US Army Corps of Engineers®
Portland District

WILLAMETTE VALLEY SYSTEM OPERATIONS AND MAINTENANCE

FINAL ENVIRONMENTAL IMPACT STATEMENT

CHAPTER 1 INTRODUCTION

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CHAPTER 1 - INTRODUCTION

CHAPTER 1 HAS BEEN REVISED FROM THE DEIS
REPEATED INFORMATION HAS BEEN DELETED
INSERTION OF LARGE TEXT IS IDENTIFIED; MINOR EDITS ARE NOT DENOTED

Summary of changes from the DEIS:

- **Willamette Valley System construction dates and authorizing acts have been added as FEIS Table 1.1-1.**
- **Table 1.2-1, Summary of Chapter Terminology, has been revised for clarity.**
- **Additional information has been added regarding "tiering" under NEPA in FEIS Section 1.3.1.1.**
- **The listed species identified in DEIS Section 1.1.2, Endangered Species Act, have been removed because species list was an incomplete depiction of listings under the ESA since 1980. Listed plants and animals are addressed in Section 3.6, Vegetation, Section 3.8, Fish and Aquatic Habitat, and Section 3.9, Wildlife and Habitat.**
- **Additional information has been added on WVS ESA and NEPA history since 2008 in FEIS Section 1.3.3.**
- **Information on the geographic scope as been clarified in FEIS Section 1.4.1.**
- **Clarifications have been made to the Proposed Action in FEIS Section 1.5. Information on the purpose and need for the Proposed Action has been moved to Chapter 2, Alternatives.**
- **Dam and reservoir descriptions have been moved from DEIS Section 1.5, USACE-managed Dams and Reservoirs in the Willamette River Basin, to a new appendix: Appendix S, USACE-managed Dams, Reservoirs, and Bank Protection Structures.**
- **Information has been added to provide an overview of bank protection projects in the Willamette River Basin, including those operated and maintained by local sponsors, in FEIS Section 1.7.2, Revetments and Other Structures for Bank Protection. Additional detail is provided in FEIS Appendix S, USACE-managed Dams, Reservoirs, and Bank Protection Structures.**
- **Information has been added to describe dams not managed by USACE in the analysis area as FEIS Section 1.8, Non-U.S. Army Corps of Engineers-managed Dams in the Willamette River Basin.**
- **Information has been added on Forecast-informed Reservoir Operations in FEIS Section 1.9.5.**

Summary of changes from the DEIS, continued:

- **Information has been added regarding continued work with the WATER Forum in FEIS Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocation.**
- **Information on the description of flood pools, conservation pools, power pools, and dead pools has been revised for clarity in FEIS Section 1.11.1, Reservoir Pools and Water Control. New information on inactive pools has been provided.**
- **Additional information has been provided on the relationship between the 2019 Biological Opinion and conservation pool allocations in FEIS Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocation.**
- **Information has been added to clarify the relationship between master plans and the WVS EIS in FEIS Section 1.12.1, Master Plans and Operational Plans.**
- **Information on operational management plans and their relationship to master plans has been added to FEIS Section 1.12.1.2, Operational Management Plans.**
- **Updated information on the drop structure near Monroe, Oregon, has been provided in FEIS Section 1.12.6, Long Tom River Restoration Project.**
- **Information on the 2022 Water Resources Development Act Report to Congress on Willamette Valley System Hydropower has been added to Section 1.12.7.**

1.1 Background

The U.S. Army Corps of Engineers (USACE) Portland District operates and maintains the Willamette Valley System (WVS) to meet Congressionally authorized purposes. This National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) was prepared by USACE to analyze alternatives for the continued operation and maintenance of the system over a 30-year period while complying with Congressionally authorized purposes, the Endangered Species Act (ESA), and other applicable laws.

The WVS is located in the Willamette River Basin and comprises 13 multipurpose dams and reservoirs, hatcheries, adult fish facilities, and bank protections structures[1]. Variations in operations and maintenance are necessary because of unique component designs (dams, revetments, adult fish facilities, etc.) and their Congressionally authorized purposes (Figure 1.1-1 and Figure 1.1-2). These components also work together as a system to further meet the Congressionally authorized purposes for the WVS.

[1] While the term "project" is traditionally used to describe each dam and its related components, this term is not used in that context throughout the EIS. "Project" is used only in its traditional meaning as related to a "planned undertaking" (Webster Dictionary).

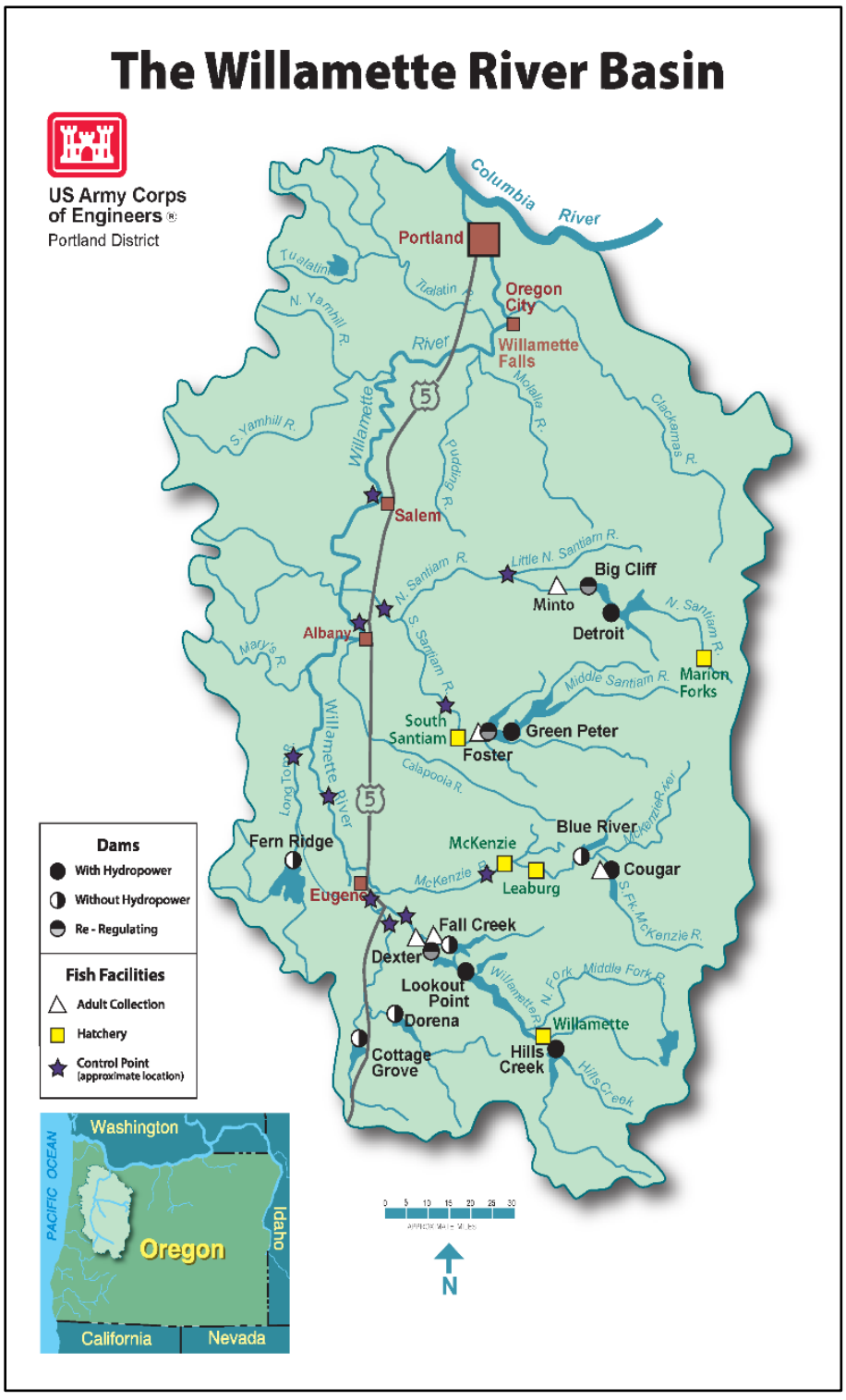


Figure 1.1-1. USACE-managed Dams and Fish Facilities in the Willamette River Basin.

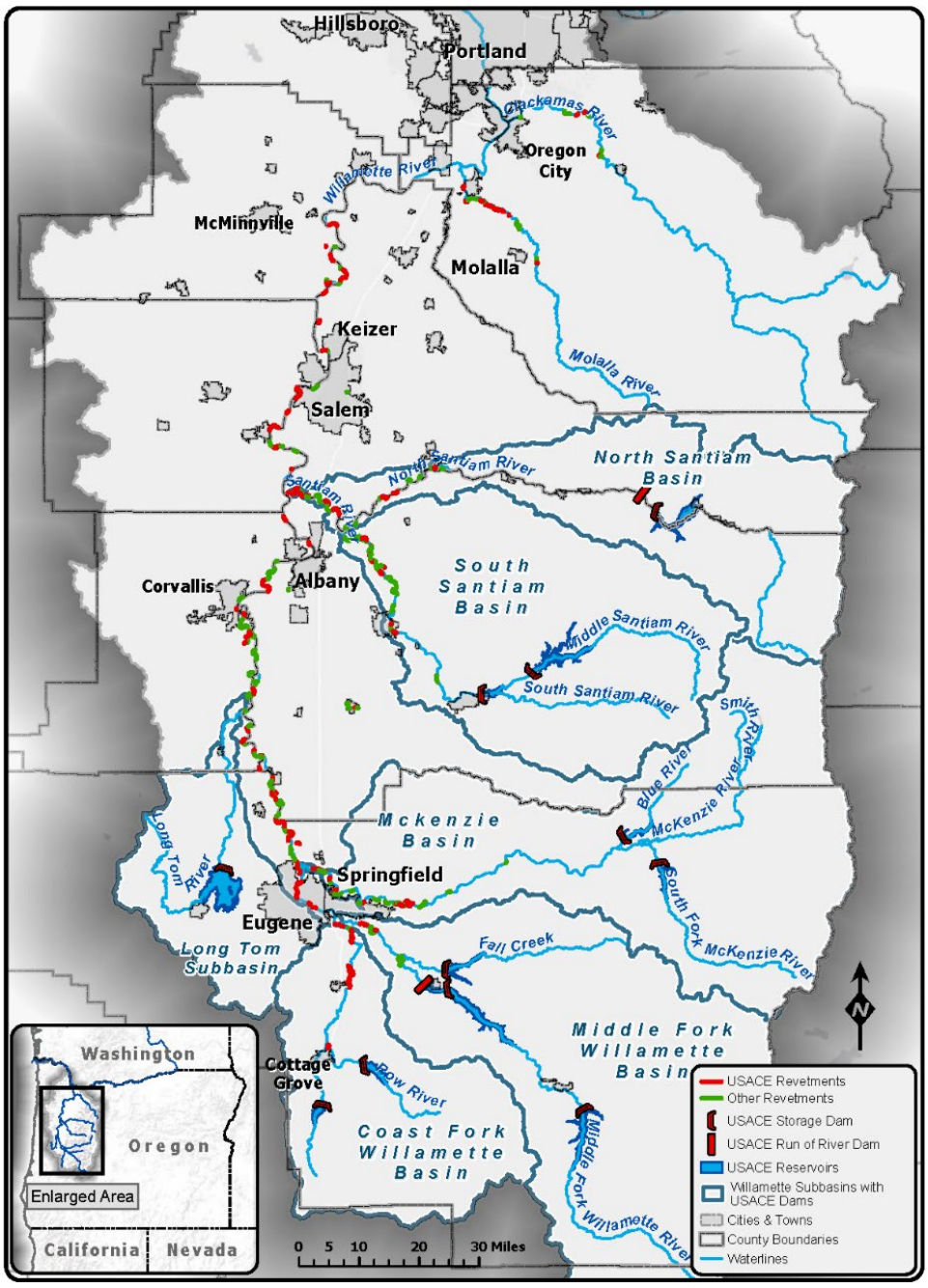


Figure 1.1-2. Willamette River Basin Bank Protection Projects.

Note: Due to unknown locations of non-USACE-constructed revetments in the Willamette River Basin, the figure only depicts USACE-constructed revetments.

System-wide environmental effects of ongoing operations and maintenance activities were last analyzed in an EIS in 1980. Conditions in the Willamette River Basin have changed, and new information has become available since 1980 (e.g., continued population growth and associated development, operational modifications, structural improvements implemented for fish passage, and temperature control). Federal Biological Opinions have also been issued under the

ESA, seeking to lessen effects of WVS operations and maintenance on Federally listed threatened and endangered species.

This EIS is a programmatic-level review operations and maintenance of the WVS as a result of these changes. Additionally, the timeframe since an EIS was last prepared warranted an updated review. The programmatic approach provides an overview of effects on resources that could potentially be impacted by USACE actions. Additional NEPA analyses may be required for site-specific actions in the WVS and tiered from this EIS analysis as applicable (Section 1.3.1.1, Programmatic Reviews and Subsequent Tiering under the National Environmental Policy Act).

USACE constructed 13 dams and reservoirs between 1940 and 1969 through the passage of several flood control acts (Table 1.1-1). The various purposes of the WVS were authorized by Congress in the Flood Control Acts between 1938 and 1962, the Water Supply Act of 1958, and the Water Resources Development Act of 1986.

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING TABLE IN THE FEIS

Table 1.1-1. Willamette Valley System Construction Dates and Authorizing Acts.

Dam	Subbasin	Construction Dates	Authorizing Flood Control Act
Fern Ridge	Long Tom River	1940-1941	Flood Control Act of 1938
Cottage Grove	Coast Fork Willamette River	1940-1942	Flood Control Act of 1938
Dorena	Coast Fork Willamette River	1940-1949	Flood Control Act of 1938
Big Cliff	North Santiam River	1949-1953	Flood Control Act of 1948
Detroit	North Santiam River	1948-1953	Flood Control Act of 1938
Dexter	Middle Fork Willamette River	1953-1954	Flood Control Act of 1950
Lookout Point	Middle Fork Willamette River	1947-1955	Flood Control Act of 1938
Hills Creek	Middle Fork Willamette River	1956-1962	Flood Control Act of 1950
Cougar	McKenzie River	1956-1964	Flood Control Act of 1950
Fall Creek	Middle Fork Willamette River	1961-1965	Flood Control Act of 1950
Green Peter	South Santiam River	1963-1967	Flood Control Act of 1950
Foster	South Santiam River	1964-1968	Flood Control Act of 1950
Blue River	McKenzie River	1963-1969	Flood Control Act of 1950

Congress designated the purpose for each dam and reservoir in these acts, which can include a combination of the following:

- flood control (i.e., flood risk management)
- hydropower
- fish and wildlife
- recreation
- navigation
- irrigation (i.e., agricultural irrigation)
- municipal and industrial water supply
- water quality

1.2 Chapter Terminology and Organization

THE DEIS HAS BEEN MODIFIED TO REVISE THE FOLLOWING TABLES

Table 1.2-1. Summary of Chapter Terminology.

