US Army Corps
of Engineers ®
Portland District

Long-term Release of Additional 1,000 Acre-feet (Totaling 3,500 Acre-feet) Draft Supplemental Environmental Assessment to the Long-term Withdrawal of Irrigation Water Willow Creek Lake, Morrow County, Oregon Final Environmental Assessment, March 2008

Willow Creek Dam and Lake, Heppner, Oregon (Balm Fork arm on right; Willow Creek arm on left). May 2016.

Draft February, 2018

Executive Summary

Purpose of and Need for Action. The purpose of the Proposed Action assessed in this supplemental environmental assessment (SEA) is to carry out the U.S. Army Corps of Engineers' (Corps') purpose for irrigation at the Willow Creek Project for the authorized irrigation storage volume of 3,500 acre-feet. The Proposed Action is to increase the volume of stored water released for irrigation by 1,000 acre-feet, from 2,500 to 3,500 acre-feet. The need for the increase is to provide the irrigation district, Willow Creek District Improvement Company (Company), with a more reliable, annual, long-term source of additional irrigation water, as stored water is considered more reliable than groundwater sources. The Company made the request for the increase in June 2015.

Background. The Corps owns and operates the Willow Creek Dam and Lake Project (Willow Creek Project), located in Morrow County, Oregon. In the environmental assessment (EA) by the Corps, *Long-term Withdrawal of Irrigation Water, Willow Creek Lake, Morrow County, Oregon, Portland District*, dated March 2008 (2008 EA), the Corps assessed the effects of releasing 2,500 acre-feet of irrigation water annually from Willow Creek Lake. Based on the 2008 EA analysis, the Corps signed a *Finding of No Significant Impact* (FONSI) and then annually implemented the release of 2,500-acre-feet. In June 2015, the Company submitted an application to Reclamation to amend their water service contract for an additional 1,000 acre-feet, for a total of 3,500 acre-feet of stored water in Willow Creek Lake. The Corps is preparing this SEA to evaluate the incremental effects of the Proposed Action to release an additional 1,000 acre-feet compared to the No Action Alternative which is to release 2,500 acre-feet of irrigation water.

Environmental Effects and Alternatives Comparison. Generally, the Proposed Action would draw down Willow Creek Lake at a faster rate than the No Action Alternative, resulting in a lower surface elevation of the lake for most of the year. Water quality, recreation, and fish and sportfishing, are the most relevant resources, and effects to those resources are described below.

Water Quality - There is insufficient information available to assess the incremental difference in water temperature and pH released from the lake or to assess the incremental difference on dissolved oxygen and algae blooms in the lake. While there is not enough information, there are no indications that water quality would be significantly worse with the Proposed Action. The Corps would continue to manage the temperature and pH of the releases by selecting the reservoir depth from which the water is withdrawn. There are no requirements or standards in place for water quality in the lake; however if water quality in the lake became less desirable, recreation and sportfishing could potentially be affected. The Corps assessed that the incremental effects of the Proposed Action on water quality of the releases and in the lake will be minimal.

Recreation - The boat ramp would be usable for the entire year for both the No Action Alternative and Proposed Actions. In very dry years, for the No Action Alternative, the boat dock would be usable during the high usage period from Memorial Day weekend through the Fourth of July, but with the Proposed Action, the dock may not be usable for several weeks during this period, beginning in about mid-June, affecting swimmers and boaters who wish to use the dock. The Corps assessed that, overall, there would be no impacts to boat ramp use, and that impact to dock use would be affected only in very dry years.

Fish and Sportfishing - The Oregon Department of Fish and Wildlife (ODFW) manages non-native warm water fish, trout, and sportfishing in Willow Creek Lake. The incremental effects of the Proposed Action on warm water fish that are present in the lake primarily for sportfishing, may be to additionally decrease or eliminate successful spawning of largemouth bass and pumpkinseed fish. The next year's harvest of fingerling trout that are annually stocked in the lake may also be affected. The ODFW has placed regulations on fishing, and annually stocks the lake with trout. If sportfishing impacts are realized by the Proposed Action, warm water fish could potentially be introduced to help alleviate impacts to sportfishing; therefore incremental effects of the Proposed Action on sportfishing is considered to be minimal.

Action by Reclamation. A connected action for the Proposed Action is that Reclamation would enter into a contract with the Company for the additional 1,000 acre-feet, for a total of 3,500 acre-feet of stored water in Willow Creek to be used for irrigation. Reclamation would use this SEA as a basis for their NEPA decision document.

Consultation and Coordination. Letters requesting consultation were sent to the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO), the Yakama Nation, and the Nez Perce Tribe to coordinate any concerns that they may have. The Corps and the CTUIR held a staff level consultation meeting to exchange information. Highlights of the meeting included a discussion of the CTUIR interest in reintroducing anadromous fish into Willow Creek. For cultural resources, the Corps consulted with the CTUIR, the CTWSRO, and the Oregon State Historic Preservation Office (SHPO). The Corps is conducting a 30-day public review and is seeking comments on this draft SEA. The Corps' public outreach includes federal, state, and local agencies, Tribes, interested groups, and individuals in the local area. Section 5 of the 2008 EA, provides a summary of the public involvement that took place during the development of that EA.

Compliance with Laws and Regulations. The No Action Alternative and Proposed Action comply with laws and regulations, including: the National Environmental Policy Act; Endangered Species Act; Clean Water Act; National Historic Preservation Act (pending consultation); Native American Graves Protection and Repatriation Act; and the Fish and Wildlife Coordination Act.

Conclusion. The Corps has assessed and concludes that there would be little to no incremental effects of the Proposed Action compared to the No Action Alternative on groundwater, air quality, noise, light, vegetation, wildlife, threatened and endangered species, cultural resources, farmlands, socio-economic resources, and real estate. Water quality of released flows would be managed by raising or lowering the water quality intake structure. Recreation in the lake would not be affected in median type years during the high usage period, but would be affected in very low water years. Lowered water levels may affect fish/sportfishing; however, the ODFW may implement regulations and stock the lake to alleviate those effects.

ABBREVIATIONS AND ACRONYMS

AQI	air quality index
CGWA	Critical Groundwater Area
cfs	cubic feet per second
Company	Willow Creek District Improvement Company
Corps	U.S. Army Corps of Engineers
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
DPS	Distinct Population Segment
FONSI	Finding of No Significant Impact
HAB	harmful algae bloom(s)
NEPA	National Environmental Policy Act
NGVD29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service (NOAA Fisheries)
NPCC	Northwest Power and Conservation Council
ODA	Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
OSU	Oregon State University
OWRD	Oregon Water Resources Department
PM	particulate matter
RCC	roller compacted concrete
Reclamation	U.S. Bureau of Reclamation
SEA	Supplemental Environmental Assessment
SHPO	State Historic Preservation Office
ug/L	micrograms per liter
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

English to Metric Conversion Factors

To Convert From	To	Multiply by
feet	meters	0.3048
miles	kilometers (km)	1.6093
acres	hectares (ha)	0.4047
acres	square meters (m^2)	4,047
square miles (mi^2)	square kilometers (km^2)	2.590
acre-feet	hectare-meters	0.1234
acre-feet	cubic meters (m^3)	1,234
cubic feet (ft^3)	cubic meters (m^3)	0.02832
feet/mile	meters/kilometer (m/km)	0.1894
cubic feet/second (cfs or ft^3/s)	cubic meters/second (m^3/s)	0.02832
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x (5/9)

Long-term Release of Irrigation Water Willow Creek Lake, Morrow County, Oregon
Draft Supplemental Environmental Assessment

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1. Introduction

1.1 Purpose of and Need for Action

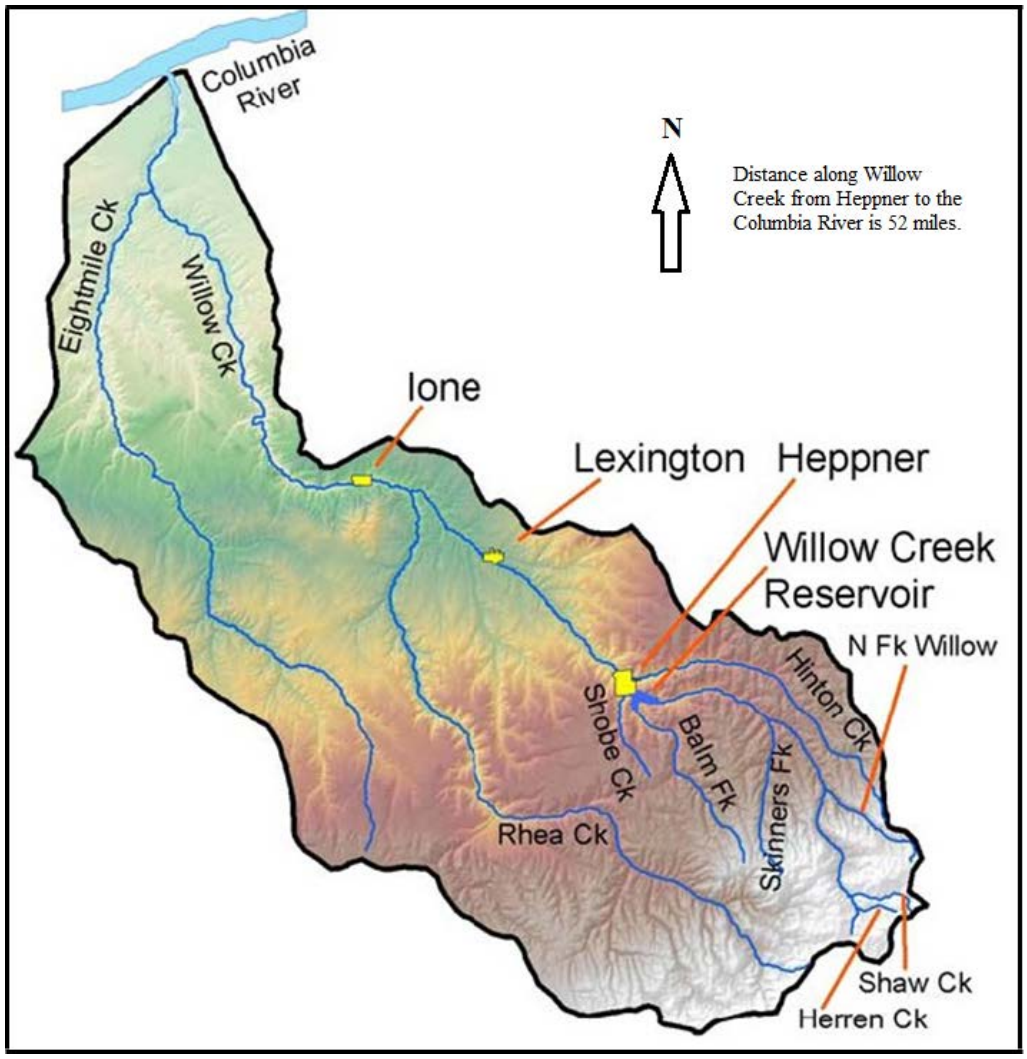
The purpose of the Proposed Action presented in this supplemental environmental assessment (SEA) is to carry out the U.S. Army Corps of Engineers' (Corps') purpose for irrigation at the Willow Creek Project for the authorized irrigation storage volume of 3,500 acre-feet. The Proposed Action is to increase the volume of stored water released for irrigation by 1,000 acre-feet, from 2,500 to 3,500 acre-feet. The need for the increase is to provide the irrigation district, named the Willow Creek District Improvement Company (Company), a more reliable, long-term source of additional irrigation water. The Company requested the increase in June 2015 by application to Reclamation to amend their water service contract. The Company currently uses a combination of pumped groundwater, live flow[1] from Willow Creek, and stored water from the lake behind the Willow Creek Project (Willow Creek Lake) for irrigation water sources. Irrigation water from storage in Willow Creek Lake is considered to be more reliable than pumped groundwater due to restrictions on new groundwater uses and the potential for future restrictions in light of dropping water levels in groundwater wells.

1.2 Background

Willow Creek Project consists of a dam and lake located on Willow Creek in Morrow County, Oregon, directly upstream from the City of Heppner (Figure 1). The project is operated and maintained by the Corps, Portland District. The Willow Creek Project is operated for flood control and irrigation with incidental benefits for recreation, sportfishing, and wildlife. Space for sedimentation (trapping of sediment from upstream sources) is also provided.

The Willow Creek Project was authorized by Public Law 95-482 in 1978 to allocate 3,500 acre-feet of stored water for future irrigation. After several years of requesting stored water ranging from 1,000 to 3,500 acre-feet for irrigation on a temporary basis, irrigators downstream of the Willow Creek Project requested the release of 2,500 acre-feet of stored water for irrigation on a long-term basis. In the year 2008, the Corps, Portland District, prepared an environmental assessment (EA), *Long-term Withdrawal of Irrigation Water, Willow Creek Lake, Morrow County, Oregon, Portland District* (2008 EA) to assess the effects of releasing up to 2,500 acre-feet of irrigation water annually from Willow Creek Lake. Based on public input and an effects analysis in the 2008 EA, the Corps prepared and signed a *Finding of No Significant Impact, Withdrawal of Irrigation Water Willow Creek Project, Morrow County, Oreg*on, on 17 April, 2008 (2008 FONSI). In the irrigation season following the 2008 FONSI, the Corps began the annual release of up to 2,500 acre-feet of stored water from Willow Creek Lake. Subsequent to 2008, irrigators downstream of the Willow Creek Project formed the Company, which diverts water from 23 points of diversion downstream of Willow Creek Lake.

[1] Live flow arises from natural hydrologic processes and is not augmented from stored water but may be impacted by diversions.



Source: DEQ 2007

Figure 1: Willow Creek Watershed

In June 2010, the State of Oregon issued a certificate of water right to Morrow County Court and the U.S. Bureau of Reclamation (Reclamation) confirming the right to store 13,250 acre-feet of water in Willow Creek Lake. Reclamation and the Company entered into a Contract for Water Service (Contract), dated April 12, 2012 (see Section 1.4), which provides the Company use of 2,500 acre-feet of water for irrigation. In June 2015, the Company submitted an application to Reclamation to amend the Contract to add 1,000 acre-feet (total of 3,500 acre-feet) of stored water for irrigation. The Company requested the 1,000 acre-feet of storage water to provide for a more reliable, long-term source of additional irrigation water. The Oregon Water Resources Department (OWRD) provisions for appropriation and use of groundwater in the Willow Creek subbasin are provided in Oregon Administrative Rules (OAR) 690-570-0090, effective May 22, 2017. Groundwater use restrictions apply within a five-mile radius of any municipal wells, including wells serving the cities of Heppner, Ione and Lexington, which are within the areas of the Company's boundary. Should the Corps implement the Proposed Action in this SEA, the

Company intends to transition, to the extent possible, from the use of limited surface water and groundwater resources in favor of stored water from Willow Creek Lake.

1.3 Decision to Implement Action

The decision to be made is whether to implement the Proposed Action or to continue with the existing condition, which is the No Action Alternative in this SEA. In this SEA, the Corps assessed the effects of the Proposed Action of releasing an additional 1,000 acre-feet of water from Willow Creek Lake for irrigation, to satisfy National Environmental Policy Act (NEPA) requirements. Reclamation is a cooperating agency in the development of this SEA, and their NEPA requirements are discussed in Section 1.4.

1.4 U.S. Bureau of Reclamation Involvement

This SEA has been developed in coordination with Reclamation; the Corps is the lead agency under NEPA, and Reclamation is a cooperating agency under NEPA. Lead and cooperating agencies are defined in 40 Code of Federal Regulations (C.F.R) § 1508.16 and 1508.5 respectively.

Reclamation holds a permit with the State of Oregon to store water in the Willow Creek Project. Under Oregon law, all water is publicly owned. With some exceptions, cities, farmers, factory owners and other users must obtain a permit or water right from the Oregon Water Resources Department (OWRD) to use water from any source - whether it is underground, or from lakes or streams. State Water Right Permit No. R-10880 (Application No. R-42065), which confirms the right to store 13,250 acre-feet of water in the Willow Creek Project, is held jointly by Reclamation and Morrow County. With respect to this water right, all interest in the right to store 3,500 acre-feet of water for irrigation purposes is held solely by Reclamation as a result of Morrow County's execution of a partial assignment of their interest in this portion of the right in 1983.

On April 12, 2012, the Company entered into Contract No. 129E101776, a 40-year Contract for Water Service, with Reclamation for the use of up to 2,500 acre-feet of stored water from Willow Creek Lake. In accordance with Section 9(e) of the Act of August 4, 1939 (53 Stat. 1187); Section 8 of the Act of December 22, 1944 (58 Stat. 887, 891); the Flood Control Act of 1965 (P.L. 89-298), and the Act of October 18, 1978 (P.L. 95-482), Reclamation is responsible for the administration of any contracts for the use of water stored in the Willow Creek Project for irrigation. The Contract includes payment of a proportionate amount of operation and maintenance costs and a small component of construction costs for the Willow Creek Project. In addition to the Contract, the Company obtained Permit S-54980, dated February 8, 2016, from OWRD to use up to 2,500 acre-feet of storage water per the Company's contract with Reclamation.

A connected action is that Reclamation would enter into a contract with the Company for the additional 1,000 acre-feet of stored water in Willow Creek to be used for irrigation. There are no effects to environmental resources for this action that are outside of the analysis conducted by

the Corps for their operations leading to the release of an additional 1,000 acre-feet of stored water. Therefore, Reclamation would use this SEA as a basis for their NEPA decision document.

1.5 Consultation

During development of this SEA, the Corps conducted consultation by letters dated July 27, 2017, seeking input from the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), the Yakama Nation, and the Nez Perce Tribe. The CTUIR replied with a letter dated August 9, 2017, expressing their interests regarding cultural resources, reintroduction of steelhead in the Willow Creek Basin, Treaty Rights, and questions regarding congressional authorization for the Willow Creek Project. The Corps replied by letter September 25, 2017 providing information on congressional authorization and suggested a staff-level meeting to better understand the CTUIR interests. The meeting between the Corps and the CTUIR was held in Pendleton, Oregon on November 14, 2017. Discussion regarding the CTUIR's interest in reintroducing steelhead into the Willow Creek is provided in Section 4.12.3b.

The National Historic Preservation Act (NHPA) establishes a program for the preservation of historic properties. Consultation for protection of historic properties is covered under Title 36, C.F.R. Part 800, Subpart A, Section 106. The Corps is consulting with the CTUIR, the CTWSRO, and the Oregon State Historic Preservation Office (SHPO) in accordance with Section 106.

1.6 Previous NEPA Documentation

The following is a list of previous NEPA documents related to reservoir operations prior to and after construction, along with a determination of the proposed action:

(i) Final Environmental Impact Statement, Willow Creek Lake (Corps, December 1979). This EIS was for the construction and operation of Willow Creek Project (A record of decision (ROD) of the proposed action has not been found).

(ii) Environmental Assessment and Finding of No Significant Impact, Elevation 2076.5 Ft. Pool Operation, Willow Creek Lake (Corps, December 1991). This EA and FONSI was for the increase in pool elevation of Willow Creek Lake for recreation.

(iii) Environmental Assessment and Finding of No Significant Impact, Emergency Drawdown for Irrigation, Willow Creek Lake (Corps, 1992). This EA and FONSI was for the release of 1,000 acre-feet of storage from Willow Creek Lake for the 1992 growing season due to a drought emergency in Morrow County.

(iv) Environmental Assessment and Finding of No Significant Impact, Emergency Withdrawal for Irrigation, Willow Creek Lake (Corps, June 30, 2003). This 2003 EA and FONSI was for the emergency release of 3,343 acre-feet of stored water for irrigation in the 2003 growing season due to drought conditions.

(v) Continuance Finding of No Significant Impact (Corps, June 23, 2004).This 2004 FONSI was based on the analyses of effects from the 2003 EA. This FONSI documents the Corps' decision to release 3,273 acre-feet of stored water for

irrigation in the 2004 growing season due to drought conditions.

(vi) Continuance Finding of No Significant Impact (Corps, June 27, 2005). This 2005 FONSI was made based on the analyses from the 2003 EA. This 2005 FONSI is for the Corps' decision to release 3,364 acre-feet of stored water for irrigation in the 2005 growing season due to drought conditions.

(vii) Continuance Finding of No Significant Impact (Corps, May 24, 2006). This 2006 FONSI is based on the 2003 EA. This 2006 FONSI documents the Corps' decision to release up to 3,500 acre-feet for the 2006 and 2007 growing seasons due to the continuing drought situation.

(viii) Long-Term Withdrawal of Irrigation Water, Willow Creek Lake, Final Environmental Assessment and Finding of No Significant Impact (Corps, April 2008). This 2008 EA and FONSI provided the analyses and decision for the Corps action of releasing 2,500 acre-feet of stored water from Willow Creek Lake for irrigation on an annual basis.

The 2008 EA was written to address the effects of providing 2,500 acre-feet of stored water for irrigation releases for downstream irrigation interests. The 2,500 acre-feet of water was the amount requested in the year 2008 by irrigators downstream of Willow Creek Project based on their projected needs. The 2008 FONSI followed the 2008 EA. Subsequently, the Corps implemented the release of up to 2,500 acre-feet of stored water for irrigation on an annual basis. The 2008 EA is on file at Portland District of the Corps and is incorporated by reference in this SEA.

