

# Arnold Irrigation District

## Infrastructure Modernization Project

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*Final Watershed Plan-Environmental Assessment*

*Deschutes County, Oregon*

*August 4, 2022*



United States Department of Agriculture, Natural Resources Conservation Service – Lead Federal Agency in cooperation with the Deschutes Basin Board of Control and Arnold Irrigation District

Prepared by Farmers Conservation Alliance

## Watershed Plan-Environmental Assessment for the Arnold Irrigation District - Infrastructure Modernization Project

**Lead Agency:** United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Oregon

**Sponsoring Local Organization:** Deschutes Basin Board of Control (lead sponsor) and Arnold Irrigation District (AID) (co-sponsor).

**Authority:** This Watershed Plan-Environmental Assessment (Plan-EA) has been prepared under the Authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law [PL] 83-566). The Plan-EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, PL 91-190, as amended (42 United States Code [U.S.C.] 43221 et seq.).

**Abstract:** This document is intended to fulfill requirements of NEPA and to be considered for authorization of PL 83-566 funding of the Arnold Irrigation District Infrastructure Modernization Project (project). The project seeks to improve water conservation, water delivery reliability, and public safety for irrigation infrastructure in Oregon's Deschutes Basin. The project would include piping approximately 11.9 miles of AID's Main Canal. Total estimated project costs are \$34,899,000 of which \$8,701,000 would be paid by the sponsors and other non-federal funding sources. The estimated amount to be paid through NRCS PL 83-566 funds is \$26,198,000, which includes \$23,310,000 for construction costs, \$2,412,000 for technical assistance, and \$476,000 for project administration.

**Comments:** NRCS completed this Final Plan-EA in accordance with NEPA and NRCS guidelines and standards. Comments submitted in response to this Notice of Availability must be received within 30 days of the date of publication. Submit comments and inquiries to: Ron Alvarado, State Conservationist, USDA/NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, OR 97232, (503) 414-3200, or [ron.alvarado@usda.gov](mailto:ron.alvarado@usda.gov).

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<b>Authorization</b>	PL 83-566 Stat. 666 as amended (16 U.S.C. 1001 et seq.) 1954			
<b>Lead Sponsor</b>	Deschutes Basin Board of Control and Arnold Irrigation District (co-sponsor)			
<b>Proposed Action</b>	The Arnold Irrigation District (AID or the District) Infrastructure Modernization Project is an agricultural water conveyance efficiency project. The proposed action would pipe 11.9 miles of AID’s Main Canal, upgrade 88 turnouts, and install Supervisory Control and Data Acquisition (SCADA) in two locations.			
<b>Purpose and Need</b>	<p>The purpose of this project is to improve water conservation in District-owned infrastructure, improve water supply management and delivery reliability to District patrons, and improve public safety on up to 11.9 miles of the District-owned Main Canal.</p> <p>Federal assistance is needed to support the District in addressing water loss in District infrastructure, District water delivery and operation inefficiencies, diminished instream flows that limit fish and aquatic habitat, and public safety risk caused by open canals.</p>			
<b>Description of the Preferred Alternative</b>	Under the Preferred Alternative, AID would pipe 11.9 miles of the Main Canal, upgrade 88 turnouts, and install SCADA in two locations.			
<b>Project Measures</b>	Under the Preferred Alternative, project sponsors would install 11.9 miles of pipe ranging in size from 48 to 60 inches in diameter and install two SCADA locations to improve operational efficiency. Additionally, 88 turnouts would be upgraded to pressurized delivery systems. Construction of the Preferred Alternative would occur over 6 years.			
<b>Resource Information</b>				
Subwatersheds	12-digit Hydrologic Unit Code	Latitude and Longitude	Subwatershed Size (acres)	Planning Area Within Subwatershed (acres)
Lava Island Falls-Deschutes River	170703010405	43.99453392, -121.456721	12,518 acres	114
Overturf Butte-Deschutes River	170703010406	43.98818452, -121.359427	31,374 acres	172
Deschutes Junction	170703010801	44.07052471, -121.268003	47,339 acres	857
Odin Fall-Deschutes	170703010805	44.1377907, -121.2207872	66,358 acres	613

Subwatershed Total Size	157,582 acres		
Arnold Irrigation District Size	4,384 acres		
Climate and Topography	The proposed project is located in the rain shadow of the Cascade Mountain range. AID's annual average precipitation is 12 to 15 inches. The average high temperature for July is 85 degrees Fahrenheit, and average low temperature for December is 26 degrees Fahrenheit. The land within AID is slightly undulating with variation in slope. The District's Main Canal diversion is at 3,925 feet above sea level. There is approximately 60 feet of elevation loss between the diversion and the end of the Main Canal.		
Land Use (Planning Area)	<b>Use</b>	<b>Acres</b>	
	Irrigated Land	1,475	
	Non-irrigated Land	281	
Land Ownership (Planning Area)	<b>Owner</b>	<b>Percentage</b>	
	Private	99.2%	
	State-Local	0.2%	
	Federal	0.6%	
Population and Demographics	The proposed project would be constructed in Deschutes County, Oregon. In 2020, the population of Deschutes County was 198,253. Between 2000 and 2020 the County's population grew by 25.7 percent. The population of the State of Oregon grew by 10.6 percent in the same time period.		
Population and Demographics		<b>Deschutes County</b>	<b>Oregon</b>
	Population 2020	198,253	4,237,256
	December 2020 Unemployment Rate (U.S. Bureau of Labor Statistics, 2022)	6.9%	6.3%
	Median Household Income 2019	\$67,043	\$62,818
Relevant Resource Concerns	Resource concerns identified through scoping included water conservation and quality, groundwater, aquatic and fish resources, soils, land use, visual resources, cultural resources, socioeconomics, wetlands, terrestrial wildlife, public safety, and vegetation resources.		
<b>Alternatives</b>			
Alternatives Considered	Nine alternatives were initially considered; seven were eliminated from full analysis because they did not address the purpose and need for action, did not achieve the Federal Objective and Guiding Principles, or because they became unreasonable due to cost, logistics, existing technology, or social or environmental reasons. The No Action Alternative and Piping Alternative were analyzed in full.		