Term	Definition
Willamette Valley System (WVS)	The 13 USACE-managed dams, reservoirs, and bank protection structures in the analysis area.
Activities	Activities necessary to implement a measure, program, operations, or maintenance (e.g., construction of a selective withdrawal structure).
Measures	Proposed combination of activities that would be taken under an alternative to meet the purpose and need for the Proposed Action. Alternatives are formulated by suites of measures.
Analysis Area	The area defined as the Affected Environment for each resource in Chapter 3, Affected Environment and Environmental Consequences. Broadly, the analysis area is the Willamette River Basin. An analysis area may be narrower (e.g., subbasins) or broader (e.g., state- or region-wide) than the entire Basin depending on the resource analyzed.

Table 1.2-2. Chapter 1 Organization.

Section	Content
Section 1.3, Regulatory Background	Describes the history of environmental compliance for operations and maintenance of the WVS and explains the regulatory framework for the WVS EIS.
Section 1.4, Geographic and Temporal Scopes	Identifies the generally applied analysis area and the implementation timeframe under any alternative.
Section 1.5, Proposed Action	Defines the action proposed by the U.S. Army Corps of Engineers.
Section 1.6, National Environmental Policy Act Cooperating Agencies and Endangered Species Act Action Agencies	Describes the Cooperating Agency process and involvement of Action Agencies in the accompanying ESA consultation process.
Section 1.7, U.S. Army Corps of Engineers-managed Dams, Reservoirs, and Bank Protection Structures in the Willamette Valley System	Provides an overview of the setting, components, and operations of the Willamette Valley System.
Section 1.8, Non-U.S. Army Corps of Engineers-managed Dams in the Willamette River Basin	Provides an overview of the purposes for dams and reservoir in the Willamette River Basin that are not under U.S. Army Corps of Engineers management.
Section 1.9, U.S. Army Corps of Engineers Programs in the Willamette River Basin	Describes the Willamette River Basin Bank Protection Program; the Willamette Hatchery Mitigation Program; adult fish facilities; and research, monitoring, and evaluation activities.
Section 1.10, Congressionally Authorized Purposes	Details the WVS purposes as authorized by Congress.
Section 1.11, Willamette Valley System Operations and Annual Operations Planning	Describes planning implemented to meet objectives for operation of the system dams and reservoirs.
Section 1.12, Ongoing U.S. Army Corps of Engineers Planning and Environmental Reviews in the Willamette River Basin	Describes U.S. Army Corps of Engineers ongoing or future planning.

1.3 Regulatory Background

Considerable regulatory history and requirements surround development of the Proposed Action. This section summarizes that history and the regulatory actions that are foundational to the Proposed Action, specifically NEPA and ESA, which are described in further detail below (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008).

In addition to NEPA and ESA compliance, consideration of treaties, applicable laws, regulations, and executive orders is also required to implement any alternative analyzed in this EIS. A detailed description of compliance is provided in Chapter 7, Compliance with Environmental Laws, Regulations, and Executive and Secretarial Orders.

1.3.1 National Environmental Policy Act

NEPA was established to ensure that Federal agencies adequately consider the potential effects on the human environment from major Federal actions (42 U.S.C. §§ 4321). The major Federal action under NEPA review is proposed modifications to USACE operations and maintenance of the WVS for a planning period of 30 years.

USACE compliance with NEPA is governed by the National Environmental Policy Act at 42 U.S.C. §§ 4321 and implementing regulations[2], 40 CFR §§1500-1508 and USACE NEPA implementing regulations at 33 CFR Part 230. As a general overview, NEPA requires agencies to:

- Identify a Proposed Action.
- Describe the purpose of and need for the Proposed Action.
- Identify and describe all reasonable alternatives to meet the purpose and need for the Proposed Action as well as the alternative of taking no action.
- Identify, evaluate, and compare effects on the human environment under each of the alternatives as well as the No-action Alternative.
- Publish the above information in an environmental document for review by the public and other agencies (e.g., a Draft EIS).
- Consider public and agency comments in revising and publishing a Final EIS before making its decision on the Proposed Action.

[2] The NEPA process for this EIS began in 2019, prior to any revisions to the Council on Environmental Quality (CEQ) 1978 implementing NEPA regulations. Therefore, this EIS was initially subject to, and complies with, the 1978 NEPA implementing regulations as amended. Additionally, USACE applied the most current CEQ guidance on use of programmatic NEPA reviews, December 18, 2014. CEQ rescinded all of its implementing regulations on April 11, 2025. Several Executive Orders and related guidance regarding climate change analyses were also rescinded 2 months prior to finalization of this EIS. Consequently, references to the CEQ regulations and analyses of greenhouse gas emissions, social cost of carbon, and climate change were not removed in the FEIS to avoid delay in decision-making and the significant time and resources required for document revisions.

- Publish a Record of Decision that identifies all the alternatives considered in reaching a decision, identifies an environmentally preferred alternative, identifies the factors considered in the agency's decision, and states whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not adopted.

The Proposed Action is discussed in Section 1.5. The purpose and need for the Proposed Action and the alternatives analyzed in the EIS are addressed in Chapter 2, Alternatives.

A summary of the Draft EIS public comment period is provided in Chapter 6, Public Involvement. Public Comments and Responses are provided in Appendix V, Draft Environmental Impact Statement Public Comments and Responses.

1.3.1.1 Programmatic Reviews and Subsequent Tiering under the National Environmental Policy Act

Programmatic Reviews

The NEPA compliance process can be conducted for a specific project or for an entire program as defined by CEQ guidance (Section 7.3, National Environmental Policy Act).

> Programmatic NEPA reviews address the general environmental issues relating to broad decisions, such as those establishing policies, plans, programs, or suite of projects, and can effectively frame the scope of subsequent site- and project-specific Federal actions. A well-crafted programmatic NEPA review provides the basis for decisions to approve such broad or high-level decisions such as identifying geographically bounded areas within which future proposed activities can be taken or identifying broad mitigation and conservation measures that can be applied to subsequent tiered reviews… (CEQ 2014).

Appropriately, analyzing operations and maintenance of the WVS at the program level will assist USACE in framing the scope of subsequent site-specific analyses at any of the 13 dams and reservoirs. The system consists of multiple dams, reservoirs, components, and activities within a shared geography—Oregon's Willamette River Basin—and are managed individually and as a system to achieve Congressionally authorized purposes and to avoid jeopardizing ESA-listed species.

As with site-specific NEPA reviews, programmatic reviews analyze potential effects under a range of reasonable alternatives but at the broader scale. The Draft EIS was made available for a 90-day public comment period in November 2022. The Final EIS was prepared after consideration of these comments and any new information identified by USACE. The Record of Decision documents NEPA regulatory considerations and the final alternative implementation selection.

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING INFORMATION IN THE FEIS

Tiering from a Programmatic Review

Tiering a NEPA analysis from another, broader NEPA review is commonly applied when the broader NEPA review is conducted on a program (40 CFR 1508.28). The selected alternative from this WVS programmatic analysis will be implemented for 30 years. Consequently, additional analyses will be required to address site-specific impacts on the human environment if specific projects are proposed at a WVS dam, reservoir, or hatchery and are a major Federal action triggering NEPA review (e.g., operational refinements, construction projects, etc.).

> One advantage of preparing a programmatic NEPA review for repetitive agency activities is that the programmatic NEPA review can provide a starting point for analyzing direct, indirect, and cumulative impacts. Using programmatic NEPA reviews allows an agency to subsequently tier to this analysis, and analyze narrower, site- or proposal-specific issues. This avoids repetitive broad level analyses in subsequent tiered NEPA reviews and provides a more comprehensive picture of the consequences of multiple proposed actions (CEQ 2014).

The tiering process will focus on the narrower issues of a site-specific action, relying on broader analyses in this EIS to consider and to balance general impacts to the human environment. For example, construction activities may require site-specific analyses tiered from this programmatic NEPA review to disclose localized impacts such as ground disturbance, etc.

Limited analyses of potential general construction activities are included in this EIS in Chapter 3, Affected Environment and Environmental Consequences, to provide a range of potential effects. However, site-specific evaluations will determine the actual features and activities included during the subsequent tiered analyses once site-specific designs are developed.

END NEW TEXT

1.3.2 Endangered Species Act

The ESA of 1973 (16 USC 1531 et seq.) was established for the conservation of threatened and endangered species and the habitat they require for survival. The ESA was enacted to protect and conserve imperiled species and the habitats or ecosystems upon which they depend (Section 7.4, Endangered Species Act).

Species in danger of extinction may be listed by the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) (together referred to as the Services) under the ESA as a threatened or endangered species, thereby providing certain protections to the species. The ESA also authorizes the Services to designate certain areas as “critical habitat” for the survival of a listed species or subspecies (critical habitat is defined in the ESA in Section 3(5)(A)(B)(C)).

Additionally, ESA Section 7(a)(2) states that Federal agencies shall, in consultation with the Services, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

The Services listed and de-listed[3] several plant and animal species under the ESA after USACE finalized its 1980 WVS EIS. Additionally, several Evolutionarily Significant Units (ESUs) are listed by NMFS for Upper Willamette River (UWR) spring Chinook salmon and UWR winter steelhead (NWFSC 2015). An ESU, as pertains to this EIS analysis, is a Pacific salmon population or group of populations that is substantially reproductively isolated from other conspecific[4] populations and that represents an important component of the evolutionary legacy of the species.

The two listed ESUs present an important aspect of intraspecific biodiversity (i.e., genetic diversity within a given species) and an important component in the evolutionary legacy of the two listed salmonid species within the Willamette River Basin.

USACE, the Bureau of Reclamation (BOR), and the Bonneville Power Administration (BPA) consulted with the Services after these species were listed. Subsequently, NMFS issued the ESA Section 7(a)(2) Consultation, Biological Opinion and Magnuson-Stevens Fishery Conservation & Management Act Essential Fish Habitat Consultation on the Willamette River Basin Flood Control Project (2008 NMFS Biological Opinion) on July 11, 2008 (NMFS 2008).

The 2008 NMFS Biological Opinion evaluated the effect of continued operations and maintenance of the WVS on UWR spring Chinook salmon and UWR winter steelhead (NMFS 2008). NMFS concluded that the action proposed during consultation would not avoid a finding of jeopardy or adverse modification of designated critical habitat for these listed fish. The Biological Opinion stipulated a Reasonable and Prudent Alternative (RPA), which was a suite of actions expected to avoid the likelihood of jeopardizing the continued existence of the listed species or destroying or adversely modifying their designated critical habitat (NMFS 2008).

USFWS published the Biological Opinion for the Continued Operation and Maintenance of the Willamette River Basin Project and Effect to Oregon Chub, Bull Trout, and Bull Trout Critical Habitat Designated Under the Endangered Species Act (2008 USFWS Biological Opinion) in 2008, outlining effects of the WVS on Oregon chub, bull trout, and bull trout critical habitat (USFWS 2008). USFWS reached a no jeopardy determination in its 2008 Biological Opinion provided USACE, BOR, and BPA implemented the 2008 NMFS Biological Opinion RPA and considered effects on Oregon chub and bull trout when applying measures covered in the RPA.

[3] As de-listed, a species no longer falls under the protection of the ESA.

[4] "Conspecific" is defined as belonging to the same species.

Since 2008, USACE has been implementing the 2008 NMFS Biological Opinion RPA (NMFS 2008). Over time, this has changed operations and maintenance of the WVS sufficiently to necessitate additional analyses under NEPA. USACE has also reinitiated formal consultation under Section 7 of the ESA for the continued operations and maintenance of the WVS and to implement operations and to construct projects that address fish passage and water quality. This NEPA process will inform the ESA Section 7 consultation process by analyzing various alternatives that include these operations and construction projects.

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING INFORMATION IN THE FEIS

1.3.3 Willamette Valley System Endangered Species Act and National Environmental Policy History Since 2008

The 2008 Biological Opinion RPA required the BOR and USACE to engage in legal and administrative processes necessary to protect instream flows for ESA-listed species under state law and to proceed with actions to allocate water for this purpose (NMFS 2008). In compliance with that RPA, the Willamette Basin Review Feasibility Study was formally initiated in 2015.

The goal of the Willamette Basin Review Feasibility Study was to seek Congressional approval to reallocate WVS conservation storage for the benefit of fish and wildlife, agricultural irrigation, and municipal and industrial water supply over a 50-year analysis period while continuing to fulfill other WVS purposes (USACE 2019a). The study examined different ratios of storage allocations for fish and wildlife, irrigation, and municipal and industrial uses based on projected demand for irrigation and municipal and industrial uses in 2070 and tributary and mainstem flow requirements for fish. The Willamette Basin Review addressed the initial step in the process to secure protection of instream flows under state law.

In 2018, the Northwest Environmental Defense Center, WildEarth Guardians, and Native Fish Society sued USACE and NMFS alleging violations of the ESA and Administrative Procedure Act related to implementation of portions of the 2008 Biological Opinion RPA (NMFS 2008). Also in 2018, USACE reinitiated ESA consultation with the Services, and in 2019, initiated this WVS EIS.

Unlike the Willamette Basin Review and associated 2019 Biological Opinion, the WVS EIS NEPA review is related to operations and maintenance of the WVS, not to allocation or division of water stored in conservation pools of the WVS reservoirs for these purposes.

Concurrent with the EIS initiation, the Willamette Basin Review Feasibility Study was completed in 2019 and subsequently presented to Congress. In 2020, Congress authorized the reallocation

of water storage substantially in accordance with terms and conditions described in the Chief's Report[5] with modifications[6].

The Feasibility Study underwent environmental review and regulatory compliance, including, but not limited to, consultation under Section 7 of the ESA and preparation of a NEPA Environmental Assessment. Per the ESA Section 7 consultation, NMFS issued a Biological Opinion (2019 Willamette Basin Review Biological Opinion) (NMFS 2019c) with an RPA requiring various actions by USACE, including requirements on new municipal and industrial water supply agreements. Details of the 2019 Willamette Basin Review Biological Opinion RPA are provided in Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocation.