The Council on Environmental Quality regulations, 40 C.F.R. § 1500.1(c) and 40 C.F.R. § 1508.9(a)(1), implementing the National Environmental Policy Act of 1969 (NEPA), require federal agencies to "provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact" on actions authorized, funded, or carried out by the Federal government. These regulations help officials carefully consider all environmental consequences so that they will "take actions that protect, restore and enhance the environment." The Corps has prepared this SEA within the spirit of 40 C.F.R. § 1502.9(c)(1)(i) because it is changing the proposed action as described in the 2008 EA to accommodate the increase in stored water released for irrigation at the Willow Creek Project. Since the proposed action in this SEA is one for which a previous EA has been prepared, this SEA incorporates by reference analysis from the 2008 EA in accordance with 40 C.F.R. § 1502.21. As a result, this SEA does not repeat evaluations presented in the prior NEPA document but rather incorporates discussions from this document by reference and concentrates on new issues analyzed herein.

1.7 Project Authorization and History of Use

Congress authorized the construction of the Project in the Flood Control Act of 1965 (Public Law 89-298, 89th Congress, 1st Session) substantially in accordance with the report of the Chief of Engineers in House Document 233. The project as initially authorized was a multi-purpose dam and lake having a gross storage capacity of 11,500 acre-feet of which 1,300 acre-feet would be exclusively for flood control; 7,900 acre-feet would be jointly for flood control, irrigation, sportfishing and wildlife, and recreation; 100 acre-feet for municipal and industrial water supply;

300 acre-feet would be for water quality control; and the balance of 1,900 acre-feet would provide for sedimentation, recreation, and fish survival. Further, the Chief of Engineers report endorsed the District Engineer's recommendation "that certain other improvements be made in the joint interest of recreation and fish and wildlife conservation." In addition to these uses, Congress also authorized improvement of the Willow Creek channel through the City of Heppner under the Flood Control Act of 1965. The applicable portion of the authorizing Act, approved October 27, 1965, reads as follows:

> The project for flood protection on Willow Creek, Oregon, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 233, Eighty-ninth Congress, at an estimated cost of $6,680,000.

During subsequent pre-construction planning, municipal and industrial water supply, water quality, and downstream channel improvements were eliminated from the Project. Provision of 3,500 acre-feet of future irrigation storage was recommended by the Chief of Engineers in a letter report dated May 15, 1974 to the Secretary of the Army. This letter report was the basis for Congressional re-authorization of the Project to include storage for irrigation as a project purpose; this authorization was contained in Public Law 95-482 (House Joint Resolution 1139) dated October 18, 1978, which authorized, *inter alia*, amounts for programs, projects, and activities to the extent and in the manner provided for in the Energy and Water Development Appropriation Act, 1979 (House Resolution 12928).

House Resolution 12928 was originally vetoed by the President on October 5, 1978. House Resolution 12928, as later authorized in Public Law 95-482, provides that funds appropriated for the Willow Creek Project shall be used to construct the Project in accordance with the Chief of Engineer's letter report dated May 15, 1974. This letter also permitted such other modifications as the Chief of Engineers, in his discretion, might find advisable. After the President signed Public Law 95-482 into law, the Corps modified the Project further, increasing the reservoir size to 13,250 acre-feet to better accommodate summer thunderstorms and maintain 100-year flood protection. In order to maintain the future irrigation function as authorized for 3,500 acre-feet, 1,750 acre-feet of storage was allocated for exclusive irrigation use and 1,750 AF was allocated for joint irrigation and flood-control use.

As modified, the reservoir with future irrigation function provides 7,750 acre-feet for exclusive flood control; 1,750 acre-feet for joint irrigation and flood control; 1,750 acre-feet for exclusive irrigation; and a 2,000 acre-feet conservation pool for esthetics, fish and wildlife, recreation, and sediment accumulation (totaling 13,250 acre-feet)

Appendix F to House Document 233 was prepared by the U.S. Department of Interior, Bureau of Reclamation (Reclamation; April 1962) and described irrigation needs in the project area (p. 110):

> As the runoff of Willow Creek is not adequate to provide a full supply for existing water right land, storage would probably be used to supplement the water supply to these lands. There are about 3,700 acres below the Heppner site that are

covered by water rights. About 910 acres of these lands are between Heppner and Rhea Creek and the remaining 2,790 acres are below Rhea Creek.

Using an average annual diversion requirement of 4.0 acre-feet per acre, the total diversion requirement developed for the 3,700 acres is 14,800 acre-feet. The monthly distribution is as follows: April - 4%, May - 15%, June - 18%, July - 25%, August - 22%, and September - 16%.

The final EIS for the construction and operation of Willow Creek Project stated that the proposed project would not be operated for irrigation, "until such time as the Secretary of the Interior makes the necessary arrangements with non-Federal interests to recover the cost, in accordance with Federal reclamation law, which will be allocated to the irrigation purpose" (p. 4). Reclamation is responsible for contracting the sale of irrigation water from federal projects and receives all payment for the federal government for irrigation water in accordance with Section 9(e) of the Act of August 4, 1939 (53 Stat. 1187) Section 8 of the Act of December 22, 1944 (58 Stat. 887,891); the Flood Control Act of 1965 (Pub. L. 89-298), and the Act of October 18, 1978 (Pub. L. 95-482).

The Willow Creek Project was completed in the year 1983. The project was initially operated with a maximum summer pool at elevation 2,063 feet (datum for all elevations in this document is the National Geodetic Vertical Datum of 1929 (NGVD29)) with flood control as the primary use of storage space in Willow Creek Lake. Recreation, fish and wildlife, sedimentation, and future irrigation were secondary uses of storage space. Regulation for water quality was considered an incidental use of storage space. The storage space between elevations 2,047.0 and 2,063.0 feet would be reserved for future irrigation use, and prior to future irrigation use, stored water in this space was available for desirable downstream flows, evaporation and seepage losses. Desirable downstream flows are those recommended by the state watermaster, and are released from the project if available. The minimum pool elevation 2,047.0 feet is to support recreation, fish and wildlife, sportfishing, and sediment accumulation. The storage allocation for Willow Creek Lake for the initial operations is shown in Table 1. For comparison, the authorized storage as modified and prior to irrigation is provided in Table 1. The elevation-storage data in Table 1 is from the U.S. Geological Survey (USGS), Water Resources Division, Portland, Oregon, dated September 1982, except as otherwise noted.

The initial operation did not include any special regulation for recreation activities (sportfishing, boating, hunting, etc.) or for fish and wildlife. The plan for normal regulations was to maintain the lake between elevations 2,047 and 2,063 feet and provide approximately 96 to 128 acres of lake surface area for recreation, adequate storage for fish and wildlife habitat, and would usually provide continuous downstream flow. Although water quality was not recognized as an authorized project function, regulations provided procedures to release "high-quality" water from the lake.

Table 1: Storage Allocation for Willow Creek Lake, 1984-1991

Storage Use	Elevation Range (feet NGVD)	Storage* (acre-feet)	Authorized Storage*** as Modified, pre-Irrigation (acre-feet)
Exclusive Flood Control	2,063.0 to 2,113.5	9,765	11,250
Normal Pool Fluctuation**	2,047.0 to 2,063.0	1,787	
Aesthetics and Environment	2,039.5 to 2,047.0	664	600
Sedimentation	1,984.0 to 2,039.5	1,875	1400
Total	**---**	**14,091**	**13,250**

* *The elevation-storage data is from the USGS, Water Resources Division, Portland, Oregon, dated September 1982.*

** *Water stored within this space is used to supply future irrigation, desirable downstream flows, evaporation losses, and seepage losses.*

*** *The elevation-storage data was determined prior to project construction.*

In June 1984, the Corps of Engineers, Portland District assumed responsibility from the Walla Walla District for operation and maintenance of the Willow Creek Project and its facilities. In October 1984, the Portland District assumed regulation of the reservoir. In the year 1991, the Portland District changed the operation of Willow Creek after it circulated an EA for public review. A FONSI on this EA was signed on December 24, 1991. The change allowed the maximum summer target pool elevation of the lake to be increased from elevation 2,063.0 feet to 2,076.5 feet to optimize recreation use. The storage allocations for the lake due to this change is shown in Table 2.

Using the elevation storage table based on a USGS survey of the lake in the year 2001, the storage for irrigation of 3,500 acre-feet is comprised of 1,906 acre-feet between pool elevations 2,063.0 and 2,076.5 feet plus 1,594 acre-feet of the 1,739 acre-feet between pool elevations 2,047.0 and 2,063.0 feet (leaving 145 acre-feet to meet desirable downstream flows, seepage, and evaporation). Table 2 shows the lake elevation changes from the year 1991 (Table 1) and the corresponding storage volumes from the updated storage table (volumes between elevations may change from time to time based on updated surveys). The authorized storage volumes as modified with irrigation is provided for comparison. The elevation-storage data in Table 2 is based on an USGS Survey from 2001, except as otherwise noted.

Table 2: Storage Allocation for Willow Creek Lake, 1992-Present

Storage Use	Elevation Range (feet NGVD)	Storage* (acre-feet)	Authorized Storage† as Modified, with Irrigation (acre-feet)
Exclusive Flood Control	2,076.5 to 2,113.5	7,844	7,750
Joint Irrigation and Flood Control	2,063.0 to 2,076.5	1,906	1,750
Multiple Purpose**	2,047.0 to 2,063.0	1,739	1,750***
Aesthetics and Environment	2,039.5 to 2,047.0	645	600
Sedimentation	1,984.0 to 2,039.5	1,758	1,400
Total	**---**	**13,892**	**13,250**

* *The elevation-storage data is based on a UGSG Survey from 2001, and input to Rating Table, Willow Creek Lake at Heppner, OR, USGS ID 14034490, Version No. 1.00, dated 10/5/2011 (extended to elevation 2130 feet in 2011).*

** *Water stored within this space is used for irrigation, desirable downstream flows, evaporation losses, and seepage losses.*

*** *Previously labeled as exclusive irrigation*

† *The elevation-storage data was determined prior to project construction.*

1.8 Willow Creek Project Description

Willow Creek Dam is located at river mile 52.4 on Willow Creek directly upstream from the City of Heppner and just downstream from the confluence of the Balm Fork and Willow Creek (see Figure 1). The dam was the world's first gravity dam to be built completely by roller-compacted concrete methods. The dam forms a reservoir called Willow Creek Lake. At its normal operating levels, the lake has two arms that join together immediately behind the dam to form a small main lake body (see cover photo). The two arms of the lake inundated the major stream drainages in the project area, the larger being the Willow Creek arm and the smaller being the Balm Fork arm. Willow Creek Dam has a crest length of 1,780 feet, a crest width of 16 feet, and a structural height of 154 feet above the streambed. The top of the dam is at elevation 2,130 feet at the upstream face. The spillway consists of a standard ogee-shaped overflow crest with rounded abutments and vertical training walls. The ungated spillway is located near the center of the dam. The spillway is 380 feet-wide, has a crest elevation of 2,113.5 feet, and a downstream face design slope of 0.8 horizontal to 1.0 vertical. The spillway capacity is 91,700 cubic feet per second (cfs) at maximum reservoir elevation of 2,129 feet.

The dam has two outlets for discharging water: a low-level regulating outlet and a depth-selective withdrawal structure, referred to as a water quality outlet. The low-level outlet is a separate outlet which withdraws from elevation of 1,984.0 feet. The capacity of the low-level regulating outlet is 420 cfs, and the capacity of the water quality outlet is 95 cfs. The Corps designed the water quality outlet to selectively withdraw water, ranging from pool elevation 2,037.0 to 2,076.0 feet. When operating properly, the water quality outlet is set at a depth of 15-17 feet below the surface. Due to failure of the wire ropes in water year 2012 (a water year is from October 1 through September 30), the water quality intake structure is unable to be raised and lowered. It is estimated that the top of the intake structure is fixed at about elevation 2,040 feet, or 36.5 feet below the water surface when the reservoir is at its maximum pool of elevation

of 2076.5 feet. The repair of the wire ropes has been proposed. The water quality outlet is used during normal operations of the dam. The low-level outlet is primarily used during flood risk management operations when discharges in excess of the water quality outlet capacity are required for flood regulation or when maintenance of the water quality outlet is needed.

The maximum controlled flood pool elevation of 2,113.5 feet (spillway crest elevation) would create a lake that extends about 1.8 miles upstream on Willow Creek and 1.3 miles on Balm Fork. At this elevation, the surface area of the lake is about 269 acres and has about 13,892 acre-feet of available storage.

1.9 Willow Creek Project Regulation

Willow Creek Project is operated for flood risk management, recreation, sportfishing, and irrigation. Water is withdrawn from selected lake levels to manage for water quality objectives in the creek downstream of the dam. For flood risk management, Willow Creek Project is operated to maintain lake storage space in order to capture water in response to rain or snowmelt events. The flood rule curve is the maximum lake level that preserves space in the reservoir to capture high flows. The maximum lake level varies depending on time of the year. When high flows occur, the lake is allowed to temporarily fill above the flood rule curve, then flow releases are managed to reduce flood damages that would otherwise occur without the dam. The flood flow release objective is limited to 500 cfs minus the flow from Hinton and Shobe Creeks.

Figure 2 shows the maximum and minimum lake (or pool levels) and summarizes the storage allocations for the authorized purposes of Willow Creek Project as of year 2017.

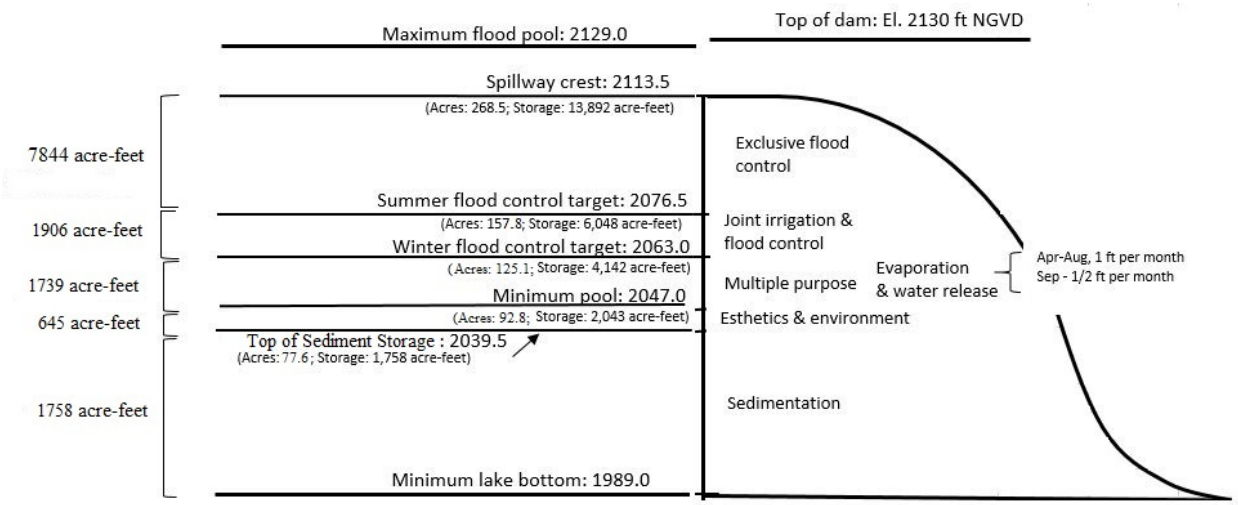


Figure 2: Willow Creek Lake Water Storage Schematic

The probability of a flood event of the magnitude necessary to fill the lake to its maximum controlled flood pool is extremely low. The normal operating range of the lake varies from the winter flood pool elevation 2,063.0 feet (surface area 125.1 acres, 4,142 acre-feet of storage) to the summer flood pool elevation 2076.5 feet (surface area 158 acres, 6,048 acre-feet of storage). During years when inflows are low and lake evaporation is high, the resulting lake elevation may

fall to elevation 2,047.0 feet (minimum pool) with a lake surface area of about 93 acres. The winter flood regulation period occurs from December 1 through January 31 and consists of maintaining the lake at elevation 2,063.0 feet, which allows for 9,750 acre-feet of flood storage from elevations 2,063.0 to 2,113.5 feet.

The spring refill period normally occurs from February 1 through April 15 and consists of filling Willow Creek Lake to elevation 2,076.5 feet. Filling the lake to this elevation provides for future recreation and irrigation benefits. Flood risk management requirements and downstream flow requests by the watermaster are provided as water is available. In low flow years, senior water rights holders may call for inflow before April 1. This can make it more difficult for the lake to fill to elevation 2,076.5 feet. As the spring refill period progresses, the reservoir regulator continually assesses hydrologic conditions and volume forecasts for the watershed. The regulator has the discretion to delay the start of filling if conditions such as large snowpack or a large runoff volume forecast warrants it.

The summer regulation period normally occurs from April 16 through October 9 and consists of releasing flows through the water quality outlet for downstream requirements and maintaining at least 7,844 acre-feet of exclusive flood space (elevation 2076.5 to 2113.5 feet) for thunderstorm floods. The fall drawdown period normally occurs from October 10 through November 30 and consists of drafting Willow Creek Lake to no higher than its winter flood pool elevation of 2,063.0 feet. Project outflow rates can range from 20 to 30 cfs or higher during this period depending upon inflow rates.

Normal seasonal regulation of the Willow Creek Project allows for recreational use (sportfishing, boating, hunting, etc.) at the project. Regulation normally maintains the lake between elevations 2,047.0 and 2,076.5 feet and provides between 93 and 158 acres of lake surface area, respectively, for recreation. No special regulation is required for fish and wildlife conservation. Regulation for downstream water quality is achieved with selective withdrawals from various reservoir levels via the outlet works.

Willow Creek Lake is operated with the consideration to not adversely affect existing downstream water rights. Generally, during the spring and summer, downstream flow needs are met by passing the state watermaster's requested flow plus inflow. The watermaster requests flows for irrigation purposes. In addition, a downstream flow requested by the State is 3 cfs for livestock watering and is provided as inflow is available. Water rights downstream of Willow Creek Dam are pre-1909, and allows for stock watering of 3 cfs, and are senior rights to storing water in the reservoir (conversation with Ken Thiemann and Mike Ladd (OWRD) on October 2, 2017).

2. Alternative and Proposed Action

This section provides a description of the alternatives, how the alternatives were determined, the reservoir modeling used in the analysis to compare the alternatives, the comparison of the alternative to meet the objectives, and states the preferred alternative. The affected environment is discussed in Section 3, and the comparison of the effects of the alternatives on the environment is provided in Chapter 4.

2.1 Description of Alternatives

This SEA evaluates the incremental impacts of the Proposed Action compared to the No Action Alternative. The No Action alternative of this SEA is the Proposed Action of the 2008 EA (with some minor modifications to the reservoir operations)**.** The No Action Alternative makes use of 2,500 acre-feet, or 71 percent of the authorized storage allocation for irrigation of 3,500 acre-feet. The Proposed Action makes use of the full authorized storage allocation for irrigation. No other alternatives were evaluated since this SEA only evaluates the incremental impact of the Proposed Action. Any request for operation outside these bounds requiring additional water releases above the proposed amounts would require congressional authorization and further NEPA review.

2.1.1 No Action Alternative

The No Action Alternative would continue to provide for 2,500 acre-feet of irrigation releases. Under this alternative, a maximum of 2,500 acre-feet of annual reservoir storage would continue to be available to the Company from Willow Creek Lake for irrigation of crops during April through October. It is assumed that the Company would continue to hold the Contract (Sections 1.2 and 1.4) with Reclamation, for the right to 2,500 acre-feet of stored water to irrigate 2,538 acres of land. The 2,500 acre-feet of stored water in the lake is used as an irrigation source for agricultural lands planted in alfalfa (75 percent) and small grains (25 percent) (Corps 2008). Small grains in the region are harvested in mid-July. These crops require about 3 feet of water per acre (total) for adequate irrigation during the spring and summer growing season. The 2,500 acre-feet of water provides 1 acre-foot of water per acre of land to be irrigated. The Federal Treasury would continue to be repaid for a share of the costs of constructing and operating the Willow Creek Project under the existing Contract.

In addition to the Contract, the Company has obtained a permit from the OWRD (Permit S-54980, dated February 8, 2016) to use the 2,500 acre-feet of water. Based on this permit, the Company diverts water at 23 diversion points downstream of the Willow Creek Project; one of these diversion points serves five land owners. It is assumed that the Company would continue to hold a permit for use of 2,500 acre-feet of water. Water for irrigation would continue to be taken from surface water rights (live flow) from Willow Creek downstream of the dam), groundwater sources, and from Willow Creek Lake storage.

The monthly release schedule shown in Table 3 is an estimate of irrigation releases by period, and the Corps used this data for reservoir modeling for the purpose of comparing the No Action Alternative with the Proposed Action discussed in Chapter 4. The actual release schedule used in

real-time regulation may be different than described in this schedule due to availability of water, annual climate variability, demand, or other circumstances. The release schedule was modified from that provided in House Document 233 (1965) which shows 4 percent release of the total volume for the full month of April, and no irrigation for October. For modeling, the Corps assumed that irrigation releases begin on April 16 (refill normally ends on April 15) and extends through October, based on the Contract which states that the irrigation season ends October 31. Two percent of the total irrigation was assumed to be released for each month, April and October.

Table 3: Modeled Monthly Irrigation Release Schedule for the No Action Alternative

Period	Percent Volume Released*	Volume and Flow Release (2,500 total) (acre-feet (cfs))
April 16-30	2	50 (1.7)
May 1-31	15	375 (6.1)
June1-30	18	450 (7.6)
July 1-31	25	625 (10.2)
August 1-31	22	550 (8.9)
September 1-30	16	400 (6.7)
October 1-31	2	50 (0.8)
Total	**100**	**2500 (6.3)**

** April and October percentages modified from the schedule provided in House Document 233 (1965). The House Document showed 4% for April and 0% for October. For modeling, the Corps assumed that irrigation releases begin on 16 April (refill normally ends on April 15) and extends through October, based on the Contract which states the irrigation season occurs through 31 October. Two percent of the total irrigation was assumed to be released for each month, April and October.*

2.1.2 Proposed Action

Willow Creek Project was authorized with 3,500 acre-feet of future irrigation storage. The Proposed Action would provide the full amount of authorized irrigation water for release annually from the Willow Creek Project, subject to water availability. The irrigation storage would be released during April through October. As a connected action, with the Proposed Action, Reclamation would enter into a contract with the irrigation district for the additional 1,000 acre-feet of stored water in Willow Creek Lake, for a total of 3,500 acre-feet. Reclamation would rely on this SEA to support their decision document for this action.

