTOR

USDI Bureau of Reclamation
Pacific Northwest Construction Office
ATTENTION: Bernie Meskimen
P.O. Box 2967
Yakima, Washington 98902
(509) 575-5946
Fax: (509) 454-5622

PROJECT DESCRIPTION: **Dam Reconstruction** -Safety of Dams reconstruction of Keechelus Dam. Work includes reconstructing the earthen dam, construction of access roads, handling and stockpiling of materials, excavating and placing fill and drain in wetlands, constructing new bridges, and installing bank protection materials.

PROJECT LOCATION: **Lake Keechelus Dam - Yakima River -** Keechelus Dam adjacent to I-90, east of Snoqualmie Pass.

#	WRIA	WATER BODY	TRIBUTARY TO	1/4 SEC.	SEC.	TOWNSHIP	RANGE	COUNTY
1	39.0002	Yakima River	Columbia River	SE	27	20 North	15 East	Kittitas

PROVISIONS

1. **TIMING LIMITATIONS:** The project may begin **May 1, 2002** and shall be completed by **November 30, 2004.**

GENERAL PROJECT PROVISIONS APPLICABLE TO ALL ELEMENTS

GENERAL

2. Work shall be accomplished per plans and specifications entitled, Keechelus Dam Modification, Solicitation Number 02SP101485, dated September 21, 2001 and information submitted by USDI Bureau of Reclamation (Reclamation) to Washington Department of Fish and Wildlife (WDFW) with the Hydraulic Project application, except as modified by this Approval. A copy of these plans shall be available on-site during construction. Plan changes must be specifically approved by the WDFW field representative.

3. Temporary run-off and erosion control measures shall be employed as necessary throughout the project area to prevent discharge of sediment-laden water, earth or sediment to watercourses or wetlands. Unless specifically approved in the plan of work, there shall be no discharge of sediment, turbid water or water containing materials harmful to fish or aquatic life to water bodies or wetlands.

4. Concrete structures shall be sufficiently cured to prevent leaching of chemicals harmful to fish or aquatic life prior to removal of containment measures and allowing contact with surface water.

5. Aggregate, sand, gravel, clay or earth needed to construct the project shall be obtained from the Bureau of Reclamation designated borrow areas referred to as DSL Borrow Area, DSLE Borrow Area, Iron Horse Trail Quarry and the Crystal Springs SnoPark site, or obtained from public or commercial sources which are not in the geomorphic flood plain of the Yakima River, except that gravel may be obtained from floodplain sources where it can be clearly shown that removal of these materials is not likely to adversely affect Middle Columbia River steelhead or bull trout.

REQUIRED SALVAGE OF TREES AND SHRUBS

6. Select trees and riparian shrubs which must be removed to construct this project shall be salvaged for use on site (see restoration plans) or stockpiled at an approved stockpile site for use elsewhere in creating fish habitat and restoring shoreline vegetation. Trees and shrubs for salvage shall be identified and clearly marked on site in collaboration with WDFW. The total number of trees with intact rootwads to be salvaged shall be determined by WDFW and Reclamation at the time of marking based on the needs for restoration work, the ability to stockpile trees and the size of the trees actually salvaged for these purposes. .

7. Removal of each tree designated for salvage shall be done by excavating around the rootwad to loosen soil and then pushing the tree over so as to keep a large rootwad attached to the tree for use as in-channel Large Woody Debris (LWD). Where practical, select trees shall be removed and placed or stockpiled as whole trees (no cutting, limbing or removal of rootwads).

8. Trees and shrubs of a size suitable for machine transplanting as part of construction site or wetland restoration shall be marked in advance, removed with a trackhoe with rootballs intact, protected from dessication and replanted as soon as possible.

STAKING AND MARKING

9. The project boundary and clearing limits shall be clearly marked/staked prior to any clearing or ground disturbing activity. Sensitive areas and trees to be protected from disturbance or salvaged shall be delineated/marked so as to be clearly visible to equipment operators.

ENVIRONMENTAL COMPLIANCE INSPECTION AND REPORTING

10. The Bureau of Reclamation shall monitor and ensure contractor compliance with HPA provisions. If work occurs in violation of permit provisions, Reclamation shall immediately stop work on the particular task or project section until the problem is corrected. Reclamation shall promptly notify WDFW of any non-compliance with provisions and the actions taken to address the problem.

