Draft Environmental Assessment
Downstream Fish Enhancement for Juvenile Salmonids
at
Fall Creek Dam, Lane County, Oregon

October 2014

US Army Corps
of Engineers ®
Portland District

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effect
BiOp	Biological Opinion
BPA	Bonneville Power Administration
Corps	U.S. Army Corps of Engineers, Portland District
CFS	Cubic Feet Per Second
CWA	Clean Water Act
DSP	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FONSI	Finding of No Significant Impact
HABS	Harmful Algae Bloom Surveillance
ITS	Incidental Take Statement
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRHP	National Register of Historic Places
OCS	Oregon Conservation Strategy
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
RM&E	Research, Monitoring, and Evaluation
RPA	Reasonable and Prudent Alternative
SHPO	State Historic Preservation Office
TCP	Traditional Cultural Property
USFWS	U.S. Fish and Wildlife Service
UWR	Upper Willamette River
TDG	Total Dissolved Gas
TMDL	Total Daily Maximum Load
WATER	Willamette Action Team for Ecosystem Restoration
WVP	Willamette Valley Project

CHAPTER 1 – INTRODUCTION

The U.S. Army Corps of Engineers, Portland District (Corps) is proposing annual winter drawdown of water elevations at the Fall Creek Reservoir, on the Middle Fork of the Willamette River and is responsible for compliance with the National Environmental Policy Act (NEPA), which is furthered by the documentation in this draft Environmental Assessment (EA). These drawdowns would be to lower elevations than previous to aid in passage and survival of juvenile salmon and steelhead (salmonids).

Fall Creek is part of a system of 13 multi-purpose dams and reservoirs that make up the Willamette Valley Project (WVP) (Figure 1). These dams and reservoirs work in conjunction serve the Willamette Valley in a variety of ways. The WVP was authorized by a variety of Flood Control Acts passed in 1938, 1950, 1954, and 1960. The Flood Control Act of 1950, as set forth in House Document 531, was critical in providing a comprehensive plan for flood control, navigation, and other purposes for the WVP. Although there are multiple project authorities pertaining to development of the WVP, the Flood Control Act of 1950 is the primary overall guiding legislation. As the projects were originally authorized under the various Flood Control Acts, the flood risk management mission is the Corps' highest priority for the WVP.

Fall Creek Dam, completed in 1966, is a multi-purpose storage project that operates to meet the authorized purposes of flood damage reduction, irrigation, fish and wildlife management, recreation, navigation, and improved downstream water quality. No hydropower exists at Fall Creek Dam, and therefore there are no turbines. In compliance with reasonable and prudent alternative (RPA) 4.8 of the 2008 Biological Opinion (BiOp) issued by the National Marine Fisheries Service (NMFS 2008) under the Endangered Species Act (ESA) for operation of the Willamette Basin dams, the Corps has drawn down the reservoir to run-of-river or near run-of-river conditions for one week in December during the last four winters. The purpose of the proposed action is to include this one week late fall/early winter drawdown, over a period of up to two weeks, as a permanent operation at Fall Creek Dam to benefit downstream passage of juvenile salmonids, specifically Upper Willamette River (UWR) Chinook salmon and UWR steelhead, both of which are listed as threatened under the Endangered Species Act (ESA). Bull trout, another federally-listed species, do not occur in the vicinity of Fall Creek Dam. Oregon chub, a federally-listed species occur downstream of the dam, but are planned to be delisted in fall of 2014.

Two alternatives are being considered and analyzed: The No Action Alternative and the Preferred Alternative. The Preferred Alternative was arrived at based on knowledge of salmonid ecology in association with dams and monitoring during the past three years of drawdown operations. The No Action Alternative would maintain the status quo of reservoir operations and fish passage at Fall Creek Dam prior to the interim measures conducted over the past four years and as detailed in the water control manual that guides reservoir management of Fall Creek and other dams in the WVP. For the No Action Alternative, the Corps would drawdown the reservoir in the late fall/early winter of each year to prepare for flood risk protection without the deep draw down for fish passage; this occurred routinely prior to implementation of interim measures over the past four years. Although the No Action Alternative does not meet the purpose and need

for action, it is being considered in order to discern the relative merits and disadvantages of the Preferred Alternative when compared to taking no action.

The Preferred Alternative involves drawing the reservoir down to run-of-river for a maximum of two weeks in late fall/early winter. The Preferred Alternative would draw the reservoir down to a lower water surface elevation than normal in order to bring the surface water elevation closer to the regulating outlet in the dam to aid salmon and steelhead, which are surface-oriented as juveniles, in locating the regulating outlets. Creating run-of-the-river flow conditions provides more favorable passage conditions than those presented by higher flows with higher reservoir levels; this is because of lower pressure and lower sheer forces during passage that would result from lower reservoir elevations and also improved accessibility to the regulating outlets. This action involves deviating from the established operations of releasing and storing water according to the existing rule curve for Fall Creek Reservoir; the rule curve identifies reservoir levels during the year to which management of reservoir elevations is based. Flood risk management would remain the priority operation. Monitoring of water quality and fish passage would continue at the dam provided that funding is available.

Implementation of the Preferred Alternative would lower Fall Creek Reservoir to an elevation lower than what is specified in the existing water control manual and hold the reservoir at this lower elevation for up to two weeks in late fall/early winter.

The biggest environmental concerns are water quality, fish (including ESA listed species), and cultural resources. In general, water quality has been a concern within the WVP area since the completion of the dams. Over the years, several water quality parameters such as temperature, dissolved oxygen, and turbidity exceeded water quality standards. In 2006, the Oregon Department of Environmental Quality (ODEQ) established total maximum daily loads (TMDLs) for stream segments in the Willamette River that do not meet water quality standards, and these stream segments are listed under Section 303(d) of the Clean Water Act (CWA).

A number of native and non-native fish species occur in the Middle Fork subbasin of the Willamette River. Salmonids occurring in the vicinity of Fall Creek Dam include Chinook salmon, steelhead, and cutthroat trout. Bull trout occur at other locations within the subbasin but not at Fall Creek. ESA listed species include UWR Chinook and UWR steelhead. Oregon chub are present downstream of Fall Creek Dam but are in the process of being delisted and likely will be before drawdown would occur in December. Downstream fish migration through the WVP has its own unique difficulties as fish leave their redds in streams above the reservoirs and work their way through the dams. Fall Creek Dam does not have upstream or downstream fish passage facilities; adult salmon and steelhead are trucked around the dam on their upstream migration. The only possibility for downstream access occurs either through fish horns or dam regulating outlets. Fish use of regulating outlets at Fall Creek Dam is linked to reservoir elevation and depth to the outlets, which fluctuates seasonally by tens of meters.

Limited archeological surveys have taken place both near and within the Fall Creek Reservoir drawdown zone. Recent archeological investigations just on the downstream side of Fall Creek Dam identified intact, buried cultural resources almost 1 meter in depth in an area previously thought disturbed. Cultural resources identified within the Fall Creek reservoir consist of

prehistoric and historic archeological sites. None of these cultural resources have been evaluated for eligibility for listing to the National Register of Historic Places (NRHP). No traditional cultural properties have been identified within or near Fall Creek Dam.

Under the No Action Alternative, the effects to water quality, fisheries [including ESA listed species], and cultural resources would remain the same as existing conditions. Under the Preferred Alternative, effects to water quality are minimal, and effects to fisheries are expected to be positive. Water quality effects are minimal because, while there are turbidity increases downstream with drawdown, these impacts are short in duration.

Under the Preferred Alternative, the Corps expects there would be a beneficial impact to downstream migrating juvenile salmonids. As reservoirs are drawn lower, the opportunity to find a regulating outlet to migrate through improves for surface-oriented juvenile salmonids. Even with these opportunities, it is still likely that there would be take of ESA-listed species but is expected to be less than the operation under the No Action Alternative. Under former conditions prior to recent winter drawdowns at Fall Creek Dam, juvenile salmonids went through regulating outlets under higher flow conditions because of higher reservoir water elevations, and under higher pressure because of greater depth of regulating outlets. Higher flows and pressure result in greater likelihood of mortality during passage through the dam because of baro-trauma and injury due to sheer forces. NMFS and U.S. Fish and Wildlife Service (USFWS) have allowed for a take while accomplishing the Reasonable and Prudent Alternative (RPA) described in their BiOps published in 2008 by incorporation of an incidental take statement (ITS). The proposed action would not increase the amount of take from that authorized in the ITS.

The potential exists for impacts to occur to known, and perhaps unknown, cultural resources within the Fall Creek Reservoir drawdown zone. However, the conditions and extent of intact cultural resources at these locations is only known for a few select locations. Historic properties inventory work can be difficult in the drawdown zone because it is not practicable to study the area until the drawdown occurs and conditions vary due to the dynamic nature of the reservoir when it is at full pool. A determination of eligibility for the NRHP has been completed for five of the 34 identified archeological sites within the drawdown zone at Fall Creek, the remaining sites have not had DOE's completed. While Section 106 consultation has been initiated with the Oregon State Historic Preservation Office regarding the Fall Creek drawdown, a consensus determination for these sites has not yet been reached. The Corps has reached a determination of adverse effects due to the effects of the reservoir on these resources. Due to the scale of historic property inventory and DOE's that has yet to occur, a Programmatic Agreement with the SHPO for operation of all of the Willamette Basin dams and reservoirs is proposed and currently underway to provide for long-term management and mitigation of effects to both known and as of yet unknown historic properties.

In accordance with NEPA, federal agencies are required to disclose potential environmental impacts for proposed actions and make efforts to involve the public. A draft EA for the Downstream Fish Enhancement for Juvenile Salmonids at three Willamette Valley Dams (Fall Creek, Hills Creek, and Cougar) was previously released for public review, but the EA was not finalized. Because of environmental issues associated with the Preferred Alternatives for Hills Creek Dam and Cougar Dam, these two components of the original EA have been eliminated.

The present EA describes the No Action and Preferred Alternatives associated only with Fall Creek Dam. For the proposed action, the Corps is the lead Federal agency for compliance with NEPA. As the lead Federal agency, the Corps ensures overall compliance with all associated environmental laws and regulations regarding the proposed federal action and has prepared this draft EA for compliance with NEPA for fish enhancement actions at Fall Creek.

CHAPTER 2 - PURPOSE AND NEED FOR ACTION

2.1 Purpose

In compliance with NMFS' RPA measure 4.8 of their 2008 BiOp, the Corps implemented drawdown to run-of-river at Fall Creek Dam within the WVP for four years (2010-2013). The purpose of the proposed action is to make this deep drawdown a standard operation. The proposed action would not involve any structural modifications to the dam but rather utilize existing regulating outlets and modify normal operation practices. This proposed action would facilitate downstream volitional migration of ESA-listed juvenile UWR Chinook salmon and UWR steelhead and decrease fish injury and mortality that occurs during fish passage under normal operations. With improved downstream passage of juvenile salmon, that the Corps expects this would improve both fish productivity and abundance in general.

2.2 Need

The need for the proposed action is to facilitate downstream passage of ESA-listed UWR Chinook salmon and UWR steelhead in a manner that increases the number of fish moving downstream while simultaneously decreasing fish injury and mortality. Anthropomorphic changes over the last century have led to a decline in fish populations, habitat, and water quality within the Willamette River system in general. Further, passage of juvenile fish through Fall Creek Dam, as well as the other WVP dams, has had limited success. The Corps recognizes these problems and has coordinated with fisheries biologists from NMFS and Oregon Department of Fish and Wildlife (ODFW) to identify the proposed action as a potential solution at Fall Creek Dam.

In addressing this need, the Corps also would comply with Section 7 of ESA. In 2008, NMFS issued a Biological Opinion (BiOp) on the Willamette River Basin Flood Control Project. As part of the BiOp several, RPAs were identified to enhance recovery of ESA-listed species. RPA measure 4.8 states that "*Until permanent downstream passage facilities are constructed or operations are established at Project dams and reservoirs in subbasins where outplanting of UWR Chinook salmon and steelhead is underway, the Action Agencies will carry out interim operational measures to pass downstream migrants as safely and efficiently as possible downstream through Project reservoirs and dams under current dam configurations and physical and operational constraints, and consistent with authorized Project purposes."* The Preferred Alternative addresses an operation that is desired to be established as permanent based on research results of interim operations over the past four years.

2.3 Justification for Permanent Operations from Monitoring

Monitoring has been a component of winter drawdown over the past three years and will continue to be provided that funding remains available. The focus of monitoring during interim operations has been on assessing juvenile salmonid survival as they migrate downstream.

In the BiOp for Upper Willamette Chinook and steelhead, NMFS outlined a number of RPA measures that would facilitate the recovery of listed species (NMFS 2008). In the same document they identified several RM&E methods that would assist in evaluating the benefits of the various RPA measures as well as help identify if species were recovering, and at what rate. RM&E actions, which include reservoir drawdowns for downstream juvenile fish passage, are a necessary tool for providing data critical to adaptive management. The results of monitoring have been very positive and support the Preferred Alternative of continuing winter drawdown of Fall Creek Reservoir on a permanent basis.

From a biological perspective, this fish passage operation has been very successful (Corps 2012). In a telemetry study on Chinook salmon conducted at Fall Creek Dam by NMFS in 2012, Nesbit et al. (2014) reported substantially higher survival for salmon released into Fall Creek Reservoir when reservoir elevation was at 703 feet compared to those released at 728 feet. Survival while fish were in the reservoir was not substantially different for the two release groups, but survival through the regulating outlet (99.9% vs. 89.4%), from the regulating outlet to tailrace (98.3% vs. 79.9%), and project survival from the forebay to tailrace (98.0% vs. 79.3%) were substantially greater for fish released at the lower reservoir elevation of 703 feet.

As the reservoir draws down below the minimum conservation pool of 728 feet, juvenile salmonids migrate through the regulating outlets in large numbers; most are out of the reservoir before the reservoir elevation reaches about 710 feet.

As the reservoir draws even lower toward the invert elevation of the regulating outlets of about 680 feet, non-native predatory fish are flushed out; primarily crappie, bluegill, and largemouth bass. This has been shown through screw trap catch data from just downstream of the dam. Survival of non-native predators, which are not accustomed to living in turbulent waters, is believed to be low through the dam, as evidence by the large percentage of dead fish found in the screw trap. Flushing of non-native predators provides for excellent rearing habitat the following year in the reservoir, and juvenile Chinook salmon and steelhead have been found to grow unusually large; likely owing to ecological consequences of reduced numbers on non-native predatory fish. Hence very deep drawdown, below the level to pass most salmonids, is desired in order to improve juvenile rearing survival in the reservoir the following year.

The Preferred Alternative has been coordinated with NMFS through the WATER process and during preparation of the Draft EA, and no further consultation is necessary.