A Finding of No Significant Impact on implementation of the storage allocation was signed by USACE in early 2020 after Congress issued its approval on water storage reallocation.

The Adaptive Management Plan addresses an overarching governance framework that includes implementation of the WVS operations and maintenance ESA consultation, the 2019 Willamette Basin Review Biological Opinion, 2019 Hatcheries Biological Opinion[7] (Section 1.9.2, Willamette Hatchery Mitigation Program), and other activities in the region (Appendix N, Implementation and Adaptive Management Plan).

Additionally, NEPA compliance has been completed on other actions related to this WVS EIS Proposed Action.

1.4 Geographic and Temporal Scopes

1.4.1 Geographic Scope

The broad analysis area, or geographic scope, for assessing the direct, indirect, and cumulative effects of the alternatives is the Willamette River Basin. The broad analysis area includes 12 subbasins in the Willamette River Basin, which encompasses all of the WVS including multipurpose dams and reservoirs, hatcheries, adult fish facilities, and bank protections structures (Section 1.4.1.1, Willamette River Basin).

However, several resource analyses focus on a narrower, subset of the 12 subbasins. Consequently, the analysis area encompasses six of the Willamette River subbasins for most resource analyses. This geographic scope could be broader or narrower than the six subbasin areas depending on the resource and may include the Mainstem Willamette River and some or all of the 12 Willamette River Basin subbasins (Section 1.4.1.1, Willamette River Basin).

[5] Chief's Report available at https://www.nwp.usace.army.mil/willamette/basin-review/

[6] Congressional approval of the Willamette Basin Review Feasibility Study in 2020 also included language that the allocations could change up to 10 percent as part of a subsequent ESA consultation if this change was not *from any one* source (i.e., fish and wildlife, irrigation, or municipal and industrial water supply).

[7] Referred to as "Willamette Opinions" in Appendix N, Implementation and Adaptive Management Plan.

For most resources, the analyses address potential effects in the following subbasins with exceptions as applicable:

Analysis Area Subbasins

- North Santiam River
- South Santiam River
- McKenzie River
- Middle Fork Willamette River
- Coast Fork Willamette River
- Long Tom River

END NEW TEXT

1.4.1.1 The Willamette River Basin

The Willamette River is a major tributary of the Columbia River, which is the largest river in the Pacific Northwest and one of the largest in North America. The Willamette River lies entirely within the State of Oregon and is the 13th largest river in the United States by annual flow volume.

A river basin, also referred to as a watershed, is an area of land that drains to an outlet to another water body. Subbasins in the watershed are drained by tributaries to the main river. The Willamette River Basin is approximately 11,500 square miles and is drained by the Willamette River, which flows north through a fertile valley in western Oregon (USACE 2019a). The Basin begins south of Cottage Grove, Oregon and extends approximately 187 miles to the north where it flows into the Columbia River (Table 1.4-1) (Figure 1.1-1).

Table 1.4-1. Willamette River Basin Tributaries and Confluence River Mile with the Willamette River.

Tributary	Willamette River Confluence River Mile
Middle Fork/Coast Fork	188
McKenzie River	177
Long Tom River	148
Santiam River	108

There are 12 subbasins in the Willamette River Basin that encompass the WVS:

Willamette River Basin

- Lower Willamette River
- Clackamas River
- Tualatin River
- Molalla-Pudding Rivers
- Yamhill River
- Middle Willamette River
- North Santiam River
- South Santiam River
- Upper Willamette River
- McKenzie River
- Coast Fork Willamette River
- Middle Fork Willamette River

In the mid-1800s, the valley was broad with a shallow braided channel across a wide floodplain that was flooded annually in winter. As homesteaders developed agricultural and suburban communities in the Willamette Valley they encountered frequent floods, including the devastating 1861 event that flooded the Portland business district for weeks. This led Congress to authorize USACE to construct, operate, and maintain the WVS for flood control purposes with authorizations beginning in 1938.

1.4.2 Temporal Scope

The temporal scope of analysis for implementation of any alternative is 30 years from the signing of the Record of Decision. USACE considered several factors when defining the temporal scope, such as the ability to project data with confidence for the resources that would be affected, the timeframe for implementation for the actions considered, and similar NEPA documents published by USACE.

1.5 Proposed Action

The Proposed Action is to continue operations and maintenance of the WVS for specific, authorized purposes. Responsibility for operating each dam and reservoir and the overall system was directed to USACE by Congress in authorizing legislation. Consequently, the Proposed Action is to continue with this authorizing legislation. The Proposed Action would be implemented over a 30-year timeframe.

1.6 National Environmental Policy Act Cooperating Agencies and Endangered Species Act Action Agencies

USACE is the lead agency under NEPA because it has the primary responsibility for operating the system for its authorized purposes and because it is proposing the action and alternatives to be considered for implementation. As the lead agency for development of the EIS, USACE

invited agencies with jurisdiction by law or special expertise relevant to the WVS and its operations and maintenance to be Cooperating Agencies in compliance with 40 CFR 1501.6 (See also 40 CFR 1508.5). Cooperating Agencies listed on the cover page contributed to the EIS by providing information and input throughout the EIS planning and document preparation process. Additional information on each agency, including special expertise, is provided in Appendix L, Cooperating Agencies.

In addition to being Cooperating Agencies as defined under NEPA, BPA and BOR are Action Agencies as defined under the ESA. An Action Agency is any Federal agency that undertakes, authorizes, or funds a Federal action (i.e., an activity or program).

ESA Section 7 consultation processes with NMFS and USFWS were initiated for the continued operation and maintenance of the WVS. BPA and BOR agency missions rely on the WVS[8]; therefore, USACE, BPA, and BOR are ESA Action Agencies. Specifically, BPA is responsible for marketing hydropower generated at eight of the WVS dams. BOR issues contracts for water stored for irrigation in the WVS reservoirs. Both missions directly depend on how USACE operates and maintains the WVS.

BPA, BOR, NMFS, and USFWS have met regularly with USACE to help ensure EIS content accuracy and coordination with ESA consultations. This engagement informed the formulation and evaluation of the Proposed Action and the Draft EIS and Final EIS Preferred Alternatives. Coordination with Cooperating Agencies occurred at the technical team level, local leadership level, and regional leadership level.

1.7 U.S. Army Corps of Engineers-managed Dams, Reservoirs, and Bank Protection Structures in the Willamette River Basin

1.7.1 Dams and Reservoirs

Congress authorized USACE to construct, operate, and maintain the WVS for flood control purposes beginning in 1938 (Table 1.1-1). Subsequently, USACE constructed 13 dams and extensive bank protection revetments along the Willamette River and its tributaries, creating the WVS by the 1970s (Section 1.1, Background). All 13 dams are operated for multiple uses (Section 1.10, Congressionally Authorized Purposes).

While the WVS is operated as one system, each dam and reservoir within the WVS is authorized for a specific set of purposes by Congress. Three are re-regulating dams (i.e., used to even out peak discharges of water utilized for power generation at an upstream dam, thereby controlling downstream river level fluctuations). Foster Dam is operated as both a re-regulating dam and for storage. Eight of the 13 dams are operated to include hydropower production (USACE 2019b).

[8] Designation as "Action Agencies" for ESA purposes does not equate to co-lead agencies under NEPA.

Additional detail on the 13 dams and reservoirs is provided by subbasin description in Appendix S, USACE-managed Dams, Reservoirs, and Bank Protection Structures.

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING INFORMATION IN THE FEIS

1.7.2 Revetments and Other Structures for Bank Protection

1.7.2.1 Bank Protection Projects and Regulatory History

USACE, Portland District, manages and maintains bank protection structures (i.e., revetments) along the mainstem of the Willamette River and the following tributaries: Row, Calapooia, Coast Fork and Middle Fork Willamette, McKenzie, South Santiam, North Santiam, Santiam, Molalla, Clackamas Rivers, and Mill Creek. Portland District has the responsibility of administering the Willamette River Bank Protection Program. The Program consists of 223 Federally constructed projects authorized under the Flood Control Acts for flood control and erosion prevention (Table 1.1-1) (Appendix S, USACE-managed Dams, Reservoirs, and Bank Protection Structures).

Bank protection projects were constructed along the Willamette River and its major tributaries. The projects cleared, sloped, and armored river banks; constructed pile and timber bulkheads and drift barriers; and conducted minor channel improvements and maintenance of existing construction. Projects are composed of one or more structures and include additional structures associated with emergency repairs. Thirty-four additional bank protection or river training structures were also constructed under various other authorizations such as the River and Harbors Act and Mitigation and Emergency Bank Protection authorities for navigation or emergency bank protection purposes. These structures are not active in the Willamette River Bank Protection Program.

At the time the alternatives were analyzed, there were 193 active projects in the Willamette River Bank Protection Program, categorized as either USACE-maintained or non-USACE-maintained. Of these active projects, 88 were constructed prior to 1953 and constructed under the Flood Control Acts of 1936 and 1938 and are USACE-maintained (Figure 1.1-2). The Federal Government is responsible for providing funding to support inspection, monitoring, and maintenance activities for these 88 projects. The remaining 105 projects, constructed post-1953 and authorized under the 1950 Flood Control Act, are locally sponsored and operated and maintained by local sponsors.

1.8 Non-U.S. Army Corps of Engineers-managed Dams in the Willamette River Basin

In addition to the 13 USACE-managed dams in the Willamette River Basin, there are 247 other dams dispersed throughout the Willamette River Basin managed by other entities (USACE 2020h). Most of these non-USACE-managed dams are more than 50 years old and are small- to medium-sized facilities; there are few large dams and reservoirs in the basin. Most dams are below 30 feet in height, and only a few reservoirs have water storage capacity that exceeds

1,000 acre-feet. Most have under 500 acre-feet of storage capacity, and many have less than 100 acre-feet. More than 90 percent of the 247 dams are earth-fill.

Most of the dams are privately owned, although some are owned by municipalities or public utilities or are Federally managed by the USFWS, BOR, or U.S. Forest Service (USFS). Most purposes are for irrigation, recreation, fish- and wildlife-related planning, and to a smaller extent, hydroelectricity and municipal and industrial water supply. Of these 247 non-USACE-managed dams in the Willamette River Basin, only 38 dams are in subbasins containing WVS dams and reservoirs.

Combined with USACE-managed dams and reservoirs, these widely dispersed dams support the growing human population and economic activity in the Willamette River Basin by providing water (both agricultural irrigation and municipal/industrial supply) and recreational opportunities and by generating electricity. However, they also affect Willamette River hydrology and salmon runs by obstructing upstream and downstream migration and altering spawning and rearing habitat.

END NEW TEXT

1.9 U.S. Army Corps of Engineers Programs and Planning in the Willamette River Basin

USACE manages several ongoing programs in the Willamette River Basin in addition to operations of the dams and reservoirs throughout the WVS. These include the Willamette River Basin Bank Protection Program, the Willamette Hatchery Mitigation Program, adult fish facility operations, and the Research, Monitoring, and Evaluation Program.

1.9.1 Willamette River Basin Bank Protection Program

USACE is responsible for the Willamette River Basin Bank Protection Program, originally authorized by the 1936 Flood Control Act, which is detailed in Appendix S, USACE-managed Dams, Reservoirs, and Bank Protection Structures.

1.9.2 Willamette Hatchery Mitigation Program

Prior to construction of WVS dams, the Oregon Fish Commission operated salmon hatcheries on the North Santiam River, South Santiam River, McKenzie River, and the Middle Fork Willamette River. These hatcheries were responsible for the collection of Chinook salmon eggs from a part of each run as well as the subsequent rearing and liberation of young fish (Mattson 1948). About 30 percent of the adults returning upstream of Willamette Falls were collected for broodstock and spawned at these hatcheries in 1947.

To collect eggs, wooden weirs, called “racks,” were placed across rivers each spring, forcing adult Chinook salmon to hold in the river throughout the summer behind these racks. The eggs were then taken in late August and throughout September.

Disease and mortality were commonly noted as a result of fish being injured attempting to pass upstream of the wooden racks. This reduced the number of natural-spawning Chinook salmon or collection of eggs each year.

Construction of the dams further adversely impacted UWR spring Chinook salmon, UWR winter steelhead, resident trout, bull trout, and Pacific lamprey by physically blocking their migrations to and from habitat upstream of the dams and by inundating some habitat through the creation of reservoirs. In addition, construction of the dams and reservoirs submerged existing hatcheries on the Middle Fork Willamette, North Santiam, and South Santiam Rivers and required the relocation of existing hatchery brood egg-collection stations operated by the Oregon Fish Commission on the Middle Fork Willamette, McKenzie, North Santiam, and South Santiam Rivers.

The WVS was authorized with the recognition that it would prevent access to extensive areas of upstream habitat for migratory salmon and steelhead (House Document 81-531, App. J, 1732 (1950)) (HD531). To mitigate for the loss of migratory corridors and inundation of habitat and existing hatcheries, Congress also authorized USACE to carry out the Willamette Hatchery Mitigation Program, in coordination with BPA as a funding source, to fund production and release of hatchery salmon, steelhead, and resident trout in the Willamette River Basin.

HD531 also acknowledged that operations and maintenance of the dams could adversely impact anadromous fish because they created physical barriers to migration and habitat loss associated with controlled inundation for the reservoirs. Consequently, HD531 provided for production mitigation to offset fish losses due to construction and operation of the WVS.

Congress did not define detailed goals for the Hatchery Mitigation Program (e.g., the level of fish production to be achieved), allowing USACE to determine how to implement the Program within the Willamette River Basin, whether through hatchery programs, passage improvements, or a combination of those measures. Although some of the dams built in the 1960s included fish passage features, including Foster, Green Peter, Fall Creek, and Cougar Dams, these facilities were unsuccessful at meeting passage goals (Schwartz and McCroskey 2021). USACE also developed hatchery programs to mitigate for adverse impacts to fish passage (Table 1.9-1).

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING TABLE IN THE FEIS

Table 1.9-1. U.S. Army Corps of Engineers-constructed Fish Hatcheries.