No Action Alternative (Future without Federal Investment)	Under the No Action Alternative, construction activities associated with the proposed project would not occur and AID would continue to operate and maintain its existing system in its current condition. The need for the project would still exist; however, the District would only modernize its infrastructure on a project-by-project basis as funding became available. This funding is not reasonably certain to be available under a project-by-project approach at the large scale necessary to modernize the District’s infrastructure.
Preferred Alternative	Under the Piping Alternative, AID would pipe up to 11.9 miles of the Main Canal. To improve water delivery reliability for patrons, AID would also install two SCADA locations. The Piping Alternative has been identified as the National Economic Efficiency (NEE) Alternative and is also the Preferred Alternative.
Mitigation, Minimization, and Avoidance Measures	<p>Consultation between the District, Natural Resources Conservation Service (NRCS) as the lead federal agency, Tribal Historic Preservation Office (THPO), Oregon State Historic Preservation Office (SHPO), and consulting parties including affiliated tribes for compliance with Section 106 of the National Historic Preservation Act (NHPA) has occurred.</p> <p>Ground disturbances would be limited to only those areas necessary to minimize effects on soil, vegetation, and land use. Where possible, construction activities would avoid or minimize effects on agricultural lands by staying within the existing right-of-way (ROW) and easements. Trees within the AID ROW and easements greater than 2 feet in diameter would be avoided during construction and retained to the extent possible. Trees would be removed only if they prevented construction activities from occurring, if they posed a safety threat to construction crews, or if their roots could interfere with the pipe.</p> <p>The width of the construction area would be clearly flagged along both sides of the canal prior to beginning construction to ensure that construction would stay within these boundaries. Stormwater best management practices (BMPs) would be employed during and after construction, and construction schedules would minimize disturbance to wildlife and the public. After construction, disturbed areas would be recontoured and replanted with a mix of native grasses and forbs to reduce the risk of erosion and spread of noxious weeds.</p> <p>Following project implementation, the District’s conveyance system would be more efficient, and by enacting similar practices to that of the District’s current and historical use of water, AID would divert only the volume of water needed by patrons. Therefore, AID would decrease its diversion rate accordingly and leave any water that the District does not divert in the Deschutes River available for use by junior water right holders. Additionally, to reduce effects on junior water right holders, AID would voluntarily reduce its maximum diversion rate and identify 118 cubic feet per second (cfs) as the District’s season 3 pre-project maximum diversion rate and 106 cfs as the District’s season 2 pre-project maximum diversion rate for the purposes of any water right administrative processes.</p>

Project costs	PL 83-566 funds		Other Funds		Total	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
Construction	\$23,088,000	75%	\$7,695,000	25%	\$30,783,000	100%
Engineering	\$222,000	75%	\$74,000	25%	\$296,000	100%
<b>Subtotal Construction Costs</b>	<b>\$23,310,000</b>	<b>75%</b>	<b>\$7,769,000</b>	<b>25%</b>	<b>\$31,079,000</b>	<b>100%</b>
Technical Assistance	\$2,412,000	100%	\$0	0%	\$2,412,000	100%

Relocation	Not applicable					
Real Property Rights	Not applicable					
Permitting	\$0	0%	\$932,000	100%	\$932,000	100%
Project Administration	\$476,000	100%	\$0	0%	\$476,000	100%
Annual O&M	Not applicable					
<b>TOTAL COSTS</b>	<b>\$26,198,000</b>	<b>75%</b>	<b>\$8,701,000</b>	<b>25%</b>	<b>\$34,899,000</b>	<b>100%</b>
<b>Project Benefits</b>						
Project Benefits	Implementation of the Preferred Alternative would improve water delivery reliability for AID patrons; save an estimated 32.5 cfs of water (11,083 acre-feet) from seepage loss during the irrigation season; pass up to 10,862 acre-feet of water to North Unit Irrigation District (NUID); release and protect up to 10,446 acre-feet for instream uses below Wickiup Reservoir during the non-irrigation season; reduce AID operation and maintenance (O&M) costs; and improve public safety.					
Number of Direct Beneficiaries	All 646 patrons within AID would benefit from the proposed project.					
Other Beneficial Effects-Physical Terms	The Preferred Alternative would have beneficial effects on agricultural water availability, water quality, and fish and wildlife habitat.					
<b>Damage Reduction Benefits</b>			<b>Proposed Project Annualized Benefits</b>			
Reduced North Unit Irrigation District Agricultural Damage			\$1,407,000			
Other- Reduced Operation and Maintenance			\$211,000			
Other-Avoided Damage from Infrastructure Failure			\$3,000			
Other- Instream Value			\$41,000			
Other- Oregon Spotted Frog Support			\$37,000			
Total Quantified Annualized Benefits			\$1,699,000			
Benefit to Cost Ratio			2.0			
<b>Period of Analysis</b>						
Installation Period (years)			6			
Project Life	100 years					