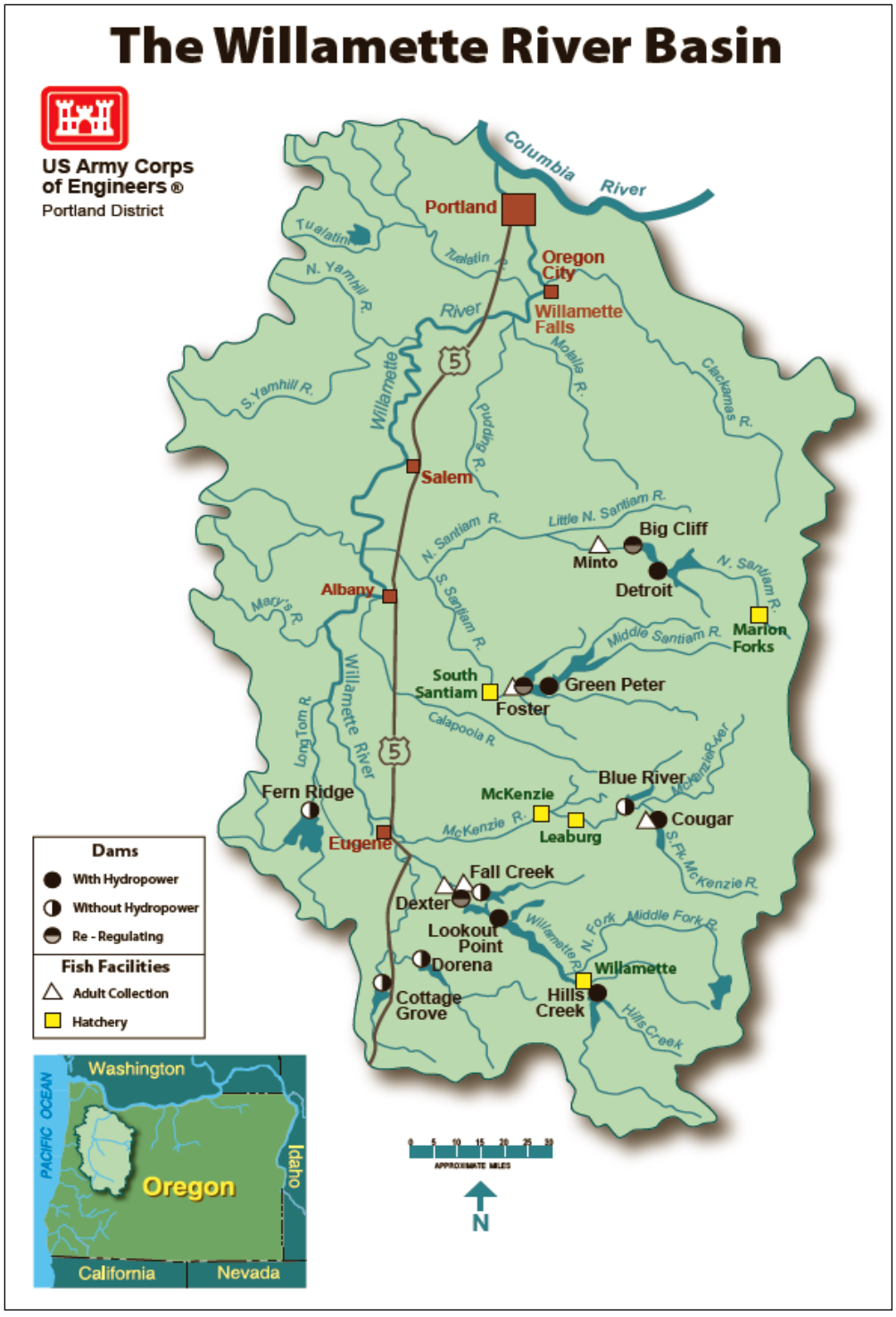

Figure 1: Location Map. Fall Creek Dam in Lane County, Oregon southeast of Eugene.

CHAPTER 3 - ALTERNATIVES

3.1 No Action Alternative

The no action alternative would maintain the status quo (prior to implementation of interim measures in 2010) with respect to operations at Fall Creek Dam as identified in the 1980 Environmental Impact Statement (EIS) on the Operation and Maintenance of the Willamette Reservoir System (Corps 1980); this EIS is incorporated by reference. Fall Creek Dam stores and releases water according to a rule curve that provides guidance to the reservoir regulators on how to manage the water storage in the reservoir to meet the multi-purpose needs. At Fall Creek, the reservoir is typically lowered in the fall to provide space to store high runoff from winter rain events. Rain events cause the reservoir to rise, and then stored water is released once the flood threat has passed. In the early spring, the reservoir is allowed to refill, capturing some of the runoff to store water for use in the summer months. Stored water may also be released downstream in the late spring and summer for fish flow augmentation during drier years. In the Willamette Basin, the conservation storage season occurs from April through October when the level of water stored in the reservoirs is governed by multipurpose uses taking into consideration biological resources, water quality, power generation, irrigation, municipal and industrial uses, and recreation (Corps 2009).

Under the No Action Alternative, there would be no deep drawdown of the reservoir for downstream migration, and fish would revert to experiencing difficulty in passing downstream. As noted above, under the current situation at Fall Creek Dam, juvenile salmonids must go through the low elevation regulating outlets under higher flow conditions. This is due to higher reservoir water elevations and higher pressure because of greater depth of regulating outlets than would be afforded with implementation of the Preferred Alternative. Although the No Action Alternative does not meet the purpose and need for action, it is being considered in order to discern the relative effects of the action alternative when compared to taking no action.

3.2 Preferred Alternative: Reservoir Drawdown to Benefit Downstream Passage of Juvenile Salmonids

It is important to note that the ability to draw the reservoir down to a specific elevation, hold it there continuously, and then refill to a desired elevation is dependent upon rain events before, during, and after the drawdown period. Implementation of the Proposed Action would involve deviating from routine operations of releasing and storing water while staying on the existing rule curve of the reservoir. If funding is available, monitoring of water quality and fish passage would occur during the drawdown to continue to quantify the effects of the proposed action. The Corps proposes to implement the Preferred Alternative as a permanent routine operation, thereby incorporating it into the rule curve. The action, as noted above, has been conducted as an interim operation over the past four years in order to assess benefits of the operation. Deep drawdown has been shown to be very beneficial, as described later in the EA.

The Proposed Action would draft Fall Creek Reservoir to a lower elevation than what is specified in the current water control manual and hold the reservoir at the deeper elevations for up to two weeks during late fall/early winter annually. The water control manual would be

modified to allow lowering reservoir elevations to 680-685 feet mean sea level (MSL), which is 43-48 feet lower than typical winter pool elevations; drawdown would occur to at least 714 feet. The ability to obtain the desired reservoir elevation, however, could be influenced by amount of precipitation. This lower elevation would be held for a two-week period; sometime between late November and the end of February in order to improve fish passage and survival during juvenile downstream migration. The target start date for drawdown is the first week of December each year. During drawdown, a wide gate opening of the regulating outlets would be maintained in order to increase survival of juvenile salmonids. After the drawdown, the reservoir would be allowed to fill back up to the minimum conservation pool elevation of 728 feet MSL for the duration of the flood control season. Lowering the reservoir to elevation 680-685 feet MSL would result in a run-of-the-river scenario, which would facilitate downstream fish passage through the dam.

The focus of the Corps' proposed action is on continuing measures that have been implemented on an interim basis over the past three years but now on a permanent basis in order to improve downstream juvenile fish passage and survival. Fall Creek Reservoir would continue indefinitely to be lowered to run-of-river for a maximum of two weeks during the late fall/early winter (preferably early December) to aid fish in finding one of the two regulating outlets. Drawdown below the minimum of 714 feet to the run-of-the-river elevation of 680 feet would pass non-native predatory fish primarily crappie, bluegill, and largemouth bass out of the reservoir in order to reduce predation on salmonids in the reservoir. Reducing populations of non-native predatory fish creates what appears to be a rearing sanctuary for juvenile salmonids the following year.

CHAPTER 4 - AFFECTED ENVIRONMENT

The Corps is responsible for flow management of the WVP and coordinates competing demands for flood risk reduction, power, domestic and irrigation water supply, recreation, and minimum stream flow requirements. All Corps storage projects follow a rule curve that provides guidance to the reservoir regulators on how to manage the water in the reservoir to meet the multi-purpose needs authorized by Congress. The Corps' storage projects are typically drawn down (i.e., water from the reservoir is released) in the fall to provide space to store high runoff from winter rain events. Rain events cause the reservoirs to rise, storing water which is then released once the flood threat has passed. In the early spring, the reservoirs begin to capture some of the runoff to store water for use in the summer months. Stored water may also be used in the late spring and summer for fish flow augmentation during drier years. The Corps, together with its partners and customers, determine the order of use for stored water among the various projects and often address environmental variables and other constraints to project operation using real-time adaptive management (Corps 2009).

Fall Creek Dam (Figure 2) is a multi-purpose storage project that operates to meet the authorized purposes of flood damage reduction, irrigation, fish and wildlife management, recreation, navigation, and downstream water quality. This dam is a rock fill structure with a gated concrete spillway and two regulating outlets. It was completed in 1966 and is primarily used for flood control. It has a length 5,050 feet, the crest elevation is 839 feet MSL, the reservoir storage is 125,000 acre feet (maximum), and the regulating outlets are rectangular conduits. The Fall Creek

regulating outlets gates are 5 feet, 6 inches in width and 10 feet in height. Fall Creek has nine fish horns that allow water to be pulled from various elevations in the reservoir. They were originally put in place to pass fish, but it was later determined that survival through the fish horns was low. The fish horns are now used mainly to supply water for the adult fish collection facility at the base of the dam on the downstream side and for temperature control operations since the openings are located at different elevations in the reservoir. The fish horns are typically above the reservoir level during juvenile downstream migration and are, therefore inaccessible to migrating fish.

In this chapter and the next chapter (Chapter 5), air, noise, socio-economics, and transportation will not be addressed or analyzed in detail because either the nature of the proposed action would have no impact or little impact would not change existing conditions.

4.1 Land Use

The Middle Fork Willamette sub-basin drains about 1,370 square miles. Four Corps projects were constructed in the sub-basin. Hills Creek Dam is on the Middle Fork Willamette River at river mile (RM) 47.8 and was completed in 1961; Lookout Point (RM 19.9) and Dexter (RM 16.8) Dams are on the Middle Fork Willamette and were completed together in 1955; and Fall Creek Dam on Fall Creek (RM 7.9) was completed in 1966 (Corps 2009).

Commercial forestry is the primary land use along the Middle Fork Willamette River. Much of the land in the upper Middle Fork Willamette River subbasin is in public ownership with the vast majority under jurisdiction of the U.S. Forest Service. The lower reaches of the sub-basin are dominated by agricultural and urban land uses that constrain the river's ability to meander, and these uses have resulted in the removal of much of the riparian gallery forest. Table 1 below compares the land use distribution between historic (1850s post-European settlement) and current conditions.

Table 1. Estimated historical and current land cover types in the Middle Fork Willamette River Subbasin (data from Corps 2013a).

Land Use	Historic acres	Current Acres	Acre Change
Agriculture	0	14,288	+14,288
Montane mixed conifer forest	6,305	16,552	+10,247
Open water – lakes, rivers, streams	1,991	6,066	+4,075
Ponderosa pine/interior white oak forest & woodlands	0	26	+26
Urban or residential	0	5,248	+5,348
Westside grasslands	19,032	142	-18,890
Westside lowland conifer-hardwood forest	368,764	378,662	+9,898
Westside oak/dry Douglas-fir forest & woodlands	14,234	546	-13,688
Westside riparian wetlands	12,075	958	-11,117

Figure 2. Fall Creek Dam and Reservoir in Lane County, Oregon

4.2 Climate

The Willamette River basin is characterized by cool wet winters and by warm dry summers. Mean monthly air temperatures in the valley range from about 37.4 to 41 degrees Fahrenheit during January to 63.6 to 68 degrees Fahrenheit during August (Corps 2013a). Mean annual precipitation in the Willamette River basin ranges from 20 to 40 inches in the Willamette Valley. About 70 to 80 percent of the annual precipitation falls from October through March, but less than 5 percent falls in July and August (Corps 2013a).

Most precipitation in the Cascade Mountains falls as snow above 5,000 feet; however, the Willamette Valley itself receives relatively little snow. The Cascade Mountains receive about 80 percent of the precipitation that falls on the Willamette River basin, and they store much of this water as snow. Snowfall accumulation exceeds 90 inches in the central Cascades. From late winter to early summer, much of this snow melts, feeding cold fast-flowing streams (Corps 2013a).

4.3 Geology

Fall Creek Dam is located on the Middle Fork of the Willamette River. The headwaters of this subbasin are distinguished by two major physiographic provinces; the High Cascades and the Western Cascades provinces. In the High Cascades the geology includes recent deep lava deposits that contribute spring-fed flows to the system. The western foothills and lower peaks of the Western Cascades province has much older volcanic material including deeply weathered rocks, steep and highly dissected hill slopes, and widespread erosion.

4.4 Hydrology

Fall Creek is a tributary of the Middle Fork Willamette River. The Middle Fork Willamette River subbasin drains an area of approximately 1,360 square miles. The hydrograph in the Middle Fork Willamette River subbasin also reflects the seasonal rainfall, with the majority of runoff occurring during the winter and low flows occurring during July and August. Typically a smaller, secondary peak occurs in May and June because headwater elevations are high enough to develop a seasonal snowpack and melt-water runoff.

Flows in the Middle Fork Willamette River have been controlled by the Lookout Point-Dexter, Hills Creek, and Fall Creek projects since 1954, 1961, and 1965, respectively. These dams are operated similarly in concert with the other Willamette system dams for flood risk management. Flood control operations at the dams have substantially decreased the magnitude and frequency of extreme high flow events in the lower Middle Fork Willamette River. In general, dam construction resulted in higher summer and fall flows and lower spring flows. In the Middle Fork Willamette River subbasin, flows are naturally lowest in the early fall (Corps 2013a).

4.5 Water Quality

Water quality has been a concern within the Willamette Basin project area since the completion of the dams. Over the years several water quality parameters including temperature, dissolved oxygen and turbidity exceeded water quality standards. In 2006, ODEQ established TMDLs for stream segments in the Willamette River that do not meet water quality standards and are listed under Section 303(d) of the Clean Water Act. Further, some stream segments in the Middle Fork Willamette River subbasin do not meet water quality standards. Most of the concern in regards to water quality are focused on temperature, turbidity, dissolved oxygen, dissolved gas saturation, and in some of the reservoirs, there are toxic algae present during portions of the year.

4.6 Flow

Fall Creek Dam does not have turbines and therefore does not generate hydropower. However it does function as a regulating dam for the Middle Fork Willamette River. The Dam has a variable seasonal minimum flow. From October to March, the minimum outflow is 50 cubic feet per second (cfs). It then increases to about 80 cfs during April to August and is set at 200 cfs from September 1 through October 15. The normal evacuation rate associated with high water events is 3,800 cfs with a maximum evacuation rate of 4,500 cfs. During the summer flow augmentation season, project maximum outflow is usually capped in order to balance flow from the various projects. Since 2006, the Corps has limited the maximum down-ramping at all three projects on the Middle Fork Willamette River to follow general ramping rate guidelines of 0.1 foot/hour during nighttime and to 0.2 foot/hour during daytime unless such restriction has been infeasible with existing equipment at the dam (Corps et al. 2007). The result has been adherence to these down-ramp rates at designated flow rates. During the winter high inflow period, the projects may ramp down at rates higher than the recommended 0.1- to 0.2-foot/hour guidance.

The allowance is for those cases where unanticipated conditions require flow reductions in order to control downstream control points for human health and safety.

4.7 Temperature

Operators use the Fall Creek Dam fish horns to achieve some control over water discharged through the dam. These fish horns (Figure 3) allow for water to be taken from different elevations within the reservoir to mix with water that is passing out of the regulating outlet. For example, warmer surface water can be mixed with deeper, cooler water to approach or achieve a more normal outflow with respect to water temperature.

Figure 3: Fish Horns (upper left) and one of the two regulating outlets (lower center) at Fall Creek Dam, Lane County, Oregon. View looking downstream during a drawdown as reservoir water enters the regulating outlet.

For the 2012 water year, the Corps' main objective for temperature control was to stay within the resource agencies downstream temperature target range while tracking the Fall Creek inflow temperatures, which was done with mixed success. The Fall Creek Dam has limited ability to affect downstream temperatures due to structural limitations (i.e., fish horn elevations), and operations are modified taking into account environmental conditions and inflow temperatures. In addition, the spillway gates are not used during typical Fall Creek Dam operations due to the western pond turtle and Oregon chub habitat located just downstream of the gates.