11. The permittee shall provide a qualified "Environmental Compliance Inspector", knowledgeable about fishes, wetlands and the environment of the upper Yakima River Basin. This inspector shall have the authority to assure compliance with plans, permit provisions and mitigation measures. This inspector shall be on site on a sufficiently regular basis to monitor work and ensure compliance with HPA provisions. The inspector shall be present during all activities of special concern identified in the approved Plan of Work and pre-construction meeting.

EQUIPMENT LIMITATIONS

12. Except for work to install containment/coffer dams, all work shall be done in isolation from surface water (i.e. wetlands, streams, Lake Keechelus, and the Yakima River). Equipment shall work from the access

roads, constructed work platforms, the bank, from the dry shoreline or dry lake bed, or from inside of containment or coffer dams.

13. Equipment operating in the shoreline zone, wetlands or associated buffers, or operating within the ordinary high water line shall be maintained in good working conditions such that petroleum products or other harmful chemicals are not leaked or spilled to these areas.

14. Equipment entering the wetted perimeter of the river, lake or tributary streams in accordance with the approved plan of work (i.e. to install containment structures, etc.) shall be cleaned prior to entering the water so as to be free of accumulations of earth, petroleum products and other materials harmful to fish life.

REQUIRED NOTIFICATIONS, MEETINGS AND SUBMITTALS

NOTIFICATION REQUIREMENT

15. The permittee or contractor shall notify the Department field office by phone (509) 925-1013 or FAX (509) 925-4702 at least 72 hours prior to starting work on those portions of this project within the ordinary high water line. Leave message for Habitat Biologist Brent Renfrow. The notification shall include the permittee's name, project location, starting date for work, and the log number for this Hydraulic Project Approval.

PRE-CONSTRUCTION MEETINGS AND SUBMITTALS

16. **Water Control Plan**. Prior to commencement of work within the ordinary high water marks, the permittee shall submit for approval a detailed water control plan showing the proposed methods for isolation of work areas from water, methods for care of the release of water from Keechelus Lake during construction, and measures to be taken to meet river flow and water quality requirements. This plan shall include back-up pump(s) installed and ready for immediate service or other satisfactory contingency measures to maintain instream flow without interruption. No work shall begin within the ordinary high water marks until a satisfactory plan is approved.

17. **Spill Prevention and Containment Plan**. Prior to commencement of work within the ordinary high water marks, the permittee shall submit for approval a detailed Spill Prevention and Containment Plan. No work shall begin within the ordinary high water marks until a satisfactory plan is approved.

18. **Plan of Work**. Prior to commencement of work, the permittee shall arrange a preconstruction meeting with WDFW, the project superintendent and key personnel to discuss and develop a detailed Plan of Work, and highlight areas of special concern. The Plan of Work shall address all elements of work related to or affecting the lake, watercourses, and wetlands. The plan shall include the timing and sequence of work, installation and removal of the temporary containment structures needed to isolate the work areas, water management in the work area, dewatering of work areas, location of settling ponds, access roads, borrow and stockpile areas, etc.. The plan of work shall describe in detail how the permittee shall ensure protection of water quality, fish and fish habitat during clearing, grubbing, and construction of the downstream drain,

outlet tunnel section, bridges, cutoff wall and embankment. No work shall begin within the ordinary high water marks until a satisfactory plan is approved and staked in the field as appropriate.

19. **Wetland Restoration and Monitoring Plan**. By August 15, 2002, the permitee shall submit to WDFW for approval a detailed wetland restoration and monitoring plan for restoring the large wetland complex immediately downstream of Keechelus Dam and monitoring the success of the restoration measures. The plan shall include the time table for restoration and the schedule for monitoring and reporting. This plan shall include landscaping and cultural measures for restoring vegetation, and structural measures to restore pre-project (i.e. 1998) hydrology to the wetland complex and stream channels. The plan shall also include a ten-year monitoring program and contingency measures to ensure that vegetation is successfully restored and that the hydrology is not adversely affected by the toe drain or other project features.

CARE AND MANAGEMENT OF WATER DURING CONSTRUCTION

TEMPORARY CONTAINMENT STRUCTURES

20. Temporary containment structures shall be in place prior to initiation of in-water work or ground-disturbing work within or adjacent to the ordinary high water line of Lake Keechelus, water courses or wetlands. Containment structures must effectively isolate the work area and prevent discharge of sediment or harmful materials to water or wetlands.

21. Containment structures placed or worked in water shall be installed using only clean materials (e.g. sand bags, "ecology blocks", plastic sheeting, washed gravels, etc.) until the structure is closed and the work area fully contained. Only clean materials shall be allowed on the outboard side of structures. After the work area is contained, materials containing fines may be used within the contained area if necessary.