<b>Funding Schedule</b>			
<b>Year</b>	<b>PL 83-566</b>	<b>Other Funds</b>	<b>Total</b>
2022—2028	\$26,198,000	\$8,701,000	\$34,899,000
<b>Environmental Effects</b>			
<p>The Preferred Alternative would be planned, designed, and installed to have long-term net-beneficial effects on agricultural production, ecosystem services, and public safety.</p> <p>Implementation of the Preferred Alternative to improve water conservation, water delivery reliability, and public safety may result in minor, unavoidable short-term effects such as impacts to soils and noxious weeds along the Main Canal. Most short-term adverse effects would result from construction activities in the project area.</p> <p>There would be long-term minor effects on wetland habitat within the project area. Opportunistic hydrophytic vegetation growing along 11.9 miles of canal would be permanently removed as a result of the construction activities. However, following construction, BMPs would be followed and disturbed areas would be recontoured and seeded with native vegetation, which would result in an increase in native upland vegetation in the project area.</p> <p>Other long-term minor effects include potential changes in wildlife distribution patterns, reduction in groundwater recharge, and disturbance to vegetation. Construction would occur outside the primary nesting period for migratory birds of concern. Should an active nest be found, construction would be paused and consultation with a local U.S. Fish and Wildlife Service (USFWS) biologist would occur. After construction, disturbed areas above buried pipelines would be revegetated and recontoured to blend in with the existing landscape. BMPs would be implemented to minimize effects on trees.</p> <p>A moderate long-term effect would occur to visual resources. The visual change would be localized to properties adjacent to the project area. Following construction and revegetation, the revegetated corridor would blend in with the natural landscape</p>			
<b>Major Conclusions</b>	Implementation of the Preferred Alternative would improve water delivery reliability for AID patrons, save an estimated 11,083 acre-feet of water from seepage loss, pass up to 10,862 acre-feet to NUID, release and protect up to 10,446 acre-feet below Wickiup Reservoir for instream uses during the non-irrigation season, reduce AID’s O&M costs, and improve public safety.		
<b>Areas of Controversy</b>	Property value, canal lining, groundwater, and loss of trees.		
<b>Issues to be Resolved</b>	None.		
<b>Evidence of Unusual Congressional or Local Interest</b>	Comments during the scoping and public comment period were received from USFWS, U.S. Army Corps of Engineers, Oregon Water Resources Department, local non-governmental organizations, and individuals.		
<b>Compliance</b>	Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? Yes <u>  X  </u> No <u>    </u>		

## 1 Introduction

Aging infrastructure, growing population, shifting rural economies, and changing climate conditions have increased pressure on water resources across the western United States. Within the Deschutes Basin, irrigated agriculture is the main out-of-stream water use and relies on primarily 100-year-old infrastructure to divert, store, and deliver water to farms and ranches. In recent years, the improvement of water resources has been a coordinated focus among the eight irrigation districts within the Deschutes Basin, with the goal of addressing environmental needs for instream flows while still delivering enough water to district patrons (Figure 1-1).

Arnold Irrigation District (herein referred to as AID or the District) operates 39 miles of canals and laterals in the Deschutes Basin. Most of this infrastructure consists of open, earthen canals. AID's Main Canal loses up to an estimated 32.5 cubic feet per second (cfs) of water during the irrigation season (11,083 acre-feet annually) due to seepage into the porous volcanic geology and evaporation. This water never reaches District patrons and farms.

Over the years, AID has pursued infrastructure upgrades to provide a permanent solution to system-wide water losses. Although some improvements have been made, aging and outdated infrastructure continues to contribute to water delivery insecurity for out-of-stream users and limits streamflow due to the need to divert more water than is delivered; this affects water quality and aquatic habitat along the Deschutes River. The Main Canal has become a public safety risk to more people as the surrounding areas have urbanized. Aging infrastructure also affects the financial stability of AID and its patrons as AID must find new approaches to fund growing maintenance needs.

Improving irrigation infrastructure offers an opportunity to conserve water, increase the reliability of water delivery to patrons, enhance streamflow and habitat conditions for fish and aquatic species in the Deschutes Basin, reduce risks to public safety from open irrigation canals, and reduce operation and maintenance (O&M) costs for the District.

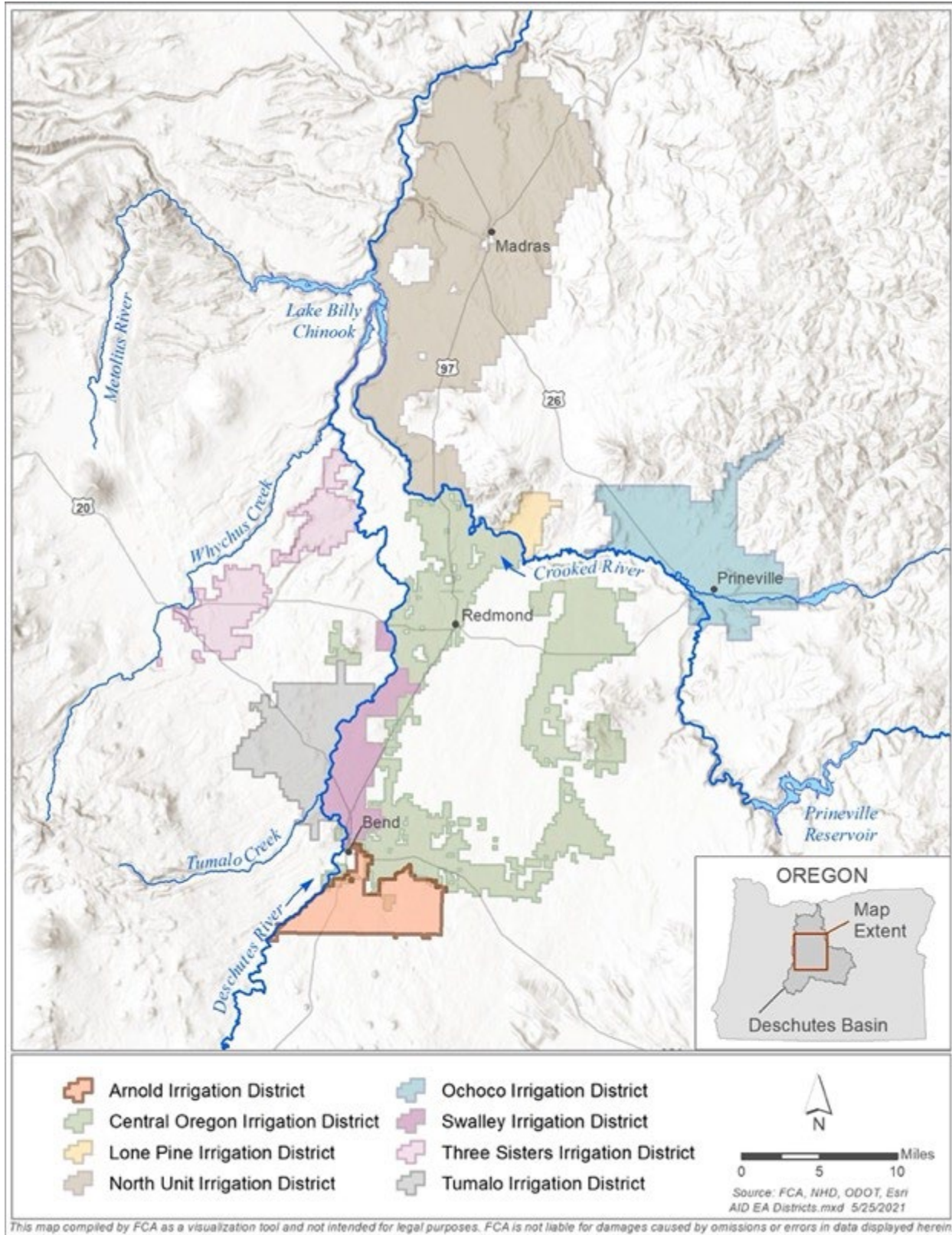


Figure 1-1. Irrigation districts within the Deschutes Basin.