Despite these limitations, Fall Creek Dam temperature targets were achieved for a good portion of the spring and summer. Since outflow discharges exceeded the upper fish horn capacity during drawdown, the lower elevation fish horns and regulating outlets were used to release the additional flow. The operation of the regulating outlets during this drawdown released much of the cold water storage in Fall Creek Reservoir. From October to early November, outflow

temperatures climbed and were above the 50 ºF maximum target, ranging between 56 to 58 ºF, since there was no accessible cold water remaining in Fall Creek Reservoir to moderate downstream temperatures. As a result, temperatures in the fall and winter were too warm and exceeded targets for spawning and incubation due to the lack of cooler water. Previous temperature data collected shows that thermal conditions in the Middle Fork and Fall Creek below the dams are typically unsuitable for spring Chinook spawning and incubation (Corps 2013b). Salmonids passing through fish horns sustain substantial mortality (Normandeau 2014).

4.8 Dissolved Gas

Little data has been collected below Fall Creek Dam on total dissolved gas (TDG), but based on historical data, discharges above about 500 cfs have been found to produce near-field TDG saturations that exceed the state water quality standard (Corps 2009); therefore, discharges are kept under 500 cfs.

4.9 Algae

Algal blooms are routinely monitored at Fall Creek Reservoir by Oregon State Parks. Fall Creek has been listed on the 303(d) list for aquatic weeds or algae (ODEQ 2010). According to their website, only one Harmful Algae Bloom Surveillance (HABS) advisory was issued for Fall Creek Reservoir, which occurred in 2011. Information regarding algal blooms can be found at the following internet site:

http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/index.aspx.

4.10 Vegetation

Fall Creek Dam is located on the west side of the Cascades Mountains and included within a temperate coniferous forest with Douglas-fir/western hemlock as the predominant tree species. It is located in the Western Hemlock Zone as described by Franklin and Dyrness (1973). Forest practices are the dominant land use with numerous clear cuts and logging roads near the reservoir.

Extensive riparian gallery forests once dominated floodplains in the region but have since been largely replaced by agricultural land and residential development. Some riparian forests still exist along the margins of Fall Creek below the dam. Common tree species include bigleaf maple, black cottonwood, red alder, Oregon white oak, and Oregon ash. The uplands to the west are part of the Valley Foothills eco-region, a transitional area between the Willamette Valley and the Cascade Mountains. The Valley Foothills eco-region is characterized by mixed oak woodlands, grasslands, and Douglas-fir forests, although this eco-region has been extensively converted to pasturelands, vineyards, orchards, tree farms, and residential development. (FERC 2013).

Lands to the east of the dam consist of extensive and highly productive coniferous forests managed for both commercial and recreational uses. Dominant tree species include western

hemlock, Douglas-fir, and western red cedar. Mixed coniferous forests cover the hillsides surrounding the Fall Creek dam and reservoir. Douglas-fir is the principal overstory species, but western hemlock, western red cedar, black cottonwood, alder, and bigleaf maple are also common. Most of the forests in the area have been harvested previously, creating a patchwork landscape of tree stands where stand age and conditions vary considerably. Downstream of the dam, riparian gallery forests remain relatively intact along the margins of Fall Creek; see Figure 4 (FERC 2013).

Figure 4: The riparian corridor below Fall Creek Dam, Lane County, Oregon.

4.11 Wildlife (Including ESA-listed Northern Spotted Owl and Oregon Spotted Frog)

The varied landscape in the vicinity of Fall Creek Dam supports a diverse assemblage of wildlife. The reservoir provides breeding, foraging, and migratory stopover areas for waterfowl, shorebirds, and raptors. Shallow waters and nearby wetlands provide habitat for birds, amphibians (including the rare northern red-legged frog), reptiles, and mammals. Common aquatic mammals include the mink and beaver. At least one bald eagle pair nests along the shoreline of the reservoir, and an osprey pair nests approximately 0.5 mile downstream from the project along Fall Creek. Numerous hawk, falcon, and owl species nest and/or forage in nearby Douglas-fir forests and oak woodlands. Resident and migratory songbird communities typical of the Willamette Valley and the West Cascade Mountains are present (FERC 2013).

Black-tailed deer and Roosevelt elk occur in nearby forest, woodland, and savannah-like habitats. Other game species in the area include ruffed grouse, ring-necked pheasant, California quail,

mountain quail, and wild turkey. Other mammals in the area include black bear, coyote, bobcat, cougar, red fox, raccoon, numerous bat species, and several mice, vole, and shrew species. Western gray squirrels use nearby oak woodlands and mixed oak-conifer forests (FERC 2013).

The northern red-legged frog is a federal species of concern and is listed by ODFW as sensitive-vulnerable. Red legged frogs are typically found near permanent waters associated with stream pools, marshes, ponds, and other quiet water bodies. They occur in upland forests during much of the non-breeding time of year. Breeding typically occurs between March and July and lasts 1 to two weeks. Eggs are attached to stiff stems near the surface of the water and hatch in about five to seven weeks. Larvae metamorphose into adults in 11 to 20 weeks. Summer refuge sites for adults include small mammal burrows and moist leaf litter in riparian areas. A breeding population of northern red-legged frogs is known to occur in wetlands associated with the Fall Creek spillway channel (FERC 2013).

The western pond turtle is a federal species of concern. A petition for listing under the ESA was found not to be warranted in 1993 because of the species' widespread distribution and lack of evidence for broad-scale threats. The western pond turtle is classified in Oregon as a Strategy Species under the Oregon Conservation Strategy (OCS) and as a Sensitive-Critical species (ODFW 2006 and 2008). While appropriate habitat is present downstream of Fall Creek Dam, apparently no western pond turtles occur there.

The bald eagle is a state threatened species but was delisted from the federal ESA on July 9, 2007, but is still protected under the Golden and Bald Eagle Protection Act. Bald eagles breed and reside year-round throughout the Willamette Basin and are mostly associated with forested rivers and lakes. They nest mainly in large Douglas-fir or cottonwood trees. During summer, these eagles feed mainly on fish (live or dead), then augment this in other seasons with waterfowl and even sheep (carrion). Eagle Rock is a 200-acre sensitive area managed for the protection of bald eagles near the Lookout Point Reservoir. The eagles frequently forage in Dexter Lake especially in the winter months and in the nest initiation season. They also have been observed flying over Lowell Butte to forage in Fall Creek Reservoir and fishing in the river below Dexter Dam. Bald eagles have been observed at Fall Creek and nest sporadically in conifer stands around the lake. Bald eagle territories also are found on Forest Service land at Hills Creek (Corps 2013a).

<u>Oregon Spotted Frog (ESA Threatened)</u>

The Oregon spotted frog was listed as threatened under ESA on August 28, 2014 with designation of critical habitat expected in fall of 2014. The Oregon spotted frog is highly aquatic, living in marshes, permanent ponds, lake edges and slow streams where there is dense aquatic vegetation. They prefer shallow slower water to breed in. Breeding occurs in early to mid spring (February to March at low elevations and April to May at higher elevations), with eggs laid on aquatic vegetation such as reeds. Predators include the introduced bull frog as well as the introduced warm water fish species such as large and small mouth bass (Corkran 1996). The Oregon spotted frog was formerly fairly widespread in Oregon but is not known currently to occur in the vicinity of Fall Creek Dam. No critical habitat is proposed in the vicinity of Fall Creek Dam.

Northern Spotted Owl (ESA Threatened)

The northern spotted owl was listed as threatened and critical habitat designated under the Endangered Species Act on June 26, 1990. Spotted owls are generally associated with old-growth forests and require multilayered canopies. Some coniferous forests in the Middle Fork subbasin may be suitable nesting habitat for spotted owls. Other habitats may provide foraging or dispersal habitat for the species. Several spotted owls have been located near Fall Creek Reservoir. In a 2000 Biological Assessment for the Willamette River Basin Flood Control Project prepared by the Corps for the operation of the entire Willamette Project, the Corps determined the operation and maintenance of the project would not likely adversely affect the Northern Spotted Owl; the USFWS concurred with the Corps' determination (USFWS 2008).

4.12 Fish (Including ESA-listed UWR Chinook Salmon, UWR Steelhead, and Oregon Chub)

Native fish species present in the vicinity of Fall Creek Dam include spring Chinook salmon, steelhead (including resident rainbow trout), cutthroat trout, mountain whitefish, northern pikeminnow, dace, redside shiner, sculpin, largescale sucker, and Oregon chub. Non-native species include largemouth and smallmouth bass, crappie, brown bullhead, and bluegill. The focus of this EA is on assessing impacts of a run-of-river drawdown of the reservoir to improve downstream migration for ESA-listed salmonids through Fall Creek Dam. While all native fish species are important to the local ecology, the focus in recent years has been on the recovery of listed species under ESA. Increasingly, because of scarcity, spring Chinook have been the focal point with the assumption that what benefits Chinook will also benefit listed steelhead.

Construction of high head dams in the Willamette River system has substantially altered the hydrologic and thermal regimes in the mainstem and tributaries from natural conditions (NMFS, USFWS 2008); a summary of impacts of the WVP can be found in the Supplemental Biological Assessment prepared by the Corps in 2007 and the BiOps prepared by NMFS and USFWS in 2008, which are incorporated by reference in this EA. Several of the fish mentioned in this EA have portions of their life history that are migratory in nature as they travel downstream and ultimately to the ocean to grow and return up-river to spawn. The presence of many dams and diversions within the Willamette River basin makes downstream migration problematic. When the WVP was originally conceived, fish passage was a concern (albeit, this was prior to the Endangered Species Act). Fish passage design components did not all ultimately function and did not provide the fish passage intended. For example, the fish horns at Fall Creek Dam resulted in high fish mortality, and their use for fish passage was discontinued. Today the fish horns are utilized instead to benefit fish downstream by controlling temperature of water released from Fall Creek Dam.

Historically, the Middle Fork Willamette River supported viable populations of spring Chinook salmon, bull trout, Oregon chub, and cutthroat trout. Steelhead are not thought to have been present in the Middle Fork Willamette River subbasin historically, although there were likely large resident steelhead (rainbow trout) populations (Corps 2013a).

Bull trout were thought to be extirpated from the Middle Fork Willamette River, the North and South Forks of the Santiam River, and the Clackamas River. No bull trout were identified during

extensive surveys in the Middle Fork Willamette River subbasin in the early 1990s (NPCC 2004a as cited in Corps 2013a). As cited in Corps (2013a) Buchanan et al. (1997) listed bull trout as probably extinct in the Middle Fork. A plan to rehabilitate bull trout in the upper Middle Fork Willamette River subbasin was approved by the Willamette Basin Bull Trout Working Group in 1997. Beginning in 1997, bull trout fry from Anderson Creek in the McKenzie River subbasin were reintroduced into four cold-water springs and four creeks above Hills Creek Reservoir by the Forest Service and ODFW (NPCC 2004a as cited in Corps 2013a). Monitoring has shown good growth and survival of juvenile bull trout in the release sites (ODFW 2001 as cited in Corps 2013a). Adult bull trout are once again present in the Middle Fork Willamette River subbasin, but not in Fall Creek.

Upper Willamette River (UWR) Chinook (ESA Threatened)

The UWR Chinook salmon Evolutionarily Significant Unit (ESU) includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River and its tributaries above Willamette Falls as well as UWR Chinook from seven artificial propagation programs (NMFS 2008). UWR Chinook were listed as threatened under ESA on March 24, 1999 and on June 28, 2005, and critical habitat was designated on February 16, 2000 and on September 2, 2005. UWR Chinook salmon is currently at a high risk of extinction (NMFS 2008). Although the annual returns of Chinook to the basin have been stronger since the late 1990s, the vast majority of fish are of hatchery origin, and numbers of unmarked (wild) fish continue to decline. Analyses of returns to spawning areas during 2002-2006, a period of relatively high marine survival, suggest an annual run of natural-origin UWR Chinook averaging about 5,000 adults above Willamette Falls, with most of these fish (with a possible exception in the McKenzie subbasin) unlikely to be more than a few generations removed from a fish hatchery. These hatchery-influenced natural returns represent only about 2% of the ESU's historic abundance above the falls. The return of 2008 was the lowest return of adult Chinook (14,141 adults) since fish counting began in 1946 (Corp 2009). The Middle Fork population of UWR Chinook salmon is considered to be at very high risk of extinction, based on an analysis of its recent abundance, productivity, spatial structure, and diversity (McElhany et al. 2007 as cited in Corps 2009). NMFS listed five major limiting factors for UWR Chinook that included reduced access to spawning and rearing habitat, degraded water quality, high water temperature, lost or degraded floodplain connectivity, and reduced stream flow (NMFS 2008).

In its final designation of critical habitat for UWR Chinook, NMFS included the mainstem Middle Fork Willamette, including extensive mainstem reaches and tributaries above Dexter, Lookout Point, and Hills Creek Dams. NMFS also included the North Fork Middle Fork Willamette and Salt Creek above Lookout Point Dam, as well as Fall Creek and many tributaries above and below Fall Creek Dam (NMFS 2008).

Upper Willamette Steelhead (ESA Threatened)

UWR steelhead were listed as threatened under ESA on March 25, 1999 and January 5, 2006, and critical habitat was designated on February 16, 2000 and on September 2, 2005. The UWR winter steelhead is currently at a moderate risk of extinction. Since Willamette steelhead have more widespread spawning habitat in the tributaries unaffected by Corps dams, their risk of extinction is not as high as Chinook salmon (NMFS 2008). Chinook salmon have become of greatest concern when considering operations at Fall Creek Dam. Winter steelhead numbers for

the entire ESU remain low. NMFS listed five major limiting factors for UWR steelhead, and they include reduced access to spawning and rearing habitat, degraded water quality, high water temperature, lost or degraded floodplain connectivity, and reduced stream flow (NMFS 2008). Although native winter steelhead may have occasionally been present in the Middle Fork Willamette River subbasin, it no longer supports an independent population, and the UWR steelhead Distinct Population Segment (DPS) does not include steelhead in this subbasin (Myers et al.2006 as cited in Corps 2013a). However, some winter steelhead are observed each year in Fall Creek, including up to Fall Creek Dam (ODFW 2002 as cited in Corps 2013a). There is no designated critical habitat for steelhead associated with Fall Creek.

Oregon Chub

Oregon chub were listed as endangered under ESA on October 18, 1993, and critical habitat was designated on March 10, 2010. They were proposed for delisting on February 6, 2014 and are expected to be delisted in fall of 2014 (pers comm. with USFWS). Oregon chub are endemic to the Willamette Basin and live in calm waters such as sloughs and backwater areas. Because of habitat loss and other factors, the Oregon chub was listed as endangered in 1993. Oregon chub are not separated into DPSs, and no genetic data have been collected to indicate the existence of different segments; genetic mixing was more likely for downstream than upstream populations (USFWS 1998 as cited in Corps 2009). Oregon chub were found historically throughout the Willamette Basin between Oregon City and Oakridge, in the Clackamas~~,~~ South Santiam, North Santiam, Luckiamute, Long Tom, McKenzie, Mary's, Coast Fork Willamette, Middle Fork Willamette, and the mainstem Willamette Rivers. The largest populations of Oregon chub are currently found in the Middle Fork Willamette sub-basin. At present, abundance of Oregon chub appears to be related to the degree of connectivity of off-channel habitat to the river (Scheerer 1999 as cited in Corps 2009). Isolated habitats appear to contain the greatest densities of chub. Habitats that are more frequently and directly connected appear to be more accessible to competing and predatory non-native fish species, and there is an inverse relation between non-native species' and Oregon chub population size. There is a population of Oregon chub that inhabits the Fall Creek spillway ponds. Additionally, Oregon chub have recently been documented downstream of Fall Creek Dam in four backwater sites. There is critical habitat for Oregon chub designated downstream of Fall Creek Dam, specifically in the Fall Creek spillway ponds (Critical Habitat Unit 3A), but these areas would no longer be considered as critical habitat after the likely delisting of Oregon chub to occur in 2014.