22. Removal of containment structures and cofferdams shall be done in the reverse of the sequence in which they are installed. Removal shall be done in a manner which minimizes the release of fine sediment to water or wetlands. Materials used in the temporary containment structures shall be removed from the site and disposed of in approved locations.

DEWATERING OF WORK AREAS

23. During initial dewatering of work areas, turbid water shall be pumped to an upland area to allow fines to settle out before the water re-enters the river. Subsequent pumping to remove clean water infiltrating through sands and gravels may be discharged directly to water courses and wetlands provided that: a) a perforated sump chamber is installed away from the main work area to intercept the inflow, b) waste water containing raw concrete or other harmful materials is NOT reaching the sump chamber, c) water being pumped from the sump is clear (no suspended solids or turbidity), and d) state water quality standards are satisfied. Lines discharging water shall be equipped with a diffusing device which shall prevent the scouring and dislodging of fine sediments from the bank or bed of the watercourse or wetlands.

24. Wastewater containing earth, silt or contaminants (e.g. bentonite, raw concrete, etc.) shall be pumped to an upland area where these contaminants shall be treated and removed from the water. Care shall be taken to ensure no harmful material (e.g. fresh cement, petroleum products, wood preservatives, toxic chemicals, etc.)

are allowed to enter the water of the river, lake, streams or wetlands. (Note that raw concrete is toxic to fish and other aquatic life.)

SETTLING PONDS

25. Settling ponds shall be located in upland sites away from watercourses and wetlands, or at specifically approved locations. Water and erosion control measures shall be taken at all sites so as to prevent transport of sediment or harmful materials (e.g. fresh cement, petroleum products, bentonite, chemicals, etc.) to waters or wetlands.

MAINTENANCE OF INSTREAM FLOW BELOW DAM

26. Flows released from the dam to the river shall be set at approximately 100 cfs by September 10th. Once spawning of chinook and bull trout occurs downstream from the dam, there shall be no reduction in flow released from the dam except as follows: a) flow below the dam may be reduced to 70 cfs for a period of time not to exceed 24 hours to allow installation and removal of low flow bypass facilities as per the approved water control plan; and b) flow below the dam may be reduced to less than 100 cfs IF, based upon the location and distribution of redds, Reclamation's ability to operate, and recommendations of SOAC, WDFW and Reclamation concur that a lower instream flow is acceptable.

27. After September 10th, WDFW shall be notified prior to altering flows. Leave message for John Easterbrooks (509) 457-9330 and Brent Renfrow (509) 925-1013. Except for emergency actions, notification shall be at least 72 hours in advance of the anticipated change.

28. During the period when the dam's outlet works are blocked to replace the outlet conduit section, river flow shall be monitored continuously to ensure that the bypass system is functioning adequately and that there is no disruption of water flow to the river.

29. Sufficient measures shall be taken to prevent sediment from entering the river from the bypass operations or from construction-related discharges from the work area. If pumps are used to bypass flow to the river, the pump intake shall be located where only clean water will be drawn into the pump. If necessary to obtain proper submergence of the intake, a pool sufficient to accommodate the pump intake and pump screen may be excavated in the lake bed at the location of the intake. The pump outlet shall be equipped with a diffusing device or located where the discharge will not mobilize fine materials nor scour the river bank or bed. There shall be no increase of turbidity (over background) permitted in the river below the project.

30. If pumps are used to bypass flow to the river, the pump system shall be equipped with a fish guard (screen) to prevent passage of fish into the pumps. The screen shall be consistent with the current WDFW screening criteria (copy attached). Screen maintenance shall be adequate to maintain screen criteria and to prevent injury or entrapment to juvenile fish. The screen shall remain in place whenever water is withdrawn through the pump intake.

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CLEARING AND GRUBBING OF CONSTRUCTION AREA

TREE AND STUMP REMOVAL

31. All work within wetlands or watercourses shall be done in isolation from the wetted perimeter, or performed during a period when the site is dry.

32. The work area shall be protected from erosion. Water and sediment control measures shall be installed and maintained to prevent discharge of earth or silty water to wetlands or watercourses.

EMBANKMENT REMOVAL AND RECONSTRUCTION

REMOVAL AND RECONSTRUCTION OF EXISTING EMBANKMENT

33. Work shall be performed per the plans and specifications and as detailed in the approved Plan of Work (refer to provision #18 above).

34. Any surplus or waste embankment material shall be disposed of at approved location(s) outside of the Yakima River floodplain.