## 1.1 Planning Area

The District is located south of Bend in Deschutes County, Oregon. The District contains 4,384 irrigated acres used by 646 patrons. The main point of diversion is on the Deschutes River (River Mile [RM] 174.5). The planning area is based on the irrigation problem area<sup>1</sup> and is identified as the tax lots traversed by the proposed project (Table 1-1, Figure 1-2). See Appendix E.14 for a map of tax lots included in the planning area.

**Table 1-1. Arnold Irrigation District Planning Area.**

Subwatershed Name	12-Digit Hydrologic Unit Code	Subwatershed Size (acres)	Planning Area Falling within the Subwatersheds (acres)
Lava Island Falls-Deschutes River	170703010405	12,518	114
Overturf Butte-Deschutes River	170703010406	31,374	172
Deschutes Junction	170703010801	47,339	857
Odin Falls-Deschutes River	170703010805	66,358	613
<b>Total</b>		<b>157,589</b>	<b>1,756</b>

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<sup>1</sup> The “planning area” referred to in this Plan-EA is equivalent to the term “watershed area” as defined by the National Watershed Program Manual (NWPM) 506.60.TTT (NRCS 2015a). The term “planning area” is used in this Plan-EA in an effort to reduce confusion between the NWPM 506.60.TTT watershed area definition and watershed areas as defined by hydrologic unit codes.

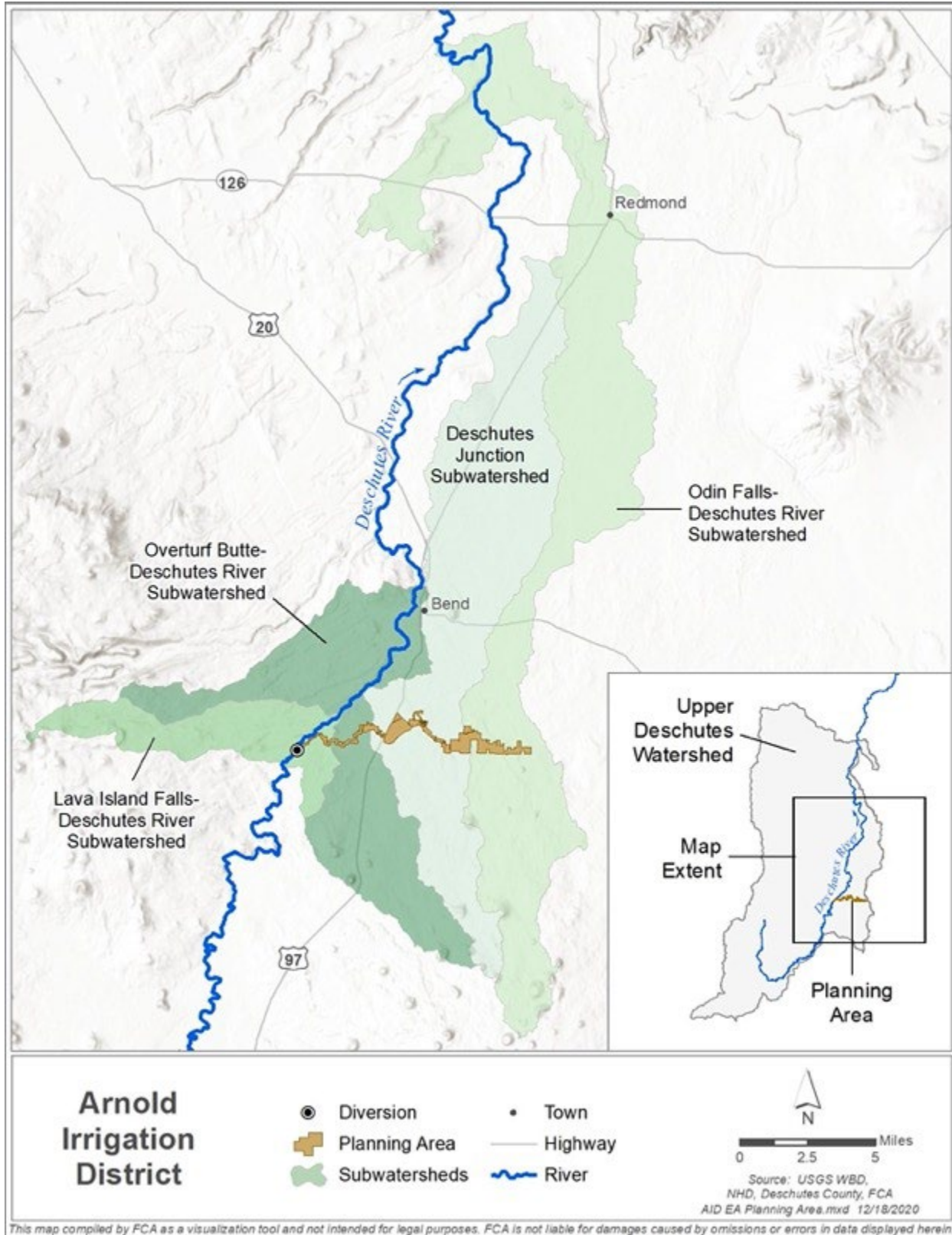


Figure 1-2. The Arnold Irrigation District planning area.