4.13 Biological Opinions and Incorporated Reasonable and Prudent Alternatives

Section 7 of the Endangered Species Act requires a federal agency to consult with NMFS and USFWS if they are proposing an action that may affect listed species or their designated critical habitat. For the proposed action, as detailed above, the ESA listed species are UWR Chinook and UWR steelhead under the jurisdiction of NMFS and northern spotted owl, Oregon spotted frog, and Oregon chub under the jurisdiction of USFWS; Oregon chub will likely be delisted in fall of 2014. In 2000, the Corps, Bonneville Power Administration, and the Bureau of Reclamation ("action agencies") consulted with NMFS and USFWS for the operation of the WVP. The purpose of the consultation was to ensure that any action the agencies authorized, funded, or carried out would not likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. As part of the

consultation process the action agencies prepared a Biological Assessment. In 2007 while continuing the consultation process, the Corps submitted a supplemental Biological Assessment. The following year (2008) both NMFS and USFWS provided two separate BiOps. Each of the BiOps included coordinated RPAs. The BiOPs included recommended RPA measures to the proposed operation of the WVP that the Services concluded would avoid jeopardizing the listed aquatic species and adversely modifying critical habitat to ESA listed species.

An RPA is an action, identified during formal consultation, that can be carried out consistently with the project purpose (in this case the operation of the WVP), is within the scope of the agency's legal authority, is economically and technologically feasible, and avoids jeopardizing the continued existence of ESA-listed species and the destruction or adverse modification of their designated critical habitats (2008 NMFS BiOp).

These RPA measures address structural and operational changes at the WVP projects and improvements in Corps programs that affect salmonid habitat downstream of the dams and that allow upstream and downstream fish passage that are needed to address the effects of the WVP, thereby increasing the viability of the affected populations and the functioning of the primary constituent elements of their designated critical habitat (2008 NMFS BiOp).

In their 2008 BiOp, NMFS concluded that for UWR Chinook salmon and UWR steelhead, poor juvenile passage is one of the single most adverse effects on both the species and their designated critical habitats. NMFS identified the need for more specific measures with associated time frames in their analysis of adverse modification of critical habitat. Specific passage measures are necessary to address the effects of the WVP. Therefore, NMFS and USFWS included specific passage measures to be completed and operational by set deadlines (2008 NMFS BiOp).

Deep late fall/early winter drawdowns have been evaluated and have been found to be very successful in improving survival of juvenile salmonids, as described in this EA. This increased survival ultimately benefits the populations of UWR Chinook and UWR steelhead in the subbasins where interim measures have been used at Fall Creek Dam.

The weight of evidence indicates that dams seasonally inhibit downstream migration, entrap some migrants in reservoirs for extended periods, and present passage mortality risks. Some salmon likely reside in reservoirs for a year or more, with mortality being high when these larger fish eventually pass dams (Keefer et. al. 2012).

There are four RPA *measures* (three in this section and another under the monitoring section) that are relevant to the proposed actions in this EA. The following section provides the specific RPA measures and the rationale behind them:

<u>RPA 4.8 Interim Downstream Fish Passage through Reservoirs and Dams:</u>
Until permanent downstream passage facilities are constructed or operations are established at Project dams and reservoirs in subbasins where outplanting of UWR Chinook salmon and steelhead is underway, the Action Agencies will carry out interim operational measures to pass downstream migrants as safely and efficiently as possible downstream through Project

reservoirs and dams under current dam configurations and physical and operational constraints, and consistent with authorized Project purposes.

RPA- 4.8.1 Fall Creek Drawdown:
Beginning in Water Year 2008, the Action Agencies will adjust timing of storage and release of flow at Fall Creek Reservoir to promote downstream passage of juvenile Chinook salmon through the reservoir and dam. Drawdown will be to at least elevation 714.0 by the end of November each year, and the Action Agencies will hold the reservoir at this elevation during all of December and January except during flood events, and possibly longer. The Action Agencies will conduct monitoring and evaluation studies to determine the effectiveness of the operation and to assist in deciding whether or not to continue the operation in future years. The depth and timing of the drawdown may be adjusted in subsequent years, based upon monitoring results, with NMFS' agreement. During this operation, when inflow is less than Project minimum flow objectives and the reservoir is at or below 714.0', then outflow will equal inflow and this will not be considered a deviation from flow objectives.

Past studies have indicated that juvenile spring Chinook salmon migrate from Fall Creek Reservoir primarily during late fall and early winter, and that smolts passing through the regulating outlet under conditions of lower reservoir elevations had better survival compared to when the reservoir was held high. Also, smolts migrating late in the season under conditions of very low head appeared to sustain lower injury or mortality rates compared to passage under high reservoir levels.

The effect of this measure will be to improve downstream fish passage survival through Fall Creek Dam, increasing productivity of the Fall Creek Chinook salmon population, and ultimately resulting in increased abundance and improved spatial distribution. Another effect of this measure will be to minimize adverse effects on critical habitat by providing a component of the primary constituent element, "migration corridors free of obstruction."

RPA 4.10 Assess Downstream Juvenile Fish Passage through Reservoirs:
The Action Agencies will, in coordination with and review by the Services, assess juvenile fish passage through the following Project reservoirs: Cougar, Lookout Point and Dexter, Detroit and Big Cliff, Green Peter and Foster, Fall Creek, and Hills Creek.

These evaluations will be developed consistent with the RM&E process described below in RPA measure 9 (RM&E). The Action Agencies must seek NMFS' review of evaluation proposals. Comments submitted by NMFS on draft evaluation proposals must be reconciled by the Action Agencies in writing to NMFS' satisfaction prior to initiating any research-related activities anticipated in this RPA measure. The proposals must identify annual anticipated incidental take levels by species, life stage, and origin for each year. The Services will inform the Action Agencies whether they agree with the proposed studies, reports, and NEPA alternatives. The Action Agencies will begin these studies in 2008; field investigations, study reports, and NEPA analyses, if necessary, will be completed by December 31, 2015 (2008 NMFS BiOp).

4.14 Cultural Resources

The evaluation of cultural resources generally follows guidance and definitions provided in the National Historic Preservation Act (NHPA) of 1966. Section 106 of the NHPA and the implementing regulations at 36 CFR Part 800 require all Federal agencies to consider the potential effects of their undertakings on historic properties either eligible for or currently listed on the National Register of Historic Places (NRHP) (http://www.cr.nps.gov/nr/). Historic properties are defined as prehistoric or historic archeological or non-archeological districts, sites, buildings, structures, or objects. An additional resource type eligible for the NRHP are traditional cultural properties (TCPs). These are defined by the National Park Service as properties or places eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that: a) are rooted in that community's history, and b) are important in maintaining the continuous cultural identity of the community (NPS NRB 38). Often TCPs are associated with Native American Tribes who once occupied and utilized the area. Native American Tribes possess unique and traditional knowledge regarding the existence and continuing use of TCPs, information that can often times not be shared with individuals outside of their communities.

The NHPA requires federal agency's to define an area of potential effects (APE), an area in which the action has the potential to effect historic properties. The APE is evaluated for historic properties, most often through a process of extensive archeological survey, historic and technical records research, and discussions with relevant Native American Tribes or other individuals possessing knowledge of historic properties or TCPs. The agency must then determine the potential effect of the project on known historic properties within the APE. Finally, the agency is responsible for consulting with the State Historic Preservation Officer (SHPO) and relevant Native American Tribes and other interested parties regarding the determination of the APE, the evaluation of the APE for cultural resources, and the effects determination of the action on any historic properties within the APE.

Known cultural resources in the Willamette River Basin and its tributaries include both prehistoric and historic archaeological sites, historic buildings and structures, and the remains of settlement and development activities. No TCPs have been identified within or near Fall Creek Dam. Limited archeological surveys have taken place both near and within the Fall Creek Reservoir drawdown zone (Cole 1968). Recent archeological investigations just on the downstream side of Fall Creek Dam identified intact, buried cultural resources almost 1 meter in depth in an area previously thought disturbed (Purdy et al 2009). Cultural resources identified within the Fall Creek reservoir consist of prehistoric and historic archeological sites. These prehistoric sites include open air lithic scatters, possible seasonal or temporary campsites, and two potential quarry sites. The historic sites consist of historic home sites, trash dumps, historic artifact scatters, and a historic spring house. Currently, five of these cultural resources have been evaluated for eligibility for listing to the NRHP. The Portland District also is currently evaluating the Fall Creek Dam and Fish Facility for NRHP eligibility as well. Currently, a total of 34 prehistoric archeological sites have been identified either in the reservoir drawdown zone or at the very close periphery. The actual number of both prehistoric and historic archeological sites, along with any currently unknown Traditional Cultural Properties (TCPs), is difficult to

gauge and will become more clear as new inventory employing modern inventory methodologies is undertaken and completed.

4.15 Recreation

Fall Creek Reservoir currently provides many recreational opportunities for the outdoor enthusiast. The reservoirs and Fall Creek itself provide opportunities for recreational boating including water-skiing, swimming, fishing, kayaking, and canoeing. Fall Creek Reservoir is a prime recreation area surrounded by day-use parks and a campground (Cascara Campground). The primary providers of recreational facilities at Fall Creek Reservoir include the Corps, Lane County Parks, Oregon Parks and Recreation Department, and the Forest Service's Willamette National Forest. Many of the campgrounds are open only partly during the year, typically from May 1st through September 30th. While much of the recreation is aquatically oriented, there are some other outdoor options available such as hiking and hunting that occur near project lands including the Eugene to Pacific Crest Trail. Fall Creek Reservoir is heavily used for water-based recreation, especially boating, fishing, swimming, and water-skiing. Facilities include drinking water, restrooms, picnic sites, campgrounds, and boat ramps.

4.16 Aesthetics

Short-term increases in turbidity with drawdown would have minor effects on aesthetics.

CHAPTER 5 - ENVIRONMENTAL CONSEQUENCES

5.1 Land Use

No Action Alternative
Under the no action alternative no work is proposed. The project area would remain in a similar state as conditions prior to the interim deep drawdowns that have occurred over the past three years. No change in land use would occur in the immediate term.

Preferred Alternative
Under the preferred alternative, there would be no change to current land use in the project vicinity due to the nature of the proposed action.

5.2 Climate

No Action Alternative
Under the no action alternative, no work is proposed. The project area would remain in a similar state as conditions prior to the interim deep drawdowns that have occurred over the past three years. There would be no impact on climate as a result.

Preferred Alternative
The small change in dam operations proposed under the preferred alternative would have no impact on the local climate.

5.3 Geology

No Action Alternative
Under the no action alternative there would be no work proposed. The current geology and geologic processes would remain the same as conditions prior to the interim deep drawdowns that have occurred over the past three years.

Preferred Alternative
The most likely geologic processes that could be altered as a result of implementation of the Preferred Alternative are increased channelization in the reservoir. Increased channelization within the reservoir can be expected from drawing down the reservoirs deeper than is typically done; erosion in the reservoir is expected until channels obtain a stable depth. For Fall Creek, the draw down would be done to the same elevation as in 2012-13, which is 48 feet below normal operations. The draw down would be of short duration (completed within two weeks), with erosion impacts of short duration. The volume of material eroded from the reservoir bed is expected to decrease with subsequent years' drawdowns due to the anticipated establishment of a channel through the reservoir bed. Turbidity and sedimentation has been observed in backwater areas downstream of the dam with deep drawdown; downstream sedimentation would continue to be observed. Under the preferred alternative, long term impacts to geology are expected to be negligible. Under the Preferred Alternative, run-of-the-river flows would aid in creating more natural geologic conditions.

5.4 Hydrology

No Action Alternative
Under the no action alternative there would be no work proposed. The current hydrologic regime and rule curve would remain the same as conditions prior to the interim deep drawdowns that have occurred over the past three years.

Preferred Alternative
Hydrology under the preferred alternative would change slightly over the current condition as reservoir levels are brought lower than the norm in order to facilitate downstream fish passage. The intent of lowering the reservoir elevation is to provide better access to regulating outlets for downstream migration and allow fish to pass through the dam under lower flow conditions which has been shown to increase survival. The current minimum conservation pool elevation for Fall Creek Reservoir is 728 feet msl. Under the preferred alternative, reservoir elevation would be lowered by a maximum of 48 feet to 680 feet msl. Figure 5 below shows the proposed changes in elevation of Fall Creek Dam.

Under the Preferred Alternative, bankfull or flood stage flows are expected to lessen slightly under the proposed operation. Total project outflows from Fall Creek reservoir are expected to increase during the fall months in order to reach lower reservoir elevations by mid-November. The reservoir would typically return to minimum conservation pool within about one week after the deep drawdown. Since Fall Creek lacks turbines and the spillway is only used during emergency situations, all project flows would be released from the regulating outlets. Under this

measure, Fall Creek Reservoir is likely to refill each summer for at least 50% of the water years, and about as often as with the No Action Alternative. Field studies have indicated that this operation would not necessarily need to be implemented for months at a time, as drawing the reservoir down for 4 or 5 consecutive days passed sub-yearlings effectively through the dam in 2011 (Corps 2012). As noted above, the reservoir would be lowered an additional 48 feet over the condition prior to implementation of interim measures. Figure 5 below illustrates the difference between normal operation prior to interim measures and what is proposed under the Preferred Alternative. Under the Preferred Alternative, run-of-the-river flows would aid in creating more natural hydrologic conditions.

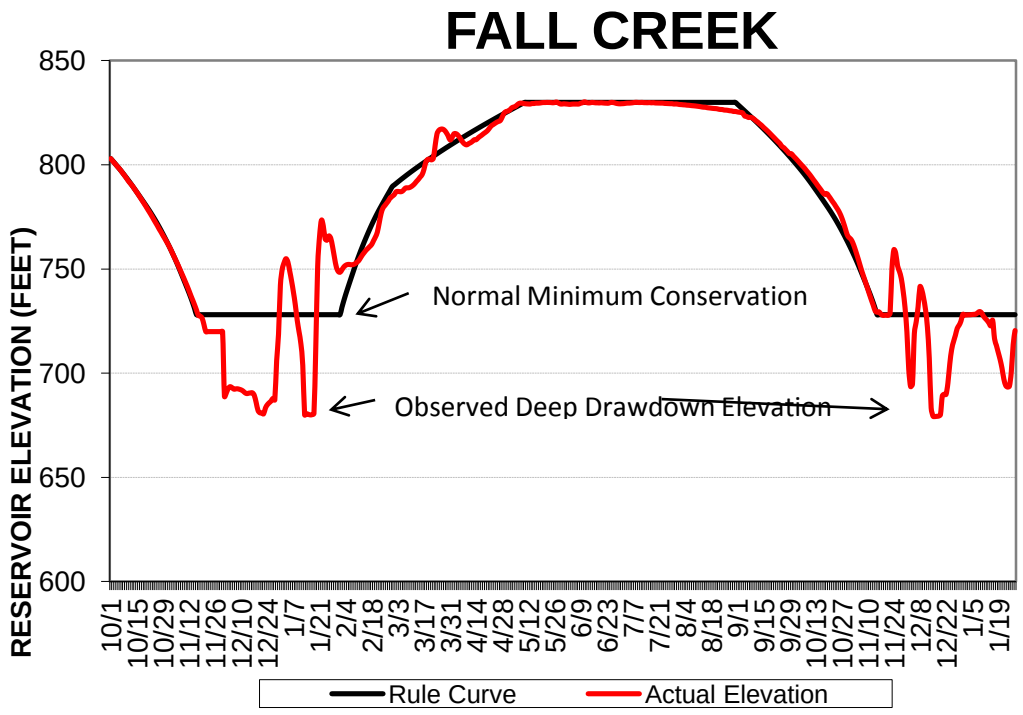

Figure 5. Typical reservoir elevation as a function of date, compared to observed deep drawdown from recent implementation of interim operations, Fall Creek Reservoir, Lane County, Oregon.

5.5 Water Quality

No Action Alternative

Under the no action alternative water quality conditions would remain the same under conditions prior to the interim deep drawdowns that have occurred over the past three years.