OUTLET WORKS AND OUTLET CHANNEL

REPLACEMENT OF PORTION OF OUTLET CONDUIT

35. Work shall be done in the dry.

36. Any concrete or grout shall be sufficiently cured prior to contact with water to avoid leaching of materials harmful to fish. (Note that raw concrete is toxic to fish and other aquatic life.)

RIPRAP

37. Grouted riprap installation in the outlet channel shall be placed in the dry.

CLEARING AND MODIFICATION OF OUTLET CHANNEL BANKS

38. To prevent sloughing of earth into the outlet channel and the Yakima River, the outlet channel shall be isolated from the excavation area during bank sloping by a temporary containment barrier of ecology blocks or equivalent, durable and sturdy containment barrier.

SPILLWAY AND OUTLET CHANNEL BRIDGES

GENERAL

39. The work areas at each bridge site shall be separated from the channel by a secure barrier that shall prevent sloughing or erosion of earth and fine material from the work area into the water course.

REMOVAL OF EXISTING BRIDGES

40. Prior to bridge removal, any accumulation of earth or traction material on the bridges shall be carefully removed in a manner which does not discharge this material to the watercourse. Waste material shall be disposed of in approved locations.

41. The existing steel bridges shall be removed in a manner which does not damage the beds or banks of the watercourses. Bridge members shall be fully suspended while being removed from across the channel. There shall be no dragging of the bridge members through the riverbed or across the face of the bank.

BRIDGE CONSTRUCTION

42. During preparation of abutments, adequate containment shall be provided to prevent discharge of earth, raw concrete, grout, chemicals or other harmful material to the channel.

43. The new bridges shall be installed in a manner as to not damage the beds or banks of the watercourses. Bridge members shall be suspended while being placed across each channel. There shall be no dragging of bridge members through the channel or across the face of the bank.

44. During grouting or pouring of concrete, the bridges shall be draped or sealed to prevent leakage of raw cement or other harmful materials, or leakage of water contaminated with such materials to the watercourses.

45. Bridge approach material shall be structurally stable and protected from erosion. Adequate drainage facilities shall be incorporated in the roadway and bridge approach material to direct road runoff away from the bridge and into biofiltration swale or other suitable stormwater treatment area.

46. Curbs or wheel guards shall be installed on each bridge.

GATEHOUSE BRIDGE

BRIDGE REPLACEMENT

47. Removal of the existing bridge and installation of the new gate house bridge shall be done in a manner which does not allow earth, debris or waste materials to be entrained in to the outlet of the reservoir and discharged to the Yakima River.

DOWNSTREAM DRAIN CONSTRUCTION

WORKSITE LIMITATIONS

48. All work shall be done in isolation from surface water. All sediment shall be contained within the work area boundary.

49. The equipment travel routes, clearing limits, and excavation limits shall be clearly staked in the field prior to beginning work within the wetland complex. The wetland outside of the construction area shall be clearly marked in the field and separated from the construction area with silt fence or equivalent barrier.

50. During construction, water in the drain trench shall be pumped to suitable location for treatment. Following treatment, this water shall be directed back to the wetland complex to help maintain the natural soil water table. Clean water infiltrating into the drain trench may be discharged directly to the wetland area in a manner consistent with provision #23 above.

TRENCH EXCAVATION AND INSTALLATION OF DRAIN IN WETLAND

51. Equipment operating within the delineated areas of the wetlands shall be maintained in good working condition such that petroleum products and other harmful materials are not leaked to wetlands.

52. All wetland soils removed during trench excavation shall be transported to the borrow pit or other approved site for temporary stockpiling for use in final restoration of the borrow pit.

DOWNSTREAM DRAIN OUTFALLS

53. Outfall to the Yakima River shall be constructed in isolation from the flowing water of the river.

54. The outfall shall be protected from erosion.

FISH PASSAGE IN LAKE KEECHELUS TRIBUTARY STREAMS DURING DAM CONSTRUCTION

TEMPORARY FISH PASSAGE DURING RESERVOIR DRAWDOWN

55. During the time period that Keechelus Reservoir is drawn down below the average low pool elevation (approximately elevation 2456), Reclamation shall monitor fish passage from Lake Keechelus into the major tributary streams to Lake Keechelus (i.e. Gold Creek, Meadow Creek and Coal Creek) at least two times per week. If passage is impaired, permittee shall immediately report this information to WDFW and consult with WDFW to determine what corrective measures shall be taken to provide passage (e.g. temporary flume, minor channel modification, permanent channel modification, etc.). Reclamation shall construct corrective measures as soon as possible but not later than seven days after determining that passage is impaired.