## 1.2 Project Area

The project area is located in a portion of the planning area. The project area describes the area where the AID Infrastructure Modernization Project would occur (Figure 1-3). The proposed project includes 11.9 miles of the Main Canal, which is only a portion of the District's total conveyance system. The project area consists of the District right-of-way (ROW) and easements that contain these 11.9 miles of the Main Canal. The existing water conveyance infrastructure in the project area consists of earthen dug canal and two siphons.

## 1.3 Current Infrastructure

The District diverts water from the Deschutes River at the Arnold Main Canal Diversion (herein referred to as the Main Canal) on the Deschutes River (RM 174.5). The diversion has a radial gate that regulates the intake flow rate and a vertical flat-plate fish screen that keeps fish and debris out of the District's conveyance system. The Oregon Water Resources Department (OWRD) gauge number 14065500 measures inflows into the conveyance system; AID is in the process of adding remote measurement and control systems just below its fish screen. The Main Canal conveys water generally northeast, starting with an approximately 1-mile-long flume and trestle system and then transitioning to a typical earthen and rock substrate open canal. After the flume, the Main Canal runs approximately 12.2 miles from west to east. Along the way, it delivers water directly to patrons and to multiple laterals.

AID has already piped approximately 22 percent of its system—primarily laterals that are not part of the project area. Patron turnouts from the Main Canal are gate-regulated and weir-measured by AID field staff. An additional six private direct withdrawals from the Deschutes River irrigate 30 acres of the District.

The Main Canal loses up to an estimated 32.5 cfs of water during the irrigation season (11,083 acre-feet annually) due to a combination of seepage related to the condition of the distribution system, the porous nature of the underlying geology, and evaporation.<sup>2</sup> Water loss associated with specific sections of the Main Canal is detailed in the District's System Improvement Plan (Crew, 2017; also see Appendix E.4).

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<sup>2</sup> Evaporation generally contributes to water losses from canals in the Deschutes Basin with evaporation rates varying throughout the basin (USGS 2001). However, the two site-specific water loss studies completed for AID calculated losses in the Main Canal from both seepage and evaporation but do not differentiate between what loss is a result of evaporation versus seepage.

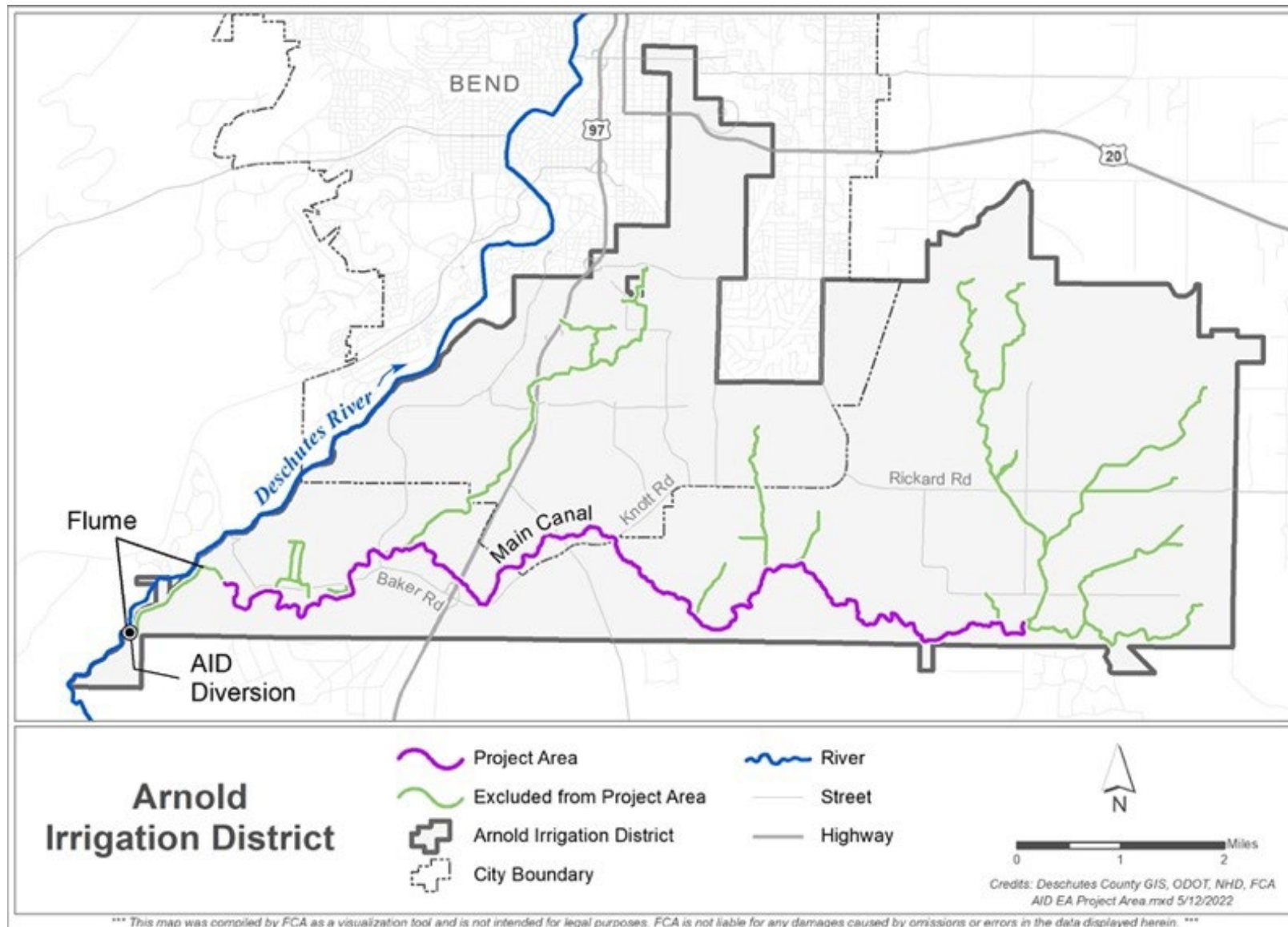


Figure 1-3. Arnold Irrigation District Infrastructure Modernization Project area.