Preferred Alternative

The Corps expects that there would be some short term localized impacts to water quality as a result of the proposed drawdown of Fall Creek Reservoir. The potential for water quality impacts by parameter are addressed below:

Total Dissolved Gas (TDG). Based on limited historical data, implementation of the Preferred Alternative could result in downstream TDG that exceeds the state water quality standard, however these exceedances are not expected to be any greater than what typical dam operations produce (Corps 2012). To minimize the impact of TDG, outflow through the regulating outlets would be kept under 500 cfs. Total dissolved gas would be monitored downstream of the dam to evaluate levels of gas saturation.

Turbidity. Fall Creek Reservoir was drawn down to elevation 690 feet MSL in 2010. During this operation, high turbidity levels were visible and shoals formed immediately downstream of the dam. In 2011 and 2012, the reservoir was drawn down an additional 10 feet lower to 680 feet MSL, and turbidity was monitored just downstream of Fall Creek Dam. During these drawdowns, large amounts of sand, gravel, suspended particulates, and woody debris were transported from the reservoir to the downstream waterways, restoring natural geomorphologic processes to the Fall Creek reach just below the dam (Corps 2012). The USGS completed a sediment study report for the 2012 drawdown, which includes turbidity data. The report is available online at: http://pubs.usgs.gov/of/2014/1114

In 2011, redd surveys indentified six redds in the Fall Creek reach below the dam. These redds were likely buried through sediment transport. It should also be noted that water temperatures peaked to 62.5°F during fall 2011, so it is likely that up to 50% of downstream redds had already experienced mortality (Corps 2012). The redds found to occur downstream of the dam are considered by Corps and ODFW fisheries biologists to be within "low" quality spawning habitat as opposed to the higher quality spawning habitat upstream of the head of the reservoir. ESA-listed salmonids that arrive at the Fall Creek Adult Fish Collection Facility are trapped, hauled, and released at sites upstream of the head of the reservoir. Further, fine sediment material that visually accumulated immediately downstream of Fall Creek Dam were observed to flush from the area after subsequent winter storm events, so the Corps anticipates future winter storm events would flush some of the sediments that may collect just downstream of the dam. The Corps would continue to share the results of further sediment and water quality monitoring with ODEQ.

Temperature. Water turnover during fall typically occurs during early to mid-November at Fall Creek Reservoir. For this reason, water temperatures would not be negatively impacted by this operation since release temperatures would be uniform regardless of where or how water is released from Fall Creek Dam (Corps 2012).

Algae. Algal growth in the reservoir should not be affected during the winter because of cool water temperatures and shortened daylight hours when drawdown would occur.

5.6 Vegetation

No Action Alternative

Under the no action alternative there would be no work proposed so the existing vegetation would remain the same.

Preferred Alternative

Under the preferred alternative there would be a small change in operation of Fall Creek Dam. The existing rule curve would be modified but these small changes in flow and flow timing would have no effect on vegetative conditions at the project areas.

5.7 Wildlife (Including ESA-listed Northern Spotted Owl and Oregon Spotted Frog)

No Action Alternative
Under the no action alternative there would be no work proposed, and conditions would remain the same. The current condition for wildlife would remain the same and, as noted above, there would be no changes to vegetation.

Preferred Alternative
Under the preferred alternative, there would be a 48-foot change in reservoir elevation and a decrease in pool extent but, as noted above, there would be no changes to vegetation as there is no vegetation below the maximum conservation pool elevation. This change to reservoir pool may have a small temporary effect to waterfowl that would normally utilize the area. This effect would be relatively short in duration (about a month). As part of the normal rule curve, the Fall Creek Reservoir is normally in flux at this time of year (December to January). Waterfowl are capable of dispersing to other nearby water bodies. The impact would be negligible and temporary in nature.

There will be no impact to the northern spotted owl because their habitat would not be affected; and Oregon spotted frogs are not known to occur in the vicinity of Fall Creek Dam. Critical habitat for listed species would not be impacted from the implementation of the Preferred Alternative because the drawdown would not impact critical habitat for northern spotted owls.

5.8 Fish (Including ESA-listed UWR Chinook Salmon, UWR Steelhead, and Oregon Chub) and Take

No Action Alternative
Under the no action alternative there would be no work proposed, and conditions would remain the same conditions prior to the interim deep drawdowns that have occurred over the past three years. The situation would be reverted to conditions for fish characterized by difficulties in accessing regulating outlets and low survival during passage under high flows would.

Preferred Alternative
Under the Preferred Alternative it is anticipated there would be a beneficial effect to downstream migrating salmonids. As reservoirs are drawn lower, surface-oriented juvenile salmonids have a better opportunity to find a regulating outlet to migrate through, and fish passing under lower flows associated with lower reservoir water elevations are subjected to less trauma and mortality. Mortality of juvenile migrant salmonids at Fall Creek Dam decreased as elevation of Fall Creek Reservoir decreased. Similarly, mortality decreased as discharge increased below Fall Creek (Keefer et.al. 2012). The vast majority of salmon passed dams in late fall and winter when reservoirs were drawn down near annual lows (Keefer et. al. 2011). Hydro-acoustic and screw trap results both indicate the highest Chinook salmon dam passage rates occur during winter. High dam passage rates coincided with relatively high river discharge from low reservoir

elevations. That is, fish passage at dams increases as reservoir elevation drops. This passage timing is likely related to river flow discharge and route availability, rather than physiological cues (i.e., smoltification). Presumably, these fish were cued by high flows to emigrate during a period with ready access to regulating outlets. As reservoirs are drawn lower, the opportunity to find a regulating outlet to migrate through improves for surface-oriented juvenile salmonids. Prior to interim measures being implemented at Fall Creek Dam, juvenile salmonids were required to go through regulating outlets under higher flow conditions and at greater pressure, because of higher reservoir water elevations, than has been afforded with implementation of the interim measures and that would be afforded these measures being implemented on a permanent basis. Higher flows and pressure result in greater likelihood of mortality during passage through the dam because of baro-trauma (from high pressure) and injury and death due to sheer forces and greater likelihood of contact with hard surfaces (from high velocities).

As a trial, the drawdown for fish passage was implemented at Fall Creek Dam the past four years (2010-2013). In 2010, the reservoir was drawn down to elevation 690 feet. Keefer and others (2011) indicated that capture rates of juvenile Chinook in screw traps were highest below Fall Creek Dam at the lowest reservoir elevations. From November 20-24, 2011, Fall Creek reservoir was drawn down to elevation 680 feet. This lowered the reservoir elevation 10 feet lower than the previous year. During this passage operation, it was estimated that upwards of 20,000 spring Chinook salmon sub-yearlings were passed through the dam, averaging about 25 millimeters larger than sub-yearlings passed in previous years. Based on screw trap studies conducted by Corps biologists, the largest number of fish passed once Fall Creek reservoir was drawn down below minimum conservation pool elevation. Most salmonids passed through the dam before reservoir elevations reach 700 feet, while most non-native predatory fish exited before reservoir elevations reached 680 feet (run-of-the-river).

From a biological perspective, this fish passage operation has been very successful (Corps 2012). In a telemetry study on Chinook salmon conducted at Fall Creek Dam by NMFS in 2012, Nesbit et al. (2014) reported substantially higher survival for salmon released into Fall Creek Reservoir when reservoir elevation was at 703 feet compared to those released at 728 feet. Survival while fish were in the reservoir was not substantially different for the two release groups, but survival through the regulating outlets (99.9% vs. 89.4%), from the regulating outlest to tailrace (98.3% vs. 79.9%), and project survival from the forebay to tailrace (98.0% vs. 79.3%) were substantially greater for fish released at the lower elevation of 703 feet. As the reservoir draws down below the minimum conservation pool of 728 feet, juvenile salmonids migrate through the regulating outlets in large numbers; most are out of the reservoir before the reservoir elevation reaches about 710 feet.

It has been shown that smolts migrating from the reservoir via the regulating outlets survive best when Fall Creek pool elevations are below normal winter minimum levels and regulating outlet discharges are less than 500 cfs (Downey 1992). With run-of-river drawdown, piscivorous fish (primarily bass, crappie, and blue gill) are flushed from the reservoir, leaving fewer competitors and predators in the reservoir to interfere with the next year class of salmon (Corps 2012). As the reservoir draws even lower toward the invert elevation of the regulating outlets of about 680 feet, non-native predatory fish are flushed out. This has been shown through screw trap catch data from just downstream of the dam. Survival of non-native predators, which are not accustomed to

living in turbulent waters, is believed to be low through the dam, as evidence by the large percentage of dead fish found in the screw trap. Flushing of non-native predators provides for excellent salmonid rearing habitat the following year in the reservoir, and juvenile Chinook salmon and steelhead have been found to grow unusually large; likely owing to ecological consequences of reduced numbers of non-native predatory fish. Hence very deep drawdown, below the level to pass most salmonids, is desired in order to improve juvenile rearing survival in the reservoir the following year.

Marginal spawning and rearing areas are available downstream from Fall Creek Dam. Spawning has been documented below the dam, but successful hatching and rearing has been very limited. Egg mortality has been near 100%, and surviving fry emerge prematurely because of warm water discharged from the dam in fall and winter (Sullivan and Rounds 2004 as cited in Corps 2012). The Magnuson-Stevens Fishery Conservation and Management Act requires Federal Agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). Affected portions of the Willamette and Columbia rivers and several affected Willamette basin tributaries serve as migratory corridors for anadromous salmonids, including Chinook and coho salmon. Portions of affected Willamette basin tributaries also serve as spawning and rearing habitats for Chinook and coho salmon (2008 NMFS BiOp). The Middle Fork Willamette up to Dexter Dam is designated as EFH for listed Chinook. NMFS stated in their 2008 BiOp that the Corps adopt and implement the terms and conditions of the BiOP as EFH conservation measures. Because the proposed action continues implement of RPA 4.8 of the NMFS 2008 BiOp to enhance downstream fish passage through reservoir operational modifications, this proposed project is in compliance with MSA.

Section 9(a)(1) of the ESA prohibits any taking (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of ESA-listed species without a specific permit or exemption. Protective regulations adopted pursuant to Section 4(d) of the ESA extend the prohibition to threatened species. Harm is defined to include significant habitat modification or degradation that results in death of or injury to listed species by significantly impairing behavioral patterns such as spawning, rearing, feeding, and migrating (50 CFR § 222.102; NMFS 1999f) (NMFS 2008).

An Incidental Take Statement specifies the impact of any incidental taking of ESA-listed species. It also provides reasonable and prudent measures that are necessary to minimize these impacts and sets forth terms and conditions with which the Corps must comply in order to implement the RPAs (NMFS 2008).

To monitor the impact of incidental take, the Corps has reported on the progress of the action and its effect on listed species to NMFS, as specified in this incidental take statement (50 CFR § 402.14(i)(3)) (NMFS 2008). The Corps has implemented the RPAs in the incidental take statement to minimize incidental take. As the RPA was implemented, incidental take due to juvenile passage mortality has declined substantially.

Sediment released during the proposed drawdown at Fall Creek could potentially affect the small number of documented Oregon chub downstream of the dam. Oregon chub have been proposed

for delisting, which is expected to occur in 2014. The original 3-in1 EA (including Fall Creek, Hills Creek, and Cougar Dams) was released for public review prior to the proposed delisting. The Corps has a monitoring agreement with ODFW to monitor the four backwater habitats for fish, including Oregon chub, which would occur during implementation of the Preferred Alternative. The Corps would coordinate planned operations through the WATER process in advance of making late fall/early winter drawdown a permanent operation.

5.9 Monitoring and Take

No Action Alternative
Under this alternative, minimal monitoring would occur.

Preferred Alternative
Under the preferred alternative there would be an increase in fish and water quality monitoring. Monitoring is an essential component of the preferred alternative. Water quality monitoring would include an evaluation of water temperature, total dissolved gases, and turbidity. In order to evaluate the effectiveness of downstream fish migration, it would be necessary to capture and handle fish at the downstream end of the project. Typically, screw traps are employed but other methods such as netting may also be used. The Corps, in cooperation with resource agencies including NMFS and USFWS, have developed protocols on how to capture and handle fish. The trapping, capturing, or collecting and handling of juvenile fish using traps is likely to cause some stress on listed fish. However, fish typically recover rapidly from handling procedures. The primary factors that contribute to stress and mortality from handling are excessive doses of anesthetic, differences in water temperature, dissolved oxygen conditions, the amount of time that fish are held out of water, and physical trauma (NMFS 2008).

Research monitoring and evaluation studies under the preferred alternative would have direct effects on both UWR Chinook salmon and UWR steelhead that are used in field studies. Fish may be trapped, examined, released, confined, re-located, marked or tagged and subjected to related handling operations, subjected to the administration of pharmacological agents, including anesthetics, subjected to capture by electrofishing, killed or injured during test and control conditions, and affected in diverse other ways (NMFS 2008).

NMFS and USFWS anticipated the need for monitoring the effectiveness of the RPA and developed an RPA measure to specifically address what kind of monitoring should be accomplished. RPA measure 4.11 in the 2008 NMFS BiOp states the following:

4.11 Assess Downstream Juvenile Fish Passage through Dams: At Cougar, Lookout Point and Dexter, Detroit and Big Cliff; Foster and Green Peter, Fall Creek, and Hills Creek dams, the Action Agencies will, in coordination with and review by the Services, do the following:

1. Assess passage survival and efficiency through all available downstream routes, including turbines, spillways, regulating outlets, hatchery water supplies, etc., noting injury and mortality through each route. [Note: For Fall Creek Dam, survival through regulating outlets is applicable].

2. Identify and propose alternatives for reducing juvenile mortality passing through the routes noted above, including, but not limited to, operational and structural modifications. [Note: For Fall Creek Dam, survival through regulating outlets is applicable].

As stated earlier in the Purpose and Need section, as a result of monitoring of downstream fish passage at Fall Creek Dam, the Corps now proposes to make winter drawdowns a permanent action. Continued high survivorship of juvenile salmonids passing downstream would ultimately increase populations in the Middle Fork Willamette River.

There is always some small level of harm and mortality when handling many fish. The Corps employs experienced biologists who are familiar with monitoring methods and have developed protocols to minimize impacts to the resource. Incidental take from fish passage RM&E has included harassment, handling, injury, and mortality of adults at trapping sites; handling and mortality of adults during transport; juvenile injury and mortality during project passage; and juvenile trap mortality at the lower end of the study site. The NMFS 2008 BiOp allows for mortality of up to 1% associated with research/monitoring activities, which was not and would not be exceeded.

5.10 Cultural Resources

No Action Alternative
Under this alternative there would be no work proposed. The current condition for cultural resources would remain the same.

Preferred Alternative
Fluctuating reservoir shorelines can directly impact archeological sites (BPA et al 1995:4-134 - 4-136). A variety of impacts can occur to cultural resources during reservoir drawdown operations. Fluctuating flow, current, and water levels often cause wave action, exposure, and repeated inundation of cultural resources, potentially causing effects. Additional types of impacts that can occur include wind and water deflation of archeological deposits; repeated cycles of inundation (wetting) and drying causing deterioration to organic materials; wind generated wave action can cause erosion and deflation of archeological material; changing underwater currents due to surface water level fluctuation can cause displacement of archeological material or slumping. Also, reservoir drawdowns can subject surface archeological materials to looting, vandalism, illegal off road vehicles, and animal impacts such as burrowing, wallowing, and the establishment of temporary game trails.

A DOE for the NRHP of five of the 34 identified archeological sites within the drawdown zone at Fall Creek has been completed, although the remaining 29 sites have not been evaluated. Consultation regarding the APE for the deep drawdown at Fall Creek with the Oregon SHPO and affected tribes has been initiated in December of 2012 and an APE has yet to be established. Five of the known archeological sites at Fall Creek were assessed for condition, impacts, and eligibility to the NRHP during the 2013 deep drawdown. The Corps determined three of these sites as eligible for the NRHP; furthermore, that reservoir operations are having an adverse effect upon them. The Corps has yet to submit these DOE's to the SHPO for consensus determination but has continued consultation and expressed the desire to enter into a Programmatic Agreement

(PA) for system-wide operations of the Willamette Valley Projects. The results of this assessment will help inform the agency in its effects determination and completion of the consultation process with SHPO and Native American Tribes.