FISH PASSAGE AT KEECHELUS DAM OR ALTERNATIVE

56. Permittee shall immediately conduct a project-wide assessment of fish passage at all Yakima Project reservoirs. This assessment shall be done in collaboration with WDFW and the first phase of the assessment shall be completed and distributed by January 31, 2003. The first facility to be considered in this project-wide assessment shall be Keechelus Dam. The assessment shall include investigations as to the engineering, constructability and biological considerations of fish passage at each facility. The assessment shall include consideration of the potential fish production and likelihood of sustainability above each dam using a mutually acceptable assessment tool. Phase II of the assessment shall prioritize where fish passage is

determined to be desirable and practicable, based upon the results of the phase I assessment. Phase II shall focus on engineering feasibility, cost, water management implications, and biological parameters for restoring specific stocks. Phase II of the assessment shall be completed by January, 2004. Where fish passage is determined to be both desirable and feasible, the permittee shall seek funding and complete design and construction of fish passage facilities in a timely manner. A separate HPA or HPA amendment is required for construction of these facilities. Where fish passage is determined to be undesirable or impractical, based upon the results of this assessment, Reclamation shall negotiate with WDFW an alternative to providing fish passage consistent with state law. The net benefit of this alternative shall provide equal or greater productivity and ecological function than that predicted for fish passage facilities if constructed at the dam(s).

57. **The Permittee shall immediately begin the assessment of Keechelus Dam as per provision #56 above, and determine whether the proposed design and construction of the Safety of Dams Project will adversely affect the feasibility, cost or efficacy of fish passage facilities at this dam. Reclamation shall modify the Safety of Dams work as necessary to ensure that the proposed Safety of Dams reconstruction-related actions at Keechelus Dam will not result in significant additional costs for retrofitting fish passage facilities at Keechelus Dam nor require future modification of the portions of the dam being reconstructed as part of the SOD work.**

58. **The Permittee shall provide interim fish passage (e.g. trap and haul program) in collaboration with WDFW at facilities where fish passage is desirable based upon the results of the project-wide passage assessment.** Interim passage shall be provided at locations agreed upon by the fish management entities as soon as possible but not later than one year from completion of Phase II of the passage study.

SITE RESTORATION

GENERAL SITE RESTORATION

59. Settling ponds and other earthworks within the ordinary high water mark of Lake Keechelus shall be recontoured to original grade, unless an alternate restoration/grading plan is specifically approved by WDFW.

60. All earth areas adjacent to the watercourse which have been exposed or disturbed by this project are to be graded to a stable grade, seeded with a suitable erosion control seed mix which includes native grasses and forbs, and protected from erosion with a straw mulch or equivalent.

61. Riparian and wetland plantings shall be cared for and maintained as per the monitoring plan, so as to ensure survival and rapid establishment of a robust plant community.

LONG-TERM WETLAND RESTORATION

62. Permittee shall complete the implementation of the approved wetland restoration plan by **November 30, 2004.**

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63. The wetland channels shall be restored to include complex large woody debris such as rootwads or small debris jams, etc.. The banks of the channel, where not fully vegetated, shall be planted with appropriate native plants adapted to streamsides and wetlands.

POST-CONSTRUCTION MONITORING

WETLAND COMPLEX RESTORATION MONITORING

64. The permittee shall monitor the performance and function of the wetland complex, the impacts of the new toe drain on the wetland and flow within the wetland channels, the success in restoration of pre-1998 wetlands hydrology and the success of revegetation of the areas disturbed during construction. Monitoring shall also assess whether mitigation objectives described in the EIS are achieved. Project monitoring shall be as per the approved submitted monitoring plan, and shall include a detailed inspection with sampling and photo documentation and written report submitted to WDFW for approval for one, three, five and ten years post construction. Copies of the monitoring results shall be sent to WDFW following each periodic site review. Any failures of features or revegetation and any deficiencies in performance shall be corrected in a timely fashion. Any corrective action which requires work within the lake, river, wetland or stream channels shall require specific approval from WDFW.

65. If monitoring results indicate that the restoration plan is not successful (i.e. wetland hydrology is not fully restored or that areas remain where native vegetation has not been successfully established) by year five the permittee shall develop a contingency plan to address the restoration deficiencies. The permittee shall submit this plan to WDFW for review and approval, and implement the approved corrective measures in a timely fashion.