Hatchery Name	Year Completed	Notes
Dexter Holding Ponds	1954	Located at Dexter Dam; mitigation for Dexter Dam; operated in conjunction with Willamette Hatchery.
Leaburg	1953	18.5 miles west of Cougar Dam; mitigation for Blue River and Cougar Dams.
McKenzie	1938, 1975	Rebuilt in 1975; mitigation for Blue River and Cougar Dams.
Marion Forks	1951	17.5 miles southeast of Detroit Dam; updated in 1986 and 2013; mitigation for Detroit and Big Cliff Dams.
Minto Adult Fish Facility	1953, 2013	3.8 miles west of Big Cliff Dam; rebuilt 2013; mitigation for Detroit and Big Cliff Dams.
Oakridge Salmon Hatchery[1]	1911, 1952	2.65 miles north of Hills Creek Dam; rebuilt in 1952; mitigation for Hills Creek, Lookout Point, and Dexter Dams; now part of Willamette Hatchery.
South Santiam	1968	Located at Foster Dam; mitigation for Green Peter and Foster Dams.
Willamette Hatchery[1]	1922, 1950s	2.65 miles north of Hills Creek Dam; rebuilt in 1950–1956; now part of the Willamette Hatchery.

[1] Two hatcheries collectively referred to as the Willamette Hatchery.

USACE funds the operation and maintenance of five hatcheries for mitigation and conservation within the WVS. The USACE Willamette Hatchery Mitigation Program is conducted in the North Santiam, South Santiam, McKenzie, and Middle Fork Willamette River Subbasins (Figure 1.9-1). The hatchery programs within these subbasins include UWR spring Chinook salmon, UWR summer steelhead, and rainbow trout.

Figure 1.9-1. Rearing Ponds at Marion Forks Fish Hatchery in the North Santiam Subbasin.

These five hatcheries contribute to the UWR Chinook salmon[9] (Section 1.3.2, Endangered Species Act). UWR summer steelhead and rainbow trout are produced exclusively for sport harvest interests. The purpose of the Hatchery Mitigation Program is to supplement the natural origin population and to support reintroduction of spring UWR Chinook salmon in the WVS due to very low abundances, high extinction risks, and lack of fish passage at some WVS dams.

Recently completed Hatchery Genetic Management Plans (HGMPs), prepared jointly by Oregon Department of Fish and Wildlife (ODFW) and USACE for compliance with the ESA, provide the most up-to-date definition of hatchery fish production commitments for the USACE Willamette Hatchery Mitigation Program (NMFS 2019a)[10]. Hatchery performance goals are driven by standards and performance targets identified in the HGMPs for the North Santiam, South Santiam, McKenzie, and Middle Fork Willamette River Subbasins (Figure 1.9-2).

[9] For purposes of this EIS analysis, an evolutionarily significant unit—or ESU— is a Pacific salmon population or group of populations that is substantially reproductively isolated from other conspecific populations and that represents an important component of the evolutionary legacy of the species.

[10] "HGMPs are technical documents that thoroughly describe the composition and operation of each individual hatchery program. The primary goal of an HGMP is to describe biologically-based artificial propagation management strategies that ensure the conservation and recovery of ESA-listed salmon and steelhead populations. [NMFS], who oversees the ESA for salmon and steelhead, uses the information provided by HGMPs to evaluate impacts on salmon and steelhead listed under the Endangered Species Act. Completed HGMPs may also be used for regional fish production and management planning by federal, state, and tribal resource managers" (https://wdfw.wa.gov/fishing/management/hatcheries/hgmp).

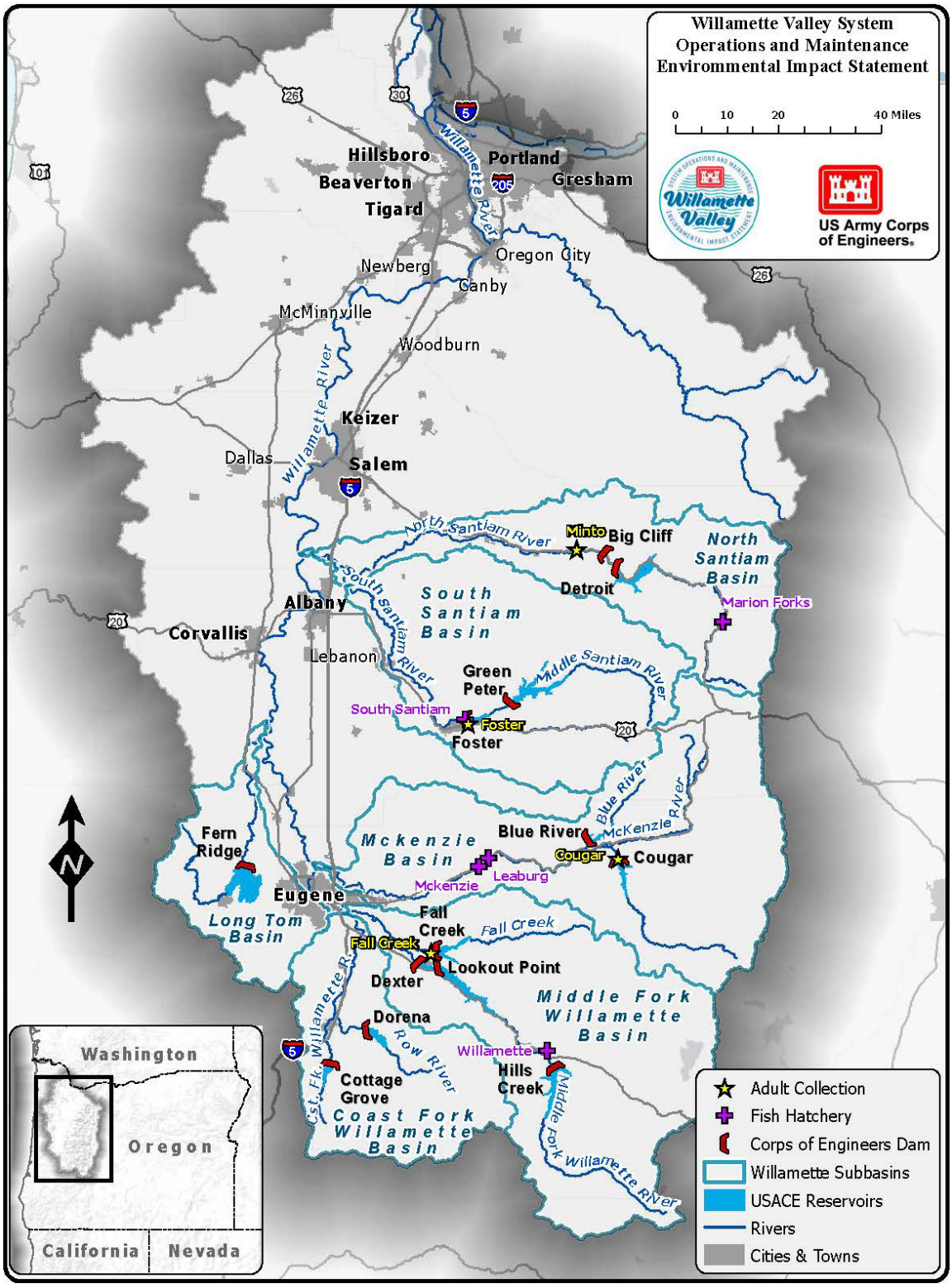


Figure 1.9-2. Willamette Valley System Fish Hatcheries and Adult Fish Facilities.

ODFW co-owns, maintains, and operates the hatcheries with funds from USACE and the State of Oregon. USACE also promotes resident fisheries throughout the McKenzie River Subbasin through the continued support of Leaburg Hatchery and as a partner with several agencies in efforts to support Oregon chub populations and to recover ESA-listed bull trout within the McKenzie River Subbasin (USACE 2020a).

Marion Forks Hatchery in the North Santiam River Subbasin was constructed in 1951 to compensate for the loss of salmon and steelhead habitat caused by construction of the Detroit and Big Cliff Dams without adult fish passage (Figure 1.9-2). Minto Fish Facility is an adult fish facility located downstream of Big Cliff Dam. USACE constructed the Minto Fish Facility to collect adult UWR Chinook salmon as broodstock (mature individuals used for breeding purposes) to supply eggs for Marion Forks Hatchery (USACE 2019b).

1.9.3 Adult Fish Facilities

USACE operates and maintains adult fish facilities located at Foster, Fall Creek, Minto (downstream of Big Cliff), Cougar, and Dexter Dams to help reduce adverse passage effects from WVS dams and to assist with upstream fish migration. These facilities have been redesigned to accommodate adult salmon and steelhead collection, sorting, outplanting, recycling (summer steelhead), monitoring, and juvenile acclimation of spring UWR Chinook salmon (Figure 1.9-3).

Figure 1.9-3. Cougar Dam Adult Fish Facility.

Although the design and current operations of the facilities are focused on UWR spring Chinook salmon and UWR winter steelhead, the adult fish facilities are also used to pass any native migratory fish species that are collected during the trap operations, including lamprey. Due to the lack of lamprey trapping infrastructure, lamprey passage is very rare.

Fish that are collected and require transport are loaded into specialized trucks designed for the safe transportation and release of fish (i.e., trap and transport) (Figure 1.9-4). Many release sites have dedicated infrastructure to reduce injuries and mortality for fish released above a dam (e.g., release pipes).

Figure 1.9-4. Trap and Transport Tanker Truck.

1.9.4 Research, Monitoring, and Evaluation

The 2008 NMFS Biological Opinion documented a lack of information necessary to make informed adaptive management decisions[11] and to track and document progress toward achievement of the RPA measures (NMFS 2008) (Section 1.3.2, Endangered Species Act; Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008). Additional information was needed on local environmental conditions, specific effects of the WVS on UWR spring Chinook salmon and UWR steelhead, operational constraints, technical feasibility, and effectiveness of actions taken to achieve substantive RPA measures. Consequently, the 2008 NMFS Biological Opinion included development of a

[11] Adaptive management is a systematic approach for improving resource management by learning from management outcomes…An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions (USDI 2009).

comprehensive research, monitoring, and evaluation program to obtain this needed information (NMFS 2008).

The program is managed with considerable coordination and input from the Willamette Action Team for Ecosystem Restoration (WATER) Forum established from the 2008 Biological Opinion to provide this input[12] (Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocations).

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING INFORMATION IN THE FEIS

1.9.5 Forecast-informed Reservoir Operations

Forecast-informed Reservoir Operations refers to a strategy that integrates additional release decision flexibility. This strategy is based on flood risk mitigation and is framed by use of enhanced observations and/or improved weather and streamflow forecasts.

Forecast-informed Reservoir Operations seek to improve outcomes in water supply, fish and wildlife, hydropower, and recreation authorized purposes without material increases in flood risk. To accomplish this goal, this strategy is designed as a partner- and stakeholder-informed viability study that identifies flood risk and benefits among several operational options (i.e., alternatives) for release decision-making.

The outcome of the Forecast-informed Reservoir Operations strategy development is a non-binding recommendation for updating the water control plan that USACE may elect to pursue in a formal request to Congress while ensuring NEPA and other regulatory requirements are met.

The USACE Directorate of Civil Works has committed to a multi-year viability study of Forecast-informed Reservoir Operations in the WVS.

END NEW TEXT

1.10 Congressionally Authorized Purposes

The WVS authorization history is described in Section 1.1, Background. The authorization purposes are detailed below.

Each of the 13 dams and reservoirs within the WVS are operated according to a Water Control Manual authorized by Engineering Regulation 1110-2-240. These manuals provide specific information to meet the Congressionally authorized purposes of flood risk management, generation of hydropower, fish and wildlife, recreation, navigation, irrigation, municipal and

[12] WATER, a collaborative advisory body made up of USACE, other Federal and state agencies with fisheries and water resource management responsibilities in the Willamette River Basin, and affected tribes, was established under the Services 2008 Biological Opinions to coordinate with USACE on operation of the WVS (NMFS 2008; USFWS 2008)

industrial water supply, and water quality. The manuals also detail operations, procedures, and rule curves[13] for each dam and reservoir.

Each manual includes a Drought Contingency Plan that addresses flow needs, drought management organizations, a drought assessment process, and a framework to carry out a drought response. The draft Master Water Control Manual for the Willamette Valley Project describes operations of the 13 dams and reservoirs as a system to meet the Congressionally authorized purposes of the WVS (USACE 2015a). The draft manual will be completed following a NEPA review tiered from this EIS (Section 1.3.1.1, Programmatic Reviews and Subsequent Tiering under the National Environmental Policy Act).

1.10.1 Flood Risk Management

Flood risk management is the primary authorized purpose of the WVS dams. The dams are operated as a system providing flood risk management on six major tributaries affecting approximately 27 percent of the watershed area upstream of Portland, Oregon. The 13 dams are operated as a system to prevent an estimated $1 billion in flood damages annually, based on the Annual Flood Damage Reduction numbers reported to Congress from 1994 to 2022, at 2022 price levels.

USACE coordinates with multiple partnering agencies to efficiently execute its flood risk management mission:

- National Oceanic and Atmospheric Administration's (NOAA's) Northwest River Forecast Center is responsible for flood forecasting and is co-located with the National Weather Service, which is responsible for both meteorological forecasting and the issuance of flood warnings. These two offices coordinate closely with USACE's Portland District for dissemination of river information and forecasts.
- The Natural Resources Conservation Service is responsible for obtaining hydrologic data. The Conservation Service Snow Survey monitors snow water content and cumulative precipitation at many stations in the Willamette River Basin. Both the Natural Resources Conservation Service and National Weather Service develop volume runoff forecasts in the spring of each year based on data provided by these field stations. These data are essential for planning for the best use of available water to meet the multiple purposes of the WVS.
- The U.S. Geological Survey (USGS) in Portland, Oregon, with field assistance from its Eugene, Oregon office, has the responsibility of collecting, calibrating, and publishing streamflow and water quality data in the Willamette River Basin.

[13] A rule curve is seasonal reservoir elevation target or restriction, represented graphically as curves, that guide reservoir operations.

1.10.2 Hydropower

Federal hydroelectric power facilities are installed at 8 of the 13 USACE dams in the Willamette River Basin (Figure 1.10-1). The volume of water flowing through a dam and the change in elevation, known as fall or head, from one point to another determines the amount of available energy in moving water. In general, the greater the water flow and the higher the head (fall), the more electricity a hydropower plant can produce.