The additional 1,000 acre-feet of water would provide an additional 0.4 acre-feet of water per acre of land to be irrigated. Water from lake storage would be used for irrigation by some users in lieu of groundwater, which has been declining in the region and of which the OWRD has enacted restrictions on new groundwater uses.

Table 4 shows the release schedule by month for the Proposed Action and the increase in release volume per period between the Proposed Action and the No Action alternative. The monthly

release schedule shown in Table 4 is an estimate of irrigation releases by period, and the Corps used this data for reservoir modeling for the purpose of comparing the No Action Alternative with the Proposed Action discussed in Chapter 4. The actual release schedule used in real-time regulation may be different than described in this schedule due to availability of water, annual climate variability, demand, or other circumstances. As for the No Action Alternative, the release schedule was modified from that provided in House Document 233 (1965). For modeling, the Corps assumed that irrigation releases begin on 16 April (refill normally ends on 15 April) and extends through October, based on the Contract which states that the irrigation season ends October 31. Two percent of the total irrigation was assumed to be released for each month, April and October.

The percent of total volume released by period that was modeled for the Proposed Action (3,500 acre-feet) is the same as that modeled for the No Action Alternative (2,500 acre-feet). The actual release schedule used in real-time regulations may vary from what is reported in this SEA as long as it remains within the bounds that were evaluated for environmental impacts.

Table 4: Modeled Monthly Irrigation Release Schedule for the Proposed Action

Period	Percent Volume Released*	Volume and Flow Release for Proposed Action (3,500 total) (acre-feet (cfs))	Increase in Volume and Flow Release (compared to No Action release of 2,500) (acre-feet (cfs))
April 16-30	2	70 (2.4)	20 (0.7)
May 1-31	15	525 (8.5)	150 (2.4)
June1-30	18	630 (10.6)	180 (3.0)
July 1-31	25	875 (14.2)	250 (4.1)
August 1-31	22	770 (12.5)	220 (3.6)
September 1-30	16	560 (9.4)	160 (2.7)
October 1-31	2	70 (1.1)	20 (0.3)
Total	**100**	**3,500 (6.3)**	**1,000 (2.5)**

* *April and October percentages have been modified from the schedule provided in House Document 233 (1965). The House Document showed 4% for April and 0% for October. For modeling, the Corps assumed that irrigation releases begin on 16 April (refill normally ends on April 15) and extends through October, based on the Contract which states the irrigation season occurs through 31 October. Two percent of the total irrigation was assumed to be released for each month, April and October.*

If the Proposed Action were to be implemented, the Contract between the Company and Reclamation for stored water in Willow Creek Lake could be amended to reflect the 3,500 acre-feet of stored water available, and the Company would need to secure a permit from the State of Oregon to use the stored water.

2.2. Reservoir Regulation Modeling

The project regulation for modeling flood operations is as provided in Section 1.8, with reservoir releases for irrigation as discussed in Section 2.1.1 for the No Action Alternative, and Section 2.1.2 for the Proposed Action. To evaluate the magnitude and timing of reservoir drawdown and outflows, the Corps made a model run for the No Action Alternative and a model run for the Proposed Action using the Hydrologic Engineering Center Reservoir Simulation (HEC ResSim)[2] model. Inflows were computed based on actual change in storage and outflows. Actual inflows for the 33-year period from March 1984 through September 2017 from the *Willow Creek, above Willow Creek Lake* gauge plus actual and estimated flows (when actual flows were not available) for Balm Fork were used to determine releases.

Two modeling rules were developed to prevent the lake from falling below minimum pool elevation 2,047.0 feet. The first modeling rule is to limit total releases during the irrigation season of mid-April through October, at 50 cfs when the reservoir is between elevations 2,076.5 and 2,047.0 feet. Releases during the irrigation season are generally live inflow plus irrigation releases. Live flow is Willow Creek plus Balm Fork flow as measured at the inflow gauges. Irrigation releases used in modeling are up to 10.2 and 14.2 cfs (in July) for the No Action Alternative (Table 3) and the Proposed Action (Table 4), respectively. Based on recent past experience, irrigation requests have not been greater than about 20 cfs. This modeling rule allows for conservation (storing) of water and aids in reducing the risk of drafting the lake to below minimum pool in future months. The magnitude of the cap could be refined during real-time operations.

During initial model runs, it was found that lowering the pool to elevation 2,047.0 feet for irrigation releases results in the pool falling below minimum pool in later months, in some years, due, in part, to evaporation. In order to prevent the lake from lowering below minimum pool, a second modeling rule was developed. This rule consists of suspending irrigation releases when the pool was at or below elevation 2,050.0 feet. When the pool was at or below elevation 2,050.0 feet, the lower of live inflow or 3 cfs was released. Modeling by trial and error found that suspending irrigation releases at pool elevations of less than elevation 2,050.0 feet, for example, at elevation 2,049.0 feet, resulted in the pool dropping below minimum pool in some years. The pool may be expected to reach elevation 2,050 feet in late summer to early fall, and the following months are generally dry. During this time, evaporation of water in the reservoir may be greater than live inflow, and passing live inflow could cause the lake level to drop, in some years, to near minimum pool. In real-time operations, management of the lake may be more fine-tuned than as modeled, to be able to provide the full or near full irrigation releases without falling below minimum pool.

In the modeled years when the reservoir did not fill to 2076.5 feet by April 15, there is less water available for irrigation. For modeling purposes, the irrigation flows (shown on Tables 3 and 4) were adjusted by the ratio of the storage volume of the actual fill to the storage of the full conservation level (pool elevation 2076.5 feet and conservation storage volume of 3,645 acre-

[2] Hydrologic Engineering Center (HEC) ResSim model is software developed by the U.S. Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center, to model reservoir operations for a variety of operational goals and constraints.

feet). For example if the reservoir only filled to 3,000 acre-feet above elevation 2,047.0 feet (elevation 2,072.3 feet) by April 15, the irrigation releases were reduced by 3,000/3,645 = 82.3 percent. This adjustment allowed for spreading out irrigation releases over the irrigation season, rather than depleting water available for irrigation earlier in the season. This adjustment could be evaluated for use in real-time operations.

2.3 Comparison of Alternatives to Meet Objectives

The Corps' objective is to provide a reliable long-term source of an additional 1,000 acre feet of stored water for irrigation to the existing 2,500 acre-feet of stored water to provide the full authorized volume of irrigation water of 3,500 acre-feet. The objective of the Company is to gain additional stored irrigation water and to transition from groundwater use to stored water which would aid in meeting the OWRD objective to conserve groundwater supplies for municipal use and other reasons (see Section 3.3, Groundwater). The No Action Alternative would continue to provide 2,500 acre-feet of stored water, and use current (year 2017) groundwater practices subject to the OWRD groundwater use restrictions. The Proposed Action would allow irrigators to use an additional 1,000 acre-feet of stored water from the reservoir, thereby likely reducing groundwater pumping and conserving groundwater supplies. In comparing the No Action Alternative to the Proposed Action, the latter would better meet the objectives.

2.4 Preferred Alternative

The Proposed Action is the Corps' preferred alternative.

3. Affected Environment

This chapter begins with a description of the Willow Creek watershed characteristics. The remainder of the chapter is organized by resource and provides some background and a description of each resource under existing conditions as of year 2017. The affected area for the resource analysis in this SEA varies by resource, but the main effects are in and around Willow Creek Lake; however there is some discussion of effects downstream of the dam for some resources. Descriptions of the human environment, such as socio-economic and farmlands are for Morrow County.

3.1 Watershed Characteristics

3.1.1 General

Willow Creek is a 79-mile long stream that drains into the Columbia River near river mile 253. Willow Creek and its tributaries drain an area of about 880 square miles. The drainage area above the Willow Creek Project is 93 square miles or 10.6 percent of the total watershed area. Watershed elevations range from about 200 feet at the mouth of Willow Creek to about 5,900 at its headwaters near Black Mountain in the Umatilla National Forest. The most widespread land use in the watershed is agriculture – dry land wheat and valley bottom irrigated crops. There are numerous irrigation diversions and structures along Willow Creek downstream of the dam.

3.1.2 Tributaries

The Willow Creek Project regulates flows from the Balm Fork and the mainstem of Willow Creek above Heppner. Balm Fork is the only tributary that enters Willow Creek upstream of the dam. Hinton Creek and Shobe Canyon enter Willow Creek downstream of Willow Creek Project in Heppner, and these creeks pose potential flood threats to the town. The major tributaries to Willow Creek, in downstream order, are summarized in Table 5.

Table 5: Major Tributaries to Willow Creek

Tributary	Drainage Area (sq. miles)	Watershed Length (miles)
Balm Fork	28	11
Shobe Canyon	7	4
Hinton Creek	44	17
Blackhorse Creek	26	10
Clark Canyon	50	13
Rhea Canyon	226	35
Eight Mile Canyon	150	40

3.1.3 Climate

The climate for most of the watershed is semiarid with average annual precipitation ranging from 8 inches at the mouth of Willow Creek to 34 inches in the headwaters. Yearly precipitation occurs mostly from December through May, with the annual mean rainfall of 13.49 inches for the period 1893 to 2012. The climate in Heppner is characterized by low precipitation, wide variation of annual temperatures, low humidity, and high evaporation rates during the summer. For the period 1893 to 2012, the maximum and minimum recorded temperatures at Heppner are 110 and -19 degree Fahrenheit, respectively. The annual mean temperature for the same period is 50°F. Intense thunderstorms occur frequently in the summer and may deposit extraordinary amounts of rainfall in a short period of time, usually less than one hour.

3.1.4 Hydrology

Streamflow records for gaging stations in the Willow Creek watershed are shown in Table 6. The average annual runoff at Heppner for water year 1952 through 2012 is 14,798 acre-feet, which is about 2.89 inches of water over the 96 square mile watershed. The computed average annual runoff for individual years has varied from a minimum of 1,843 acre-feet in year 1968 to a maximum of 48,947 acre-feet in year 2011.

Prior to construction of the Willow Creek Project, peak annual flows in Willow Creek near the Heppner gaging station (downstream of the dam) generally occurred in the early spring and rapidly receded to low or no flow by mid-June. By late summer, Willow Creek usually dried up for short periods. This general pattern was occasionally changed by the occurrence of intense rainfall from spring or summer thunderstorms. Such storms caused a sharp increase in streamflow with a very high peak discharge followed by a rapid recession to base flow.

Table 6. Streamflow Records for the Willow Creek Watershed

Station	USGS Station Number	Drainage Area (sq. miles)	Location (river mile)	Period of Record	Operator
Willow Creek above Willow Creek Lake*	14034470	67.9	54.1	1982-present	USGS
Balm Fork near Heppner	14034480	26.3	1.1	1982-2003 Some peak flows 1903	USGS
Willow Creek Lake at Heppner	14034490	96.6	52.4	1984-present	USGS
Willow Creek at Heppner*	14034500	96.8	52.2	1951-present; Some peak flows from 1903	USGS
Willow Creek near Morgan Street	14034608	147	51.1	1996-2007	Corps
				2007-present	USGS
Rhea Creek near Heppner	14034800	120	25.4	1960-1991	USGS
Willow Creek near Morgan	14035000	630	23.7	1921, 1929-1931	USGS
Willow Creek above Eight Mile Canyon	14035500	680	7.5	1905	USGS

** Project operation gage; USGS = U.S. Geological Survey*

3.1.5 Geology

The oldest rocks in the area are Tertiary sedimentary strata of the Clarno Formation. This formation is exposed in Willow Creek Canyon about 15 miles southeast of the dam. Overlying the Clarno Formation are several hundred feet of Miocene Columbia River basalts, which form the basic bedrock strata in the area. Overlying the basalts on the slopes and ridges are fine-grained windblown silts, which vary in thickness from trace amounts to 10 feet. The valley floors consist of gravel deposits that are generally less than 10 feet in thickness. Willow Creek and its tributaries have eroded the gravel deposits and exposed the underlying basalt strata. Soils overlying bedrock consist of surficial silt and sandy silt deposits underlain by mixtures of silt and angular rock fragments above the top of the basalt. The thickness of the soil cover on the valley floor varies from less than 5 feet to localized areas of 18 feet. Soil types vary from rock-free silts to some silty sands found near stream areas. There are no known economic mineral deposits in the area.

3.2 Water Quality

The lake has been considered eutrophic (high in nutrients), and the water quality is impaired. A major source of water quality impairment is heat input, as well as sediment and nutrient loading. Temperature increases may be caused by natural events and may result in low seasonal flows, changes in channel shape, alteration to the flood plain, and vegetation removal (ODA 2017). Nonpoint sources of pollution combine to contribute to water quality impairment in the Willow Creek subbasin. Nonpoint sources likely include lack of healthy riparian vegetation communities, eroding agricultural and forest lands, eroding streambanks, runoff and erosion from roads and urban areas, and runoff from livestock and other agricultural operations. These land use practices, continue to contribute high nutrient loads to Willow Creek Lake during the spring run-off. As a result, harmful blue-green algae blooms continue to frequent the lake during the summer and fall months. Water quality issues include low dissolved oxygen, increased methane, hydrogen sulfide, and increased ammonia, iron, and manganese. The Corps regularly monitors water quality in Willow Creek Lake mainly for research purposes but also reports results to the state of Oregon to meet the Total Maximum Daily Load (TMDL) requirements and for public safety reasons related to harmful algal blooms and associated cyanotoxins.

Section 303(d) of the Clean Water Act (CWA) directs states to develop a list of water quality limited streams, which are streams that violate water quality standards and do not support their beneficial uses. Beneficial uses in the Willow Creek watershed include public and private water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetics (DEQ 2007). Of the beneficial uses of water in the watershed, the most sensitive uses for most waters is spawning and rearing of fish and water contact recreation.

Subbasin water bodies on the CWA Section 303(d) list include: temperature for Willow Creek from the mouth to its forested headwaters (river mile 73), potential hydrogen (pH) for Willow Creek below the Willow Creek Lake, and bacteria for Balm Fork. The CWA also directs states to develop TMDLs for CWA Section 303(d)-listed streams. TMDLs are discussed in more detail in Section 3.2.1. Algae blooms in the reservoir are also of concern for public health reasons. Algae blooms are addressed in Section 3.2.2.

3.2.1 Total Maximum Daily Loads (Temperature, pH, Bacteria)

A TMDL study (ODEQ 2007) was completed by the ODEQ which finalized the TMDLs for the Willow Creek subbasin. These TMDLs were approved by the U.S. Environmental Protection Agency (EPA) on February 19, 2007. According to this study, Willow Creek Lake maintains an important role in controlling flow, pH, and stream temperature in Willow Creek below the dam. The study addressed the CWA Section 303(d) listings for temperature, pH, and bacteria in the watershed. These TMDLs result in allocations of pollutant loads, e.g. degrees of temperature or tons/acre of sediment, to different sources such as private agriculture, urban areas, and federal lands. The TMDLs from that study are in effect as of year 2017. In the case of Willow Creek Project, the load allocations set by the State are for the temperature and pH of water released from the dam. The TMDL for Willow Creek Project outflows is 9.0 standard units for pH. The

temperature TMDL is 20.2 degrees Celsius during the critical period, typically late June to late September in the Heppner vicinity. The temperature and pH measurements are taken about 0.2 miles downstream of the dam at the Willow Creek at Heppner gage. The Corps has the ability to affect water temperatures and pH immediately below Willow Creek Dam through the operation of the water quality intake that can be raised or lowered on the face of the dam to release water from different depths of the lake when operating properly. The water quality intake has been unable to be raised or lowered since sometime in year 2011 and is proposed for repair in year 2018. Despite this state of disrepair, recent annual water quality reports by the Corps state that the water temperatures met the state standard; however, the pH was not consistently met. The ability to meet the water quality standards downstream of the dam can vary from year-to-year. The variability is not only a function of the level to which water is withdrawn from the lake, but is also a function of ambient temperatures and the water quality condition of the inflow to the lake affected by upstream land use practices.

For water conditions downstream of the dam, typically during late July through August, Willow Creek becomes a dry streambed at some point below Lexington (about 9 miles downstream of Heppner) or Ione (about 9 miles downstream of Lexington). Irrigation withdrawals (live flow rights plus flow from storage), bed losses, and/or evaporation may entirely attenuate the flow of the creek. Increased outflow from Willow Creek Lake due to temporary irrigation contracts (every year from 2003 through 2011) and for the long-term contract (since 2012) likely has pushed this point further downstream, giving the flowing stream more thermal assimilative capacity and improved water quality.

3.2.2 Dissolved Oxygen and Algae Blooms

Every year during spring runoff, nutrients and organic matter attributed largely by the forested headwater sub-catchments, along with agricultural fertilizers, livestock wastes, and human sewage from the lower reaches of the watershed, are deposited into Willow Creek Lake. Increased (nutrient) loading from the headwaters of Willow Creek is likely due to logging activities and associated road construction (Rajkovich 2014). This loading stimulates algae blooms that creates oxygen demands in the reservoir, and it fuels a series of processes creating anoxic conditions (without oxygen), which results in the production of methane, hydrogen sulfide, and ammonia. Low dissolved oxygen alters the reservoir chemistry leading to the release of phosphorous, nitrogen, iron, and manganese from bottom sediments.

To improve water quality conditions within Willow Creek Lake, an aeration system aimed at increasing hypolimnetic dissolved oxygen was tested. This aeration system was installed in the forebay of Willow Creek Lake in June 2004. This system was installed to increase dissolved oxygen in the hypolimnion (lower level of the water column) and inhibit the release of nutrients and the production of methane, hydrogen sulfide, and ammonia from bottom sediments. In general, increasing oxygen at lower, reservoir depth levels increases circulation in the lake, incorporates oxygen into the water at depth, speeds up algal decay, and increases the utilization of nutrients. However, the aerators the Corps tested destratified the reservoir, creating warm and uniform water temperatures throughout the water column. This allowed for nutrient mixing and created higher concentrations of nutrients in the middle and upper layers of the water column than historically. The warmer water and increased nutrients in the upper layers of the lake (i.e.

the photic zone) created increased densities and the duration of harmful algal blooms (HABs) especially during 2006 and 2007. Subsequently, the aeration system was abandoned in 2008.

The most abundant blue-green algae species found in Willow Creek Lake include *Anabaena flos-aquae*, *Microcystis aeruginosa*, *Aphanizomenon flos-aquae* and *Oscillatoria limnosa,* and *Gleotrichia*. Blue-green algae blooms can lead to the production of toxins harmful to humans and animals that come in contact with it by consumption, skin contact, or by inhalation (via water sports activities such as water skiing). There are generally three types of toxins – liver toxins (hepatotoxins), nerve toxins (neurotoxins), and skin toxins (dermatoxins). Microcystin and cylindrospermopsin are examples of liver toxins, and anatoxin-a and saxitoxin are examples of a neurotoxins. All of these toxins could potentially be produced by the blue-green algae species found in Willow Creek Lake.

Until year 2012, water samples from the Willow Creek Lake were only analyzed for microcystin toxins. The Oregon Department of Human Services guidelines for Oregon recreational waters recommends that concentrations of microcystin not exceed 10 micrograms per liter (ug/L). Otherwise, a health advisory is put in place for the lake. Historically, the highest microcystin concentration measured was at the boat dock on September 12, 2006 at 1,150 ug/L. Since year 2012, samples have also been analyzed for the toxins anatoxin-a, cylindrospermopsin, and saxitoxins; however, concentrations for these toxins have not been detected or have been below the health advisory guidelines. The health advisory guideline is 20 micrograms per liter (ug/L) for each anatoxin-a, and for cylindrospermopsin, and 10 ug/L for saxitoxins.

Past research data indicate that water containing blue-green algae toxins, when sprayed on plants, may enter the plants and inhibit photosynthesis. Furthermore, lettuce that was spray-irrigated from a water source containing the blue-green alga *Microcystis aeruginosa* and microcystin toxins contained *Microcystis aeruginosa* colonies on the leaf surfaces and microcystins throughout the plant. This type of research is in its early phases but may bear on the use of water for irrigation from Willow Creek Lake. Since most algae growth occurs in surface waters, release water can be selected from a depth where algae toxins are not present or are in low concentrations; however, since the water quality intake is not able to be raised or lowered (as of year 2017), the release depth is at about 33 feet when the reservoir is at elevation 2076.5 feet.

The timing of toxins released in the cycle of a bloom, or whether a HAB would even produce toxins is highly unpredictable. For example, while high concentrations of microcystin toxins were detected in the summer of 2006 (1,150 ug/L and 416 ug/L), the following summer (2007) the Corps collected toxin data during two HAB events and found mostly non-detects for microcystins in surface, mid-depth, and bottom water samples. In addition, since 2008, based on the Oregon Health Authority Algae Bloom Advisory Archive, there have been one or two algae blooms in the reservoir each year that occurred in the summer and fall and occasionally extended into winter; however, these HAB's did not necessarily include toxins.

To address the HAB problems in Willow Creek Lake, in year 2008, the Corps agreed to a three-year pilot study to test a circulation system designed to circulate and mix the upper layer of the lake to reduce favorable conditions for HABs (Corps 2016). For the first year of the three-year study, the circulators were installed in the Balm Fork arm. After finding no difference in

cyanobacteria in the Balm Fork Arm versus the remainder of the reservoir, six circulators were installed in the reservoir for the next two years. Despite these efforts, HABs continued to be problematic, requiring public health advisories.