5.11 Recreation

No Action Alternative
Under this alternative there would be no work proposed. The current condition for recreation would remain the same.

Preferred Alternative
With implementation of the preferred alternative, no impact to recreation would occur because during winter, the parks and boat ramps are closed for use (Corps 2012).

CHAPTER 6 - CUMULATIVE IMPACTS

"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7).

The area of consideration for cumulative effects is the Middle Fork of the Willamette River. Considerable changes have occurred to the Middle Fork of the Willamette River since Euro-American settlement began around 1850s. Prior to this time much of the Willamette basin and its tributaries would have been dominated by western hemlock forest. Starting around the 1850s with the advent of European settlement the landscape began to change. Table 1, in Section 4.1 earlier in the EA, provides a good example of the types of alterations that have taken place as well as the scale. The major incremental transformation that has occurred over time in the study area included deforestation that has been converted to agricultural and urban development, construction of dams and revetments, water withdrawals and removal of wood from the rivers. These effects have changed vegetative patterns, altered the hydrology and geomorphology of the rivers disconnecting the rivers from their floodplains. As a result, riparian and off-channel habitats have been greatly reduced resulting in adverse impacts to some populations.

Off-channel habitats immediately downstream of Fall Creek Dam and further downstream in the Middle Fork Willamette River are likely to be impacted by sediment movement from Fall Creek Reservoir with drawdown as described in USGS (2014); these habitats doubtlessly have been affected to a lesser degree by shallower drawdowns with past operation of Fall Creek Dam. During the winter of 2012-13, the drawdown of Fall Creek Reservoir resulted in the net transport of approximately 50,300 tons of sediment during the 6-day drawdown operation. The transported sediments likely were deposited primarily in Fall Creek downstream of Fall Creek Reservoir, but also were mobilized downstream to the Middle Fork Willamette River (USGS 2014). Sediment has been a concern with respect to Oregon chub residing in off-channel habitats downstream of the dam. Oregon chub populations have done well in this area, and have increased approximately

three-fold from 2007 to 2013. This species is scheduled to be removed from the threatened and endangered species list by the USFWS in fall of 2014. The Corps believes that less sediment would be transported as drawdowns continue into the future because of establishment of channels in the reservoir resulting in less scouring. The Corps has a monitoring agreement with ODFW to monitor the four backwater habitats for fish, including Oregon chub, which would occur during implementation of the Preferred Alternative. The Corps will coordinate any permanent action through the WATER process, and future concerns including issues with sedimentation can be vetted through the WATER process.

Cumulative effects would also result from collaborative endeavors such as participating in ESA recovery plans as well as any habitat restoration projects within the Willamette Valley under the Corps restoration authorities (such as section1135 and 206 under the Water Resource Development Act and General Investigations). The proposed trap and haul facility at Fall Creek Dam is an example of projects that are proposed for the near future. Potential future passage enhancement projects at Hills Creek Reservoir and Lookout Point Reservoir prescribed by the 2008 BiOp would combine with the project presented here with the expectation that adult salmonid returns would be higher than with the Fall Creek project alone. Benefits to salmonids would be cumulative without overlap with these three projects since fish spawning above Fall Creek would not compete for spawning or reservoir rearing with upstream reservoirs. As with the implementation of many projects, either changes in operations or construction, there are usually short term impacts. As noted in this document, implementation of the preferred alternative may result in temporary water quality impacts and harm or even cause mortality to ESA-listed UWR Chinook and UWR steelhead, but it is expected that survival of juveniles will improve from the baseline condition. Implementation of this proposed action combined with the other actions being taken in the Willamette Valley per the NMFS 2008 BiOp are expected to benefit listed UWR Chinook and UWR steelhead in the long term despite incidental take expected to occur with Fall Creek Reservoir drawdowns.

CHAPTER 7 - COORDINATION

The proposed action at Fall Creek Dam covered in this EA was previously included in an EA released for public review along with proposed work at two other WVP dams, Hills Creek Dam and Cougar Dam (3-in-1 EA). Hills Creek and Cougar were subsequently removed from immediate consideration because of potential complications from environmental impacts. The draft 3-in-1 EA was issued for 15-day public review on November 19, 2013. The Public Notice was sent to interested persons, groups, and government agencies. Government agencies included the following:

National Marine Fisheries Service
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service
Bureau of Land Management
Confederated Tribes of the Warm Springs Reservation
Confederated Tribes of the Grand Ronde Community of Oregon
Columbia River Inter-Tribal Fish Commission
Oregon Department of Environmental Quality

Oregon Department of Fish and Wildlife
Oregon Department of Parks and Recreation
Oregon State Historic Preservation Office

Public comments were received on the 3-in-1 EA. Responses to comments that were specific to Fall Creek Dam, and general comments not specific to Hills Creek and Cougar Dams, are listed below.

This draft EA, for Fall Creek Dam only, was prepared to address the requirements of the National Environmental Policy Act (NEPA) and is issued for 30-day public and agency review under Public Notice CENWP-PM-E-14-11. This EA was sent to the government agencies listed above, as well as other groups.

Public comments will be addressed. After consideration of all public comments, if it is determined that the Preferred Alternative would have no significant impact on the quality of the human environment, then a Final EA, incorporating the responses to comments, and a Finding of No Significant Impact (FONSI) would be signed which would conclude the NEPA process. If it is determined that the Preferred Alternative would have a significant impact on the quality of the human environment, then further consideration under NEPA would occur.

CHAPTER 8 - COMMENTS AND RESPONSES RELATIVE TO OPERATIONS AT FALL CREEK DAM FROM THE 3-IN-1 EA IN 2013

Note that page numbers and section numbers in the comments below refer to the 2013 draft 3-in-1 EA, not this draft EA.

Comment 1: Overall, the Service is supportive of such a drawdown in Fall Creek Reservoir in 2014. However, we have concerns regarding the potential for increased take of species listed under the ESA under Service jurisdiction (e.g. Oregon chub and bull trout) with increased reservoir drawdowns that are not adequately described in the dEA. The Service recommends the Corps coordinate closely well in advance with the Service prior to scheduling any increased drawdowns to ensure there is adequate ESA coverage for future actions. Such coordination should occur annually through the interagency technical teams (aka Willamette Action Team for Ecosystem Restoration or WATER) established to implement the 2008 biological opinions.

Response 1: The Corps would coordinate any permanent action through the WATER process.

Comment 2: As the Corps plans to continue funding monitoring of these chub populations and habitats, and the proposed drawdown will benefit ESA-listed salmonids, the Service supports the 2013/2014 Fall Creek Reservoir drawdown and does not see the need for additional consultation at this time. However, the dEA needs to adequately describe the new information on chub in Fall Creek and disclose the potential effects to chub and their habitats. The Service also recommends the dEA specify coordination will occur annually via the WATER process for future drawdowns.

Response 2: The Corps appreciates support of the Fall Creek Reservoir drawdown. Additional information has been provided in this draft EA with respect to Oregon Chub. The Corps has a

monitoring agreement with ODFW to monitor the four backwater habitats for fish, including Oregon chub, which would occur during implementation of the Preferred Alternative. The Corps will coordinate any permanent action through the WATER process. Since release of the 3-in-1 EA, Oregon chub have been proposed for delisting and are expected to be delisted in fall of 2014.

Comment 3: Introduction: This section describes the preferred alternative in the first and last sentence as a winter drawdown of three reservoirs. However, in section 2.2, Preferred Alternative, the action includes preferential use of the regulating outlets (RO) as well as reservoir drawdown. This preferential use of the RO is especially important at Cougar, where fish survival studies have shown higher survival through the RO than the turbines for yearling-size fish. At Fall Creek there are no turbines, and the other outlets, the "fish horns," are usually above water level during winter flood control season. At Hills Creek, we have little fish survival data for either the turbines or RO. NMFS recommends this section be revised to include this preferential use of the RO, at least for Cougar Dam.

Response 3: Discussion of fish horns relative to water elevation in Fall Creek Reservoir and their extremely limited utility to pass fish has been incorporated into this draft EA.

Comment 4: Duration of Actions: The Public Notice and Draft EA are unclear with respect to the duration of these interim actions. The Public Notice states that they will occur over a five-year period for each dam, and the Draft EA states that the operations will continue for seven years. From conversations with Corps staff, NMFS understands that the apparent discrepancy is due to the fact that drawdown at Fall Creek Dam will start in 2013 and presumably continue for another four years, but similar operations at Cougar and Hills Creek will not start until 2014 or 2015, and will be on a staggered timeframe for completion after five years. This planned approach needs to be clarified in both the Public Notice and Draft EA. More importantly, NMFS is concerned with the decision to limit the Fall Creek drawdown to five years, despite our understanding the Corps considers this a successful downstream fish passage operation. We recommend that this operation be considered a normal, rather than special, operation and be included in the Willamette Annual Operations Plan, Willamette Fish Operations Plan, and Water Control Manual.

Response 4: Implementation of the Preferred Alternative, beginning in 2014, would be considered a normal, rather than special, operation and be included in the Willamette Annual Operations Plan, Willamette Fish Operations Plan, and Water Control Manual. Adoption of the Preferred Alternative on a permanent basis is proposed based on research results on juvenile salmonid passage and survival over the past four years during interim operations.

Comment 5: Section 1.3 Purpose and Need for Action: This section needs to clearly state that the purpose for these actions is to ensure compliance with NMFS' RPA measure 4.8. We appreciate that the RPA measure is described in this section but recommend that this requirement be stated in the initial "Purpose" paragraph. Additionally, in the first sentence of the "Need" paragraph, the word "maximizes" should be replaced with "increases." There are other actions that could be taken to maximize downstream fish passage, but this action is more correctly described as increasing fish passage.

Response 5: The Purpose and Need Statement has been revised to incorporate RPA 4.8, which has been accomplished on an interim basis (2010-2013) per RPA 4.8. Because of the great improvement in juvenile salmonid survival, winter drawdown done on an interim basis is now proposed to be done on a permanent basis.

Comment 6: Section 2.2.2 Fall Creek: Drawdown and Prioritize Use of Regulating Outlet for Downstream Fish Passage Improvements: In this section, the drawdown elevations appear correct, but the first sentence states that the reservoir would be held at this elevation "from late-November through February except during flood events" and the fourth sentence describes the duration as "approximately 2 weeks." Based on the Corps' tests at Fall Creek in recent years, we suggest the correct description is "for an approximate 2-week duration between late-November and end of February." NMFS is not opposed to testing a longer duration drawdown.

Response 6: Text has been revised to adopt the recommended language.

Comment 7: Fall Creek additional operational alternatives not considered in the Draft EA: In the WATER process, NMFS has recommended a delayed refill operation be tested at Fall Creek to better mimic normative spring migration patterns of spring Chinook salmon. We have also suggested that the winter drawdown start earlier in the fall rather than wait until late November or December. While we support the winter drawdown described in the preferred alternative, we urge the Corps to test these other operations during the next few years.

Response 7: From research over the past four years, early December is good timing for drawdown, however this can vary by year, and would not have to necessarily occur during the same timeframe every year. Deep drawdown would typically occur during an approximately two week period, most often of shorter duration than two weeks, and would typically occur in late fall/early spring. Implementation of the Preferred Alternative would be coordinated through the WATER process, and ideas for adjustments to operations can continue to be made through the WATER process, although there may be operational limitations that preclude adjustments.

Comment 8: Page 28, Section 3.9 Fisheries: The third sentence states that the Willamette project dams "have had a profound effect on resident fish species…" Later in the paragraph, NMFS' 2008 Biological Opinion (Opinion) is referenced and spring Chinook are described as a focal species of the analysis. It appears that this section is referring to both resident and anadromous fish species, and should be modified for clarity.

Response 8: This has been incorporated into this EA.

Comment 9: Page 30, Fish access, downstream migration and mortality: The last sentence of this paragraph states, "When the Willamette Valley Project was originally conceived, fish passage was not considered, but a hatchery system was included to mitigate the lost [sic] of access to natal streams and spawning grounds." In fact, fish passage was heavily debated when the Project was originally authorized. Downstream fish passage facilities were installed at several projects, including the fish horns at Fall Creek (described on page 13 of the draft EA) and

a gulper-like structure at Cougar Dam. None of these downstream passage structures functioned as well as intended and were abandoned within a few years after Project construction.

Response 9: This has been incorporated into this EA.

Comment 10: Pages 34 - 38, Section 3.10 Threatened and Endangered Species: This section does a good job of describing NMFS' 2008 RPA for the Willamette Project. To avoid future confusion, we request three minor corrections: (1) The RPA is a complete action that is comprised of many measures. When referring to an individual required activity within the RPA (both in this section and throughout the draft EA), please describe it as an "RPA measure." (2) The final sentence of the first paragraph in this section on page 34 states that, "The BiOps included recommend [sic] RPAs to the proposed operation of the Willamette Valley Project…" This should be revised to state that the RPA is an alternative to the proposed action which the Corps must carry out to avoid jeopardizing the listed species or adversely modifying habitat designated as critical for the listed species. (3) Although cited properly elsewhere in this section, the NMFS 2008 Biological Opinion is cited as "NMFS 2001 BiOp" in the section quoting RPA measure 4.12.1, Cougar Dam Downstream Passage on page 38.

Response 10: This language has been incorporated into this EA.

Comment 11: Pages 43 – 44, Section 3.11 Monitoring: This section summarizes sections of NMFS 2008 Opinion and RPA requiring extensive research, monitoring, and evaluation (RM&E). In the Opinion, NMFS authorized incidental take of listed Chinook salmon and steelhead for RM&E studies. We have established a process for annual review of RM&E and quantification of take for research purposes. Additionally, NMFS authorized take associated with downstream fish passage at each of the Project dams, based on estimates of fish mortality through the unimproved passage routes. NMFS stated that as improved fish passage facilities came on-line during the term of the Opinion, acceptable take levels would be decreased. Recent monitoring at the three dams described in this draft EA shows take levels in the same range as that authorized by NMFS' Incidental Take Statement (chapter 11 of the Opinion). Thus, a new consultation with NMFS is not necessary for the proposed operations at these three dams.

Response 11: Comment acknowledged.

Comment 12: Pages 55 – 59, regarding Take of listed fish species: NMFS agrees with the characterization of anticipated incidental take of Upper Willamette River Chinook salmon associated with the proposed action and RM&E to evaluate the proposed action. The Corps will monitor during the operations and notify NMFS if fish losses approach the take limits to determine how best to proceed to remedy the situation. NMFS concurs with this approach.

Response 12: Comment acknowledged.

Comment 13: Page 65, Magnuson-Stevens Fishery Conservation and Management Act: The last two sentences of the first paragraph in this section need minor corrections. Please revise to state, "The McKenzie River up to Cougar Dam is designated as EFH [Essential Fish Habitat] for

listed Chinook and unlisted coho. The Middle Fork Willamette up to Dexter Dam is designated as EFH for listed Chinook."

Response 13: The text has been revised accordingly.

Comment 14: Willamette Riverkeepers (WR) believes that moving forward with winter drawdowns and operations at Fall Creek and Cougar dams is necessary. These measures will provide some level of improvement for downstream salmonid fish passage at the Corps dams.

Response 14: Comment acknowledged.

Comment 15: Drawdown Timing: WR wonders at the decision to limit the Fall Creek drawdown to five years, despite our understanding the Corps considers this a successful downstream fish passage operation. At what point will this operation be considered a normal, rather than special, operation and be included in the Willamette Annual Operations Plan, Willamette Fish Operations Plan, and Water Control Manual?

Response 15: As a result of great success of the interim measures with respect to juvenile salmonid survival, the proposed action is to continue winter drawdown on a permanent basis.