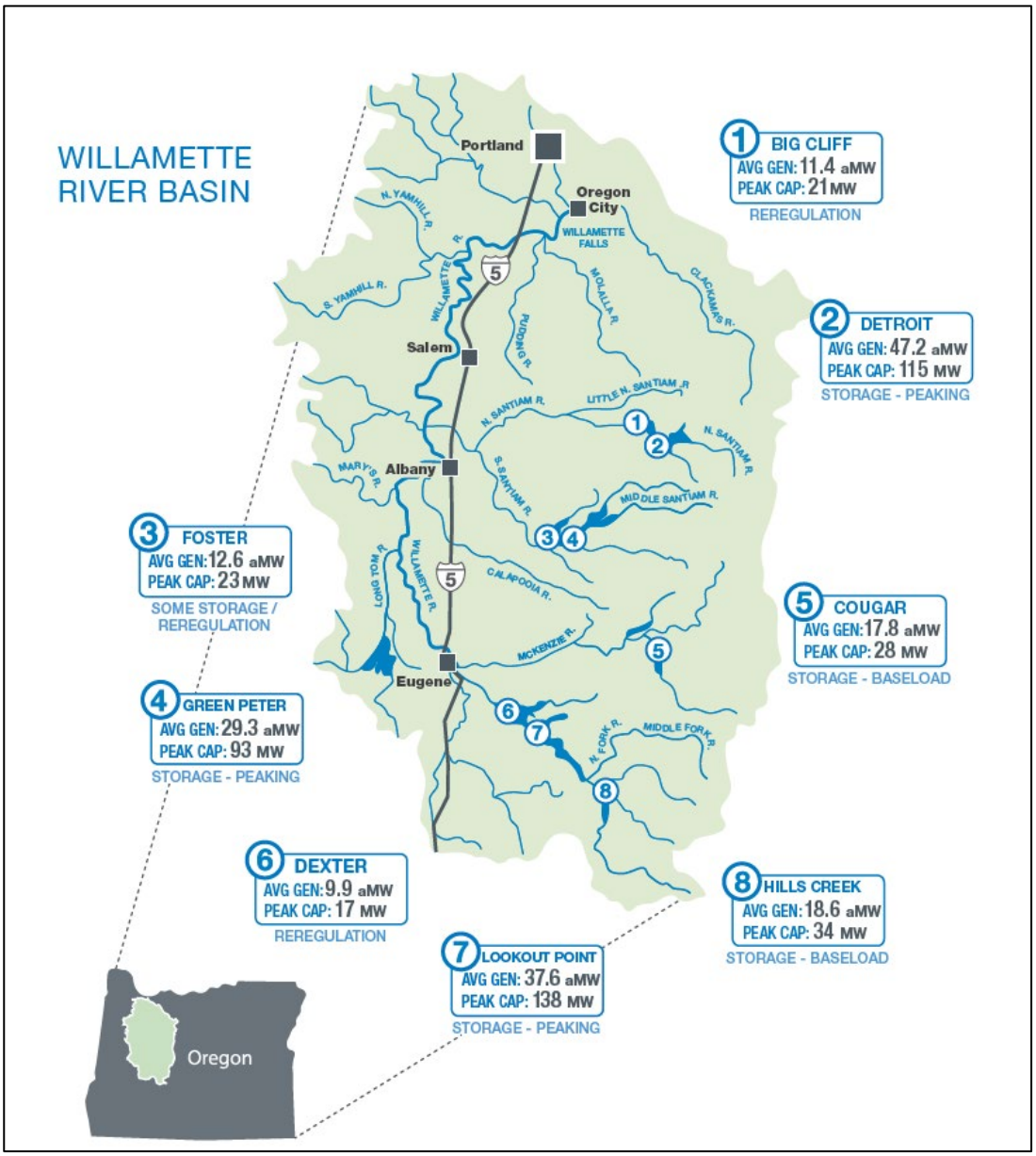


Figure 1.10-1. Locations, Dam Type, and Capacities of Hydropower Units in the Willamette Valley System.

Hydropower plants are located at the base of dams. At a hydropower plant, water moving past a dam flows through a pipe, or penstock, and then pushes against and turns blades in a turbine to spin a generator to produce electricity (Figure 1.10-2 and Figure 1.10-3).

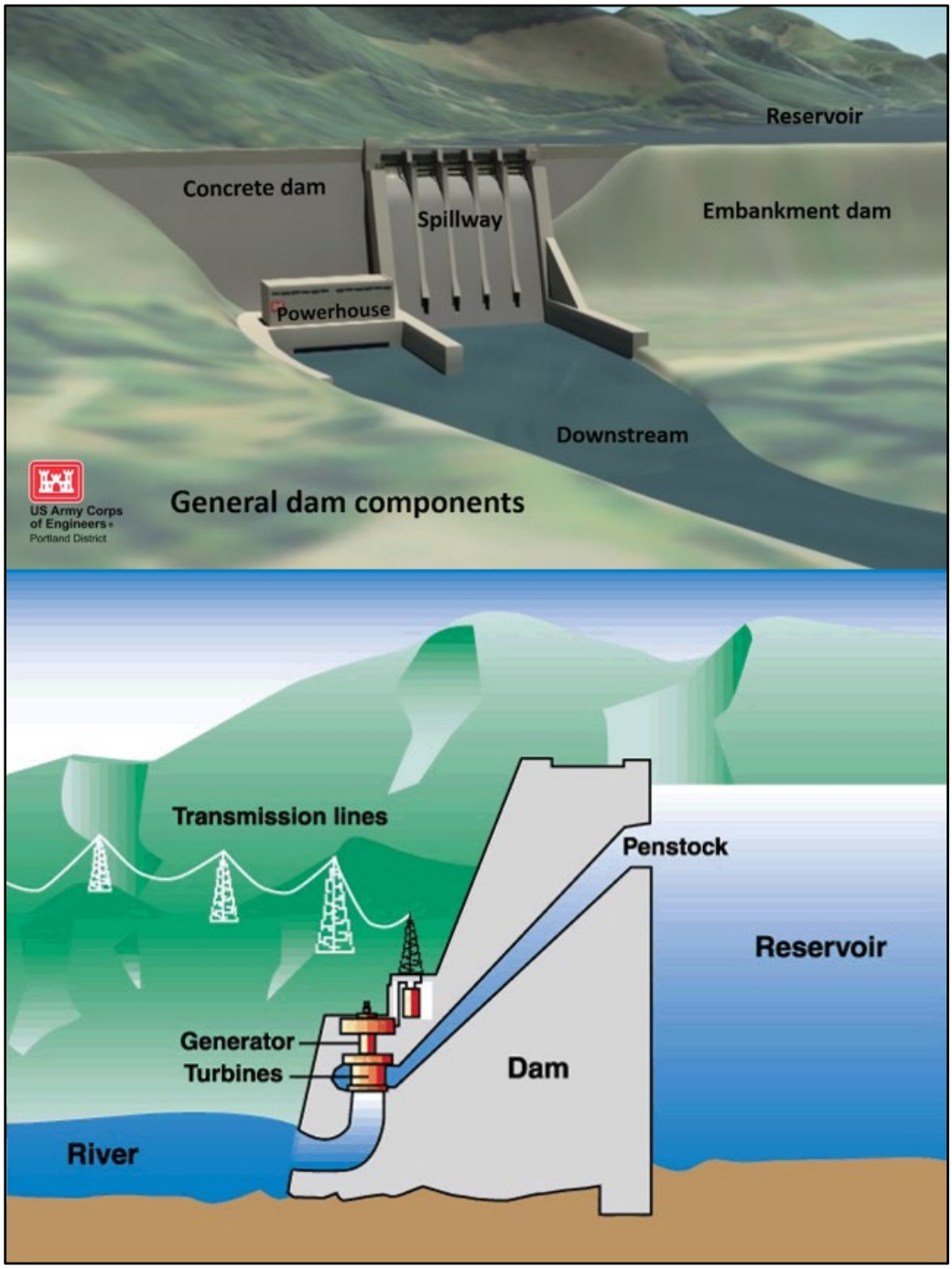


Figure 1.10-2. General Dam Components (upper diagram) and Hydropower Dam Components (lower diagram).

Figure 1.10-3. Transmission Lines Extending from the Powerhouse at Detroit Dam.

In the WVS, all water flow through dams is directed through the hydropower plants, or generating facilities, unless there are special circumstances that require use of another outlet. Special circumstances include operations for downstream fish passage, operational temperature control, turbine power outages, or outflow that exceeds turbine capacity.

Operation of the power transmission facilities at the dams is a highly coordinated effort between USACE and BPA. BPA is a non-profit, Federal power marketing administration located in the Pacific Northwest responsible for maintaining the safety and reliability of the transmission grid and for marketing electrical energy generated at the WVS dams and reservoirs (Appendix L, Cooperating Agencies).

There are two main types of Federal hydropower dams in the WVS: storage dams and reservoirs that receive unregulated inflow and re-regulation dams and reservoirs that receive and moderate dynamic flows from upstream dams—Foster Dam performs both storage and re-regulation functions. Power generation from storage dams and reservoirs is often based upon daily, weekly, and seasonal fluctuations in power demand (i.e., load); flows downstream are therefore subject to fluctuations that require re-regulation (Section 3.12, Power Generation and Transmission).

The re-regulation reservoirs are used to absorb the fluctuations in flows from upstream storage dams and reservoirs and to ensure downstream river flows are uniform for protection of aquatic habitat and human life and bank stability.

Lookout Point, Detroit, and Green Peter Dams are storage dams and reservoirs; their outflows are re-regulated by Dexter, Big Cliff, and Foster Dams, respectively, located downstream. Foster

Dam and Reservoir is also a storage facility because it receives unregulated inflow from the South Santiam River along with controlled flows from Green Peter Dam and Reservoir.

Hills Creek and Cougar Dams are storage dams and reservoirs without associated re-regulation dams located downstream but they do generate hydropower. Dorena Dam has a private hydropower facility regulated by FERC, and power generated is not part of the BPA system.

Hydropower operations are generally flexible and can allow electricity generation to vary with daily and seasonal demand. During the critical power production period from October through March, reservoirs at hydropower facilities have allocated storage space for power generation called the "power pool." This is water stored for when there are generally high demands for electricity.

1.10.3 Fish and Wildlife

The WVS is operated and maintained in a manner that supports fish and wildlife. Reservoirs and surrounding areas provide opportunities for sport fishing and wildlife hunting, improving habitat, and preserving wildlife. Under this purpose, USACE conducts projects to restore ecological function, promote species biodiversity, and monitor sensitive species. Additionally, USACE has modified operations to support habitat within the reservoirs and to augment stream flows downstream of dams during dry months.

1.10.4 Recreation

Recreation use and development is authorized at all the WVS dams and reservoirs. Recreational facilities managed by USACE (or other agencies or private organizations) are provided at all USACE dams and reservoirs and in the Willamette River below the dams. USACE cooperates with the USFS, Oregon State Parks, ODFW, and Linn and Lane Counties to build and manage a system of water-related recreation facilities.

Recreational demand in the Willamette River Basin places pressure on maintaining reservoirs at high levels for summer and early fall months. Many boat ramps and marinas become unusable when reservoir levels become abnormally low due to drought or other factors, which often occur during peak recreation season.

1.10.5 Navigation

Navigation was authorized at most of the dams and reservoirs in the WVS. HD531 recognized low channel depths due to increased withdrawal of streamflow as an impediment to navigation upstream of Willamette Falls. The navigation purpose is met by release of water for water quality and biological needs.

Storing excess spring runoff and releasing this stored water during the low-flow season would provide adequate channel depth from Corvallis, Oregon through the Willamette Falls. However, the upper river above Willamette Falls Locks is no longer utilized by commercial navigation. HD531 documents that flows released for navigation on the Mainstem Willamette River, with

flow targets at Albany and Salem, Oregon[14], would also reduce pollution concentrations in the river, providing for improved water quality and fish life.

1.10.6 Irrigation

Agriculture is an important part of the vitality and economy of Oregon.

There are 37,200 farms in Oregon, which generate $5.01 billion in agricultural products. Of these farms, 19,468 farms are in the Willamette River Basin, producing $2.3 billion in agricultural products. The total land area in farms in the Basin is 1.58 million acres, or approximately 17 percent of the land area of the Basin (ODA 2021a).

Agricultural irrigation diversions in the Willamette River Basin are not centralized. There are eight irrigation districts in the Basin; however, most irrigation needs are met via individual wells or diversions. In the Basin, there are more than 18,000 water rights permitted for irrigation uses, representing 65 percent of all authorized water rights.

Oregon ranks first in the United States for producing several commodities, including hazelnuts, multiple varieties of grass seed, and Christmas trees (ODA 2025).

There are presently no supplemental USACE releases intended specifically for irrigation use. Withdrawals associated with BOR's irrigation water service contracts are generally met within normal dam operations and releases (Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocation).

1.10.7 Municipal and Industrial Water Supply

Municipal and industrial water supply was an originally authorized purpose, as listed in authorizing HD531 (Appendix J, Water Supply Analysis). However, the need for municipal and industrial storage was found to be relatively low at the time the storage capacity of the reservoirs was planned. The Water Supply Act of 1958 (Public Law 85-500) added water supply as an authorized purpose at USACE dams and reservoirs.

The Willamette River and its tributaries are a major source of water for municipal and industrial needs; these systems rely on natural flow in the Willamette River Basin along with groundwater wells. However, population growth is leading to a demand for water that exceeds existing supplies for many systems throughout the Basin. This need was one of the factors that led to the Willamette Basin Review Feasibility Study along with strong support from the State of Oregon and municipal water providers (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008). The Feasibility Study resulted in the reallocation of 159,750 acre-feet from conservation storage used for all

[14] A flow target is the volume of water intended to be met at a given location. HD531 identifies Albany, Oregon, and Salem, Oregon, as locations where minimum flows are to be met.

authorized purposes to municipal and industrial water supply (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008).

To date, there are no signed agreements to use storage from any of the WVS reservoirs for municipal and industrial water supply, but there is considerable interest among water suppliers in the Willamette River Basin for such use (Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocation). As of 2023, USACE was processing a request from Eugene Water and Electric Board for 437 acre-feet of storage from the Dorena and Cottage Grove Reservoirs.

1.10.8 Water Quality

HD531 authorizes the release of water for "stream purification" by diluting pollution levels. Congress anticipated that the water released for navigation purposes would increase discharges on the upper Willamette River threefold and approximately double present low-water discharges on the lower river (HD531), diluting pollution levels in the Willamette River.

In the 1996 Water Resources Development Act (Pub. L. No. 104-303) and 1999 Water Resources Development Act (Pub. L. No. 106-53), Congress authorized construction of a water temperature control tower at Cougar Dam. The control tower was implemented to manage water temperatures downstream of the dam for the benefit of spring Chinook salmon and native trout, including bull trout, which were listed as threatened under the ESA in 1999.

1.11 Willamette Valley System Operations and Annual Operational Planning

Operation of the WVS generally follows a seasonal cycle and is dynamically managed to meet several related, but sometimes conflicting, objectives. These objectives include:

- ✓ Providing adequate flood storage space for managing floods downstream.
- ✓ Providing sufficient water levels for water quality, recreation, and fish and wildlife.
- ✓ Providing adequate water releases for water quality and fish and wildlife.
- ✓ Providing adequate water supply for irrigation and municipal and industrial uses.
- ✓ Maximizing power generation within the requirements imposed by other objectives.