SEPA: DS, Adoption of Existing Environmental Document and addendum - Washington Department of Ecology, April 8, 2002

APPLICATION ACCEPTED: April 17, 2002 **ENFORCEMENT OFFICER:** Rogers 125 [P1]

Brent Renfrow
Area Habitat Biologist **(509) 925-1013**

For Director
WDFW

Enclosures: Location map, site plan, construction boundary map, and project narrative

State of Washington
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GENERAL PROVISIONS

This Hydraulic Project Approval (HPA) pertains only to the provisions of the Fisheries Code (RCW 77.55 - formerly RCW 75.20). Additional authorization from other public agencies may be necessary for this project.

This HPA shall be available on the job site at all times and all its provisions followed by the permittee and operator(s) performing the work.

This HPA does not authorize trespass.

The person(s) to whom this HPA is issued may be held liable for any loss or damage to fish life or fish habitat which results from failure to comply with the provisions of this HPA.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All HPAs issued pursuant to RCW 77.55.100 or 77.55.200 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The permittee has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All HPAs issued pursuant to RCW 77.55.110 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the permittee: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.170.

APPEALS - GENERAL INFORMATION

IF YOU WISH TO APPEAL A DENIAL OF OR CONDITIONS PROVIDED IN A HYDRAULIC PROJECT APPROVAL, THERE ARE INFORMAL AND FORMAL APPEAL PROCESSES AVAILABLE.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.100, 77.55.110, 77.55.140, 77.55.190, 77.55.200, and 77.55.290:
A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:
   (A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA; or
   (B) An order imposing civil penalties.
It is recommended that an aggrieved party contact the Area Habitat Biologist and discuss the concerns. Most problems are resolved at this level, but if not, you may elevate your concerns to his/her supervisor. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30-days of the denial or issuance of a HPA or receipt of an order imposing civil penalties. The 30-day time requirement may be stayed by the Department if negotiations are occurring between the aggrieved party and the Area Habitat Biologist and/or his/her supervisor. The Habitat Protection Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or its designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.100 OR 77.55.140:

State of Washington
Department of Fish and Wildlife
Region 3 Office
1701 South 24th Avenue
Yakima, Washington 98902-5720

DATE OF ISSUE: April 17, 2002 **LOG NUMBER:** 00-E1998-01

A person who is aggrieved or adversely affected by the following Department actions may request an formal review of:

(A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA;
(B) An order imposing civil penalties; or
(C) Any other "agency action" for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091, shall be plainly labeled as "REQUEST FOR FORMAL APPEAL" and shall be RECEIVED DURING OFFICE HOURS by the Department within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.110, 77.55.200, 77.55.230, or 77.55.290:
A person who is aggrieved or adversely affected by the denial or issuance of a HPA, or the conditions or provisions made part of a HPA may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS RESULTS IN FORFEITURE OF ALL APPEAL RIGHTS. IF THERE IS NO TIMELY REQUEST FOR AN APPEAL, THE DEPARTMENT ACTION SHALL BE FINAL AND UNAPPEALABLE.

SETTLEMENT AGREEMENT

Confederated Tribes and Bands of the Yakama Nation v. J. William McDonald, et al.,
9th Cir. Docket No. 03-35229,
District Court No. CY-02-3079-AAM (E.D. Wash.)

WHEREAS, the parties consent to execution of this Settlement Agreement (Agreement) in full settlement of all issues arising in *Confederated Tribes and Bands of the Yakama Nation v. J. William McDonald, et. al.*, 9th Cir. Docket No. 03-35229, District Court No. CY-02-3079-AAM (E.D. Wash.),

WHEREAS, the parties have conferred and engaged in negotiations pursuant to the Mediation Program of the U.S. Court of Appeals for the Ninth Circuit,

WHEREAS, this Settlement Agreement is the result of each party's good faith effort to resolve this case,

WHEREAS, each government party to this Settlement Agreement desires to work within the framework of a government-to-government relationship,

WHEREAS, the parties agree that this Settlement Agreement constitutes a fair resolution and compromise of this matter and its underlying competing contentions,

WHEREAS, the parties intend that this Settlement Agreement completely resolve, as among them, all issues raised in this case, or that could properly have been raised in this case, and that this Settlement Agreement is binding upon the parties, and

WHEREAS, though intended to resolve all issues in this case, this Settlement Agreement primarily addresses the establishment of a cooperative framework among the parties for achieving the ultimate goal of passage of anadromous fish at all U.S. Bureau of Reclamation (BOR) irrigation water storage facilities within the Yakima Basin where feasible, as well as anadromous fish reintroduction and habitat restoration efforts,

THE PARTIES AGREE AS FOLLOWS:

1. The Yakama Nation agrees to voluntarily dismiss its appeal in this action before the U.S. Court of Appeals for the Ninth Circuit, with prejudice.