Comment 16: Fish access, downstream migration and mortality, p 30: The last sentence of this paragraph states, "When the Willamette Valley Project was originally conceived, fish passage was not considered, ..." In fact, fish passage was debated when the Project was originally authorized, and downstream fish passage facilities were included at several projects. None of the original downstream passage structures functioned as well as intended, and were abandoned within a few years after Project construction. In our view this provides ample precedent that can be utilized by the Corps to make significant structural improvements and modifications to aid downstream fish passage.

Response 16: The EA has been revised accordingly.

Comment 17: In general, ODFW is supportive of drawdown efforts at Fall Creek, but recommends increased monitoring of potential impacts to downstream native fish populations, including Oregon chub populations and their habitats. ODFW is supportive of the drawdown efforts at Cougar Dam, but feel benefits will be limited, so we also recommend continued efforts to move ahead with permanent downstream fish passage alternatives that provide safe downstream passage for both bull trout and juvenile Chinook. ODFW does not support drawdown efforts at Hills Creek Dam due to concerns about impacts to bull trout populations and limited benefits to Chinook populations.

Response 17: Comment acknowledged. The Corps has funded and appreciates the efforts of ODFW in monitoring Oregon chub and other native fish species in the Fall Creek dam area.

Comment 18: 3.2: Incorrect statement: "Hills Creek Dam and Fall Creek Dam are on two creeks that flow into the upper Middle Fork Willamette River."

Response 18: This statement is correct; Hills Creek and Fall Creek are tributaries of the Middle Fork Willamette River. Hills Creek dam impounds the confluence of Hills Creek and the Middle Fork Willamette River.

Comment 19: Page 25: Information on salmon spawning distribution should reference ODFW spawning survey reports.

Response 19: Reference to salmonid spawning in below Fall Creek Dam has been incorporated into this EA.

Comment 20: Page 34; 4th paragraph – The differences in percent fish mortality observed may simply be due to differences between traps in capture efficiencies of dead fish, as mentioned in the report (Romer et al. 2012).

Response 20: Comment acknowledged.

Comment 21: Page 54; Section 4.8; Sentence beginning 'Mortality increased with increasing reservoir elevation…' does not agree with statement on page 55 ('Smolts showed a decrease in the mortality rate…'). Also, the statement on page 54 should cite the Keefer et al. 2011 paper, not the 2012 paper.

Response 21: The EA has been revised accordingly.

Comment 22: Throughout: needs extensive revision for grammatical errors and technical inaccuracies.

Response 22: Comment acknowledged.

Comment 23: In addition, we are concerned that nonnative fish are likely transported from the reservoir in increased numbers, which may impact Oregon chub and other native, resident fishes in off-channel habitats located downstream of the dam.

Response 23: The Corps has a monitoring agreement with ODFW to monitor the four backwater habitats for fish, including Oregon chub, which would occur during implementation of the Preferred Alternative. Survival of non-native predators, which are not accustomed to living in turbulent waters, is believed to be low through the dam, as evidence by the large percentage of dead fish found in the screw trap. Flushing of non-native predators provides for excellent rearing habitat the following year in the reservoir, and juvenile Chinook salmon and steelhead have been found to grow unusually large; likely owing to ecological consequences of reduced numbers on non-native predatory fish. Hence very deep drawdown, below the level to pass most salmonids, is desired in order to improve juvenile rearing survival in the reservoir the following year. The Corps will continue to coordinate closely in advance of operations that implement the 2008 BiOp through the WATER process.

Comment 24: We request that the Corps address our concerns pertaining to Oregon chub, sedimentation, and potential impacts of nonnative fish in off-channel habitats downstream of Fall Creek dam in the final EA.

Response 24: The text has been revised accordingly.

Comment 25: However, because of the large quantities of sediment stored behind the dams, the drawdowns have the potential to significantly alter the balance of the process, resulting in short and/or long term loss of off channel areas to the detriment of fish populations. ODFW's Native Fish Investigations program has collected data in off channel areas below Fall Creek which suggests that these effects should be given careful consideration and balanced against the likely benefits to salmonids.

Response 25: The Corps has funded and appreciates the efforts of ODFW in monitoring Oregon chub and other native fish species in the Fall Creek dam area. The Corps has also funded the USGS to monitor and report on the sediment/turbidity that is produced during the drawdown of Fall Creek reservoir. With implementation of the Preferred Alternative, the Corps would have the ability to drawdown over a two week period and can adjust drawdown levels to allay potential problems with sediment and turbidity. As channels develop more in Fall Creek Reservoir with annual deep drawdowns, sediment transport to downstream of the dam is expected to become less.

Comment 26: As stated on page 50 of the EA, shortly after the drawdowns, sediment was washed from the primary channel of Fall Creek. However, accumulated fine sediments were not washed out of the off-channel habitats, but rather accumulated there.

Response 26: During the winter of 2012-13, the drawdown of Fall Creek Reservoir resulted in the net transport of approximately 50,300 tons of sediment during the 6-day drawdown operation. The transported sediments likely were deposited primarily in Fall Creek downstream of Fall Creek Reservoir, but also were mobilized downstream to the Middle Fork Willamette River (USGS 2014). Sediment has been a concern with respect to Oregon chub residing in off-channel habitats downstream of the dam. Oregon chub populations have done well in this area, and have increased approximately three-fold from 2007 to 2013. This species is scheduled to be removed from the threatened and endangered species list by the USFWS in fall of 2014. The Corps believes that less sediment would be transported as drawdowns continue into the future because of establishment of channels in the reservoir resulting in less scouring. The Corps has a monitoring agreement with ODFW to monitor the four backwater habitats for fish, including Oregon chub, which would occur during implementation of the Preferred Alternative. The Corps will coordinate any permanent action through the WATER process, and future concerns including issues with sedimentation can be vetted through the WATER process.

Comment 27: High flow events, with the capability to alter floodplain channel habitat, are uncommon in the managed reaches of the Willamette basin. Off-channel habitat typically has higher roughness compared to primary channel habitat, meaning that water moves more slowly through these areas. In contrast to the mainstem river, during a drawdown flows are not sufficient in many off-channel habitats to move fine sediment, resulting in deposition and

accumulation. To reduce the risk of flooding, the maximum managed Fall Creek Reservoir outflow is 4,500 cfs. Flows of this magnitude occurred after the 2011 drawdown in January 2012. However, despite reaching peak flows, our data suggest that fine sediment that was deposited during the drawdown was not transported out of the off-channel habitats. Thus, the magnitude of flow necessary to flush deposited sediment from the off-channel habitats is likely greater than the currently managed maximum flows. This is concerning, as over time much of the off-channel habitat downstream of Fall Creek may be reduced or lost and there is low likelihood of creating new areas under the current flow management regime. Some managers, both ODFW and Corps, have speculated that sediment transport will likely be lower during subsequent drawdowns once a channel is scoured in Fall Creek reservoir.

Response 27: The drawdown of Fall Creek Reservoir in 2012-2013 resulted in net transport of approximately 50,300 tons of sediment from the lake during the 6-day drawdown operation. Off-channel habitat will continue to be monitored and concerns of decreased off-channel habitat can be vetted in the future at WATER meetings. As channels develop more in Fall Creek Reservoir with annual deep drawdowns, sediment transport to downstream of the dam is expected to become less.

Comment 28: An additional concern with drawdowns is the potential downstream transport of nonnative predatory fishes, which are common in reservoir habitats. As mentioned on page 55 of the EA, nonnative fish are likely passed downstream of the reservoir in great numbers. During a drawdown, these fish may invade off-channel habitats used by Oregon chub, with potential negative effects. As mentioned above, ODFW recommends monitoring of nonnative fish populations to evaluate effects of drawdown on those populations, as well as potential impacts to native fish populations downstream.

Response 28: The Corps has funded and appreciates the efforts of ODFW in monitoring Oregon chub and other native fish species in the Fall Creek dam area. The Corps would coordinate via the WATER process to evaluate how the most recent monitoring data would influence future operations. Survival of non-native predators, which are not accustomed to living in turbulent waters, is believed to be low through the dam, as evidence by the large percentage of dead fish found in the screw trap. The Corps will continue to coordinate closely in advance of operations that implement the 2008 BiOp through the WATER process.

Comment 29: We hope that the Corps seeks alternative drawdown strategies to meet the downstream passage needs of salmonids, while not jeopardizing the habitat suitability of off-channel habitats for native, non-salmonid fishes, including Oregon chub. Fall Creek is the only reservoir where the Corps plans to completely draw down the elevation to the stream bed. The goals are to provide salmonid passage and limit nonnative fish in the reservoir. However, we recommend the Corps investigate implementing partial drawdown of Fall Creek (eg, 10-20 feet above the stream bed), which may pass salmonids, while limiting downstream sediment transport. In addition, the Corps should evaluate potential impacts to nonnative fish populations if varying drawdown levels are pursued. We recognize that the Corps may be implementing the complete drawdown of Fall Creek reservoir as an experiment to test feasibility of complete drawdowns at other Willamette basin dams. If the Corps plans on continuing the complete

drawdown at Fall Creek reservoir, the long term study of the reservoir and downstream habitat and fish assemblage is likely necessary to understand the cumulative effects of the drawdowns.

Response 29: The Corps would coordinate via the WATER process to evaluate how the most recent monitoring data will influence future operations.

Comment 30: Page 35: Critical habitat was designated for Oregon chub in 2010. Please see Federal Register document 75: 11010-11068.

Response 30: Language added to identify listing date.

Comment 31: Page 40: No Oregon chub populations were historically documented in the Molalla basin.

Response 31: Text has been revised by deleting the reference to the Molalla Basin.

Comment 32: Page 41: The hypothesis that Oregon chub require hydrologically isolated habitats is out of date. In our recent investigations, we have documented many highly abundant populations in frequently connected habitats. Oregon chub often share these habitats with a variety of other species, including nonnative piscivorous fish. The conditions which allow Oregon chub to coexist with nonnative fish in connected habitats are currently under investigation, and likely due to fluctuating temperatures regimes and timing of annual connectivity which limits nonnative fish overabundance. Please see our most recent Oregon Chub Investigations report.

Response 32: Text has been revised to reflect this.

Comment 33: Page 41: Currently we don't know of any amphibian species that have a significant effect on Oregon chub through predation or competition.

Response 33: Comment acknowledged.

Comment 34: We have concern about the statement "no adverse effect to Oregon chub", for the reasons we have mentioned above. (reference to the comments stated above this on the table)

Response 34: Text has been revised. Please note that in their letter, dated December 3, 2013, the USFWS states that, "…the Service…does not see the need for additional consultation at this time."

Comment 35: There are likely numerous previously unrecorded sites within Fall Creek Reservoir, and there is no indication of how they would be addressed.

Response 35: The Corps believes that this is likely.

Comment 36: Mitigation of impacts to cultural resources from the draw downs are not addressed.

Response 36: Agreed. The Corps aims to produce a Programmatic Agreement for the Willamette Basin dams, and has identified funding through Fiscal Year 2016 for cultural resources work at the Willamette Valley projects. The Corps has issued Government-to-Government consultation letters to the appropriate Tribes (Confederated Tribes of the Grande Ronde, Confederated Tribes of the Siletz, and Confederated Tribes of the Warm Springs).

Comment 37: Request notification when archaeological work is to be performed at any of the reservoirs and to respect that villages are known to occur along rivers in these areas and are known to potentially contain burials.

Response 37: Appropriate Tribes will be informed.

Comment 38: Request notification in the event inadvertent discoveries are made and/or changes in scale or scope of work.

Response 38: Appropriate Tribes will be informed.

CHAPTER 9 - COMPLIANCE REQUIREMENTS

9.1 National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.)

NEPA requires that Federal agencies consider the environmental effects of their actions. It requires that an Environmental Impact Statement (EIS) be included in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. The EIS must provide detailed information regarding the proposed action and alternatives, the environmental effects of the alternatives, appropriate mitigation measures, and any adverse environmental effects that cannot be avoided if the proposal is implemented. Agencies are required to demonstrate that these factors have been considered by decision makers prior to undertaking actions. Major Federal actions determined not to have a significant effect on the quality of the human environment may be evaluated through an Environmental Assessment (EA).

In accordance with the NEPA, federal projects are required to disclose potential environmental impacts and make efforts to involve the public. The draft EA for the Downstream Fish Enhancement for Juvenile Salmonids at Three Willamette Valley Dams was released for a 15 day public review period on November 19, 2013. Comments were received, and comments and responses relevant to Fall Creek are included in this draft EA. This draft EA will be released for a 30-day public review.

9.2 Endangered Species Act

The Endangered Species Act (16 U.S.C. 1531-1544), amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat upon which they depend. Section 7(a) of the ESA requires that Federal agencies

consult with USFWS and NMFS, as appropriate, to ensure that proposed actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy designated critical habitats.

Interim measures have been implemented per RPA 4.8 of the NMFS and USFWS 2008 BiOps to enhance downstream fish passage through reservoir operational modifications. Implementing RPA 4.8 has improved juvenile salmonid survival. The Corps has coordinated with the resource agencies by phone during preparation of this Draft EA to make winter drawdown a permanent operation. NMFS has expressed interest in earlier drawdown and delayed operation in the spring, which can be discussed in future WATER meetings.

9.3 Magnuson-Stevens Fishery Conservation and Management Act (MSA), (16 U.S.C. 1801 et seq.)

The MSA requires Federal Agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). Affected portions of the Willamette and Columbia rivers and several affected Willamette basin tributaries serve as migratory corridors for anadromous salmonids, including Chinook and coho salmon. Portions of affected Willamette basin tributaries also serve as spawning and rearing habitats for Chinook and coho salmon (2008 NMFS BiOp). The Middle Fork Willamette up to Dexter Dam is designated as EFH for listed Chinook. NMFS stated in their 2008 BiOp that the Corps adopt and implement the terms and conditions of the BiOP as EFH conservation measures. Because the proposed action continues implement of RPA 4.8 of the NMFS 2008 BiOp to enhance downstream fish passage through reservoir operational modifications, this proposed project is in compliance with MSA.

9.4 Migratory Bird Treaty Act

No birds covered under this Act would be affected by the proposed action.

9.5 Clean Water Act

This act is the primary legislative vehicle for Federal water pollution control programs and the basic structure for regulating discharges of pollutants into waters of the United States. The CWA was established to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." The CWA sets goals to eliminate discharges of pollutants into navigable waters, protect fish and wildlife, and prohibit the discharge of toxic pollutants in quantities that could adversely affect the environment. No pollutants would be discharged with implementation of the Preferred Alternative.

A temporary increase above background turbidity is anticipated for the drawdown of Fall Creek Reservoir due to the change from an impounded lake to a return to a run-of-river scenario. Under interim operations, the Corps employed Nationwide Permit (NWP) 4 (Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities) pursuant to Section 404 of the Clean Water Act; this NWP allows for discharges of fill into waters of the U.S. associated with fish enhancement activities. The Corps concluded that the project was functionally analogous to

Nationwide Permit (NWP) 4 (Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities) pursuant to Section 404 of the Clean Water Act. NWP 4 allows for discharges of fill material (in this case, sediment) into waters of the United States associated with fish enhancement activities. Under proposed permanent operation, i.e. returning flow to run-of-the-river, CWA coverage is not required (Corps 2005). The discharge would not cause the loss of any wetlands or the impoundment/semi-impoundment of waters of the United States. The sediment that comprises the reservoir bed of Fall Creek have been analyzed and found to be below screening levels for all chemicals of concern per the Sediment Evaluation Framework; http://www.nwp.usace.army.mil/Portals/24/docs/environment/sediment/2009_SEF_Pacific_NW.pdf). Therefore, the sediment is free from toxic pollutants in toxic amounts. An evaluation of sediment release associated with the drawdowns and the impacts on fish are included with the research, monitoring, and evaluation plan for Fall Creek Reservoir.