Seasonal Operational Cycles

The seasonal cycle that is generally followed includes the winter flood risk management season, spring conservation storing (refill) season, and summer and fall conservation use season.

The exact timeline of water control operations can shift depending on the dam, reservoir, and season (Table 1.11-1).

THE DEIS HAS BEEN MODIFIED TO REVISE THE FOLLOWING TABLE IN THE FEIS

Table 1.11-1. Generic Reservoir Water Control Operations by Month.

Months	Operation	Description
November/ December – January	Winter Flood Risk Management Season	Reservoirs maintained near minimum flood/conservation pool elevations. During storm events, inflows are retained, and water is released downstream to minimize flooding effects.
February – May	Conservation Storing Season	Water is stored in the reservoir for later use for purposes such as minimum flows for fish, water supply, irrigation, recreation, and power production while still operating for its flood risk management purpose. Refill of the reservoirs according to the water control diagram during the conservation storing season is largely dependent on rain events and releases for ESA-listed-fish flow requirements, but maximum conservation pool is generally reached in May.
May – November	Conservation Release Season	Stored water is released for conservation benefits, such as minimum flows for fish, water supply, irrigation, recreation, and power production.

Operating the WVS to meet multiple purposes is in part made possible by releasing water through outlets located at various depths in each dam. Surface water can be released over a spillway when there is sufficient stored water (Figure 1.11-1).

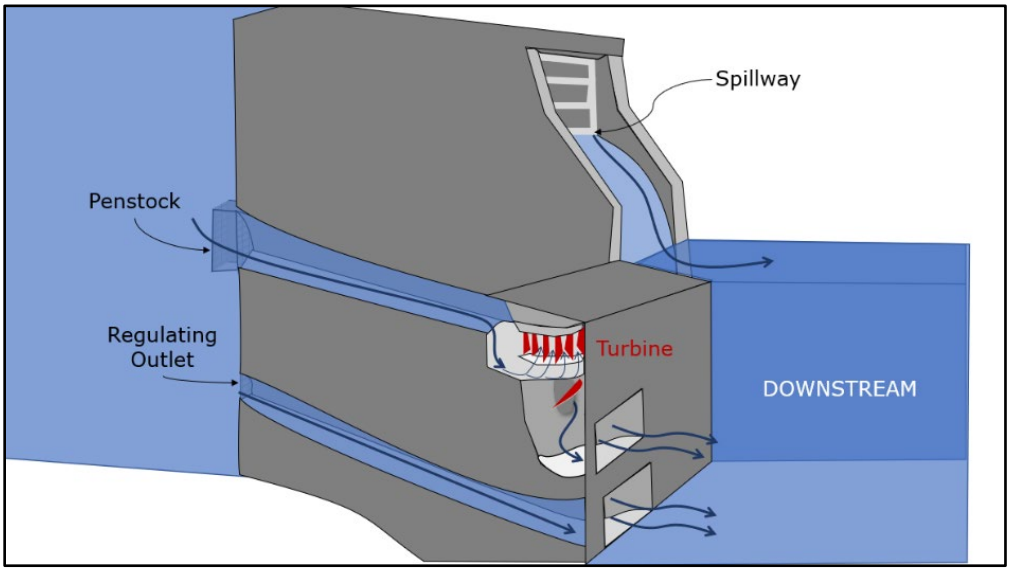


Figure 1.11-1. Hydropower Dam Outlet Configuration.

Spillways are structures that either form part of a dam or are found just beside it. Spillways are located high in the reservoir and allow for large volumes of water to be released. Many WVS dams have spillways with gates that allow operators to control flow over the spillway anytime the reservoir is high enough (i.e., spillgates). These outlets pass floodwater safely and in a controlled way, but also have been used for fish passage and downstream temperature management. However, these outlets are not available to release water once reservoir water elevations drop below the operational elevation of a spillway. Spillways that do not discharge immediately into the channel are only used for large flood control operations such as at Hills Creek, Fall Creek, Cougar, and Blue River Dams.

Water is also released through the regulating outlets located at a lower elevation than the spillways on the dam and deeper in the reservoir. These consist of pipes, box culverts, or tunnels with gates or valves to regulate the flow rate (Figure 1.11-1).

Hydropower dams have an additional outlet, the penstock, that directs water through the turbines to produce power[15]. Some dams have multiple penstocks.

The multiple outlets and USACE operational procedures allow some flexibility in WVS operations as USACE attempts to meet the diverse and changing needs of the region based on information that becomes available during an operating year. Many factors cause short-term operational adjustments. For example, periods of heavy rain can cause high flows in the winter, spring, and fall. In a dry year, minimum fish flows and other constraints dictate how much water USACE must discharge.

Actual operations occur as "real time," that is, decisions must be made in a few minutes, days, or at most, a few weeks. Operators regulate the WVS to satisfy all the various purposes contained in the annual operating plan. In-stream conditions for fish, generator outages, the weather, and even the timing of recreational events can influence operational decisions. Periodic maintenance and inspection activities also affect reservoir levels and outlet priorities.

General procedures for reservoir elevation and water control, as well as the annual system operation processes and activities, are described below.

1.11.1 Reservoir Pools and Water Control

Reservoir water storage capacity can be conceptualized as pools making up an overall reservoir pool. Pools indicate designated purposes or management targets and occupy elevation bands that shift by season or specific operating conditions.

A typical WVS reservoir comprises flood, conservation, power (if a power-producing dam), inactive, and dead pools (located below any outlets, rendering water in this deep pool area inaccessible for release through the dam).

[15] Dams that produce hydropower in the WVS include Cougar, Hills Creek, Lookout Point, Dexter, Foster, Green Peter, Detroit, Big Cliff, and Dorena Dams.

THE DEIS HAS BEEN MODIFIED TO REVISE THE FOLLOWING INFORMATION IN THE FEIS

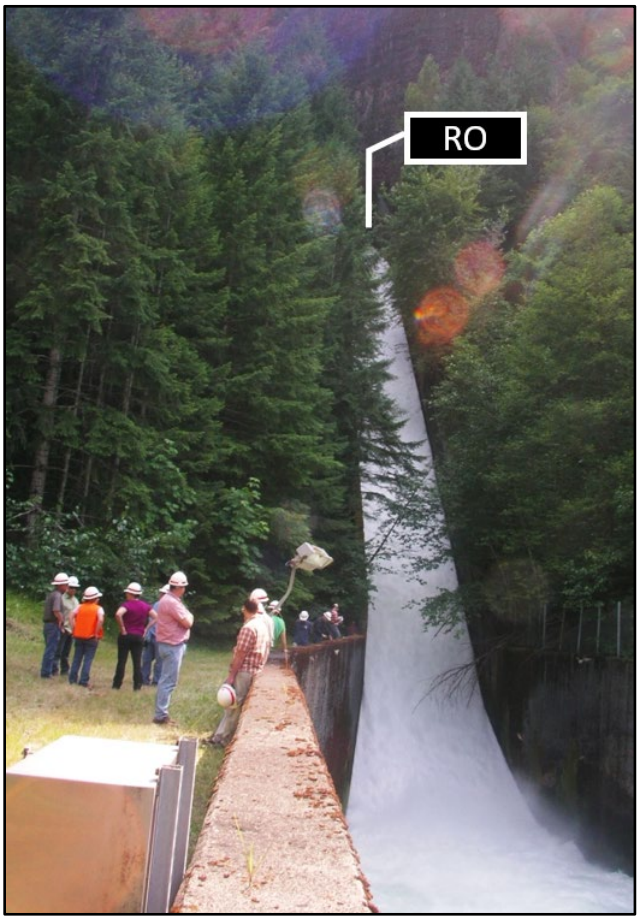
Flood Pools	Flood pools contain space used during storm events to retain flood waters that reduce downstream risks. The flood pool is further designated by primary flood and secondary flood storage pools that pertain to different management conditions. Storage volumes are seasonal and defined by the rule curve (more in the winter, less in the summer). The summer flood storage pool is the space above the conservation pool up to the maximum allowable elevation of a reservoir. When this pool is filled, it is called "full pool."
Conservation Pools	Conservation pools contain the space allocated for conservation season Congressionally authorized purposes. The storage space is allocated between municipal and industrial water supply, agricultural irrigation, and fish and wildlife, but also supports water quality, recreation, and hydropower. The conservation pool overlaps some of the same elevation levels as the flood pool, but the conservation pool does not rise to the elevation of the overall reservoir maximum pool. Minimum flood pool and minimum conservation pool elevations are the same.
Power Pools	Power pools contain the space allocated for the generation of hydropower and lie below the conservation and flood pools and a distance above the penstock intake. All dams with hydropower facilities include storage space designated for power generation during the critical power period from October through March. This storage is relatively small and is between minimum conservation pool and minimum power pool elevations. The power pool is generally kept full to increase the hydraulic head, defined as the potential energy of water due to its height above the bottom of the dam, for hydropower generation.
Inactive/Dead Pools	The inactive pool is the lowest storage area in a reservoir and contains space designed to trap sediment. The inactive pool is below the normal operating minimum pool down to the lowest outlet. Similar to an inactive pool, a dead pool is the space also designed to trap sediment but is located below the lowest outlet.

END REVISED TEXT

1.11.1.1 Water Control Diagrams

To manage for the different purposes and seasonal needs, USACE utilizes water control diagrams (Figure 1.11-2). Individual water control diagrams depict allocated pools and elevations, also known as water-year-based rule curves[16], over the course of a year for each dam operation.

Water control diagrams are contained in the water control manuals for each individual dam and reservoir, along with detailed operations and procedures. The draft Master Water Control Manual integrates the operation of the individual dams and reservoirs to meet the system-wide goals of the WVS (Section 1.10, Congressionally Authorized Purposes).



Unknown Photo Credit (USACE Media Images Database)

Regulating Outlet and Channel at Cougar Dam.

[16] A rule curve is a seasonal reservoir elevation target or restriction, represented graphically as a curve, that guide reservoir operations.

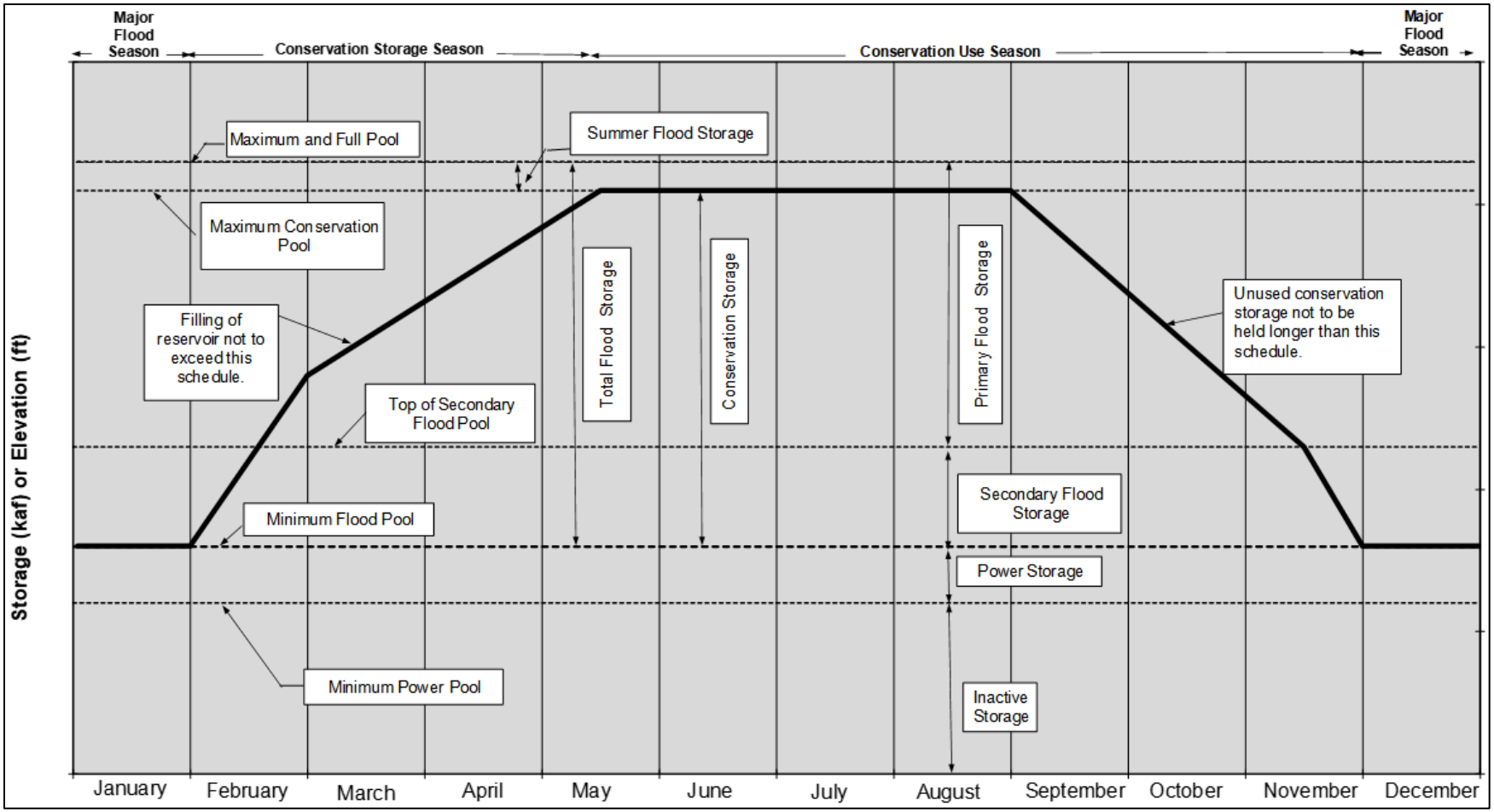


Figure 1.11-2. Typical Water Control Diagram for WVS Dams and Reservoirs.

Departures from the rule curves (storage or elevation targets) during reservoir refill may be necessary due to the need for regulation of floods, excessive snowpack above the reservoirs, inadequate water supply, or critical power needs. Refill can be delayed when high runoff is expected, as this provides additional storage for flood damage reduction operations. Generally, each reservoir may be filled at a rate no faster than shown by the rule curve or as described in the water control manual unless the reservoir is being managed for downstream floods or there is an approved deviation.