## 1.4 Decision Framework

This Final Watershed Plan-Environmental Assessment (Plan-EA) has been prepared to assess and disclose the potential effects of the proposed action. This Plan-EA is required to request federal funding through the Watershed Protection and Flood Prevention Program, Public Law (PL) 83-566, which was authorized by Congress in 1954 (herein referred to as PL 83-566).

The Natural Resources Conservation Service (NRCS) is the lead federal agency for this Plan-EA and is responsible for the review and issuance of a decision in accordance with the National Environmental Policy Act (NEPA). NEPA requires that projects using federal funds be evaluated for effects on the quality of the human environment and natural environment (individually or cumulatively). When a proposed project is not likely to result in significant impacts, but the activity has not been categorically excluded from NEPA, an agency can prepare an Environmental Assessment. If it is determined that the project would result in significant effects on the human or natural environment, an environmental impact statement must be prepared (Whether to prepare an environmental impact statement, 2021; Environmental assessment, 2010; When to prepare an environmental assessment (EA), 2008).

NRCS has determined the need for a Plan-EA to analyze the effects of the proposed action under PL 83-566 watershed authority and determine if the project, as proposed, significantly affects the quality of the human and natural environment. The proposed action would be completed over the course of 6 years in four different phases. This document presents an analysis in sufficient detail to allow implementation of the proposed action within the designated project area.

If a Finding of No Significant Impact is issued and the Plan-EA authorized, prior to the implementation of each project phase, an onsite Environmental Evaluation review would occur using the form NRCS-CPA-52, Environmental Evaluation Worksheet. The Environmental Evaluation process would determine if that particular project phase meets applicable project specifications and whether the site-specific environmental effects for that phase are consistent with those as described and developed in this Plan-EA. This process provides information for the Responsible Federal Official to determine if the proposed action has been adequately analyzed and if the conditions and environmental effects described in the Plan-EA are still valid. This Plan-EA would be supplemented if it is determined through the onsite Environmental Evaluation that additional analysis is needed.

Additionally, the continued feasibility of a project is monitored and documented in the project files every 5 years in accordance with NEPA requirements in the Title 190, General Manual, Part 410. Factors to be considered in determining the continued feasibility are economic, environmental, and social defensibility and the sponsoring local organization commitment to continue the project. Modifications to this Plan-EA and project are prepared as necessary.

This Plan-EA has been prepared in accordance with the 1978 Council on Environmental Quality regulations for implementing NEPA (CEQ Regulations for Implementing the Procedural Provisions of NEPA, 2005), U.S. Department of Agriculture (USDA) NEPA regulations (When to prepare an

environmental assessment (EA), 2021), NRCS Title 190 General Manual Part 410, and the NRCS National Environmental Compliance Handbook Title 190 Part 610.

This Plan-EA has been prepared in accordance with the guidelines in the 2015 NRCS National Watershed Program Manual (NWPM; USDA-NRCS, 2015a) and the 2014 NRCS National Watershed Program Handbook (USDA-NRCS, 2014). It has also been prepared in accordance with the Principles and Requirements issued in March 2013 along with Interagency Guidelines and Agency Specific Procedures established in DM 9500-013. These documents comprise the Principles, Requirements, and Guidelines (PR&G; USDA-NRCS 2017a). The PR&G revise and replace the 1983 Principles and Guidelines. The PR&G constitute the comprehensive policy and guidance for federal investments in water resources. Some considerations and analyses in this Plan-EA are strictly NRCS program requirements; they are not required by NEPA. These differences are identified throughout this Plan-EA.

## 2 Purpose and Need for Action

The purpose of the proposed project is to improve water conservation in District-owned infrastructure, improve water supply management and delivery reliability to District patrons, and improve public safety on up to 11.9 miles of the District-owned Main Canal.

Federal assistance is needed to support AID in addressing water loss in District infrastructure, water delivery and operation inefficiencies, diminished instream flows that limit fish and aquatic habitat, and public safety risks caused by open canals. These topics are discussed in Section 2.1.

In addition to meeting the above purpose and need, to meet NRCS requirements for a federal investment in a water resources project, the proposed project must meet the Federal Objective set forth in the Water Resources Development Act of 2007, promote the Federal Objective and Guiding Principles (as identified in the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments [PR&G; USDA-NRCS 2017a]), and be an authorized project purpose under Sections 3 and 4 of PL 83-566. See Appendix E.8 for more information on the Guiding Principles.

Per the Federal Objective, water resource investments—including the proposed action—put forth in this Plan-EA should “reflect national priorities, encourage economic development, and protect the environment by: (1) seeking to maximize sustainable economic development; (2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and (3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems” (USDA-NRCS, 2013). Additionally, the project should seek to achieve the following Guiding Principles as identified by the federal government: Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, Public Safety, Environmental Justice, and Watershed Approach (USDA-NRCS, 2017a). See Appendix E.8 for more information on the Guiding Principles.

The proposed project would be eligible for funding under the PL 83-566 requirement “Authorized Project Purpose (v), Agricultural Water Management”<sup>3</sup> due to the proposed project’s focus on irrigation water conservation and more reliable agricultural water supply delivery.

### 2.1 Watershed Problems and Resource Concerns

#### 2.1.1 Water Loss in District Conveyance Systems

Currently, during the irrigation season, the District’s Main Canal loses up to approximately 32.5 cfs of water (11,083 acre-feet annually) to seepage through the porous underlying geology and evaporation. This water never reaches farms. Details on water losses and demands can be found in Appendix E.4 of this Plan-EA and the District’s System Improvement Plan (Crew, 2017).

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<sup>3</sup> A description of Authorized Purposes can be found in 390-NWPM, Part 500, Subpart A, Section 500.3B (NRCS 2015a).

### 2.1.2 Water Delivery and Operations Inefficiencies

Over the years, AID has developed rigorous measurement and management methods that have greatly increased efficiency; however, high seepage loss rates make it challenging to deliver the patrons' desired delivery rate throughout the irrigation season and cause delivery shortages during the peak season (May 15 through September 14).