9.6 Clean Air Act

The Clean Air Act requires states to develop plans, called State Implementation Plans (SIP), for eliminating or reducing the severity and number of violations of National Ambient Air Quality Standards (NAAQS) while achieving expeditious attainment of the NAAQS. The Act also required Federal actions to conform to the appropriate SIP. An action that conforms with a SIP is defined as an action that will not: (1) cause or contribute to any new violation of any standard in any area; (2) increase the frequency or severity of any existing violation of any standard in any area; or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The proposed action would slightly modify reservoir operations. There are no activities that would generate emissions. The proposed project, thus, would have no impacts to air quality.

9.7 National Historic Preservation Act

Section 106 of the NHPA (16 U.S.C. 470) requires that Federal agencies evaluate the effects of Federal undertakings on historical, archeological, and cultural resources and afford the Advisory Council on Historic Preservation opportunities to comment on the proposed undertaking if there is an adverse effect to an eligible Historic Property. The lead agency must examine whether feasible alternatives exist that would avoid eligible cultural resources. If an effect cannot reasonably be avoided, measures must be taken to minimize or mitigate potential adverse effects.

As mentioned earlier in the EA, a determination of eligibility for the NRHP of the 34 identified archeological sites within the drawdown zone at Fall Creek has not been completed. Consultation regarding the APE for the deep drawdown at Fall Creek with the Oregon SHPO and affected tribes has been initiated. Five of the known archeological sites at Fall Creek have been assessed for condition, impacts, and eligibility to the NRHP during this deep drawdown. The Corps has determined three of these sites as eligible and is seeking concurrence from the SHPO. The agency has also determined proposed and continuing reservoir operations are having an *adverse effect* upon these NRHP eligible sites and will pursue a Programmatic Agreement with SHPO and relevant Native American Tribes to mitigate these effects.

9.8 Native American Graves Protection and Repatriation Act

This Act provides for the repatriation or disposition of Native American (and Native Hawaiian) cultural items and human remains to Native Americans. It also establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on federal land. This Act also provides for the protection, inventory, and repatriation of Native American cultural items, human remains, and associated funerary objects.

If human remains are discovered during operations, the Corps would be responsible for following all requirements of the Act.

9.9 Coastal Zone Management Act

Not Applicable, as the project is not within the coastal zone.

9.10 Wild and Scenic Rivers Act

Not Applicable, as Fall Creek is not designated as a wild and scenic river under the Wild and Scenic Rivers Act.

9.11 Fish and Wildlife Coordination Act

Not Applicable, as this project not a water resources development project.

9.12 Marine Protection, Research, and Sanctuaries Act

Not Applicable, as this project is not near the coast and would not affect coastal areas.

9.13 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) prohibits the taking, possession or commerce of bald and golden eagles, except under certain circumstances. Amendments in 1972 added to penalties for violations of the Act or related regulations.

The proposed action would slightly modify reservoir operations. No activities are proposed that could result in harassment of bald and golden eagles. Therefore, the proposed project would not result in any impacts to bald and golden eagles that would result in a takings or a need for a permit.

9.14 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resources Conservation and Recovery Act (RCRA)

There is no indication that any hazardous, toxic, and radioactive waste (HTRW) are in the vicinity of the project area. Presence of HTRW would be responded to within the requirements of the law and Corps regulations and guidelines.

9.15 Analysis of Impacts on Prime and Unique Farmlands

Not Applicable, as no farmlands are present in the proposed project area.

9.16 Executive Order 11988: Floodplain Management

Executive Order 11988 requires Federal agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy of the floodplain, and to avoid direct and indirect support of floodplain development where there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains."

The proposed action would result in a modification of reservoir operations; however total project outflow rates would not be affected. In the event flood risk became a concern, the proposed project would be discontinued. Thus, the proposed action is in compliance with this executive order.

9.17 Executive Order 11990: Protection of Wetlands

Executive Order 11990 encourages Federal agencies to take actions to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when undertaking Federal activities and programs.

No wetlands would be impacted by the proposed action as a result of the proposed operational changes at the dam. The action proposed by the Corps is consistent with Executive Order 11990.

9.18 Executive Order 12898: Environmental Justice

Executive Order 12898, dated February 11, 1994, requires Federal agencies to consider and address environmental justice by identifying and assessing whether agency actions may have disproportionately high and adverse human health or environmental effects on minority or low income populations. Disproportionately high and adverse effects are those effects that are predominately borne by minority and/or low income populations and are appreciably more severe or greater in magnitude than the effects on non-minority or non-low income populations.

The action would not have disproportionately high and adverse human health or environmental effects on minority or low income populations.

9.19 Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175 refers to regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on one or more Indian Tribes, on the relationship between the Federal Government and Indian Tribes, or on the distribution of power and responsibilities between the Federal Government and Indian Tribes.

Concurrent with this Draft EA, the Corps provided letters expressing interest in coordination and consultation. Tribes contacted included the Confederated Tribes of the Grand Ronde, the Confederated Tribes of the Siletz, and the Confederated Tribes of the Warm Springs. These Tribes were provided notification of the 2013 EA when it was available for public review and have been invited to the periodic WATER meetings.

9.20 Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance

The goal of Executive Order 13514 is to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies.

The action involves no construction and would not increase greenhouse gas emissions.

9.21 Executive Order 13112, Invasive Species

Executive Order 13112 aims to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

There is no indication that invasive species would be introduced as a result of the action. Non-native predatory fish including bluegill, largemouth bass, and crappie would be flushed out of the reservoir. Mortality is high for these fish moving through the dam, and they likely would not survive as well in waters downstream of the dam compared to the placid reservoir. It is desirable to flush these fish out of the reservoir to improve conditions for juvenile salmonids that rear there.

9.22 Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 aims to conserve migratory birds and their habitats.

The action will result in a brief change in available bird habitat in the reservoir from deepwater habitat to exposed mud with small channels of water. As a result, some birds that may use the reservoir as wintering habitat such as ducks may be temporarily displaced. This is not predicted, however, to result in adverse impacts to migratory birds as available habitat is present nearby, including Lookout Point Reservoir.

CHAPTER 10 - REFERENCES

Bass, R.E., A.I. Herson, and K.M. Bogdan. 2001. The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act. Solano Press Books. 475 pp.

Bonneville Power Administration, US Army Corps of Engineers, and US Bureau of Reclamation. 1995. Columbia River System Operation Review: Final Environmental Impact Statement. DOE/EIS0170. Portland, Oregon.

Cole, D.L. 1968. Archaeology of the Fall Creek Dam Reservoir: Final Report. Report of the Museum of Natural History, University of Oregon, to the Nation Park Service.

Corkran, C. and C. Thomas. 1996. Amphibians of Oregon, Washington and British Columbia. Lone Pine Publishing

Erickson, N., G. Taylor, and T. Pierce. 2014. Draft Monitoring of the Fall Creek Dam Fish Horn Evaluator, 2013-14.

Federal Energy Regulatory Commission (FERC). 2013. Draft Environmental Assessment for Hydropower License, Fall Creek Dam Hydroelectric Project, FERC Project No. 12778-004, Oregon.

Franklin, J. and Dyrness, C. 1973. Natural Vegetation of Oregon and Washington. USDA Forest Service General Technical Report PNW-8

Keefer M., G. Taylor, D. Garletts, C. Helms, G. Gauthier, T. Pierce, C. Caudill. 2011. Reservoir entrapment and dam passage mortality of juvenile Chinook salmon in the Middle Fork of the Willamette River. Ecology of Freshwater Fish.

Keefer M.L., Taylor G.A., Garetts D. F., Helms C.K., Gauthier G.A, Pierce T.M. and Caudill C.C. 2012. High-Head Dams Affects Downstream Fish Passage Timing and Survival in the Middle Fork Willamette River. River Research and Applications

Leonard, W. and H. Brown, L Jones, K McAllister and R Storm.1992. Amphibians of Washington and Oregon. Seattle Audubon Society

Middle Fork Willamette Watershed Council (MFWWC). 2002. Lower Middle Fork Willamette River Watershed Assessment

National Marine Fisheries Services (NMFS). 2008. Endangered Species Act Section 7(a)(2) Consultation, Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Action Essential Fish Habitat Consultation, Consultation on the Willamettee River Basin Flood Control Project. Log F/NWR/2000/02117, Northwest Region.

National Park Service. National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties.

Nesbit, M.F., F.A. Axel, B.P. Sandford, B.J. Burke, K.E. Frick, and J.J. Lamb (NMFS). 2014. Passage behavior and survival of juvenile spring Chinook salmon at Fall Creek Dam, 2012. Contract JPL 13-05-FCR.

Normandeau Environmental Consultants. 2014. Estimate of Direct Effects of Downstream Passage through the Fish Horns at Fall Creek Dam (Draft). Task Order No. DT05.

Noyes J., Potter,M., Bedrossian, K. 1985. Wildlife And Wildlife Habitat Loss Assessment At Cougar Dam and Reservoir Project. Oregon Department of Fish and Wildlife

Oregon Department of Environmental Quality (ODEQ). 2010. 303(d) list at http://www.deq.state.or.us/wq/assessment/2010Report.htm

Oregon Department of Fish and Wildlife. 2006. Oregon conservation strategy. Oregon Department of Fish and Wildlife. Salem, Oregon.

Oregon Department of Fish and Wildlife. 2008. Oregon Department of Fish and Wildlife sensitive species. http://www.dfw.state.or.us/wildlife/diversity/species/docs/SSL_by_taxon.pdf

Purdy, Sarah, Scott Byram, and Darby Shindruk. 2009 Archaeological Testing at Site 35LA31 for the Fall Creek Dam Hydroelectric Project, Lane County, Oregon.

Romer J., Monzyk F., Emig R. and Friesen T. 2012 Juvenile Salmonid Outmigration Monitoring at Willamette Valley Project Reservoirs. Oregon Department of Fish and Wildlife.

Ryan, M. 2001. Western pond turtle trapping and telemetry, Hills Creek Reservoir. Unpublished report, U. S. Forest Service, Middle Fork Ranger District.

Suchy, M. 1967. Report of mineral examination, Cougar Dam Project, Lane County. Oregon Department of Geology.

Tackley, K. Alternative Reservoir Operations to Meet Biological Objectives, Willamette Basin, Oregon. Slide Show Presentation. U.S. Army Corps of Engineers.

Taylor, G. 2000. Monitoring of Downstream fish Passage at Cougar Dam in the south Fork McKenzie River, Oregon 1998-00. Oregon Department of Fish and Wildlife.

Taylor, G., D. Garletts, C. Helms, T. Pierce, and N. Erickson. Fall Creek Drawdown: Let it Flow, Let it Flow, Let it Flow. Slide Show Presentation. U.S. Army Corps of Engineers

U.S. Army Corps of Engineers. 1980. Environmental Impact Statement on the Operation and Maintenance of the Willamette Reservoir System.

U.S. Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation. May 2007. Supplemental Biological Assessment of the Effects of the Willamette River Basin Flood Control Project on Species Listed Under the Endangered Species Act. Submitted to National Marine Fisheries Service and U.S. Fish and Wildlife Service.

U.S. Army Corps of Engineers. 1995. Final Environmental Assessment Willamette Temperature Control Project Cougar Dam Trap-and-Haul Facility Lane County, Oregon.

U.S. Army Corps of Engineers. 1999. Cougar Lake Intake Structure Modifications Willamette Temperature Control McKenzie Subbasin, Oregon

U.S. Army Corps of Engineers. 2000. Biological assessment of the effects of the Willamette River Basin flood control project on species listed under the Endangered Species Act. Submitted to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. Prepared by U.S. Army Corps of Engineers, Portland, OR, and R2 Resource Consultants, Seattle, Washington.

U.S. Army Corps of Engineers. 2005. Regulatory Guidance Letter No. 05-04. Guidance of the Discharge of Sediments From or Through a Dam and the Breaching of Dams, for Purposes of Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

U.S. Army Corps of Engineers. 2009. Willamette Valley Projects Configuration/Operation Plan. Portland District. Portland, Oregon.

U.S. Army Corps of Engineers. 2010. Hills Creek Reservoir Public Use Plan Amendment to Master Plan Design Memorandum.

U.S. Army Corps of Engineers. 2012. Final Willamette River Basin Operational Measures Evaluation Report. November 2012. Portland District, Portland, Oregon.

U.S. Army Corps of Engineers. 2013a. Draft Willamette River Floodplain Restoration Study, Integrated Feasibility Report/Environmental Assessment, Lower Coast and Middle Fork Willamette River Subbasins. March 2013. Portland District, Portland, Oregon.

U.S. Army Corps of Engineers. 2013b. Draft Willamette Basin Annual Water Quality Report for 2012. Portland District, Portland, Oregon.

U.S. Geological Survey (USGS). 2010a. USGS Scientific Investigation Report 2010-5016.

U.S. Geological Survey. 2010. Thermal Effects of Dams in the Willamette River Basin, Oregon. Scientific Investigations Report 2010-5153.

U.S. Geological Survey. 2014. Assessment of Suspended-Sediment Transport, Bedload, and Dissolved Oxygen during a Short-Term Drawdown of Fall Creek Lake, Oregon, Winter 2012-2013. Open-File Report 2014-1114.

U.S. Fish and Wildlife Service. 1958. A Detailed report on Fish and Wildlife Resources Affected by Hills Creek Reservoir Project

U.S. Fish and Wildlife Service. 2008. Endangered Species Act Section 7 Consultation, Biological Opinion on the Continued Operation and Maintenance of the Willamette River Basin Project and Effects to Oregon Chub, Bull Trout, and Bull Trout Critical Habitat Designated Under the Endangered Species Act. File Number 8330.F0224(07). Tails Number 13420-2007-F-0024. July 11. Oregon Fish and Wildlife Office, Portland, Oregon.

APPENDIX 1

Scientific Names of Flora and Fauna Mentioned in Text

Fish	
Brown Bullhead	*Ameiurus nebulosus*
Largescale Sucker	*Catostomus macsocheilus*
Sculpin	*Cottus* spp.
Bluegill	*Lepomis macrochirus*
Smallmouth Bass	*Micropterus dolomieu*
Largemouth Bass	*Micropterus salmoides*
Cutthroat Trout	*Oncorhynchus clarki*
Steelhead (including Rainbow Trout)	*Oncorhynchus mykiss*
Chinook Salmon	*Oncorhynchus tshawytscha*
Oregon Chub	*Oregonichthys crameri*
Crappie	*Pomoxis* spp.
Mountain Whitefish	*Prosopium williamsoni*
Northern Pikeminnow	*Ptychocheilus oregonensis*
Redside Shiner	*Richardsonius balteatus*
Bull Trout	*Salvelinus confluentus*
Dace	*Thinichthys* spp.
Birds	
Ruffed Grouse	*Bonasa umbellus*
California Quail	*Callipepla californica*
Bald Eagle	*Haliaeetus leucocephalus*
Wild Turkey	*Meleagris gallopavo*
Mountain Quail	*Oreortyx pictus*
Osprey	*Pandion haliaetus*
Ring-necked Pheasant	*Phasianus colchicus*
Northern Spotted Owl	*Strix occidentalis caurina*
Mammals	
Coyote	*Canis latrans*
Beaver	*Castor canadensis*
Roosevelt Elk	*Cervus elaphus*
Cougar	*Felis concolor*
Bobcat	*Lynx rufus*
Mink	*Neovison vison*
Black-tailed Deer	*Odocoileus hemionus*
Raccoon	*Procyon lotor*
Western Gray Squirrel	*Sciurus griseus*
Black Bear	*Ursus americanus*
Red Fox	*Vulpes vulpes*

Reptile

Western Pond Turtle	*Actinemys marmorata*

Amphibians

Bullfrog	*Lithobates catesbeianus*
Red-legged Frog	*Rana aurora*
Oregon Spotted Frog	*Rana pretiosa*

Plants

Bigleaf Maple	*Acer macrophyllum*
Red Alder	*Alnus rubra*
Oregon Ash	*Fraxinus latifolia*
Black Cottonwood	*Populus trichocarpa*
Douglas-fir	*Psuedotsuga menziesii*
Oak	*Quercus* spp.
Western Red Cedar	*Thuja plicata*
Western Hemlock	*Tsuga heterophylla*