When excess flood water stored above the rule curve is released, discharges are targeted to stay at or below downstream channel capacity. During dry conditions, the reservoir may be higher than the rule curve to reduce the risk of not filling the reservoir. Maintaining minimum in-stream flows downstream of a dam generally takes precedence when water supply is inadequate to maintain both minimum flows and the scheduled rate of filling, per the 2008 NMFS Biological Opinion (NMFS 2008) (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008).

1.11.1.2 Conservation Pool Allocation

Under the 2008 RPA, USACE and BOR were directed to work toward protecting instream flows. A key step in complying with the RPA was completion of the Willamette Basin Review Feasibility Study (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008). In December 2020, Congress authorized a substantial reallocation of the conservation storage space in the WVS reservoirs for three purposes: fish and wildlife, municipal and industrial water supply, and agricultural irrigation (Table 1.11-2) (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008).

Table 1.11-2. Authorized Use Allocation of Combined Conservation Storage.

Purpose	Acre-feet of Combined Storage Space
Fish and Wildlife	1,102,600
Agricultural Irrigation	327,650
Municipal and Industrial Water Supply	159,750

Storage allocations were based on forecasted peak water demand in the year 2070, following the 50-year planning horizon of the Willamette Basin Review Feasibility Study. For the purposes of this EIS, the demand for municipal and industrial water supply and agricultural irrigation was calculated to the year 2050 to address the 30-year implementation timeframe of the alternatives in this EIS.

RPA Measure 2 in the 2019 NMFS Biological Opinion includes a limit on new municipal and industrial water supply agreements of 11,000 total acre-feet until certain conditions are met (NMFS 2008) (Section 1.3.3, Willamette Valley System Endangered Species Act and National Environmental Policy Act History Since 2008). It further restricts USACE from executing any

agreements in the Santiam River Subbasin until NMFS issues a written statement that instream water rights are in place and providing sufficient protection to flows intended to benefit fish. Under any alternative, USACE would continue to work with BOR and the State of Oregon to ensure stored water released for fish and wildlife is protected instream. Consequently, USACE determined it is reasonable to assume this cap would be lifted in the future for EIS analysis purposes, allowing USACE to enter into agreements for the full allocation, which is projected to occur over the next 50 years.

Agricultural irrigation was anticipated to be a substantial use of water stored in the WVS reservoirs when the system was first authorized by Congress. BOR administers water service contracts for irrigators within 15 water service contract reaches. Irrigation use from the WVS reservoirs in the Willamette River Basin has not increased as initially projected in the authorizing legislation and is not expected to increase at levels near the scope and scale originally envisioned.

The 2008 NMFS Biological Opinion RPA included a cap of 95,000 acre-feet for irrigation water service contracts. The 2019 NMFS Biological Opinion maintained this cap (Section 2019 Biological Opinion Reasonable and Prudent Alternative, below). As of June 2024, there were 277 BOR water service contracts for 84,349 acre-feet of water per year (approximately 5 percent of the conservation storage).

USACE does not make special operational adjustments, such as increasing flow releases, to meet contract requirements. In “deficit" water years, as defined in the 2008 NMFS Biological Opinion, partial water supply or no water supply may be available to satisfy irrigation contracts. Water deliveries may be ceased or curtailed under these conditions, per RPA Measure 3.4 (NMFS 2008). In other years, the RPA requires USACE to release more than minimum flow to ensure water service contract users do not take water intended for fish purposes (this does not apply in the Long Tom River or Coast Fork Willamette River Subbasins).

The fish and wildlife allocations were based on how much stored water is used to augment natural streamflows to meet the 2008 Biological Opinion flow targets. As of 2024, USACE and BOR were working with the Oregon Water Resources Department to use this allocation in the State’s process of converting Minimum Perennial Streamflows (MPSFs) into instream water rights. This process will provide the mechanism needed for the State to ensure water releases provide intended fish and wildlife benefits.

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2019 Willamette Basin Review Biological Opinion Reasonable and Prudent Alternative

The NMFS 2019 Biological Opinion RPA included five measures for USACE implementation of the Willamette Basin Review so that effects are not likely to jeopardize Upper Willamette River Chinook salmon and Upper Willamette River steelhead or adversely modify their designated critical habitat.

RPA Measure 1 Required that USACE request to retain sufficient local authority to modify the reallocation without further Congressional action. Congress included language as part of the Willamette Basin Review Reallocation Authorization in the 2020 Water Resources Development Act giving USACE the ability to reallocate up to 10 percent of storage without further approval from Congress.

RPA Measure 2 Required USACE to defer entering into any new water storage contracts for municipal and industrial use beyond an agreed-upon cap at projected 2025 demands of 11,000 acre-feet until instream flows are protected by the state, with no agreements in the Santiam River Subbasin.

RPA Measure 3 Required that new water supply agreements for municipal and industrial uses will specify restrictions that are consistent with the 2008 Biological Opinion requirements for new and renewed water service contracts issued by the BOR.

RPA Measure 4 Required USACE to work to meet 2008 Biological Opinion flows (or subsequent targets from a new Biological Opinion). Additionally, the Flow and Water Quality Management Team will convene to adaptively manage the Willamette Valley System and will make recommendations to USACE for curtailment if forecasts indicate flows will not be met.

RPA Measure 5 Required USACE to annually document the Willamette Basin Project Conservation Release Season Operating Plan (also known as the Conservation Plan) progress from the previous water year in a Willamette Basin Year in Review Report. USACE will also participate in an annual coordination meeting with NMFS to discuss the annual report before finalizing a Conservation Plan for the next water year.

Per the 2019 Willamette Basin Review Biological Opinion, USACE will continue to coordinate with the WATER Forum when there is not enough water to meet instream flow targets for both fish and consumptive uses of stored water. The WATER Forum includes the Flow Management and Water Quality Team, which provides advice to the USACE Water Management group on in-season adaptive management. This group was identified in the 2019 Willamette Basin Review Biological Opinion to recommend reductions during dry years for municipal and industrial agreement holders.

END NEW TEXT

1.11.2 Water Control Annual Planning

The conservation season is approximately from February through October but can extend through November when the minimum conservation pool is reached and includes the spring filling season and the summer conservation season. Forecasts are required during the conservation storage period to assess the timing and capability of refilling to the desired maximum conservation elevation of individual dams and reservoirs while prioritizing flood risk management. Operational planning for the conservation release season begins with the March water supply forecast[17].

Forecasts during the conservation season are needed to maintain spring mainstem flows based on the minimum flow objectives for ESA-listed species included in the 2008 NMFS Biological Opinion (NMFS 2008). The Willamette Basin Project Conservation Release Season Operating Plan (Conservation Plan) is prepared annually to provide flow requirements based on the Willamette River Basin water supply for that year. The Conservation Plan identifies flow and storage needs for each tributary and USACE reservoir in the WVS and Mainstem Willamette River control points.

The hydrology of the basin is not conducive to long-range runoff forecasting for daily reservoir regulation purposes. A major portion of the runoff during November through March and even into early June occurs as a direct result of rainfall. Detailed forecasts are not quantitatively predictable beyond 24 to 48 hours.

While climate information is being produced by the NOAA Climatic Data Center, long-range streamflow forecasts beyond those required for the conservation release season described are not used for the WVS. This is because all dams and reservoirs operate on a fixed rule curve that requires reservoirs to be at minimum conservation pool during the winter flood season, and then to refill during the spring.

A Drought Contingency Plan provides a plan of action if a potential drought situation were to occur. Like the long-range forecasts, drought forecasts beyond those required for the conservation release season are not used for regulation of the WVS because all dams and reservoirs are operated on individual, fixed, rule curves. Prediction of winter/spring droughts is nearly impossible due to the variability of regional weather systems.

1.11.2.1 Operational Considerations for Streamflow and Water Quality

WVS dams were designed and constructed to modify, control, and regulate streamflow characteristics of associated tributaries and the mainstem Willamette River. In general, WVS operations have resulted in higher flows in the summer and reduced peak flows in the winter and spring than historical flows. These hydrologic effects modify fish habitat characteristics in downstream reaches.

[17] Information presented in this section has been adapted from the *Master Water Control Manual for the Willamette Valley Project* (USACE 2015a).

The WVS is operated in a manner that helps mitigate adverse effects of the dams, including augmenting tributary flows downstream of WVS dams and in the mainstem of the Willamette River. Augmenting Mainstem Willamette River flows at Albany and Salem, Oregon is important for water quality and fish and wildlife purposes.

The 2008 NMFS Biological Opinion (NMFS 2008) requires USACE to release flows at WVS dams to achieve minimum streamflows in tributaries and in the Mainstem Willamette River throughout the year and to stay below maximum flows during key spawning periods in the tributaries. Additionally, the 2008 Biological Opinion established ramping rates that dictate how quickly flows are increased or decreased (NMFS 2008). USACE strives to adhere to established ramping rates except during emergencies and flood risk management operations (Section 1.11.1, Reservoir Pools and Water Control, Conservation Pool Allocation).

Streamflow augmentations increase flows during the low water period and benefit water quality conditions along the mainstem by diluting pollution, moderating extreme temperatures, and increasing the dissolved oxygen content of Willamette River Basin streams, resulting in a beneficial effect on fish and wildlife. The increased flows also benefit fish and wildlife along tributaries by augmenting instream flows reduced by withdrawals for consumptive uses.

Water quality management objectives in the WVS include management of instream water temperature and reduction in total dissolved gas concentrations in river reaches below dams.

1.11.2.2 Operational Considerations for Hydropower

USACE performs ongoing, coordinated water management actions at the dams to increase or decrease power generation in response to the needs of the Federal transmission system. These needs include management of operating reserves and the accommodation of planned or emergency transmission line outages (Section 1.10.2, Hydropower).

Dam releases can be limited by different constraints such as ESA flow requirements, although hydropower production can be used to manage downstream temperatures and to reduce total dissolved gas generated from dam outflows. Operational changes are coordinated with the Services if they deviate from criteria in the 2008 Biological Opinions during non-flood operations (NMFS 2008; USFWS 2008). In emergency situations and in managing the system to avoid emergencies, power system operations would be prioritized to protect human health and safety as well as the safety and reliability of the power grid.

1.11.2.3 Operational Considerations for Recreation

Recreational facilities are provided at all USACE reservoirs. Recreational demand in the basin puts pressure on maintaining reservoirs near maximum conservation pool for the entire recreational season. Use of the reservoirs to meet tributary and mainstem flow targets is based on given hydrologic conditions and instream biological needs.

The three most visited reservoirs for recreational opportunities at the time the alternatives were analyzed, in order of most use, were Fern Ridge, Foster, and Cottage Grove Reservoirs (Section 3.14, Recreation Resources). Seasonally, Foster, Fern Ridge, and Detroit Reservoirs are last to be drained to meet summer instream flow objectives, so they support recreation later into the summer season (USACE 2019a).

All reservoirs but Detroit Reservoir lack the capacity to substantially augment mainstem flows. Detroit Dam and Reservoir are also located the farthest downstream in the WVS. Consequently, operations can only be used to augment mainstem flows at Salem.

Conservation pools at these reservoirs are typically maintained at as high an elevation as possible until early September. Reservoirs with larger conservation pools, lower recreation demand, and located farther up in the Willamette River Basin are used first for meeting summer flow requirements at Albany and Salem, Oregon.

1.11.2.4 Operational Considerations for Environmental Flows

Dam releases that benefit downstream ecosystem health are termed environmental flows, or e-flows. E-flow targets were developed by collecting and synthesizing relevant hydrologic and ecological information and expert knowledge into a set of flow recommendations, summarized in a USACE Memorandum for the Record, dated July 17, 2015 (USACE 2015l).

E-flow implementation has been developed by USACE in coordination with The Nature Conservancy at multiple dams within the Willamette River Basin. The implementation of e-flows is event-driven, meaning flows are based on regulator/operator judgement. Maximizing e-flows is valuable to efficiently manage aquatic habitats as it creates both opportunities for, and the means to manage, fish spawning, incubation, and other habitat needs. Fish populations and other aquatic organisms are adapted to these variable flow conditions.

Each seasonal flow contributes to some aspect of ecosystem health. Fall flows occur from October to November, winter high flows occur from November to February, and smaller spring flows occur from March to June. E-flow recommendations have been developed for the Middle Fork Willamette River; McKenzie River; and the North, South, and Mainstem Santiam Rivers. Flow recommendations are defined by event duration, number of events per year, range of flow magnitude, and frequency.

E-flow operations are governed by water control manual operational requirements for each dam and reservoir and the NMFS Biological Opinion (NMFS 2008). The general intent is to maximize opportunities for achieving e-flows while considering operational constraints and forecast uncertainty. This can be particularly difficult to achieve during hydrologically and meteorologically dry water years.

1.11.3 Operation, Maintenance, Repair, Replacement, and Rehabilitation

The operation, maintenance, repair, replacement, and rehabilitation phase begins after a WVS facility is constructed. Ongoing activities are conducted during this phase to support facility functions.

This phase includes a spectrum of activities that range from regular maintenance activities, such as repainting a rusty guardrail or replacement of lightbulbs, to major maintenance and rehabilitation activities such as the repair, replacement, or rehabilitation of entire facility components (e.g., the replacement of the slide gate seals or repair of hydraulics in a dam) as well as routine inspections of WVS structures. These collective activities occur at all facilities in the WVS, including within and around the dams and powerhouses, adult fish facilities, and hatcheries. Distinctions between regular and major activities are described below.

1.11.3.1 Scheduled and Routine Maintenance

Scheduled and routine maintenance is defined as the maintenance, repair, or replacement of existing fixtures or parts in which no changes are made to an original design or purpose to ensure that WVS facilities run safely. Routine maintenance includes those activities that are predictable and repetitive, but not those that would constitute major repairs or rehabilitation of a capital asset. This type of preventative and corrective maintenance is coordinated and planned to occur at regular intervals and is also referred to as scheduled maintenance.

Routine maintenance is performed on all WVS hatcheries, fish facilities, spillway components, generating units, and supporting systems to ensure dam and reservoir operational reliability and to comply with Federal regulatory requirements. Routine maintenance is coordinated and scheduled through a regional forum, such as the Willamette Fish Passage Operations & Maintenance[18] (WFPOM) and WATER, to minimize effects to ESA-listed fish species by designating in-water-work timeframes and other construction constraints.

The routine maintenance program allows staff at USACE, BOR, and BPA to proactively plan and schedule capital improvement programs based on equipment condition and degradation to ensure system operations remain safe, reliable, and in compliance with applicable laws and regulations.

These activities are described in the Operations and Maintenance Manuals for each facility. The library of Operations and Maintenance Manuals is incorporated here by reference; an annotated bibliography of these manuals is provided in Appendix A, Alternatives Development.