2. BOR agrees to use its existing congressional authority and funding under § 1206 of the Yakima River Basin Water Enhancement Project (YRBWEP), Pub. L. No. 103-434, 108 Stat. 4550, 4560 (1994), to implement interim juvenile (downstream) fish passage measures at Cle Elum Dam, as developed by the Technical Yakima Basin Storage Fish Passage Work Group described in ¶ 6(a). BOR has implemented interim juvenile (downstream) fish passage at Cle Elum Dam and shall continue to do so per this paragraph.

3. "Interim" is defined throughout this Settlement Agreement as the period of time from the execution date of this document to the time at which permanent adult (upstream) and/or

juvenile (downstream) fish passage is implemented, or to the time at which the Regional Director, Pacific Northwest Region, BOR, concludes that permanent adult (upstream) and/or juvenile (downstream) fish passage is infeasible, for Cle Elum and Bumping Lake Dams as described in ¶ 7.

4. The parties agree to study and develop feasible measures, if any, for inclusion in a Cooperative Technical Plan for permanent juvenile (downstream) and adult (upstream) fish passage implementation at Cle Elum and Bumping Lake Dams.

5. BOR agrees to provide up to $65,000.00 in annual funding to the Yakama Nation for cooperative planning activities by the Yakama Nation Fisheries Resource Management Program, beginning in FY 2005 and continuing until submission of the planning report to the Office of the Secretary as described in ¶ 7. To receive this funding, the Yakama Nation must enter into an appropriate financial agreement with BOR, and thereafter comply with the terms of that financial agreement, or any future agreement executed to provide additional funding to the Yakama Nation. After the planning report is submitted to the Office of the Secretary as described in ¶ 7, BOR's funding obligations to the Yakama Nation shall cease.

6. BOR will develop the Cooperative Technical Plan in accordance with the following principles:

a. The Technical Yakima Basin Storage Fish Passage Work Group shall provide technical assistance in the development of biological and engineering measures for anadromous fish passage and reintroduction of anadromous fish above the Yakima Project storage dams. The Work Group shall provide technical assistance in the evaluation and monitoring of such measures upon implementation. This Work Group may consist of biologists and engineers from BOR, the Yakama Nation, irrigation interests, NOAA Fisheries, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the Washington Department of Fish and Wildlife.

b. To the extent that interim fish passage measures are implemented, the Cooperative Technical Plan shall include a proposed program to monitor and evaluate the performance of the fish passage measures at Cle Elum and Bumping Lake Dams and a proposal for authorization of participation by, and funding for, the Yakama Nation in the monitoring and evaluation activities.

c. The Cooperative Technical Plan will include a section discussing whether existing data from Cle Elum and Bumping Lake Dams and from the monitoring programs discussed in ¶ 6(b) can be used in the development of additional plans for fish passage measures at other BOR dams in the Yakima Basin, including Keechelus, Kachess, and Tieton Dams. The section shall also identify uncertainties and additional data necessary to determine the feasibility of fish passage at these three dams.

7. Consistent with federal law and applicable planning principles and standards, the Regional Director, Pacific Northwest Region, BOR, shall prepare a planning report with regard to the feasibility of implementing permanent fish passage at Cle Elum and Bumping Lake Dams. BOR shall include the Cooperative Technical Plan in BOR's administrative record for this

planning report and in the report itself as an appendix. The planning report shall include the Regional Director's recommendations and conclusions with respect to the feasiblity of implementing permanent juvenile (downstream) and adult (upstream) fish passage implementation at Cle Elum and Bumping Lake Dams. BOR shall submit, through appropriate Departmental channels, the Regional Director's planning report and any other required documentation to the Office of the Secretary, U.S. Department of the Interior, for consideration.

8. Within six months of the completion of the planning report for Cle Elum and Bumping Lake Dams outlined in ¶ 7, the parties shall meet to discuss whether the Technical Yakima Basin Storage Fish Passage Work Group should study and develop additional plans (consistent with federal law and applicable planning principles and standards) with regard to the feasibility of implementing permanent adult (upstream) and juvenile (downstream) fish passage at Kachess, Keechelus and Tieton Dams within the Yakima River Basin. If the parties agree that additional plans are warranted, they shall attempt to negotiate a memorandum of agreement outlining the process and establishing deadlines for the completion of additional plans addressing passage at Kachess, Keechelus, and Tieton Dams.