In 2009 and 2010 the Corps funded further studies related to HAB reduction. These studies were completed by the University of Idaho to reduce HABs by altering the total nitrogen to total phosphorous nutrient ratio. The study demonstrated that by manipulating the nutrients in the lake (either through the addition of nitrogen, or reduction of phosphorus), water quality improved. This sort of lake management strategy could prove effective by reducing the occurrence of HABs, but watershed improvements to control the high input of phosphorus and sediment loading into Willow Creek Lake would likely also be necessary (Corps 2016).

Since 2015, the University of Idaho has been conducting research to address the problem of annual blooms blue-green algae, and the research will continue through 2020. The objective of the research is to evaluate internal and external loading of phosphorus at the reservoir. The findings are being used evaluate strategies for riparian restoration in the upper Willow Creek watershed to address external nutrient loading; and estimate and plan in-lake nutrient sequestration techniques and solutions, such as alum treatments. These potential solutions may limit the amount of phosphorus in the reservoir and thereby decrease the number of toxic blooms. The implementation of the potential solutions is dependent upon funding and collaboration with other local, state and federal agencies.

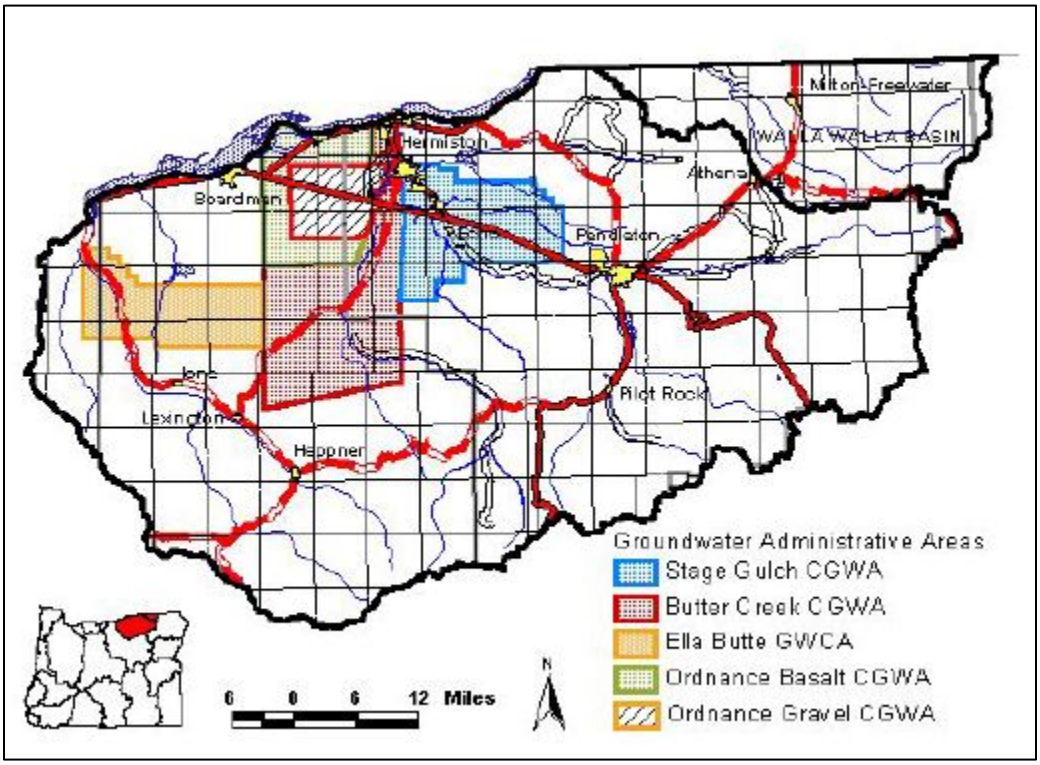
3.3 Groundwater

Willow Creek Project is located in the Umatilla Basin. The Umatilla Basin is located in northcentral Oregon in an area of rolling hills covered in grasslands, desert vegetation in the lowland, and forested mountains to the south in the Blue Mountains. The 5,800 square mile Umatilla Basin is an arid area that supports agricultural industry and a growing population. Water demands continue to grow resulting in critical water management problems. Current issues facing water managers include long-term water level declines in basalt aquifers and potential streamflow depletion from groundwater withdrawals.

Geologically speaking, the Umatilla Basin lies within the Columbia Plateau, a broad area underlain by volcanic flood basalt, and are called the Columbia River Basalt Group (CRBG) (https://or.water.usgs.gov/proj/umatilla_gw/background.html). A layer of sediments overlies the basalt. The CRBG is a series of layers of interflow zones of productive aquifers consisting of interflow zones separated by low permeable flow interiors. The permeable zones are an important source of water supply for the Umatilla Basin. The uppermost part of the CRBG is permeable and has a good hydraulic connection with the overlying alluvial aquifer. Continued withdrawals of water result in large declines in water levels because of low storage properties and limited recharge of water reaching these productive zones through the low permeability flow interiors.

In the 1960s, it became apparent that development and management of groundwater resources in the Umatilla Basin would require attention, as overdraft, excessive declines, unstable water levels, and other groundwater problems existed or were developing in the basin. In the mid-

1970s, to correct for overdraft and excessive declines, the Oregon Water Resources Commission began imposing control measures. Critical groundwater areas (CGWA) were established by order of the OWRD in the Ordnance for Butter Creek, and Stage Gulch areas in Morrow County (Figure 3), and groundwaters within the basalt in the Ella Butte were restrictively classified. Within these areas, the OWRD will not issue new permits to appropriate groundwater (OWRD 2003).



Source: Ground Water Supplies in the Umatilla Basin (OWRD 2003). (CGWA is "critical groundwater area").

Figure 3: Groundwater Restricted Areas, Umatilla Basin.

The State of Oregon's objectives for management of surface and groundwater resources in the Willow Creek subbasin, are provided in the Oregon Administrative Rules (OAR) 690-507-0090, and took effect on May 22, 2017. The objectives are to:

(a) Protect instream values by limiting future appropriations to selected nonirrigation or nonconsumptive uses;
(b) Preserve the opportunity for future upstream storage for all beneficial uses;
(c) Permit artificial groundwater recharge to offset declining groundwater levels and supplement existing groundwater uses;
(d) Achieve a balance between groundwater pumpage and natural recharge in designated critical groundwater areas and groundwater study areas;
(e) Protect municipal groundwater supplies;
(f) Prevent new appropriations from causing groundwater /surface water interference.

The OAR also includes appropriation and use of groundwater provisions. Briefly summarizing,

groundwater within aquifers in the Ordnance, Butter Creek and Stage Gulch Areas are closed to further appropriations. Permits to use groundwater in the study areas or critical groundwater areas only may be issued for exempt uses. Groundwater from the basalt reservoir in a five-mile radius around any municipal well of the cities of Heppner, Ione, and Lexington is classified for municipal or group domestic use and is statutorily exempt groundwater uses. Other uses may be permitted if it is documented that a barrier to groundwater movement separates a proposed well from municipal wells and there will be no interference with municipal wells. For more details, refer to the OAR.

Municipal and industrial water supplies in the Willow Creek watershed are obtained from wells. Each of the cities of Heppner, Lexington, and Ione obtain their water from wells. The City of Heppner also has a water right to 1.75 cfs of surface water from Willow Creek; however, according to the Public Works Director for the city of Heppner, water has not been withdrawn from the creek for at least the last 13 years. The Public Works Director also stated that the city of Heppner withdraws water from four wells for irrigation and municipal use; one well is beside the reservoir, the three other wells are 2 miles, 10 miles and 12 miles above the reservoir. A fifth well has been taken off line.

3.4 Air Quality/Noise/Light

The air quality in the project area is generally good. The air pollutants of greatest concern in Oregon include fine particulate matter, known as PM2.5 (2.5 micrometers and smaller in diameter, that include wood smoke, other combustion sources, cars, and dust), air toxics (such as benzene and acetaldehyde), ground level ozone (commonly known as smog), and greenhouse gas emissions (ODEQ 2016).

The ODEQ uses an air quality index (AQI) to assess ambient air quality. The AQI is calculated using monitoring data and then posted under various descriptors (good, moderate, unhealthy for sensitive groups, unhealthy, very unhealthy). The AQI is reported for various cities and includes Pendleton, which is the closest city to the project area with air quality monitoring year-round (only summer monitoring occurred at Hermiston). For Pendleton in year 2015, 312 days were classified as good, 47 days were moderate, 2 days were classified as unhealthy for sensitive groups, and 2 days were classified as unhealthy (ODEQ 2016). From years 2006 through 2010, there were no exceedances of the National Ambient Air Quality Standards for PM10 (no data for 2011-2015) at Pendleton and no exceedances for ozone in Hermiston for 2007 through 2015 (no data for 2006) (DEQ 2016).

Existing noise levels in the project area consist of those generated by trucks and automobiles traveling on the roads near Willow Creek Lake and by watercraft on the lake. There are no practices in the project area that substantially affect natural light conditions.

3.5 Biological Environment

3.5.1 Vegetation

Shrub-steppe habitat dominates the Willow Creek Project area. Rabbitbrush and cheatgrass are the dominant vegetation in shrub-steppe areas. This habitat typifies the sloping banks and hills surrounding the project. Some riparian habitat is found along Willow Creek, Balm Fork Creek, and at South Canyon. There is no riparian vegetation around the perimeter of the lake. The majority of wet meadow habitat in the project area is situated at the east end of the Willow Creek arm of the lake. A small woodland is also located in this area. Another wet meadow area is located at the end of the Balm Fork arm of the lake. A popular woodland is located at a spring on the north shore of the lake. As the water is drawn down each season, mudflats are exposed around the perimeter of the lake. Mudflats are most extensive at the ends of the Balm Fork and Willow Creek arms.

3.5.2 Fish

No anadromous salmonids currently occur in the Willow Creek watershed (see Section 3.5.4 for more information on anadromous fish); however, Willow Creek Lake supports warm water fish primarily consisting of non-native smallmouth bass (*Micropterus dolomieui*),), black crappie (*Pomoxis nigromaculatus*), brown bullhead (*Ictalurus nebulosus*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), and bridgelip sucker (*Catostomus columbianus*). Many of these species spawn and rear in the shoreline areas of the lake. In addition, the ODFW annually stocks the lake with trout. All fish mentioned are gamefish which anglers target.

The ODFW is responsible for managing fish in Willow Creek Lake. Basic warm water fisheries management is for maximum sustainable harvest. Warm water fish are managed to be self-sustaining. When spawning populations are affected by reservoir management, fishing regulations are implemented to prevent over harvest of those populations. The fishing regulations can and do impact recreational use (ODFW, 2017).

The ODFW uses electrofishing to inventory warm water fish populations in the lake. An inventory (ODFW 2006) was made to assess the effects of the temporary irrigation contracts over the years 2003-2006. From this study, the three warm water species that appeared to have been affected most by the change in the lake's water level management are pumpkinseed, largemouth bass, and black crappie (the 2012 sampling study reported that results for black crappie were inconclusive). These three species have some combination of shallow preferred spawning depth, later initiation of spawning, or short spawning duration. The two species that did not appear to be greatly impacted by increased water releases are smallmouth bass and bluegill. These two species either spawn deeper and/or have a protracted spawning period.

Sampling spawning information for warm water fish species in Willow Creek Lake is shown in Table 7. There is no spawning period information available for brown bullhead and bridgelip sucker, other than that they are both spring spawners. Trout spawning information is not

provided because the lake is stocked annually and are not managed to be self-sustaining, as are warm water fish.

As of year 2017, the most recent sampling study was conducted by the ODFW in the spring and fall of 2012 (ODFW 2012). The objective of the study was to provide an assessment of the effects of water releases from lake storage provided for irrigation contracts to warm water gamefish populations (trout is a cold water fish, therefore it was not addressed in the 2012 report). The water releases include the operation for up to 2,500 acre-feet of irrigation releases (the No Action Alternative).

Table 7: Spawning Information for Fish Species in Willow Creek Lake

Species	Temperature at initiation of spawning (°F)	Preferred depth (range) of spawning (feet)	Duration of spawning/fry dispersion (days)	Timing of spawning period in Willow Creek
Largemouth bass	60	2 (1-6)	12-17	June 7-July 15
Smallmouth bass	55	7 (6-10)	12-14	May 13-July 15
Black crappie	59	9.5 (1-20)	7-9	June 7-July 7
Bluegill	63	2 (0.5-4)	10	June 10-August 7
Pumpkinseed	59	(0.75-2.5)	11	June 7-July 9

Source: ODFW 2006. Values for the first three columns are taken from a variety of literature sources, while the dates given for spawning time period in Willow Creek Lake were generated after considering the previous three columns and then comparing Willow Creek Lake recorded temperatures to observed water temperatures and spawning of smallmouth bass and crappie in Brownlee Reservoir from 1991 to 1996.

From the 2012 study, brown bullhead, black crappie, and smallmouth bass were the most common warm water gamefish species, followed by bluegill, largemouth bass, and pumpkinseed. Table 8 shows the results of sampling over years 1988 through 2012. The spring 2012 sampling did not yield any statistically noteworthy results that would change previous assessments of fisheries for largemouth bass and pumpkinseed production recruitment since 2003. The 2012 data suggests that largemouth bass and pumpkinseed populations have continued to struggle to reproduce since 2003, as both species spawn in shallow water and are most affected by the lowered water levels. Since 2003, bluegill recruitment has remained unchanged, and smallmouth bass year class (year class is young fish produced in the once a year spawn) strength has decreased.

Conclusions for black crappie were difficult to draw because crappie populations tend to fluctuate depending on spawning conditions. In addition, in some years there is successful spawn, and that cohort of fish slowly declines until there is another successful spawn. For example, as shown in Table 8, in 2004 there was a relative high number of black crappie, then in 2005 the numbers dropped by about half, and declined or remained relatively low in the years following. In 2011, there was another successful spawn and in 2012, black crappie numbers dropped off again. Losses may be attributed to natural loss and entrainment.

Table 8: Electrofishing Catch-per-unit-effort for Fish in Willow Creek Lake, 1988-2012

Species	Density (CPUE)														
	1988	1989	1996	1997	1999	2000	2001	2004	2006	2007	2008	2009	2010	2011	2012
Largemouth bass	1.4	54.5	29.8	11.7	9.1	6.2	13.3	4.7	5.8	1.3	5.1	7.2	6.0	6.4	6.8
≥ 200 mm					8	6.2	7	4	5.4	1.3	2.1	4.3	3.9	2.6	4.6
≥ 300 mm					7.6	5.9	7	3.7	5.1	1.3	2.1	4.3	3.2	1.5	4.6
Smallmouth bass	65.6	80	19.8	18.3	6.9	61.7	53.3	47	21.7	8.0	8.4	5.1	27.3	16.2	19.6
≥ 200 mm					3.6	34.0	20.3	9	7.1	6.3	5.4	1.3	5.7	1.9	5.7
≥ 300 mm					1.1	0.7	0.6	8.3	1.7	1.0	0.9	0	1.4	0.0	0.0
Black crappie	20.1	12	93	15.7	3.3	4.2	0.6	69.7	34.8	0.7	11.6	5.1	11.7	47.0	20.0
≥ 100 mm					3.3	4.2	0.6	65.3	34.5	0.7	11.3	5.1	0.7	46.2	20.0
≥ 200 mm					2.2	1.0	0.6	0	2.9	0.7	6.0	4.5	0.7	0.0	1.1
White crappie	---	3	---	2.1	---	---	---	---	---	10.3	---	---	---	---	---
≥ 100 mm					---	---	---	---	---	10.3	---	---	---	---	---
≥ 200 mm					---	---	---	---	---	2.0	---	---	---	---	---
Bluegill	---	---	9.6	8.6	5.5	3.6	6.7	---	4.4	---	0.3	0.3	6.0	16.5	8.2
≥ 100 mm					3.3	2.6	4.8	---	3.0	---	0	0	1.4	6.8	4.3
≥ 200 mm					0	0.0	0	---	0.3	---	0	0	0.0	0	0
Pumpkinseed	11.4	36	22.5	10	3.6	24.8	20.3	9.3	1.7	1.9	0.3	2.1	0.7	0.4	6.1
≥ 100 mm					2.2	17.3	15.2	6.3	1.4	1.9	0.3	1.6	0.4	0.4	5.4
≥ 200 mm					0	0	0	0	0	0	0	0	0	0.0	0.0
Brown bullhead	---	---	0.9	---	0.4	2.0	6.7	4.7	21.3	29.2	15.8	6.9	8.9	8.6	37.5
Bridgelip sucker	74.3	7	1.8	1.7	1.8	3.9	4.1	1.0	2.7	---	---	5.6	0.7	1.1	---

Source: 1988, 1989, 1996, and 1997 data from ODFW (2006), all other years from ODFW (2012)

The ODFW (2006) stated that the effects of increased irrigation releases on pumpkinseed, largemouth bass, and black crappie could be decreased by delaying the initiation of the water release until the end of the spawning period (July 15). In March 2008 (see Section 5, *Coordination*), the ODFW recommended holding the lake level steady from June 10 to July 10 in order to minimize impacts to largemouth bass [these dates are tied to key water temperatures (surface water temperature reaching 60 degrees Fahrenheit for 2 or 3 days) for increased spawning success]. If water level drawdown can be minimized until the fry leave the nest, then losses of largemouth bass and pumpkinseed may be lessened. This same strategy would also reduce nest mortality of black crappie but may not lessen mortality of black crappie fry because of entrainment. Entrainment is when fish are flushed out of the reservoir, which happens to crappie as they are in the open water after swim-up. Black crappie fry tend to move to the pelagic zone following swim-up which makes them much more susceptible to entrainment compared to the more demersal fry of the other warm water species in the lake.

According to ODFW (2012), largemouth bass recruitment success had decreased in Willow Creek Lake since 2003. The condition of large-sized largemouth bass, although lower than seen in recent years prior to 2006, remained high due to low population density and abundant available forage. Also, smallmouth bass successfully recruited fish to the population more frequently (three times) since 2000 than largemouth bass. Smallmouth bass spawn at deeper levels and over a greater depth range and are less vulnerable to water level fluctuations. The smallmouth bass condition was not as good as that for largemouth bass which is typical of a higher density population.

To support the sport fishery purpose of the project, the Oregon Department of Fish and Wildlife (ODFW) operates a put-and-take rainbow trout (*Oncorhynchus mykiss*) fishery in the lake. Trophy trout were introduced at Willow Creek Lake in 2016 with the goal to help boost economic development opportunities for regions that rely heavily on hunting and fishing tourism (http://www.dfw.state.or.us/news/2016/03_march/030416.asp). As of 2017, the ODFW stocks 1,500 trophy trout (0.6 fish per/lb), by stocking Willow Creek lake with 750 fish in April and again in May. In addition, 16,000 fingerlings are stocked in April.

Largemouth bass are one of the most targeted species by anglers, and anglers requested that Willow Creek Lake be managed as a trophy largemouth bass fishery. To protect largemouth bass, the ODFW implemented a catch and release only regulation for largemouth bass in year 2009. In year 2016, the regulation was modified to five bass per day, with only one bass per day over 15 inches allowed for harvest. In addition, there is a limit of 25 crappie per day to prevent over harvest and promote larger crappie into the harvestable population.

For the first time, in year 2017, the State of Oregon issued a permit to allow black crappie to be taken from Willow Creek Lake for stocking McNary Wildlife Area ponds. One hundred seventy (170) black crappie were transferred in June 2017. The intent is to continue the transfer of black crappie when the black crappie population is high enough in Willow Creek Lake to support the transfer of crappie to other locations on an annual basis (communication with Brandon Frazier, Natural Resource Specialist, McNary Lock & Dam, July 3, 2017).

3.5.3 Wildlife

In the Willow Creek Project area, the woodland, riparian, and wet meadow habitats are of major importance to wildlife populations. Small game animals (e.g., pheasant, quail, dove), small mammals (e.g., ground squirrel, jack rabbit, skunk), and many species of birds are dependent upon these habitats for cover and nesting. Food sources for animals and birds are readily available because of the nearby grain fields and abundance of weed seeds. The *Willow Creek Master Plan* (Corps 1986) indicates that 80 species of birds, 35 species of mammals, 14 species of reptiles, and 5 amphibian species occur in the project area. The limiting factor to wildlife populations in the area is believed to be suitable winter cover. Big game animals such as elk, black bear, and mule deer are mostly restricted to the timbered headwater region of the Willow Creek watershed.