[18] The Willamette Fish Passage Operations & Maintenance (WFPOM) coordination team develops recommendations for ongoing operations and maintenance activities that may affect listed fish species. This team also includes technical discussions relating to hatchery programs. This coordination team is responsible for providing input on annual changes to the Willamette Fish Operations Plan, which dictates how facilities must operate to minimize impacts to ESA-listed species.

What is Major Maintenance?

Major maintenance is defined as a non-repetitive item of work or aggregate items of related work for which the total estimated cost exceeds the limit set forth by Engineering Circular 11-2-222 and that does not qualify as major rehabilitation.

Major maintenance and major rehabilitation are defined in Engineering Circular 11-2-222.

1.11.3.2 Unscheduled and Non-routine Maintenance

Unscheduled maintenance is reactive maintenance to address issues as they arise. This maintenance can occur any time a repair issue is identified, including an unforeseen maintenance issue or emergency that requires a facility feature, such as a generating unit, to be taken offline to resolve the issue. The timing, duration, and extent of these maintenance activities are unforeseeable. Unscheduled maintenance events are coordinated through the appropriate teams under a regional forum, such as the WFPOM and the WATER Forum, to minimize negative effects on fish.

Non-routine maintenance is proactively planned but not performed at regular intervals (e.g., unit overhauls, major structural modifications, or rehabilitations). Non-routine maintenance includes tasks that may be more imperative than routine maintenance; these tasks may or may not constitute major maintenance and rehabilitation.

Major rehabilitation is defined as structural modifications to restore or ensure continuation of an existing facility's functions or outputs. This does not include normal maintenance of existing capabilities or prevention of deterioration. Examples of non-routine maintenance include powerhouse modernization and major facility upgrades.

Non-routine maintenance, major maintenance, and rehabilitation may be considered major Federal actions. Each action would be assessed for environmental compliance prior to implementation and may be subject to NEPA review.

1.11.4 Coordination of Willamette Valley System Operations with Other Agencies

USACE is ultimately responsible for the operations and maintenance of the WVS. However, USACE also coordinates with, or collects input from, regional stakeholders such as NMFS, BPA, USFWS, USFS, tribes, ODFW, ODEQ, Northwest Power and Conservation Council, and other partners on operations that may affect their management interests.

The WATER Forum, a collaborative advisory body made up of USACE, other Federal and state agencies with fisheries and water resource management responsibilities in the Willamette River Basin, and affected tribes, was established under the 2008 Biological Opinions to coordinate with USACE on operation of the WVS (NMFS 2008, USFWS 2008). One forum for this coordination is the WFPOM coordination team, which annually develops the Willamette Fish Operation Plan.

The Operation Plan describes year-round operations and maintenance activities at USACE WVS dams and reservoirs to protect and enhance ESA-listed fish species as well as non-listed species of concern. The Willamette Fish Operation Plan guides USACE actions related to fish protection and passage at the 13 WVS dams. Other USACE documents and agreements related to fish passage from the WVS are consistent with the Operation Plan.

Although USACE is the final decision-maker on all water management decisions in the WVS, USACE also considers input from regional stakeholders through a forum known as the Flow Management and Water Quality Team. This team is a technical team organized under the WATER Forum. The team meets monthly to provide flow forecast updates and to gather input on decisions related to flow management. Special operations related to fish protection and passage identified in the Willamette Fish Operation Plan are coordinated through the Flow Management and Water Quality Team.

1.12 Ongoing U.S. Army Corps of Engineers Planning and Environmental Reviews in the Willamette River Basin

In addition to the WVS NEPA review, USACE is conducting several ongoing environmental reviews pertaining to the Willamette River Basin. These reviews are either not directly related to long-term operation and maintenance of the WVS or ESA compliance, involve non-Federal sponsors, do not rise to the level of a programmatic NEPA document, or have insufficient information to be considered as related or connected to the scope of this EIS. Some of these reviews involve reasonably foreseeable future actions and are described in Chapter 4, Cumulative Effects. Details about each of these ongoing reviews as of 2024 are provided below.

1.12.1 Master Plans and Operational Management Plans

1.12.1.1 Master Plans

A Master Plan is a strategic land use management document that guides the comprehensive management and development of all recreational, natural, and cultural resources throughout the life of a USACE Civil Works project (i.e., dam, reservoir, hatchery, etc.). At the time the alternatives in this EIS were analyzed, USACE was undertaking a multi-year effort to revise six Master Plans for USACE-managed lands within the WVS grouped by subbasin. These Master Plans would replace the outdated, existing individual and regional Master Plans under any alternative.

U.S. Army Corps of Engineers regulations and policies that govern Master Plans include:

- ✓ ER 1130-2-550
- ✓ EP 1130-2-550

Master Plans cover many resources, including but not limited to water, fish and wildlife, vegetation, cultural, aesthetic, interpretive, recreational, and mineral resources. Master Plans do not address operations for flood risk management, water quality, water supply, hydropower, navigation, or maintenance of the dams and fish facilities. Consequently, Master Plans are not incorporated into the development of the alternatives described in Chapter 2, Alternatives.

Regardless, master planning will incorporate resource management consistent with operations and maintenance proposed under any alternative.

The process of updating Master Plans encompasses interrelated tasks involving the review and analyses of environmental, recreational, and socioeconomic trends within a generalized conceptual framework. This framework contemplates the regional ecosystem, resource capabilities and suitability of each dam and reservoir, expressed public interests that are compatible with Congressionally authorized purposes, and environmental sustainability elements.

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The six Master Plans and associated programmatic NEPA reviews will not tier from this EIS because the scope of this EIS does not address comprehensive management and development of all recreational, natural, and cultural resources within the WVS. However, elements of this EIS may be incorporated by reference. Additionally, information from site-specific, tiered NEPA analyses would become important information in completion of the Master Planning updates and in associated NEPA reviews (e.g., site-specific information on recreation opportunities under the selected EIS alternative).

1.12.1.2 Operational Management Plans

Details of design and administration functions are addressed in the Operational Management Plans. Master Plan concepts are implemented into operational actions in these plans. There were no Operational Management Plans for the WVS at the time the alternatives were analyzed in this EIS.

END REVISED TEXT

1.12.2 Interim Risk Reduction Measures

USACE is continuously assessing its dams as part of its comprehensive dam safety program by inspecting, assessing, and monitoring dams to better understand safety risks and to inform future actions. The USACE Dam Safety Program requires risk assessments of all WVS dams on a 10-year cycle (Appendix H, Dam Safety).

An assessment process identifies many risks using the latest science and engineering methods and standards. Identified risks are elevated for detailed analysis and design.

Many of the risks analyzed are often not consequential or probable enough to merit further action. However, in 2020, after completing a detailed analysis of the seismic risk at Hills Creek and Lookout Point Dams, it was concluded that immediate, temporary actions to mitigate the risk at these dams was necessary while the long-term studies will identify a long-term solution. Subsequently, Detroit Dam was analyzed in 2021 and resulted in the same action as Lookout Point Dam.

Per Engineering Regulation ER 1110-2-1156 (USACE Publications):

> USACE has specific public safety responsibility, when a project has known safety issues, to take appropriate interim risk reduction measures including reservoir releases. USACE statutory responsibilities require operation of dams in a manner that reduces the project's probabilities of failure when there are known issues with the integrity of the project.

These determinations resulted in development of Interim Risk Reduction Measures (IRRM) to address these risks temporarily until a permanent solution can be assessed and designed. IRRMs at these dams required a pool restriction on the maximum conservation pool elevation (i.e., the maximum elevation the associated reservoirs are allowed to reach each summer is lower than the authorized maximum identified in the water control manuals)—5 feet at Detroit and Lookout Point Dams and 10 feet at Hills Creek Dam. These temporary pool reductions will remain in place until the final studies are complete and issues resolved. However, by design, measures are temporary and may not be in place for the full 30-year implementation timeframe.

USACE, Portland District, is engaged in dam safety studies for all dams in the Willamette River Basin. IRRM Environmental Assessments have been completed for Detroit, Hills Creek, and Lookout Point Dams. Additional safety IRRMs may be recommended at other dams. All IRRMs would be assessed for environmental compliance prior to implementation and may be subject to NEPA review. Additionally, any long-term actions developed to replace the IRRMs would require environmental compliance and may be subject to NEPA compliance.

1.12.3 Court-ordered Injunction Measures

On September 1, 2021, the U.S. District Court for the District of Oregon issued an injunction in *NEDC v. USACE*[19]*.* The order requires USACE to implement interim actions intended to improve conditions for fish passage and water quality in the WVS to avoid irreparable harm to ESA-listed salmonids. These actions are to remain in effect until the completion of the reinitiated Section 7 ESA consultation with NMFS and USFWS.

The Court ordered operational changes and three structural modifications to existing dams and reservoirs (Table 1.12-1). The three structural modification actions have undergone, or are currently undergoing, separate site-specific NEPA processes by USACE to assess the direct, indirect, and cumulative impacts of their effects on the human environment.

The direct and indirect effects of these construction actions are being reviewed under separate NEPA compliance processes; therefore, they are not assessed in this EIS.

[19] *Northwest Environmental Defense Center, et al. v. United States Army Corps of Engineers, et al.*, No. 3:18-cv-00437-HZ (D. Or. September 1, 2021).

Table 1.12-1. Court-ordered Structural Improvements and Modifications[20].

Dam	Description	Status
Dexter	Design and construct upgrades to the Dexter adult fish facility.	Construction was ongoing at the time the alternatives were analyzed.
Big Cliff	Determine whether operational measures alone are sufficient to maintain acceptable total dissolved gas levels below Big Cliff Dam and, if not, design and construct a structural solution for mitigating excess total dissolved gas levels during spill operations.	USACE determined that operational fixes are not sufficient and developed a schedule for design and construction of rock weirs to further reduce total dissolved gas.
Cougar	Determine whether structural improvements/modifications need to be made to regulating outlets to ensure safer fish passage and to reduce total dissolved gas levels and, if so determined, design and construct a structural solution.	The Court established an Expert Panel that recommended resurfacing of the regulating outlet chute, which was completed in 2023.

1.12.4 Willamette Valley System Vegetation Management Plans

Vegetation management practices have been implemented at Fern Ridge Reservoir for several years. These practices include prescribed burning, mechanical and manual control, herbicide applications, and seed collection and plant propagation, which are intended to improve and maintain diverse native plant communities while preventing, eliminating, or reducing the presence or spread of invasive, noxious, and nuisance plants.

In 2023, USACE expanded vegetation management planning to encompass all 13 dams and reservoirs. A USACE Record of Environmental Consideration was signed on July 14, 2023 to implement the Vegetation Management Plan for USACE-managed lands in Lane, Linn, and Marion Counties, Oregon.

[20] Operational changes are not identified in the table because this section is focused on actions that are undergoing environmental reviews outside of, and in addition to, the WVS Operations and Maintenance EIS review.

1.12.5 Dexter Reservoir Shoreline Management

The existing Dexter Dam Shoreline Management Plan is being reviewed to determine necessary revisions to the Plan, including real estate license requirements. The Shoreline Master Plan addresses the rules and regulations, shoreline allocations, and USACE requirements for permitting shoreline use facilities, activities, or development.

Within some of the designated land use areas, USACE plans to issue permits and real estate licenses to private landowners to construct new docks, modify or maintain existing docks, modify vegetation, and construct upland support structures so long as these activities are consistent with a revised Shoreline Master Plan. Environmental compliance is required for these actions and is ongoing.

1.12.6 Long Tom River Ecosystem Restoration Project

The City of Monroe, Confederated Tribes of Siletz Indians, and the Long Tom Watershed Council are collaborating with USACE to advance an ecosystem restoration project on the Long Tom River under USACE's Continuing Authority Program Section 1135, Project Modifications for Improvement of the Environment for Ecosystem Restoration (WRDA 1986). The Long Tom River is a vital watershed for its potential high-quality juvenile salmon rearing habitat as well as spawning and rearing habitat for cutthroat trout, lamprey, and other native species.

Prior to construction of Fern Ridge Dam, the lower Long Tom River was a low-gradient river characterized by a narrow channel with high sinuosity. After completion of the dam, the downstream reaches lacked the channel capacity to convey routine water releases from the reservoir. In 1943, USACE constructed a straighter, deeper, and wider channel with a series of seven drop structures (Appendix S, USACE-managed Dams, Reservoirs, and Bank Protection Structures). Drop structures are intended to reduce channel velocities and to decrease erosion.

A drop structure, also known as a grade control, sill, or weir, is a manmade structure, typically small and built on minor streams, to pass water to a lower elevation while controlling energy and velocity of water as it passes over. Unlike most dams, drop structures are not built for water impoundment, diversion, or to raise a water level. They are mostly built on watercourses with steep gradients for other purposes such as water oxygenation and erosion prevention.

> While effective to help maintain channel stability, drop structures create barriers to fish passage. According to NMFS West Coast Region's Anadromous Salmonid Passage Design Manual:
>
> Drop structure barriers involve a combination of local hydraulic conditions downstream of a barrier and the swimming capabilities of the species and life stage to block migration (Powers and Orsborn 1985). They create hydraulic conditions that exceed the swimming or leaping capabilities of the fish to overcome the hydraulic condition. Examples include velocity barriers, vertical drop barriers, and velocity drop barriers (NMFS 2022).

THE DEIS HAS BEEN REVISED TO INCLUDE THE FOLLOWING INFORMATION IN THE FEIS

One of the seven USACE-constructed drop structures is located near the City of Monroe at River Mile 6.9, the lower-most barrier to fish on the Long Tom River (Figure 1.12-1). A USACE site-specific NEPA Environmental Assessment was completed in spring 2024 to assess environmental and human impacts from removal of this drop structure. A Finding of No Significant Impact for removal was subsequently signed.

Figure 1.12-1. Monroe Drop Structure.

Source: USACE Portland District Media Images

The tentative date to initiate removal of the structure is summer 2026. Once completed, the drop structure removal project will reconnect the Long Tom River from River Mile 10.3 (location of the Stroda drop structure) to the confluence with the Willamette River.

1.12.7 2022 Water Resource Development Act Report to Congress on Willamette Valley System Hydropower

Congress, in section 8220 of WRDA 22, directed the Secretary of the Army to conduct a study on the effects of deauthorizing hydropower produced by eight dams in the WVS. Consequently, the Portland District submitted an initial assessment of hydropower deauthorization as its WRDA Report to Congress in June 2024. The Report was under administrative review at the time the alternatives were analyzed (Appendix A, Alternatives Development, Attachment 4).

END NEW TEXT