9. Designated representatives of the parties shall meet on a semiannual basis to discuss the progress of the implementation of the Settlement Agreement.

10. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define or interpret the rights of the Yakama Nation under the Treaty of June 9, 1855. The parties do not construe this Settlement Agreement to waive, abrogate, diminish, define or interpret the Treaty rights of the Yakama Nation.

11. Nothing in this Agreement shall be construed to limit or modify the discretion accorded to the Federal Defendants, by the Endangered Species Act, 16 U.S.C § 1531 et seq., the Administrative Procedures Act, 5 U.S.C. §§ 551-559, 701-706, or other federal laws.

12. This Agreement shall not be construed as an admission or agreement by any party, whether plaintiff, defendant or intervenor, as to the validity or legitimacy of any or all of any party's factual or legal contentions made in this case, including but not limited to any party's contentions regarding Yakama Nation Treaty rights.

13. Except as set forth in this Agreement, all parties reserve and do not waive any and all other legal rights and remedies.

14. Nothing in this Agreement shall be construed to obligate the United States to pay any attorney's fees or costs associated with this case.

15. The parties agree that the United States shall not be liable for costs or attorney's fees under the Equal Access to Justice Act, 28 U.S.C. § 2412 or the Endangered Species Act, 16 U.S.C. 1540(g).

16. No provision of this Agreement shall be interpreted to constitute a commitment or requirement obligating the United States to pay funds in violation of the Anti-Deficiency Act, 31 U.S.C. § 1341, and nothing herein shall be construed to obligate the United States to expend or

involve the United States in any contract or other obligation for future payment of money in excess of appropriations authorized by law and administratively allocated for the purposes and projects contemplated hereunder.

17. No member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this Agreement or to receive any benefit that may arise out of it other than as a water user or landowner in the same manner as other water users or landowners.

18. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define, interpret or impair the rights of the landowners/water users, irrigation districts, water companies or municipalities which receive their water from or through BOR operated reservoirs, dams or other facilities.

19. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define, interpret or impair the obligation or ability of BOR to deliver water in accordance with its contracts and obligations provided by the 1945 Judgment in *KRD, et al. v. SVID et al.*, Civil 21, US. District Court (ED Wash.), and the water rights adjudicated in *Washington State Dept. of Ecology v. Acquavella*, Yakima County No. 77-2-01484-5.

20. The parties disagree as to whether reintroduced fish stocks or species, if any, and restoration of habitat for such reintroduced stocks or species constitute "enhancement" of fish life as defined in *Washington State Dept. of Ecology v. Acquavella*, Yakima County No. 77-2-01484-5. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define, or interpret the rights of any parties with regard to this issue. The parties expressly reserve their rights, as well as any arguments, on this issue.

21. This Agreement constitutes the final, complete and exclusive agreement and understanding among the parties hereto with respect to the matters addressed herein. There are no representations, agreements or understandings relating to this Agreement other than those expressly contained herein. All prior communications, discussions, drafts, meetings or writings of any kind are superseded by this Agreement and shall not be used by any party to vary, contest or otherwise interpret the terms of this Agreement.

22. In the event of a disagreement among the parties concerning the interpretation or performance of any aspect of this Agreement, the dissatisfied party shall provide the other parties with written notice of the dispute and a request for negotiations. Within 30 days of the date of the written notice, or such time thereafter as the parties may mutually agree upon, the parties shall meet and confer in an effort to resolve their differences. If the parties are unable to reach agreement within 30 days of such meeting, the dissatisfied party may seek appropriate resolution by filing the appropriate complaint based on applicable law.

23. Any notice required or made with respect to this Agreement shall be in writing and shall be effective upon receipt. For any matter relating to this Agreement, the contact persons are:

For Plaintiff

Tom Zeilman
15 North 15th Avenue
Yakima, Washington 98902

For Defendant

Area Manager
Upper Columbia Area Office
U.S. Bureau of Reclamation
1917 Marsh Road
Yakima, WA 98901

24. The parties may agree in writing to modify any provision of this Agreement.

25. The undersigned representatives of each party certify that they are fully authorized by the party or parties they represent to agree to the terms and conditions of this Agreement and do hereby agree to the terms herein.

For the Bureau of Reclamation:

J. William McDonald

Sept. 1, 2006
Date

J. WILLIAM MCDONALD
Regional Director
Pacific Northwest Region
Bureau of Reclamation
U.S. Department of the Interior

For the Yakama Nation:

Lavina Washines

Dec 6-06
Date

Chairman
Yakama Tribal Council