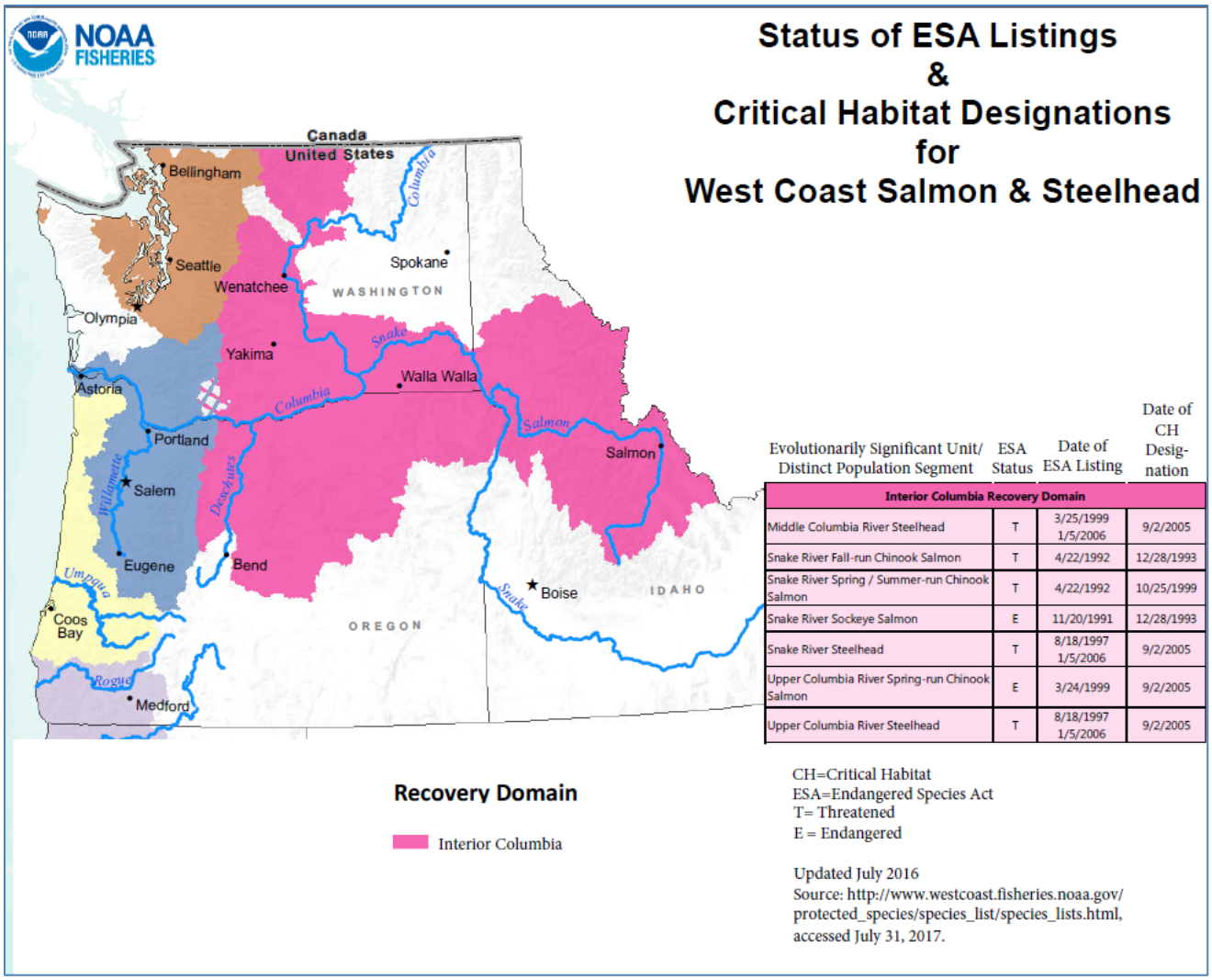
Bald eagles (*Haliaeetus leucocephalus)* have been seen in the vicinity of the Willow Creek Project, but there are no known bald eagle nests in or near the Willow Creek Project. Bald eagles may use the project area in the winter for foraging during October through March. Bald eagles were delisted by the USFWS in June 2007.

3.5.4 Threatened and Endangered Species

As of year 2017, there are no listed steelhead, Chinook salmon, or sockeye salmon species in the Willow Creek watershed; however, there is interest in reintroducing steelhead in Willow Creek. See Section 4.12.3b regarding this interest as a potential future action. Most believe that steelhead were extirpated from the system when Willow Creek was developed for agricultural irrigation in the late 1800's. Irrigated agriculture began in the late 1800's and has greatly reduced instream flow. In addition, passage is blocked during most of the year in Willow Creek below Heppner by diversion dams. Flows in Willow Creek are only substantial enough in the spring to allow passage of steelhead over the diversion dams. Downstream of Ione, which is about 18 miles downstream of Heppner, Willow Creek is almost entirely dry from late June until early September, as irrigation diversions during the summer result in total diversion of flow (personal communication: K. Ramsey, USFS, January 2004, Draft Umatilla/Willow Subbasin Plan prepared for the NPCC, May 2004).

Based on an ODFW internal memo in 1963, personal communication with a landowner in March 1963 (email from William Duke on September 6, 2017), indicated that steelhead had been seen as far upstream as Cecil, about 32 miles downstream of Heppner, where they were blocked by a dam of approximately 4 feet, which was diverting 90 percent of the flow. Several additional barriers were observed upstream which would have completely blocked passage. Steelhead are occasionally found in Willow Creek, and a population of resident redband trout is found in Willow Creek and its tributaries. Current genetic information suggests that there is little difference between redband trout and steelhead, so it is likely that the creek and its tributaries historically had a population of steelhead, but a population does not currently exist (Umatilla/Willow Subbasin Plan, May 28, 2004). It is unclear whether the Willow Creek watershed historically had a Chinook salmon population; evidence suggests that the watershed was not historically an important spawning or rearing area (NPCC 2004). See Section 4.13.2b regarding objectives for reintroducing steelhead into the Willow Creek watershed.

Figure 4 shows the threatened or endangered fish species under the jurisdiction of the NOAA Fisheries for the Interior Columbia area. Willow Creek Basin is located within the area defined as the Interior Columbia. The dates in the column, "Date of ESA Listing" in Figure 4 refer to the following rules for Critical Habitat and ESA Listings:



Evolutionarily Significant Unit/ Distinct Population Segment	ESA Status	Date of ESA Listing	Date of CH Desig-nation
Interior Columbia Recovery Domain			
Middle Columbia River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Snake River Fall-run Chinook Salmon	T	4/22/1992	12/28/1993
Snake River Spring / Summer-run Chinook Salmon	T	4/22/1992	10/25/1999
Snake River Sockeye Salmon	E	11/20/1991	12/28/1993
Snake River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Upper Columbia River Spring-run Chinook Salmon	E	3/24/1999	9/2/2005
Upper Columbia River Steelhead	T	8/18/1997 1/5/2006	9/2/2005

Note: The Willow Creek Basin falls within the Interior Columbia Recovery Domain area.

Figure 4: NOAA Fisheries ESA Listings

Critical Habitat Rules Cited

- September 2, 2005, (70 FR 52630) Final Critical Habitat Designation for 12 ESU's of Salmon and Steelhead in WA, OR, and ID
- October 25, 1999 (64 FR 57399) Revised Critical Habitat Designation for Snake River Spring/Summer-run Chinook salmon
- December 28, 1993 (58 FR 68543) Final Critical Habitat Designation for Snake River Chinook and Sockeye salmon

ESA Listing Rules Cited

- January 5, 2006 (71 FR 5248) Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead
- March 25, 1999 (64 FR 14517) Final ESA Listing for Middle Columbia River and Upper Willamette River Steelhead
- March 24, 1999 (64 FR 14308) Final ESA Listing for 4 ESU's of Chinook salmon
- August 18, 1997 (62 FR 43937) Final ESA Listing for 5 ESU's of Steelhead
- April 22, 1992 (57 FR 14653) Final ESA Listing for Snake River Spring/summer-run and Snake River Fall Chinook Salmon
- November 20, 1991 (56 FR 58619) Final ESA Listing for Snake River Sockeye salmon

The critical habitat located in Morrow County are (1) designated reaches in the mainstem Columbia River for upriver Evolutionarily Significant Units/Distinct Population Segments (ESUs/DPSs), e.g. Upper Columbia River spring Chinook and steelhead; Snake River spring Chinook, fall Chinook, sockeye, and steelhead; and Middle Columbia River steelhead, and (2) designated reaches in the upper John Day River Basin for Middle Columbia River steelhead (southern Morrow County).

Willow Creek is not designated as ESA critical habitat for mid-Columbia River steelhead nor any other NMFS ESUs/DPSs. Reference for this information is, *NOAA 50 C.F.R. Part 226 Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho; Final Rule*, dated September 2, 2005, 70 FR 52630. The supporting report is the *Final Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams For 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead*, dated August 2005.

3.6 Cultural and Historic Resources

Past archaeological surveys conducted at Willow Creek Project were limited to upstream of the dam. Prior to construction, in year 1980 a contractor to the Corps conducted archaeological and historic surveys and subsurface testing in the Willow Creek Project area (Cleveland and Sutton 1980, Cleveland and Schalk 1980). No prehistoric archaeological remains were encountered during surveys and subsurface explorations carried out in the project area. The survey identified seven historic structures or features, three of which were noted as potentially eligible to the National Register of Historic Places (NRHP). All are currently underwater. Near the end of construction of the Willow Creek Project, human remains were identified within a back dirt pile near the base of the dam. The University of Idaho confirmed the remains were human and documented the materials as site 35MW32 (Carley and Sappington 1982). Due to the disturbed context, it was not possible to verify the original location of the remains and the site was deemed not eligible to the NRHP. The human remains were collected, stored at the University of Idaho and later repatriated to the Confederated Tribes of the Umatilla Indian Reservation.

In year 2015, the Corps surveyed the area again and prepared the report, *Archaeological Inventory Report* (Harris 2016) through the services of Harris Environmental Group. During that survey, the Corps discovered three new historic resources. The Corps recommended that two of

the resources are not eligible to the NRHP while the third is unevaluated and should be managed as potentially eligible. The unevaluated site is located above the new drawdown zone and would not be affected by the undertaking. The vicinity of 35MW32 was inspected for cultural materials including human remains; none were observed during inventory.

3.7 Farmlands

The Company may irrigate up to 2,538.14 acres of land with water supplied from Willow Creek Lake, according to the Contract (described in Section 1.4). This section describes farmland classifications in Morrow County. The majority of the lands to be irrigated are located within Morrow County with some lands in Gilliam County. This section is provided for the purpose of addressing compliance with the Farmland Protection Policy Act discussed in Section 6.13.

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) operates a web site, *Web Soil Survey*, which provides farmland classification data based on soil type. The *Web Soil Survey* shows that there is a total of 1,310,498 acres of farmland in Morrow County. Of the total acreage, the NRCS has classified 35 percent as farmland of statewide importance, 17 percent as prime farmland, and 48 percent as not prime farmland.

C.F.R, Title 7, Volume 6, Part 657.5 (a) describes prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks.

Part 657.5 (c) of the C.F.R describes that farmland of statewide importance is of statewide importance for the production of food, feed, fiber, forage, and oil seed crops. Generally, farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

3.8 Socio-economic Resources

The population and economic status of Morrow County are provided in this section. Economic data as it relates to recreation is provided in Section 3.9. The population of Morrow County and the cities in the Willow Creek area are shown in Table 9. The population of these cities has remained relatively stable since the year 1970, however, Morrow County's population has increased substantially since 1970. For the county, the percent change in population from 1990 to 2010 was 46.5 percent. The population increase was caused mainly by development in and near the City of Boardman. Heppner is the largest city in the project area and is the county seat.

Table 9: Population of Morrow County and Cities in the Willow Creek Area

Location	1970	1980	1990	2000	2010	July 2016 Estimated
Heppner	1,429	1,498	1,412	1,395	1,291	1,297
Ione	355	345	255	321	329	333
Lexington	230	307	286	263	238	237
Morrow County	4,465	7,519	7,625	10,995	11,173	11,274

Sources: Corps 2005; U.S. Census Bureau at http://quickfacts.census.gov; census viewer.com

The median household income for the period 2011–2015 in Morrow County was $50,918 (in 2015 dollars), which was slightly lower than the median household income for Oregon ($51,243). The percent of persons below poverty in Morrow County was 15 percent in 2015 as compared to 15.4 percent for Oregon.

The principal industries in Morrow County include agriculture, food processing, lumber, livestock, and recreation. Morrow County is an important agricultural center including both dryland and irrigated crop farms as well as ranching. The major crops grown in the irrigated northern part of the watershed include potatoes, onions, corn, and alfalfa hay. Smaller acreages of high value crops such as mint and vegetables are also important to this area. Wheat is the major crop in the dryland central portion of the watershed, and cattle are the major commodity in the southern region. Table 10 shows the Morrow County Gross Farm Sales for year 2010 and preliminary sales for 2011 (OSU 2012). Morrow County ranks at the top of Oregon counties in several commodities and ranks first or second out of 36 counties in Oregon based on the 2012 Census of Agriculture. Table 11 shows the agricultural commodity and value for Morrow County's top ranked items. The Census of Agriculture is taken every 5 years. Between 2007 and 2012, the market value of products sold in Morrow County increased by 61 percent. The number of farms have decreased by 5 percent, but the land in farms has increased by 6 percent. In 2016, 21,000 acres of alfalfa hay were harvested. The yield per acre is 6 tons per acre, for a total of 126,300 tons (National Agricultural Statistics Service, Press Release posted April 14, 2017).

Table 10: Morrow County Gross Farm Sales, Years 2011, 2010 (in dollars)

Commodity	2011 (preliminary)	2010 (revised)
Crops		
Grains	119,660,000	71,249,000
Hays and Forage	42,010,000	29,234,000
Grass and Legume Seeds	5,191,000	2,816,000
Field Crops	68,461,000	57,998,000
Tree Fruit and Nuts	407,000	668,000
Small Fruits	1,485,000	832,000
Vegetable Crops	52,360,000	45,027,000
Specialty Products	7,890,000	6,640,000
Crops Not Disclosed	10,812,000	8,765,000
All Crops	***308,276,000***	***223,229,000***
Animal Products		
Cattle and Calves	42,780,000	46,500,000
Misc. Animals	183,000	183,000
Livestock not disclosed	125,894,000	125,894,000
All Animal Products	***168,857,000***	***172,577,000***
Total Gross Sales	**477,133,000**	**395,806,000**

Source: OSU 2012

Table 11: Morrow County Agricultural Ranking of 36 Counties in Oregon, 2012

Item	Quantity	State Rank
Total Value Agricultural Products Sold	$568,111,000	2
Grains, oilseeds, dry beans, and dry peas	$71,392,000	2
Vegetables, melons, potatoes, sweet potatoes	$96,295,000	1
Cattle and calves	$193,008,000	1
Milk from cows	$178,024,000	1

Source: 2012 Census of Agriculture

3.9 Recreation

Willow Creek Lake provides residents and visitors with water-related recreation opportunities that were not available prior to construction of the project and contribute to the overall economic health of the region. Three recreation facilities were constructed on project lands. One facility was constructed on a point of land between Willow Creek and Balm Fork and consists of a picnic area, parking lot, boat launch ramp with parking and a floating dock, and drinking water and restroom facilities. The second recreation facility is a baseball field which is located just downstream of the spillway stilling basin. A recreational vehicle (RV) park is located on the land

between Willow Creek and Balm Fork and is maintained by the Willow Creek Park District.

Fishing, boating, and swimming are the primary recreation uses for Willow Creek Lake. Willow Creek Lake is the only body of water within convenient day-use driving distance (up to 25 miles) for local residents. The lake has been receiving increased use by non-residents traveling through the region. The route from the Columbia River through Baker City has been designated by the U.S. Forest Service as the Blue Mountain National Scenic Byway. Project recreation facilities just upstream of the dam normally receive heavy use from residents of Heppner and other nearby communities. Most of this use occurs during peak use periods on summer weekends by local residents of Heppner and southern Morrow County.

The high usage period of the lake for water based recreation is from Memorial Day weekend through the Fourth of July. A key element of the Corps' recreation plan at Willow Creek Project is to maintain the lake at or above elevation 2,063.0 feet during summer and early fall to provide an adequate lake surface area and depth for water-based recreation. The floating boat dock becomes grounded when the reservoir falls below elevation 2,063.0 feet. The boat ramp concrete slab extends to elevation 2037 feet but is considered usable to elevation 2,047 feet. Silt built up on the ramp has been problematic for boat launching. The Willow Creek Park District (a local, special taxing district), is responsible for maintaining the dock.

The Corps' "Value to the Nation" website for Willow Creek Lake (http://www.corpsresults.us/recreation/fastfacts/lake.cfml?LakeID=445) provides the following information regarding recreation facilities, visitation, and economic data resulting from recreation at Willow Creek Lake. An explanation for the computations of the economic data for visitor spending can be found on the website.

Facilities in FY 2013

- 4 recreation areas
- 3 picnic sites
- 25 camping sites
- 1 trail
- 1 boat ramp

Visits (person-trips) in Fiscal Year 2012

- 111,034 in total
- 17,928 picnickers
- 5,818 swimmers
- 2,840 water skiers
- 22,245 boaters
- 21,035 sightseers
- 34,985 fishermen
- 790 hunters
- 19,525 others

Economic Data in Fiscal Year 2012

111,034 visits per year resulted in:

- $3,455 (thousands) in visitor spending within 30 miles of the Corps lake.
- $1,548 (thousands) in sales within 30 miles of the Corps lake.
- 30 jobs within 30 miles of the Willow Creek Lake.
- $519 (thousands) in labor income within 30 miles of the Corps lake.
- $892 (thousands) in value added within 30 miles of the Corps lake.

With multiplier effects, visitor trip spending resulted in:

- $1,825 (thousands) in total sales.
- 33 jobs.
- $596 (thousands) in labor income.
- $1,054 (thousands) in value added (wages & salaries, payroll benefits, profits, rents, and indirect business taxes).

3.10 Real Estate

There are two park and recreational leases at the Willow Creek Project. The first lease is to the City of Heppner for the Hager Ballfield and was renewed, effective in 2014 for a lease term of 25 years. The second lease is to the Willow Creek Park District for the Willow Creek Lake Park, which includes the boat ramp. The second lease is effective through August 31, 2018, and is expected to be renewed for a term of 25 years. Both leases reserve the right to the United States, its officers, agents, and employees to enter upon the premises at any time and for any purpose necessary or convenient in connection with Government work; to make inspections; to remove timber or other material, except property of the Lessee; to flood the premises; to manipulate the level of the lake or pool in any manner whatsoever; and or to make any other use of the land as may be necessary in connection with project purposes, and the Lessee shall have no claim for damages on account thereof against the United States or any officer, agent, or employee.

Any drawdown from the maximum lake elevation during the primary recreation season will have a negative effect on recreation suitability by reducing the amount of surface area available for water-related recreation. The Corps Real Estate Division and Natural Resource Manager for the Willow Creek Project will communicate with the Willow Creek Park District for potential impacts to the boat launch area. The boat launch area may need to be shut down from the public periodically for safety and security.

The Corps does not hold any flowage easements along the downstream channels (Hinton Creek and Shobe Canyon). The public will want assurance that any operational changes of the Willow Creek Project would not induce flooding on private property.

4. Environmental Effects

This chapter begins with a description of the physical effects of the No Action and Proposed Action on lake level and project outflows. The rest of the chapter is organized by affected resource, and for each resource, an assessment of the effects of the Proposed Action and the No Action Alternative on the environment are discussed along with an assessment of a comparison of the of the effects of the alternatives. The assessment includes a discussion of direct and indirect effects of the alternatives. Effects of climate change on the alternatives as well as effects of the alternatives on climate change are addressed. In addition, a section on cumulative actions that include past present, and reasonably foreseeable actions with the potential to affect the environment is also provided.

4.1 Physical Effects - No Action Compared to Proposed Action

This section compares the lake elevations and outflows for the No Action Alternative and the Proposed Action as modeled for this SEA. Modeling assumptions are provided in Section 2.2. The major notable difference between the No Action Alternative as compared to the Proposed Action is that Willow Creek Lake would be drawn down at a faster rate and to deeper levels for most of the year, except during refill when reservoir levels may be the same depending upon water availability. Water availability affects the ability of the lake to refill. Figures 5 and 6 show the fiftieth[3] and tenth percentile modeled reservoir elevations, respectively, for both alternatives. Figures 7 and 8 show the fiftieth and tenth percentile modeled reservoir monthly outflows, respectively, for both alternatives. Table 12 shows the end-of-month reservoir elevations for the No Action Alternative and the Proposed Action, and the reservoir elevation differences between these alternatives for the fiftieth and tenth percentiles. A positive value of the difference indicates the reservoir for the Proposed Action is below that of the No Action Alternative.

The Proposed Action would not change the flood risk management operations of the Willow Creek Project which provides space to store incoming flood flows. The flood rule curve shown on Figure 5 (labeled “Rule Curve”) represents the maximum lake elevation to be maintained to ensure adequate space to store flood flows. When the reservoir is drawn down lower than the flood rule curve, an increase in the amount of storage space for flood risk management operations would be available. This would be a benefit to flood risk management.

4.1.1 Comparison of Elevations for No Action vs. Proposed Action

The fiftieth percentile curves represent the elevations where fifty percent of the modeled years, the lake level is equal to or lower than, for any given date. The fiftieth percentile is also referred to as the median. The fiftieth percentile plot for the No Action Alternative and the Proposed Action, along with the flood rule curve is shown on Figure 5.

[3] The model runs used a 33-year period of record. The fiftieth percentile elevation curve represents the daily reservoir elevation where half of the 33 years’ reservoir elevations were above and half were below that elevation. The tenth percentile curve represents the reservoir elevation where 90 percent of the 33 years’ reservoir elevations were above and 10 percent were at or below that elevation. The daily curves do not represent a hydrologically connected water year. Fiftieth and tenth percentile monthly outflow data are provided, and this data is hydrologically connected on a monthly basis.

a. Fiftieth Percentile Elevations. The largest difference in elevation (No Action Alternative at elevation 2058.1 minus Proposed Action at elevation 2050.2 feet) is 7.9 feet and occurs in late September. The surface area is reduced by about 15.4 acres (from 114.7 acres to 99.4 acres) or about 13 percent. As shown on Figure 5, the lake reaches its summer flood pool elevation 2076.5 feet by 15 April for both actions. Shortly after filling, flow requirements begin to draw down the pool. Under the Proposed Action, the median lake level is at elevation 2,050.0 feet by late September. The median lake level begins to fill in mid-November. As the reservoir approaches elevation 2,050 feet, the objective is to pass the lower of live inflow or 3 cfs. In the model, irrigation releases were curtailed to preserve the minimum pool elevation of 2,047 feet elevation to protect the recreation and fish and wildlife authorized purposes. For the No Action Alternative and the Proposed Action, the lake reached its lowest level of elevation 2055.8 feet in late October and 2049.8 feet in early October, respectively. As compared to the No Action Alternative, the lake elevations for the Proposed Action are lower from about mid-April until early March. By early March, both alternatives are operating to meet the rule curve.

b. Tenth Percentile Elevations. The tenth percentile plot represents the elevation where ten percent of the years the lake level is equal to or lower than for any given date. The largest difference in elevation (No Action minus Proposed Action) is 7.0 feet, which occurs in late August, and the surface area is reduced by 13.3 acres (from 112.7 acres to 99.4 acres), or 11.8 percent. The tenth percentile lake elevations never reach the summer flood pool elevation 2076.5 feet for either the No Action or Proposed Action alternatives. In actual operations when this occurs, uses may be scaled back. Discussions between the Corps and Reclamation would occur to determine if all irrigation contracts could be fulfilled or if irrigation releases would have to be scaled back by some percentage.