The District's earthen Main Canal experiences failure from sinkholes, tree roots, and burrowing animals. To repair the canal, AID must stop the delivery of irrigation water—often at times for multiple days. Additionally, in the current open canal system, all patrons are required to request changes to water deliveries 24 to 36 hours in advance. Changes to water deliveries in this manner are inefficient and unresponsive to immediate need and may affect deliveries to other patrons.

Operating and maintaining the Main Canal also requires staff to clean the canal, adjust flows to patrons, clean debris from trash racks, and repair sinkholes. Overall, the Main Canal does not transport and deliver water as precisely, accurately, or efficiently as a modernized system would.

### 2.1.3 Instream Flow for Fish and Aquatic Habitat

Compared with the natural hydrologic regime, the Deschutes River and its tributaries experience extreme seasonal streamflow variability due to the storage and diversion of water for agricultural use. Resource agencies have identified streamflow as a primary concern in the Deschutes River (Upper Deschutes Watershed Council [UDWC], 2014). Reservoir operations lead to low winter streamflow and high summer streamflow in the Deschutes River upstream from the District's diversion. The combined diversions of the eight major irrigation districts and the cities that divert water in or near Bend lead to low spring, summer, and fall streamflow in the Deschutes River downstream of the District's diversion.

The Deschutes River and its tributaries support a variety of sensitive species; three are currently listed as threatened under the Endangered Species Act (ESA; see Section 4.9.2). Past and ongoing efforts support these species and their habitats;<sup>4</sup> however, lawful irrigation-related activities continue to limit streamflow and negatively affect fish and aquatic habitat.

Current irrigation activities have the potential to result in incidental “take”<sup>5</sup> of ESA-listed species in the Deschutes River and its tributaries. The eight irrigation districts of the Deschutes Basin and the City of Prineville (the applicants) have together developed and submitted the *Deschutes Basin Habitat Conservation Plan* (HCP; AID et al., 2020) to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS); the HCP includes irrigation activity conservation measures. The conservation measures set the streamflow rates in the Deschutes River and its tributaries that the applicants must meet to benefit ESA-listed species. USFWS provided a final permit decision on December 31, 2020, which adopts the HCP and enables the applicants to avoid the unauthorized take of ESA-listed species by issuing incidental take permits. As of May 2022,

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<sup>4</sup> Past and ongoing efforts have included the 2016 Settlement Agreement, Upper Deschutes River Basin Study Work Group, Deschutes Basin Habitat Conservation Plan, and ongoing water conservation projects.

<sup>5</sup> ESA defines “take” to include actions such as the harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capture, collection, or attempts to engage in any such conduct of ESA-listed species.



NMFS has yet to issue a final permit decision. To meet the requirements set forth in the HCP, the applicants must identify mechanisms that would enable them to keep water instream.

Additionally, the Deschutes River is listed as an impaired waterway under Section 303(d) of the Clean Water Act (CWA) because it does not meet one or more of the State of Oregon's water quality standards for salmon and trout, as well as other beneficial uses throughout the year (see Section 4.8).

#### **2.1.4 Risks to Public Safety**

The open Main Canal poses a risk to public safety. In addition to multiple instances of injury in the District, at least 10 deaths have occurred in other irrigation district canals near AID infrastructure (The Bulletin, 2014; KTVZ, 2014; Chu 2004; Cliff 2008; Flowers 2004; Golden, 2007; Minoura, 2007). The District's location in a partly urbanized area heightens the potential for an accident as the Main Canal passes through urban areas, rural residences, private lands, and irrigated fields.

During the summer, water depths in the Main Canal range between 2 to 6 feet with water moving through the canal at up to 3 feet per second. These conditions make it difficult for a healthy, strong adult to stand in or climb out of the canal without assistance. A child or non/weak-swimmer would have an even higher risk of drowning in a canal with these attributes. If a person or animal falls into a canal, they could have serious difficulty gaining hold on the banks to climb out due to the volume and speed of the moving water. Currently, barriers or fences are not present at the top bank of the canal. The failure of the earthen canal and risk of localized flooding is also a concern for AID. The District experiences sinkholes on a regular basis including a most recent one in May 2021.

From 2010 to 2020, Deschutes County was the fastest growing county in Oregon (Population Research Center, 2021). Public safety risks associated with the open canal will continue to grow as the county's population grows.

## **2.2 Watershed and Resource Opportunities**

The following resource opportunities would be realized through the implementation of the proposed project.

- Improve streamflow, water quality, habitat, and habitat availability in the Deschutes River downstream from Wickiup Reservoir by protecting water saved instream during the non-irrigation season.
- Support and maintain existing agriculture through enhanced water supply reliability and improved water management.
- Minimize the potential for flooding, injury, and loss of life associated with the open District Main Canal.
- Reduce AID's O&M involved in delivering irrigation water to District patrons.

## 3 Scope of the Plan-EA

### 3.1 Agency, Tribal, and Public Outreach

Federal, state, local agencies and representatives, as well as non-governmental organizations, received an invitation to participate in scoping this Plan-EA. Advertisements announcing the scoping period and associated scoping meeting were placed in a local newspaper in addition to multiple online locations including the NRCS website, the AID website, and the Deschutes Basin Board of Control's website (see Section 7). Additionally, the District notified patrons and properties adjacent to the flume and Main Canal of the scoping meeting and invited comments on the scope of the Draft Plan-EA.

NRCS conducted tribal consultation with the Tribal Historic Preservation Office (THPO) in accordance with the National Historic Preservation Act (NHPA) of 1966 and Executive Order (EO) 13175, *Consultation and Coordination with Indian Tribal Governments*, to maintain NRCS's government-to-government relationship between Native villages and tribes. NRCS sent a letter to the Confederated Tribes of Warm Springs (CTWS) on June 16, 2021 notifying them about the availability of the Draft Watershed Plan-EA and requesting input.