For the tenth percentile plot, the peak lake elevation for the No Action Alternative and the Proposed Action occurs in late April. At this point, the Proposed Action is 3.4 feet lower than the No Action Alternative. The No Action Alternative and Proposed Action draws the lake to the lowest level at elevations 2,051.2 in mid-November and 2,047.3 feet by early December, respectively.

With the Proposed Action, the Corps expects that Willow Creek Lake would refill for the following year during the winter and spring under typical climate conditions. However, if less than normal precipitation would occur during winter, then the lake may not fill to its summer pool elevation of 2076.5 feet the following spring.

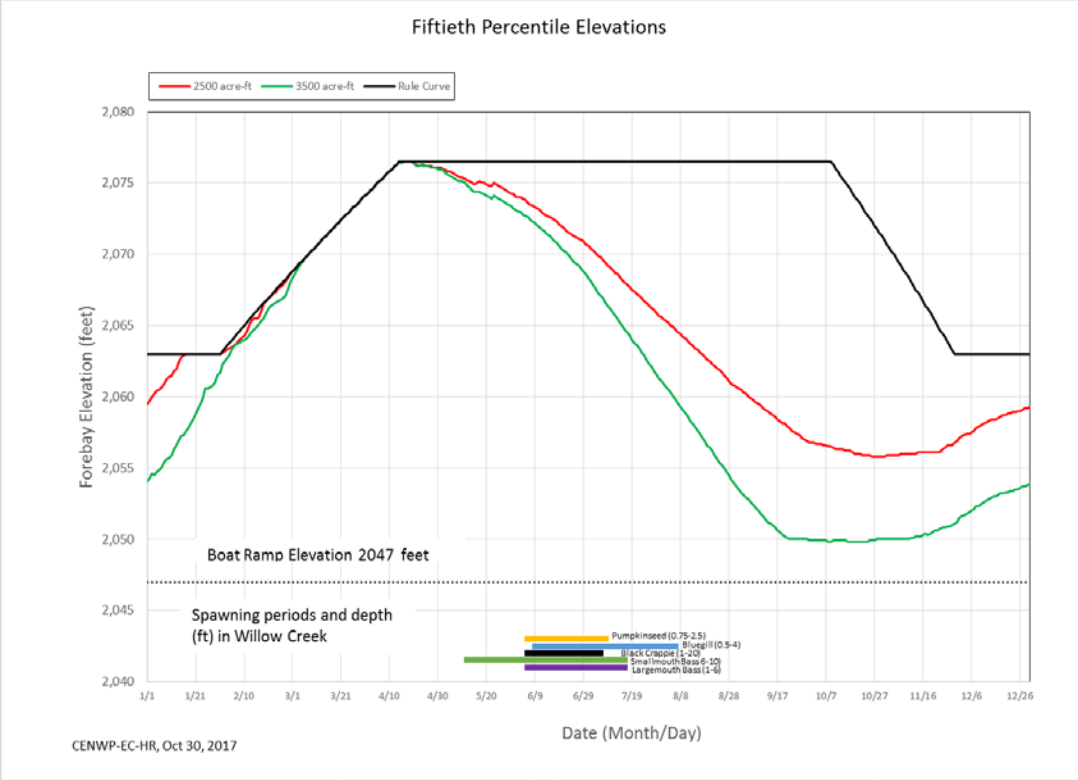


Figure 5: Fiftieth Percentile Modeled Reservoir Elevation Comparison

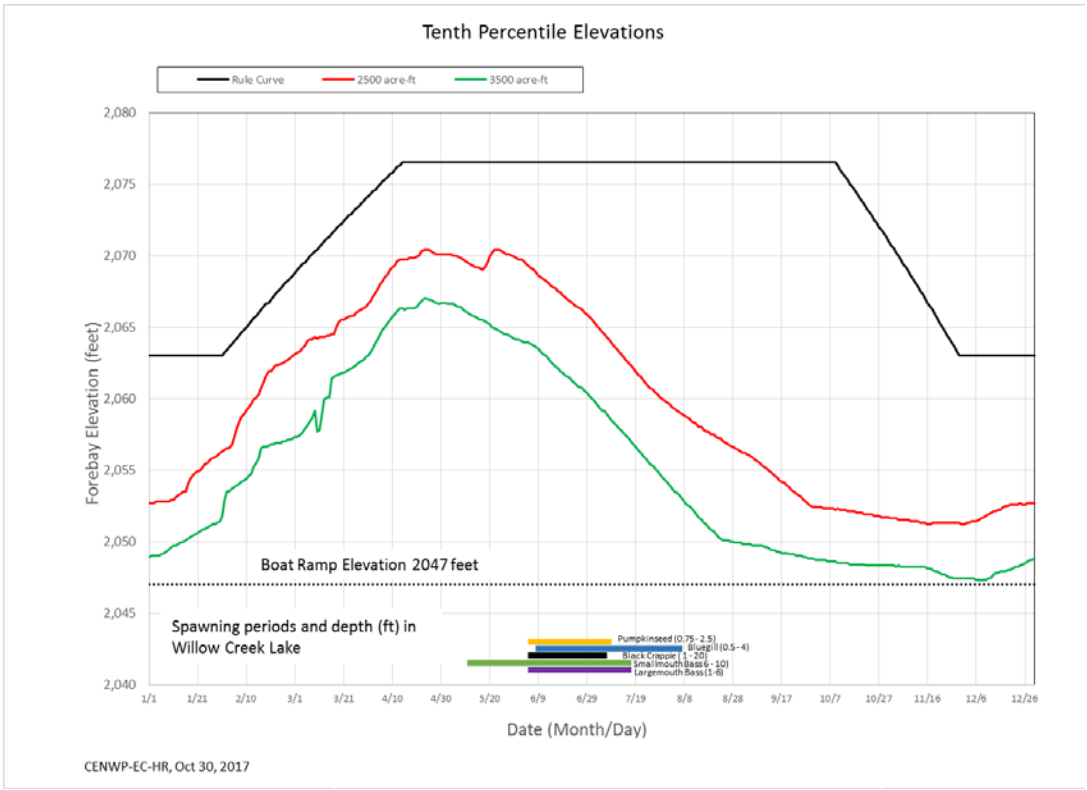


Figure 6: Tenth Percentile Modeled Reservoir Elevation Comparison

Table 12: End-of-Month Reservoir Elevation Comparisons, Fiftieth and Tenth Percentile

Date (End of Month)	Fiftieth Percentile			Tenth Percentile		
	Elevation (ft)		(ft)	Elevation (ft)		(ft)
	No Action	Proposed Action	Difference (Proposed minus No Action)	No Action	Proposed Action	Difference (Proposed minus No Action)
January	2,063.0	2,061.7	-1.3	2,056.3	2,051.8	-4.5
February	2,068.3	2,067.5	-0.8	2,062.8	2,057.1	-5.7
March	2,074.0	2,074.0	0.0	2,066.4	2,062.9	-3.5
April	2,076.1	2,076.1	0.0	2,070.1	2,066.6	-3.5
May	2,074.3	2,073.4	-0.9	2,069.9	2,064.2	-5.7
June	2,070.9	2,068.8	-2.1	2,065.9	2,060.4	-5.5
July	2,065.7	2,061.3	-4.4	2,060.0	2,054.5	-5.5
August	2,060.8	2,053.9	-6.9	2,056.4	2,049.9	-6.5
September	2,056.9	2,050.0	-6.9	2,052.5	2,048.8	-3.7
October	2,055.8	2,050.0	-5.8	2,051.7	2,048.3	-3.4
November	2,056.8	2,051.1	-5.7	2,051.3	2,047.4	-3.9
December	2,059.3	2,053.9	-5.4	2,052.7	2,048.8	-3.9

4.1.2 Comparison of Outflows for No Action vs. Proposed Action

The comparison of the No Action vs. the Proposed Action total monthly average outflows from reservoir modeling for the fiftieth percentile are provided in bar graphs on Figure 7. The bar graph represent the monthly average flow that 50 percent of the modeled years is equal to or below. The monthly average outflows for the tenth percentile is shown on Figure 8 where the bar graph represents the monthly average flow that 10 percent of the modeled years are equal to or below. Monthly average outflow information is provided to give a sense of flow conditions what could be expected for flow conditions in the stream below the dam on a monthly (length of time) basis, as daily percentile data does not provide information of length of time that particular flows occurs.

a. Fiftieth Percentile Outflows. For the fiftieth percentile modeled outflow graph, the No Action Alternative shows lower outflows than for the Proposed Action for most of the irrigation season because irrigation releases are less. At the end of the irrigation season, in October, the No Action Alternative has higher flows because the reservoir level was higher in September, and irrigation water was still available for release. For the Proposed Action, the lake reached elevation 2,050 feet by about the third week in September and irrigation releases were suspended in order to reduce the likelihood of the lake drafting below minimum pool.

The No Action Alternative also showed higher average outflows during January through April. After the irrigation season, the project generally fills to reach the flood rule curve by releasing the lower of inflow or 3 cfs until it reaches the rule curve. Since the No Action Alternative starts refill at a higher lake level because it didn't draft as deep at the end of the previous irrigation

season, it reaches the rule curve in mid-January compared to early March for the Proposed Action. This results in higher flows after mid-January for the No Action Alternative, while the Proposed Action would still be on a lower flow as it fills to reach the rule curve.

b. Tenth Percentile Outflows. For the tenth percentile modeled outflow graph, the No Action Alternative shows lower outflows than for the Proposed Action for the irrigation season until about mid-August because irrigation releases for the No Action Alternative are less than for the Proposed Action. At this point, the No Action Alternative released higher flows because the lake level was higher, and there was still water available for irrigation release. For the No Action Alternative, the tenth percentile lake elevations never fell to elevation 2,050 feet, so irrigation releases continued throughout the irrigation season. For the Proposed Action, the tenth percentile lake elevations reached elevation 2,050 feet by about mid-August at which point, the irrigation releases were suspended and only inflows were released to reduce the risk of the lake from falling below minimum pool. The tenth percentile lake elevation dropped to near the minimum pool elevation of 2,047 feet in early December because the lake evaporation was greater than inflow.

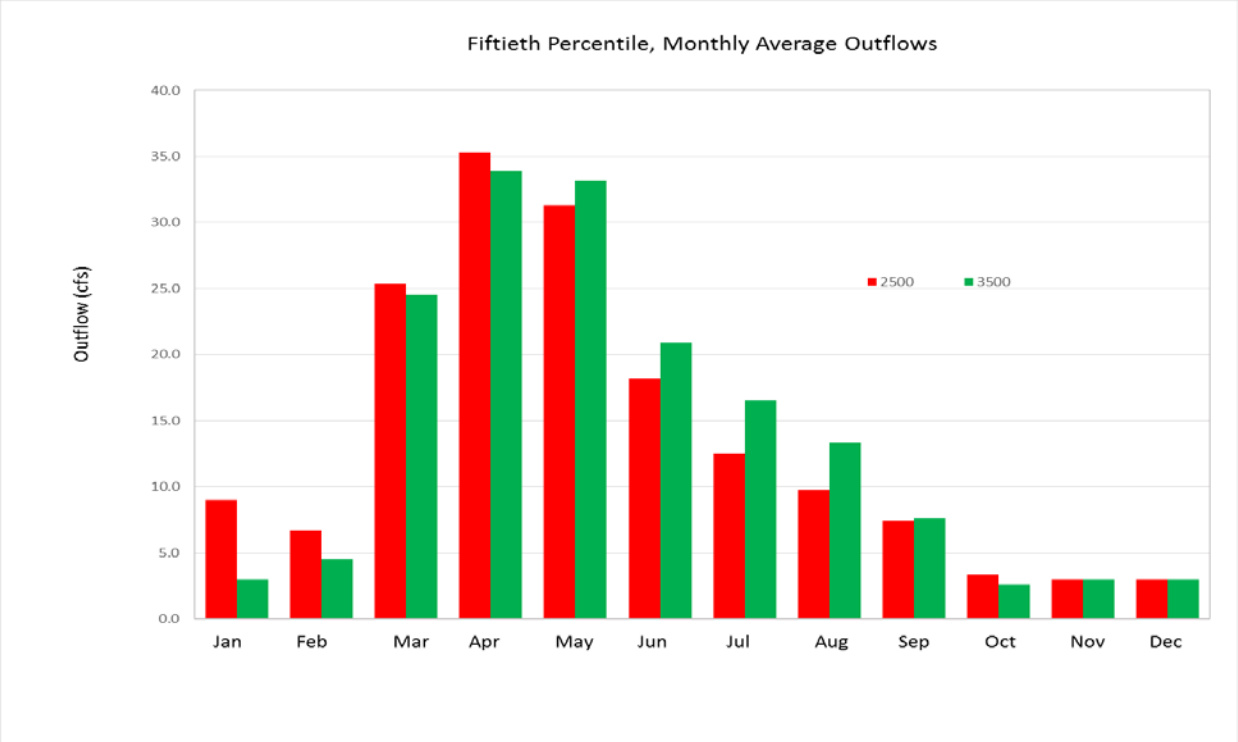


Figure 7: Fiftieth Percentile Modeled Outflow Comparison

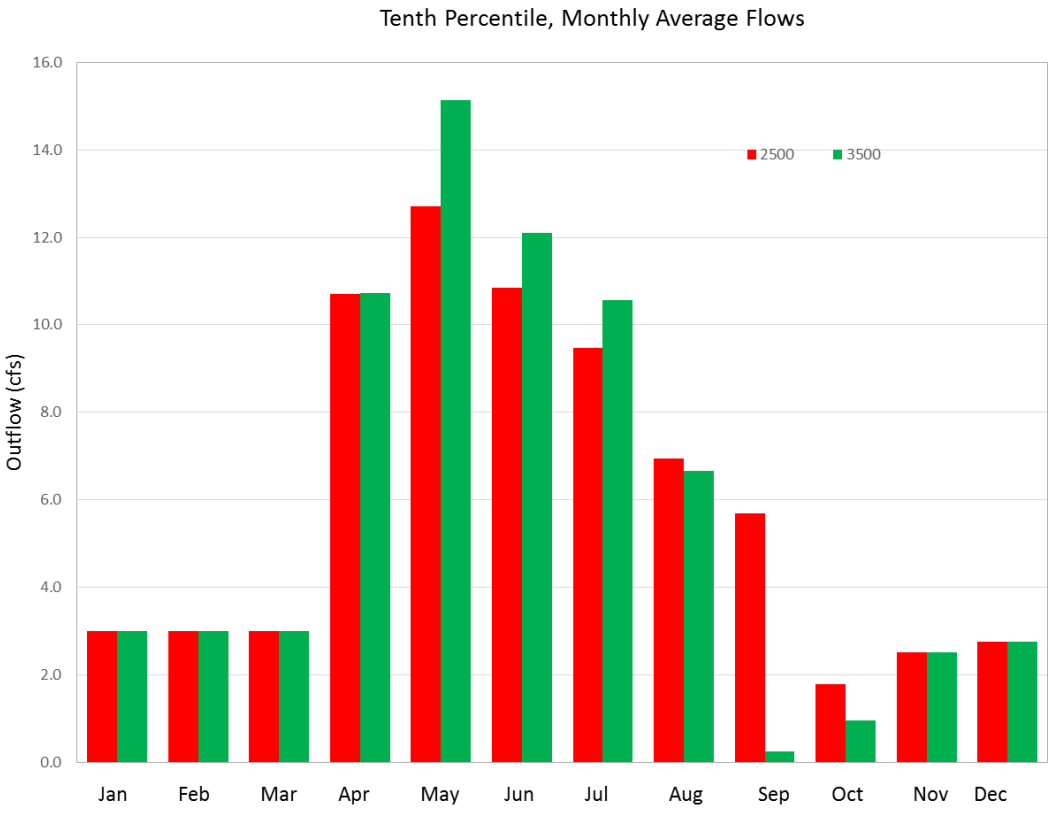


Figure 8: Tenth Percentile Modeled Outflow Comparison

4.2 Water Quality

The affected area of analysis, with respect to the water quality concerning the operation of Willow Creek Project, is in the lake and up to 0.2 miles downstream of the dam. The lake is of concern because of the quality of the water stored in the lake is that to be released and could have impacts on recreation and fish in the lake. The location 0.2 miles downstream of the dam is of importance because it is the point at which the TMDLs for water temperature and pH are monitored and targeted for meeting state water quality standards. The following describes the No Action Alternative, Proposed Action, and their effects on water quality. Also included is a comparison of the alternatives with respect to water quality. A brief discussion regarding effects of the alternatives downstream of the affected area of analysis is provided for informational purposes.

4.2.1 Total Maximum Daily Loads **(Temperature, pH, Bacteria)**

a. No Action Alternative. As stated in Section 3.2, the water quality in Willow Creek Lake is water quality impaired. For the No Action Alternative, the Corps does not expect that the current level of irrigation releases would have a different effect on water quality in the lake or

released from the lake, than under existing conditions. This is assuming that the range of ambient temperatures and upstream land use practices do not appreciably change in the future. Based on the 2011 through 2014 annual water quality reports, data indicate that the existing operations (No Action Alternative) is able to meet the temperature standard since it was consistently met in all of the four years reported. For pH, it is uncertain if the outflows would consistently meet the pH standard since three out of the four years reported, the standard was not met. Even when the water quality intake functioned properly prior to 2011, studies conducted by USACE and ODEQ indicate that the pH standard was exceeded some years due to environmental conditions such as inflow quantity and quality, solar radiation, nutrient loading, and algal dynamics. Typically, exceedances of the pH standard can occur in June-August as algae grow, causing high pH near the surface. In September and October, pH often exceeds the standard of 9.0 at all depths in the lake. When functioning properly the water quality intake may be raised or lowered in order to support the temperature and pH water quality standards. While the water quality intake currently does not function properly, data do not indicate that the pH TMDL standard would be met during the late summer when the lake exceeds 9.0 pH at all depths. .

b. Proposed Action. The Corps does not expect that irrigation releases under the Proposed Action would appreciably impact water quality in the lake based on previous studies and experience of lowering lake levels. From 1984 through 1992, the Corps operated the reservoir at a full pool elevation of 2,063 feet. In 1992, the summer flood pool was changed to elevation 2,076 feet, while the winter flood pool remained at elevation 2,063 feet. Water quality information was collected for the two decades prior to 2008, which encompassed varying pool elevations at Willow Creek Lake. In comparing water quality data from 1984 through 2003, the two different operating pool elevations showed no major difference in temperature, nutrient load, pH, and dissolved oxygen. This is also the case when the Corps compared data from 2008 through 2016, where the lake was drawn down to as low as about elevation 2,046 feet in November, 2015, although a thorough study was not conducted. Any slight changes over the years in temperature, nutrient load, pH, and dissolved oxygen may have been attributed to changing ambient conditions rather than pool elevations. When repaired, the water quality intake may be raised or lowered in order to support the temperature and pH water quality standards when lake conditions allow.

As described in Section 3.2.1, increased outflow from Willow Creek Lake due to temporary irrigation contracts has occurred every year from 2003 through 2011, and then for the long-term contract since 2012, giving the flowing stream more thermal assimilative capacity and improving water quality. It would follow that releasing more water in a shorter timeframe from the Proposed Action could improve water quality some distance downstream of the dam, when irrigation releases are made. However, as stored irrigation water becomes depleted, flows downstream of the dam could become very low in late summer and early fall. The tenth percent model data shows a monthly average outflow of 0.2 and 1.0 cfs in September and October, respectively. Lower flows in September-October could decrease vegetation growth in the channel downstream that would otherwise provide riparian shade and reduce solar heating of the stream.

c. Comparison of No Action vs. Proposed Action. The Proposed Action may result in water temperatures in the lake that may be higher on average during the warm months and cooler in the colder months because of lower lake levels (shallower depth). Lower lake levels during late summer would likely leading to warmer lake temperatures under the Proposed Action and lead to warmer water releases from the dam. No analysis has been completed to quantify this potential water temperature increase. There is no information to support that the Proposed Action would be better or worse at meeting pH standard over the No Action Alternative as measured 0.2 miles downstream of the dam; however, with either the No Action or the Proposed Action, the Corps would continue to manage the temperature and pH of water released from the dam by adjusting the level of the water quality intake (after it has been repaired).

For both the Proposed Action and the No Action Alternative, the amount of water in Willow Creek during summer and early fall would not be sufficient to reach the Columbia River. As discussed in Section 3.2.1, usually between Lexington and Ione, irrigation withdrawals (natural flow rights plus flow from storage), bed losses, and/or evaporation entirely attenuate the flow of the creek. Between this point and river mile 5, much of Willow Creek has a dry stream bed in parts of July, August, and September (DEQ 2007); therefore, the impact on water temperatures or pH beyond a short distance downstream of the dam is likely inconsequential and unmeasurable.

4.2.2 Dissolved Oxygen and Algae Blooms

a. No Action Alternative. For the No Action Alternative, the Corps does not expect that dissolved oxygen levels or algae bloom frequencies as described in Section 3.2.2, would change in the future, if all other variables, such as the range of ambient temperatures and land use practices upstream of the lake remain the same as under existing conditions. Algae blooms have occurred in the past and are expected to occur at the same frequency in the future.

b. Proposed Action. There is some evidence that lower lake elevations would cause warmer water temperatures which in turn, would decrease dissolved oxygen. While dissolved oxygen would be expected to decrease with warmer water, algae production also affects dissolved oxygen. Algae can both increase and decrease dissolved oxygen due to its production and decay. Water quality studies related to algae blooms are being undertaken by the University of Idaho, under the direction of professor, Dr. Frank Wilhelm. Potential effects on algae blooms due to the Proposed Action are uncertain and would be speculative (Dr. Frank Wilhelm, personal communication, June 26, 2017). As discussed in Section 3.2, research is being conducted to find potential solutions to decrease the number of toxic blooms. If potential solutions appear viable, the Corps will consider their implementation if collaboration with other agencies were conducted and funding was made available.

c. Comparison of No Action vs. Proposed Action. In comparing the No Action Alternative to the Propose Action, since the combined effects of potential algae production and the warmer water due to lower lake levels on dissolved oxygen has not been defined, there is not enough information to determine what the effect on dissolved oxygen and algal blooms would be from the Proposed Action.

4.3 Groundwater

The area of analysis for effects to groundwater is downstream of the reservoir and includes the area in the vicinity of the City of Heppner municipal wells and the Company's irrigation wells. The Corps' Proposed Action does not directly affect groundwater quality or availability in the Willow Creek Subbasin; however, a discussion of possible indirect groundwater availability effects is provided. A summary of groundwater affected is provided in Section 3.3. The following sections describe the qualitative effect of the No Action Alternative and the Proposed Action on groundwater availability and the comparison between the two alternatives.

4.3.1 No Action Alternative

For the No Action Alternative, groundwater availability would continue to be stressed. One of the OWRD objectives for groundwater is to preserve groundwater supplies for municipal purposes, and the No Action Alternative would not assist in meeting this objective.

4.3.2 Proposed Action

The Proposed Action would potentially have a positive effect on groundwater availability. Under the Proposed Action, irrigation water from Willow Creek Lake storage would replace some irrigation water from groundwater sources (assuming the Company replaces some groundwater with stored water as intended), resulting in reduced groundwater pumping. This would support the OWRD's objective to achieve a balance between groundwater use, natural recharge in critical groundwater areas and groundwater study areas, and in protecting municipal groundwater supplies.

4.3.3 Comparison of No Action vs. Proposed Action

The No Action alternative would provide no benefit to reduction of groundwater use; whereas, the Proposed Action would provide the Corps' fully authorized volume of stored water for irrigation at Willow Creek Project which would enable a reduction of up to 1, 000 acre-feet of groundwater as an irrigation water source. The Proposed Action would provide a positive benefit toward the State of Oregon's objective for conserving groundwater as compared to the No Action Alternative.

4.4 Air Quality/Noise/Light

The area of analysis for effects to air quality, noise, and light, is in the Willow Creek Project vicinity, around the lake.

4.4.1 No Action Alternative

The Corps does not expect changes to air quality, noise, or natural light conditions from existing conditions as described in Section 3.4, if other variables remain the same.

4.4.2 Proposed Action

The Corps expects minimal to no reduction in air quality, decrease in noise levels, or change to natural light conditions. While reservoir levels would be lower for a longer period of time, exposed mudflats that dry up do not tend to generate dust (per communication with Steve Cherry ODFW), therefore air quality due to dust is not expected. Lower water levels may slightly reduce the available recreational boating opportunities and thereby reduce the period of recreational boating. The reduction in boating may improve air quality and noise due to reduced motor exhaust over the period when boating is not occurring, but the Corps considers this change to be minimal and inconsequential.

4.4.3 Comparison of No Action vs. Proposed Action

Comparing the No Action to the Proposed Action, the Corps does not expect any appreciable differences in air quality, noise levels, or natural light.

4.5 Biological Environment

The biological environment is evaluated for vegetation, fish, wildlife, and threatened and endangered species. The area of analysis and effects of the No Action Alternative, Proposed Action, and a comparison of the two alternatives is provided in the following sections.

4.5.1 Vegetation

The area of analysis for effects to vegetation is in the Willow Creek Project vicinity, around the lake. A summary of the vegetation around the lake is provided in Section 3.5.1.

a. No Action Alternative. Under the No Action Alternative, there would be no changes to vegetation or habitat in the Willow Creek Project area from existing condition with the assumption that variables such as climate and upstream land practices remain the same as in the past.

b. Proposed Action. The Corps would annually release additional stored water for irrigation, and this would draw the lake down earlier in the release season, after April 15th and to lower levels than under existing operations (No Action Alternative) as shown on Figures 5 and 6. This in turn would impact shoreline vegetation including willows, sedges, and rushes and would expose additional mudflats around the perimeter of the lake. In the past, the existing vegetation has shown to be resilient and comes back every year (conversation with Steve Cherry (ODFW) June 2017). As the Corps lowers the reservoir each year, cheatgrass and forb would encroach on the perimeter of the reservoir but would eventually die off when the Corps refills the lake. The Corps does not expect the Proposed Action to have a negative impact on vegetation around the lake, as the vegetation that may die off is resilient and has been seen to come back every year.

c. Comparison of No Action to Proposed Action. The Corps does not expect an appreciable difference on vegetation or habitat around the reservoir.

4.5.2 Fish

The Corps supports fish in Willow Creek Lake primarily for sportfishing. The area of analysis is focused on those warm-water fish in Willow Creek Lake, since the Corps does not operate the Willow Creek Project on behalf of fish outside of the lake. A summary of existing conditions for fish is provided in Section 3.5.2. This section describes the effects of the No Action Alternative, and Proposed Action on the warm water fish in the lake and a comparison of the two alternatives.

a. No Action Alternative. For the No Action Alternative, as described in Section 3.5.2, the 2012 study data showed largemouth bass and pumpkinseed populations have struggled to reproduce since 2003 due to the effects of water releases for irrigation for existing conditions and resulting lowered water levels. Since year 2003, bluegill recruitment has remained unchanged and strength has decreased. Conclusions for black crappie were difficult to draw, but it might be assumed that the cycle of successful spawn followed by a decline in numbers, may continue. The Corps assumes that these trends could continue with the No Action Alternative.

b. Proposed Action. Figures 5 and 6 show the effect of the Proposed Action on the elevations of Willow Creek Lake for the fiftieth and tenth percentile data, respectively. The figures also show the spawning periods/depth of spawning for pumpkinseed, bluegill, black crappie, smallmouth bass, and largemouth bass in the lake. The Corps anticipates that the Proposed Action would have the following impacts to fish, with the largest impacts likely to occur in years when Willow Creek Lake is not filled to full pool as a result of low precipitation. When the pool is not filled by mid-April, the starting lake level for drawdown would be lower than under normal water conditions, providing less water for irrigation in the following months, resulting in reaching lower levels earlier.

- The additional lower lake levels may decrease or eliminate successful spawning of largemouth bass and pumpkinseed in the lake because these species spawn in shallower water; their nests may be dewatered as the water level in the lake is drawn down (Table 7).
- The lake would likely change to a smallmouth bass, and bluegill fishery. Smallmouth bass spawn in deeper water, while bluegill has a longer spawning period allowing for some portion of the population to have a successful spawn sometime during that time period.
- Fish would be concentrated in a smaller summer pool, which may also affect fish spawning and cause higher mortalities to adult fish because of higher water temperatures, possible poorer water quality for fish, and chance for increased predation by crappie, smallmouth and largemouth bass, and to a lesser degree, blue gill and pumpkinseed. When reservoirs are lowered, there tends to be less hiding habitat/cover, so the small fish are preyed upon by the larger fish at a much higher rate than when the reservoir is full.
- The drawdown for irrigation also may affect next year's harvest of fingerling trout planted in the lake by the ODFW in the previous year.

c. Comparison of No Action vs. Proposed Action. Based on the points addressed for the Proposed Action, the Corps could expect negative impacts on survival and condition of non-native warm water fish in the lake and to trout stocked in the lake, as compared to existing conditions. If the fishery becomes reduced, there may be reduced sport-fishing recreation and tourism; however, these effects have not been quantified. For both alternatives, the ODFW

would continue to stock trout annually which could alleviate impacts to trout, and may continue to impose or modify regulations on largemouth bass, and crappie. It is possible that impacts to other warm water fish could be tempered by management of these fish by ODFW, if they choose to do so. Restocking of populations of fish that are struggling is an option, but not an annual event.

4.5.3 Wildlife

The area of analysis for effects to wildlife is in the Willow Creek Project in the vicinity of the lake. A description of the wildlife in the vicinity is provided in Section 3.5.3. This section describes the effects of the No Action Alternative and Proposed Action on the wildlife and a comparison of the two alternatives.

a. No Action Alternative. The Corps expects that the No Action Alternative would not affect wildlife described in Section 3.5.3 as compared to existing conditions, as there would be no change in operation of the reservoir. There are no known bald eagle nests in or near the Willow Creek Project. Bald eagles may use the project area in the winter for foraging during the months of October through March, but the Corps does not expect any difference in effects to bald eagles from existing conditions.

b. Proposed Action. The Corps expects that the Proposed Action would not adversely affect small game animals, small mammals, raptors, passerine birds, game birds, shorebirds, and reptiles in the project area. There could be potential impacts to wildlife from a lowering pool level with avian predation on waterfowl broods. There could be potential impacts to amphibian species living in shoreline areas of the lake with less available shoreline; however, the Corps does not expect that the Proposed Action would result in appreciable effects on wildlife in the vicinity of the project as these species are mobile and are able to adapt to the changing shoreline. There are no known bald eagle nests in or near the Willow Creek Project. Bald eagles may use the project area in the winter for foraging during the months of October through March but the Corps does not expect any difference in effects to bald eagles from existing conditions.

c. Comparison of No Action to Proposed Action. The Corps does not expect any appreciable difference of effects on wildlife or to bald eagles or their habitat between the two alternatives. The No Action Alternative would not have any impacts as compared to existing conditions and the Proposed Action would not have appreciable effects as compared to the existing condition, therefore the difference between the two alternatives is likely immeasurable.

4.5.4 Threatened and Endangered Species

The area of analysis for effects to ESA Threatened and Endangered Species is in lake, and downstream of the dam to the point where the creek dries up in the summer. Section 3.5.4 provides a history of steelhead that were likely to have existed in Willow Creek. As of year 2017, no known plant, animal, or fish species under the jurisdiction of the USFWS or the NOAA Fisheries occur in the project vicinity; therefore, the Corps has determined that both the No Action Alternative and the Proposed Action would have no effect on ESA Threatened or Endangered species. See Section 4.12.3b regarding potential plans to reintroduce steelhead in Willow Creek.

4.6 Cultural and Historic Resources

The area of analysis for effects to cultural and historic resources is in and around Willow Creek Lake. A description of past archaeological and historic surveys and their findings is provided in Section 3.6. This section describes the effects of the No Action Alternative and Proposed Action on cultural and historic resources and a comparison of the two alternatives. The Corps is in the process of consulting with (i) the Confederated Tribes of the Umatilla Indian Reservation; (ii) the Confederated Tribes of the Warm Springs Reservation of Oregon; and (iiii) the Oregon State Historic Preservation Officer (SHPO) on the No Action Alternative and the Proposed Action.

4.6.1 No Action Alternative (*Note to reviewers-This section to be updated upon completion of consultation.)*

The Corps completed the environmental compliance for cultural resources for the No Action alternative in this SEA, which was the proposed action in the 2008 EA. The consultation under the NRHP for the No Action Alternative in this SEA is being conducted and encompassed under consultation for the Proposed Action. The Corps had determined that the No Action Alternative would result in *no historic properties affected* per the environmental compliance assessment for the 2008 EA. Figures 5 and 6 show the lake levels for the fiftieth and tenth percentile modeled data. The reservoir operations would be the same as existing operations, resulting in the same range of reservoir elevations as present. The three historic structures or features that were noted as potentially eligible to the NRHP are currently underwater and would remain underwater. The site found in the 2015 survey that should be managed as potentially eligible, is located above the new drawdown level, and would not be affected. Therefore, there would be no additional exposure of any possible cultural and historic resources from existing conditions in the lake. The Corps expects that the Proposed Action would result in *no historic properties affected* per the requirements of the National Historic Preservation Act

4.6.2 Proposed Action

The Corps expects that the Proposed Action would result in *no historic properties affected* per the requirements of the National Historic Preservation Act, for the same reasons stated for the No Action Alternative described in Section 4.6.1.

4.6.3 Comparison of No Action vs. Proposed Action

The Corps expects that there are *no historic properties affected* for either alternatives, therefore there would be no difference in impacts to cultural and historic resources in or around the lake.

4.7. Farmlands

The area of analysis for effects to farmlands covers Morrow County. The effects of the No Action Alternative or the Proposed Action to the farmlands is indirect. The effects of the alternatives on farmlands is provided in general and qualitatively. An analysis has not been made to determine the amount of each classification of farmlands that is within the Company's 2,538.14 acres land that may be irrigated. A description of farmlands in Morrow County as

classified by the NRCS and as pertains to the Farmland Policy Protection Act (Section 6.13) is provided in Section 3.7.

4.7.1 No Action Alternative

There may be a slight impact to irrigation of all farmlands whether it is prime farmland, farmland of statewide importance, or not prime farmland. Restrictions on new groundwater uses may limit the available source of irrigation water in the future, and long-term reliability of irrigation water for farmland would potentially be reduced.

4.7.2 Proposed Action

For the Proposed Action, there may be a small positive effect on farmlands with respect to crop production and other uses as described in Section 3.7. The Proposed Action would provide a more reliable long-term source of irrigation water, which could provide for more reliable crop production and other uses. Some irrigators operate without a permit to use groundwater, so a supplemental supply of water from lake storage would be their only back-up supply to their primary surface water rights from Willow Creek, which could benefit their farmland. The intent for the Company is to replace groundwater sources with stored water from Willow Creek Lake, so the net amount of irrigation water would be zero, however, the long-term reliability could be improved.

4.7.3 Comparison of No Action vs. Proposed Action

As compared to the No Action Alternative, the Corps expects that the Proposed Action could have a slight positive effect on farmlands served by the additional 1,000 acre-feet of irrigation water stored at and ultimately released from Willow Creek Lake because of the improved long-term reliability of irrigation water from stored water.

4.8 Socio-economic Resources

The area of analysis for effects to the population and economy is Morrow County. Refer to section 3.8 for a description of population and economy in Morrow County.

4.8.1 No Action Alternative

The No Action Alternative is not expected to have an effect on the population of the area, as there would be no change in industry to draw people into the area or cause attrition. The No Action Alternative is not expected to increase or incur economic losses, as tourism and water based recreation that help support the economy would remain the same as with existing conditions. The Corps does not expect a change to crop production and farm sales from existing conditions as described in Section 3.8. Since no population or economic effects are expected due to the No Action Alternative, no expected disproportionate impacts on low-income or minority communities is expected.

4.8.2 Proposed Action

The Proposed Action is not expected to affect the population of the area for the same reason as with the No Action Alternative. The Proposed Action may incur slight economic losses in the local area because of there may be a slight reduction in water-based recreation use and reduction in tourism. There have been no studies to quantify this effect. There may be a very small positive effect to crop production and farm sales if a long-term reliable irrigation water source is provided. There may be a small positive economic effect on farmers who transition from groundwater to stored water resources for irrigation due to reduced groundwater pumping costs. By reducing groundwater pumping, financial costs associated with the electrical power used to pump the water would be reduced. These economic effects are considered to be very small if even measurable. Because the effect is considered very small, and geographically, there is not a disproportionate number of low income people in Morrow County as compared to the state of Oregon, it is not anticipated that there would not be a disproportionate effect on low-income or minority communities.

4.8.3 Comparison of No Action vs. Proposed Action

The Corps expects no effects on population for either of the two alternatives. As compared to the No Action Alternative, the Proposed Action may have a small negative impact on the economy due to a small possible reduction in recreational opportunities that would bring in tourism, but a positive effect on farmers due to reduced pumping costs. The Corps considers the net effects to Morrow County to be minor.

4.9 Recreation

The area of analysis for effects on recreation is within the reservoir and shoreline. This section addresses the No Action Alternative and Proposed Action potential effects on use of the boat ramp, dock, and sportfishing, then compares the effects. A description of recreation opportunities on Willow Creek Lake is provided in Section 3.9.

4.9.1 No Action Alternative

The No Action Alternative is not expected to result in changes to recreational boating and swimming during the period of highest recreation use of the lake compared to the existing condition. As stated in Section 3.9, the dock and boat ramp is usable at and above pool elevations 2,063.0 and 2,047.0 feet, respectively. Based on the fiftieth percentile end of month modeled data shown in Table 12 and Figure 5, the lake level is below elevation 2,063.0 feet from mid-August through mid-January. Because most of the recreational use of the lake occurs from Memorial Day weekend through the Fourth of July, in a median type year, there would be no effect on boaters and swimmers using the dock during this time. The tenth percentile data shows elevations below 2,063.0 feet from the mid-July through February. Boaters and swimmers using the dock in very dry years would not be affected during the most popular recreation time. There were no days when the reservoir was below elevation 2,047.0 feet, therefore the boat ramp usage should not be affected at any time in a median type year or in a tenth percentile year. Effects to fish in the lake for the No Action Alternative is described in Section 4.5.2. Effects to sportfishing

would follow that, as largemouth bass and pumpkinseed populations continue to struggle, sportfishing for these species may be impacted; however, the ODFW may manage fish in the lake to alleviate the impacts.

4.9.2 Proposed Action

Based on the fiftieth percentile model data results, reservoir levels were below elevation 2,063 feet from late-July through early February. Since almost all, or most of the recreational use of the lake occurs from Memorial Day weekend through the Fourth of July, there would be little to no impact for dock users in a median type year during this period. Based on the tenth percentile model data, reservoir levels were below elevation 2,063.0 feet from mid-June through the end of March. Boaters and others using the dock may be impacted during the most popular recreational time in about ten percent of the years. The boat ramp would be usable at all times, as the lake was not below elevation 2,047.0 feet at any time.

Sportfishing opportunities may be decreased as the population of largemouth bass, and fingerling trout could be reduced or eliminated; however, the ODFW restocks catchable trout in the Willow Creek Lake on an annual basis, which would help alleviate some of the effects to the recreational fishery. The additional drawdown for irrigation would expose muddy slopes and banks that for some, are aesthetically unappealing, and lower water levels may restrict access to the shoreline of the lake.

4.9.3 Comparison of No Action vs. Proposed Action

For the fiftieth percentile modeled data, over the drawdown period beginning April 16th, the Proposed Action draws down the lake at a faster rate, and ultimately deeper than the operations under the No Action Alternative (see Figures 5 and 6). Using the Fourth of July as the criteria to compare the difference in surface lake area, the lake elevation and surface area for the No Action and Proposed Action is elevation 2070.3 feet (142.6 acres) and elevation 2067.8 feet (136.8 acres), respectively, or a surface area difference of only 5.8 acres (0.3 percent).

For the tenth percentile data, using Fourth of July as the criteria to compare the difference in surface lake area, the lake elevation and surface area for the No Action and Proposed Action is elevation 2065.1 feet (130.1 acres) and elevation 2059.6 feet (117.6 acres), respectively, or a surface area difference 12.5 acres (9.6 percent). This difference is in only ten percent of the years. The Corps assessed that overall, the impacts would be minimal to boaters and swimmers in terms of surface area.

The boat ramp would be usable year-round for both alternatives for all times of the year, as lake levels were not below elevation 2,047.0 feet in all years of modeling. For the fiftieth percentile years the dock is usable for both actions during the high usage period. For the tenth percentile years, the dock may not be usable sometime three weeks of the high usage time beginning mid-June for the Proposed Action, whereas, it would usable during the entire high usage time in the No Action Alternative, so there would be a negative impact to dock users in very dry years with the Proposed Action. The Corps assessed that, overall, there would be no impacts to boat ramp use, and that impact to dock use would be affected only in very dry years.

4.10 Real Estate

The area of analysis for the effects to real estate is in and around the vicinity of the lake and downstream of the dam where the public would want assurance that any operational changes would not induce flooding on private property. A description of the two park and recreational leases the Corps holds with the City of Heppner for the ball field and with the Willow Creek Park District are provided in Section 3.10. The lease by the Willow Creek Park District includes the boat launch area. This section describes the effects of the No Action Alternative and Proposed Action on real estate leases and property downstream of the dam with regard to flood risk, and a comparison of the two alternatives.

4.10.1 No Action Alternative

The Corps does not expect that real estate leases would be affected, as the Government has the right to manipulate the level of the lake as necessary in connection with the project purposes, as stated in Section 3.10. Flood risk on private property downstream of the dam would not be expected to change, as flood risk management operations would not change from existing operations.

4.10.2 Proposed Action

The Corps does not expect that real estate leases would be affected for the same reasons stated for the No Action Alternative. The Corps expects that the Proposed Action would provide positive benefits for flood risk management because lower reservoir levels would provide more space to capture extreme, spring and winter flood events. With more flood space, flood risk on private or public property downstream of the dam would decrease from existing operations.

4.10.3 Comparison of No Action vs. Proposed Action

The Corps expects no difference in effects to real estate leases between the two alternatives. The Proposed Action would reduce flood risk for properties downstream of the dam over the No Action Alternative. Overall, the Corps expects a positive benefit with the Proposed Action.

4.11 Climate Change

Effects to climate change of the No Action Alternative and Proposed Action, along with effects of climate change on the alternatives are addressed in the following paragraphs. There is not enough information to draw conclusions regarding climate change impacts to the alternatives; however possible climate change impacts are discussed. There is some data available regarding projected climate trends for the Pacific Northwest, but those trends may not necessarily translate to the localized area of the Willow Creek Project. A discussion of the comparison of alternatives with respect to climate change is also provided.

4.11.1 No Action Alternative

a. Effect On Climate Change. The emission of greenhouse gases (GHGs) as a contributing factor to climate change is considered for the No Action Alternative. The Corps expects that the No Action Alternative would have no measurable effect with regard to GHG emissions on climate change at the reference point of year 2017. There are no GHG emissions as a direct result of the No Action Alternative. Indirectly, some GHG emissions are a result of recreational boaters using the lake and vehicular traffic due to tourist attraction, however if existing emissions were to continue, this is considered a minor and de minimis effect on climate change.

b. Climate Change Effects. Climate change and resulting hydrologic patterns may alter the amount of stored water available for irrigation flow releases described in this SEA. Based on historical trends, recent regional climate studies suggest that the Columbia Basin is warming and snowpack is decreasing. Climate change modeling shows ambiguity as to whether the future would yield precipitation increases or decreases. If less snowpack were to occur, there may be less opportunity to fill the lake, which would provide less storage water available for irrigation. However, depending on the amount of and timing of precipitation falling as rain, the ability to fill the lake may be increased or decreased.

4.11.2 Proposed Action

a. Effect on Climate Change. The emission of GHGs as a contributing factor to climate change is considered for the Proposed Action. There are no greenhouse gas emissions directly associated with the Proposed Action. The Corps does not expect that the Proposed Action would have an effect on climate change with conditions at the reference point of year 2017; however, there may be slightly less boating activity due to a smaller surface area of the reservoir during the summer and fall, and less vehicular traffic if tourist attraction is reduced, but the Corps considers the difference inconsequential and immeasurable.

b. Climate Change Effects. For climate change effects on the Proposed Action, and as described for the No Action Alternative, climate change and resulting hydrologic patterns may alter the amount of stored water for irrigation flow releases and timing described in this SEA. If less snowpack were to occur, there may be less opportunity to fill the lake, which would provide less storage water available for irrigation. However, depending on the amount of and timing of precipitation falling as rain, the ability to fill the lake may be increased or decreased.

4.11.3 Comparison of the No Action Alternative vs. Proposed Action

The Corps does not expect that either the No Action Alternative or the Proposed Action would have a measurable effect on emissions of GHGs and climate change. Comparing climate change effects on the alternatives, if less snowpack, were to occur in the future, there may be less opportunity to fill the lake with snowmelt under the Proposed Action especially if back-to-back dry years occur. Under the Proposed Action, less opportunity to fill the lake would provide less storage water available for irrigation than in the No Action Alternative. Again, depending on the amount of and timing of precipitation falling as rain, the ability to fill the lake may be increased

or decreased counteracting or adding to the effect of less snowmelt. There is not enough definitive information to draw conclusions for the comparison of the impacts of climate change on the alternatives. The Corps, under either alternative, would continue operating the Project for multiple purposes, including releasing stored water as requested by the state watermaster.

4.12 Cumulative Effects

Cumulative effects are defined as, "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" (40 C.F.R § 1508.7). The area of effect for analysis of direct cumulative effects is in the lake and around the shoreline of the lake which is a direct result of the change in the lake levels. The area of effect for indirect cumulative effects is extended to downstream of the dam, however, the Corps does not have control, responsibility, or jurisdiction over what happens in the creek downstream of the dam. Temporally, this cumulative effects analysis covers a five-year period. This section describes past, present, potential future actions, and possible cumulative effects of these actions on resources and the human environment.

4.12.1 Past Actions

Past actions directly affecting the water regulation of the Willow Creek Project since it became operational, are (1) raising of the normal full pool from elevation 2,063.0 to 2076.5 feet, which occurred in 1992 for the purpose of optimizing recreation in the lake, and (2) the proposed operation as described in the 2008 EA, which is the No Action alternative in this SEA, releases up to 2,500 acre-feet of irrigation water during the irrigation season, from 1 April through 31 October. The 2008 EA addresses cumulative effects for the Proposed Action in that EA (No Action Alternative of this SEA), and is used as the baseline for cumulative effects.

4.12.2 Present Actions

There are no new actions at Willow Creek Project that have occurred between years 2008 and 2017 that affect the operation of Willow Creek. For this SEA, the present action is to continue with the No Action Alternative of releasing 2,500 acre-feet of water for irrigation. The combined effect of water released from the dam plus irrigation diversions downstream of the dam affect the timing, and the amount of flow in the creek downstream of the dam. A present action with a very minor effect of water in the creek downstream of the dam is the installation of a pipeline to provide an additional point of diversion for irrigation water. This pipeline will divert the stored irrigation water from Willow Creek Lake. The total flow in the creek at the mouth of Willow Creek would be about the same with or without the pipeline. The intake to the pipeline is 1.9 miles downstream of the dam, is under construction, and scheduled to be operational by the 2018 irrigation season. The effect of the pipe would be to reduce the loss of water due to evaporation that would otherwise occur in the creek, which would result in delivering more water to the irrigators. There may be less flow in the creek between the pipeline intake, to the point(s) where the water would have been diverted.

4.12.3 Potential Future Actions

A reasonably foreseeable future action identified is the development of a wetlands upstream of Willow Creek Lake. While another potential future action is the reintroduction of steelhead in Willow Creek Basin, at this time, the Corps has determined that this action is not reasonably foreseeable due to a number of factors, including water quantity, fish passage, among others. That said, the Corps briefly discusses this potential future action below at 4.12.3b as the CTUIR have expressed an interest in this action and provided the Corps with a recent anadromous fish reintroduction analysis report. There are no other reasonably foreseeable known activities that would compound the environmental effects of the No Action Alternative or the Proposed Action.

a. Wetlands. A potential future action is the development of a wetlands area immediately upstream of the reservoir on Corps property (Corps 2016). A wetland has the potential to improve water quality in the reservoir through nutrient sequestration and sediment retention with secondary benefits for recreation and fish and wildlife habitat enhancement. Local and private entities have an interest in improving the aquatic ecosystem and preserving the natural beauty of the Willow Creek Lake area. While there is an interest in this activity, a cost-share partner would need to be established in order for the activity to be pursued by the Corps. It is reasonable to assume that a wetland could be developed in the future.

b. Anadromous Fish Reintroduction. There is interest by the ODFW, NOAA, CTUIR, and others in the region, to reintroduce summer steelhead into Willow Creek. Information regarding the objectives of steelhead reintroduction by the region are provided in the report, *Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct population Segment*, dated February 2010, (Carmichael, ODFW, et al. 2010) (Oregon Mid-Columbia plan)[4]. In support of government-to-government consultation, a meeting was held at the staff level between the Corps and the CTUIR on November 14, 2017. At this meeting, the CTUIR conveyed their interest in reintroducing summer steelhead into the Willow Creek Basin. The CTUIR prepared a report, *Assessment Report for the Reintroduction of Anadromous Fish, Willow Creek Subbasin*, dated December 31, 2017, to assess the reintroduction of steelhead, Chinook Salmon, and Pacific Lamprey in the Willow Creek Basin. A copy of the report was provided to the Corps.

Support of anadromous fish would likely require a change to the flow release regime, and fish passage facilities at the dam. At this time, the Corps is reviewing the newly released CTUIR report and may, in the final SEA as appropriate (e.g., based on public comments), describe in greater depth how the proposed action might affect efforts to reintroduce anadromous fish. For this draft SEA, the potential reintroduction of anadromous fish is not included in the cumulative effects assessment because any future proposal to reintroduce anadromous fish is highly uncertain, especially in light of limited Willow Creek flows during the summer and the presence of multiple dams and diversion structures currently blocking fish passage. Also, the Corps understands that the principal effect the proposed action might have on future reintroduction efforts is the provision of additional in-stream flows below the Project during the irrigation

[4] The Oregon Mid-Columbia plan was prepared by representatives of numerous state, federal, tribal and agencies. See Appendix A of the Oregon Mid-Columbia plan for the list of participants. Appendix A can be found on the Oregon Department of Fish and Wildife's website (November 2017).

season, until such flows are diverted for irrigation use. Further, considering the Corps presently lacks authority to (1) release stored water on behalf of reintroduced species downstream of the Project and (2) construct upstream and downstream fish passage at the Project, the proponents of reintroduction would likely need to work with the Corps to study the feasibility of these types of post-authorization changes to the Project. A feasibility study of an additional Project purpose to release stored water for reintroduced species and/or construction of fish passage facilities is beyond the scope of this NEPA document.

4.12.4 Summary of Cumulative Effects

A qualitative description of possible cumulative effects of the Proposed Action with present and future possible actions is provided. There are no cumulative effects of the present action plus the Proposed Action because the actions are independent, or not additive. The environmental resources and human environment of most relevance are addressed.

a. Water Quality. For either the No Action Alternative or Proposed Action, the pipeline will not affect water quality in the lake or the ability to meet state water quality standards for water released from the lake because the pipeline intake is located downstream of the dam and downstream of the point where temperature and pH is monitored. A wetland would potentially improve water quality in the lake and that released from the lake. Improvements in water quality for water released may aid in meeting state water quality standards which could provide a positive effect for either the No Action Alternative or the Proposed Action. The Corp determined that anticipated effects of past, present, or future actions are not likely to rise to the level of significance to water quality in the lake or immediately downstream of the lake.

b. Recreation. For either the No Action Alternative or Proposed Action, the pipeline will have no impact on recreation in the lake. The future action of adding a wetland would have the benefit of improving water quality in the lake which could improve enjoyment for users of the lake. The Corp determined that anticipated effects of past, present, or future actions are not likely to rise to the level of significance to recreation.

c. Fish/Sportfishing. For either the No Action Alternative or Proposed Action, the pipeline would not have an impact on fish in the reservoir. The development of a wetland would not have an impact on warm water fish in the reservoir unless improved water quality conditions are a beneficial to warm water fish. If this is the case, then sportfishing may be improved. The Corp determined that anticipated effects of past, present, or future actions are not likely to rise to the level of significance to fish/sportfishing.

d. Other Resources. The Corp determined that anticipated effects of past, present, or future actions are not likely to rise to the level of significance to vegetation, wildlife, groundwater, cultural resources, socio-economic resources, or real estate in and around the reservoir.

5. Coordination/Public Involvement

The Corps is circulating this draft SEA for a 30-day review period to allow for public comment. The draft SEA is provided through a link on the Corps' website. A public notice and news release is to be issued to local newspapers based on industry and geographic location. The Corps will compile and consider all comments received and prepare a final SEA. The Corps public outreach includes federal, state and local agencies, Tribes, interested groups, and individuals in the local area. Section 5 of the 2008 EA, provides a summary of the public involvement that took place during the development of that EA.

6. Compliance with Laws and Regulations

6.1 National Environmental Policy Act

6.1.1 NEPA Action by the Corps

The National Environmental Policy Act (NEPA), requires that all agencies of the federal government must conduct an appropriate environmental review before taking any action. The 2008 EA and its FONSI and this SEA furthers the requirements of NEPA. Should the Corps decide to select the Proposed Action, then the Corps would issue a FONSI assuming that it finds that the effects of the Proposed Action do not rise to the level of *significance* in accordance with 40 C.F.R § 1508.27. After a FONSI is signed, the Corps would conclude its compliance for NEPA for the release of 3,500 acre-feet of water in irrigation storage from Willow Creek Lake. Should the Corps determine that the Proposed Action rises to the level of significance, then the Corps would prepare an environmental impact statement should the Corps and Reclamation determine to pursue the Proposed Action.

6.1.2 NEPA Action by Reclamation

A connected action for the Proposed Action is that Reclamation would enter into a contract with the Company for the additional 1,000 acre-feet, for a total of 3,500 acre-feet, of stored water in Willow Creek to be used for irrigation. Reclamation would use this SEA as a basis for their NEPA decision document.

6.2 Endangered Species Act

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed or proposed threatened or endangered species. As discussed in Section 4.2.4, the Corps determined that the Proposed Action would have *no effect* on species and critical habitats listed for protection under the ESA; therefore, the Proposed Action is in compliance with the ESA.

6.3 Bald Eagle Protection Act

The Bald Eagle Protection Act of 1940, as amended, provides for the protection of the bald eagle and golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. Bald Eagles were delisted in 2007. As discussed in this SEA, the Corps is not aware of any known bald eagles nests in the project vicinity, and the Proposed Action would not result in the taking, possession, or commerce of any bald eagles; therefore the Proposed Action is in compliance with the Bald Eagle Protection Act.

6.4 Clean Water Act

Section 401 of the Clean Water Act of 1977, as amended, requires certification from the state or

interstate water control agencies that a proposed water resources project is in compliance with established effluent limitations and water quality standards. Section 401(a)(1) requires from the state that a discharge to waters of the U.S. in that state will not violate the states' water quality standards. The EPA retains jurisdiction in limited cases. The Corps seeks a state Water Quality Certification per 33 C.F.R § 336.1(a)(1) when its activities result in a discharge. Storage of water does not require a Section 401 Water Quality Certificate from the State of Oregon, and in the Proposed Action, release of stored water is considered to be discharges from a water transfer, Section 401 does not apply.

Section 402 of the Clean Water Act, Section 402(a)(1) authorizes the EPA, or states in which the EPA has delegated such authority, to issue permits for discharge of pollutants under the National Pollutant Discharge Elimination System (NPDES) program. Regulated categories of discharges generally include point-source discharges and storm-water runoff. Permit conditions are usually required to ensure compliance with all applicable effluent and water quality standards. The Proposed Action results in the release of stored water from the reservoir and is considered "discharges from water transfer". Discharges from water transfer is exempt from NPDES based on 40 C.F.R § 122.3(i), and does not apply.

Section 404 of the Act authorizes the Secretary of the Army to permit the discharge of dredged or fill material into waters of the U.S. at specified disposal sites based on section 404(b)(1) guidelines. The Corps is not subject to this authorization but complies with all applicable substantive legal requirements including application of section 404(b)(1). A Section 404(b)(1) Water Quality Evaluation is not required because the Proposed Action does not involve the placement of fill material into waters of the United States.

Section 303(d) of the Clean Water Act requires each State to prepare a list of impaired water bodies. In January of 2007, the ODEQ and the EPA finalized the Willow Creek Subbasin TMDLs for temperature, pH and bacteria as a requirement of the CWA. In the case of Willow Creek Dam, the load allocations set by the State are for the temperature and pH of water released from the dam. As part of the CWA-TMDL process the ODEQ asked the Corps to develop a Water Quality Plan which describes management strategies for water temperature and pH below Willow Creek Project. Temperature and pH of water released from the dam is managed by adjusting the level of the water quality intake and monitoring the TMDLs downstream of the dam. The Corps reports progress in meeting the standards and proposes revisions to the WQP in approximately 5-year intervals. This meets the requirements of Section 303(d).

6.5 Clean Air Act

The Clean Air Act of 1970, as amended, established a comprehensive program for improving and maintaining air quality throughout the United States. Its goals are achieved through permitting of stationary sources, restricting the emission of toxic substances from stationary and mobile sources, and establishing National Ambient Air Quality Standards. Title IV of the Act includes provisions for complying with noise pollution standards. There would be no reduction in air quality or increases in noise levels from the Proposed Action. The Proposed Alternative is in compliance with the Clean Air Act.

6.6 National Historic Preservation Act (*Note to reviewers: This section to be updated upon completion of NHPA consultation.*)

The National Historic Preservation Act (NHPA) requires that federally-assisted or federally-permitted projects account for the potential effects on sites, districts, buildings, structures, or objects that are included in or eligible for inclusion in the National Register of Historic Places. Consultation is being conducted with the SHPO and Tribes as described in Section 1.5, for the No Action Alternative and the Proposed Action. Consultation will be completed prior to finalization of the SEA, and the Corps expects that both alternatives would result in *no historic properties affected*.

6.7 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act provides for the protection of Native American and Native Hawaiian cultural items, and it established ownership and control of Native American cultural items, human remains, and associated funerary objects to Native Americans. It also establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on federal land. Because human remains were found near the dam, and the lake bed is exposed from time to time, it is possible that additional human remains could be exposed. If human remains are discovered on federal lands during fluctuations of the reservoir, the Corps would be responsible for following all requirements of this Act. Currently, there is an Inadvertent Discover Plan in place for facility operations which will be followed.

6.8 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) of the United States was enacted March 10, 1934 to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. Here, the FWCA does not apply to the Proposed Action because the Corps would not be modifying or controlling the waters within the meaning of the FWCA when the agency increases, from up to 2,500 to 3,500 acre-feet, the amount of water it releases for irrigation from the existing Willow Creek dam.

6.9 Comprehensive and Environmental Response, Compensation and Liability Act

The purpose of the Comprehensive and Environmental Response, Compensation and Liability Act (CERCLA) is to clean up sites contaminated with hazardous waste, and prevent contamination of future sites by assigning liability to parties involved. The location of the proposed action is not within the boundaries of a site designated by the Environmental Protection Agency or the State of Oregon for a response action under CERCLA nor is it a part of a National Priority List site. For the Proposed Action, CERCLA does not apply.

6.10 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 and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. This executive order requires federal agencies to consider how their actions may encourage future development in floodplains and to minimize such development. The Proposed Action would not increase or decrease the existing floodplain area, nor would it encourage development in the existing floodplain. The Proposed Action is in compliance with Executive Order 11988.

6.11 Executive Order 11990, Protection of Wetlands

This executive order requires federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out their responsibilities. The lake area, which is affected by the annual refill and drawdown of the reservoir is a non-wetland waters of the U.S., therefore this executive order does not apply.

6.12 Executive Order 12898, Environmental Justice

This executive order requires federal agencies to consider and minimize potential impacts on subsistence, low-income or minority communities. The goal is to ensure that no person or group of people should shoulder a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign policy programs.

As stated in Section 3.8, the median household income for the period 2011-2015 in Morrow County was $50,918 (in 2015 dollars), which was slightly lower than the median household income for Oregon ($51,243). The percent of persons below poverty in Morrow County was 15 percent in 2015 as compared to 15.4 percent for Oregon. Comparing Morrow County to the state of Oregon statistics, the median and percent below poverty is almost the same, therefore, geographically, there is not a disproportionate number of low income people in Morrow County as compared to the state of Oregon.

The Proposed Action would not substantially alter economic conditions or cause any changes in population or other indicators of social well-being. The Proposed Action would not result in a disproportionately high or adverse effect on minority populations or low-income populations. There are no environmental justice implications from the proposed action, therefore the Proposed Action is in compliance with this executive order.

6.13 Farmland Protection Policy Act

Section 1540(b) of the Act, 7 U.S.C. 4201(b), states that the purpose of the Farmland Protection Policy Act is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. The Proposed Action does not involve conversion of farmlands, therefore the FPPA does not apply.

6.14 Treaty of 1855

The U.S. Government and the Cayuse, Umatilla, and Walla Walla Tribes signed The Treaty of

1855. In the Treaty, the Tribes ceded 6.4 million acres of land in what is now northeastern Oregon and southwest Washington. The Tribes reserved their rights to fish, hunt, and gather foods and medicines throughout the ceded lands and still protect and exercise those rights. The U.S. Government is committed to honor the provisions of the Treaty with respect to its actions in the Willow Creek Basin.

7. Conclusion

The Corps has assessed and concludes that there would be little to no incremental effects of the Proposed Action compared to the No Action Alternative on groundwater, air quality, noise, light, vegetation, wildlife, ESA threatened and endangered species, cultural resources, farmlands, socio-economic resources, and real estate. The Corps also assessed that there would be little to no effect on climate change or climate change effects on the Proposed Action or No Action Alternative. Water quality, recreation, fish and wildlife (including sportfishing) are the most relevant resources, and effects to those resources are described below.

Water Quality - There is insufficient information available to assess the incremental difference in water temperature and pH released from the lake or to assess the incremental difference on dissolved oxygen and algae blooms in the lake. There are no indications that water quality would be significantly worse with the Proposed Action. The Corps would continue to manage the temperature and pH of the releases by selecting the reservoir depth from which the water is withdrawn. There are no requirements or standards in place for water quality in the lake; however if water quality in the lake became less desirable, recreation and sportfishing could potentially be affected. The Corps assessed that the incremental effects of the Proposed Action on water quality of the releases and in the lake will be minimal.

Recreation - The boat ramp would be usable for the entire year for both the No Action Alternative and Proposed Actions. In very dry years, for the No Action Alternative, dock would be usable during the high usage period from Memorial Day weekend through the Fourth of July, but with the Proposed Action, the dock may not be usable for several weeks during this period, beginning in about mid-June, affecting swimmers and boaters who wish to use the dock. The Corps assessed that, overall, there would be no impacts to boat ramp use, and that impact to dock use would be affected only in very dry years.

Fish and Sportfishing - The ODFW manages non-native warm water fish, trout, and sportfishing in Willow Creek Lake. The incremental effects of the Proposed Action on warm water fish that are present in the lake primarily for sportfishing, may be to additionally decrease or eliminate successful spawning of largemouth bass and pumpkinseed fish. The next year’s harvest of fingerling trout that are annually stocked in the lake may also be affected. The ODFW has placed regulations on fishing, and annually stocks the lake with trout. If sportfishing impacts are realized by the Proposed Action, warm water fish could potentially be introduced to help alleviate impacts to sportfishing; therefore incremental effects of the Proposed Action on sportfishing is considered to be minimal.

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