### 3.2 Scoping Meeting

A scoping meeting was held on April 17, 2019, at Elk Meadow Elementary School in Bend. Presenters at the meeting included Tom Makowski, NRCS; Shawn Gerdes, AID; Raija Bushnell, Farmers Conservation Alliance (FCA); and Margi Hoffmann, FCA. The presentations covered the financial assistance available through PL 83-566, the project purpose and need, the Plan-EA process, and ways in which the public could get involved. After the presentations, attendees asked questions and provided comments for the public record. One hundred and twenty people attended the meeting; this does not include staff from AID, NRCS, and FCA.

### 3.3 Scoping Comments

Scoping comments were accepted from April 3 to May 15, 2019. Comments were submitted at the public meeting on April 17, 2019, and by email, online comment, mail, and phone.

Table 3-1 presents comment topics received and where the comments are addressed in this Plan-EA.

**Table 3-1. Public Scoping Comment Summary.**

Comment Topic	Section Where Topic is Discussed
Request for information on land ownership and land use of the canal and if this will change after the project	Section 6.2
Importance of mitigation for removing the flume	Based on comments received during the public comment period and additional analyses performed during and following that period, AID and NRCS removed the flume from the proposed action and Preferred Alternative.
Request for numbers of public safety incidents	Section 4.3
Effect on vegetation and trees	Section 6.6.2
Concern for who would be responsible for maintaining trees and vegetation that die after piping	Section 6.6.2
Effect on aesthetics	Section 6.7.2
Concern for groundwater and aquifer recharge and water availability for private wells	Section 6.8.2.3
Concern for property values of the adjacent landowners	Appendix D.1 (NEE), Section 6.4.2
Amount of water conserved by project, mechanism by which water would be conserved, and how the conserved water would be distributed in the Deschutes River	Section 6.8.2
Request to permanently commit 100 percent of water conserved through the project instream	Section 6.8.2
Importance of instream flows for the health of the Deschutes River and the associated fish, aquatic species, and general wildlife	Sections 4.8 and 4.9
Concern that seepage loss numbers in the Preliminary Investigative Report are incorrect	Appendix E.4
Request for Section 12 consultation with U.S. Fish and Wildlife Service	Section 7
Effect on riparian habitat	Section 6.10.2

Comment Topic	Section Where Topic is Discussed
Effect on wildlife including mammals, insects, and birds	Section 6.11.2
Concern for building along a Wild and Scenic Waterway	Section 6.12.2
Importance of scenic value of open canal to residents	Section 4.7
Request for additional alternative analyses including canal lining, on-farm efficiency, piping private laterals, duty reductions, and water leasing programs	Section 5
Concern for how the project will be funded and if patrons' costs will increase after the project is implemented.	Section 8.7
Effect of construction on property owners	Section 6.7.2
Concern that trespassers will walk above pipe and access private property after the project is implemented	Section 5.3.2

### 3.4 Identification of Resource Concerns

Concerns about the following resources were identified through scoping comments: cultural, socioeconomic, soil, vegetation, visual, surface water, groundwater, aquatic, wetland, and terrestrial wildlife. Table 3-2 provides a summary of resource concerns and their relevance to the proposed action. Resource concerns determined not relevant were eliminated from detailed study; resource concerns determined relevant were carried forward for analysis.

**Table 3-2. Summary of Resource Concerns for the Arnold Irrigation District Infrastructure Modernization Project.**

Resource	Relevant to the proposed action?		Justification
	Yes	No	
<b>Air</b>			
Air Quality		X	Oregon Department of Environmental Quality air quality data indicates that the entire project area is in attainment for all criteria pollutants. Emissions from equipment associated with construction activities would occur; however, such emissions are considered negligible when compared to background levels and the application of BMPs.
<b>Soils</b>			
Soils	X		Construction of the proposed project could affect soils.
Prime Farmlands	X		Prime farmlands occur in the project area and could be affected by the proposed project.
Geology		X	The are no active fault lines around the project area.
<b>Human Environment</b>			
Environmental Justice		X	The proposed action is not located near any racial, socioeconomic, or environmental justice groups, and therefore would comply with EO 12898.
Cultural and Historic Resources	X		Consultation with SHPO, THPO, and other consulting parties including affiliated tribes is required for compliance with Section 106 of NHPA.
Ecologically Critical Areas		X	The project area does not cross ecologically critical areas.
Land Use	X		Construction and operation of the proposed project could affect land use.
National Parks, Monuments, and Parklands		X	None occur in the project area or would be affected by the project.

Resource	Relevant to the proposed action?		Justification
	Yes	No	
Natural Areas		X	The project does not cross any Natural Area as defined and identified in Oregon’s 2020 plan (OPRD, 2020).
Noise		X	No relevant impact to noise. With implementation of BMPs, noise impacts during construction would be negligible and temporary.
Public Safety	X		Drowning risk in the open canal could be beneficially affected.
Recreation		X	No trails or parks occur in the project area. Any changes in instream flows would not be large enough to affect the quality, access, or participation in river recreation.
Scenic Beauty and Visual Resources	X		Visual resources in the project area could be affected where the open canal would be altered.
Scientific Resources		X	Scientific resources would not be affected by the project.
<b>Socioeconomics</b>			
Local and Regional Economy	X		The proposed action involves an expenditure of public funds, which could affect the local and regional economy.
National Economic Efficiency (NEE)	X		A NEE Analysis has been completed as required by DM 9500-013, Guidance for Conducting Analyses Under the PR&G (USDA-NRCS, 2017a).
<b>Vegetation</b>			
Forest Resources		X	The project area does not cross any forest resources.
Invasive Species/Noxious Weeds	X		With implementation of BMPs, the spread of noxious weeds during construction would be avoided. Invasive aquatic vegetation that occurs within canals could be reduced in the project area.
Mature Trees	X		Direct and indirect effects on mature trees could occur.

Resource	Relevant to the proposed action?		Justification
	Yes	No	
Special Status/Threatened or Endangered Plant Species		X	None have been observed in the project area, and no designated critical habitat occurs in that area.
<b>Water</b>			
Coastal Zones		X	None present.
Groundwater Quantity, Aquifer Recharge	X		Construction and operation of the proposed project could affect aquifer recharge.
Regional Water Resources Plans		X	The proposed action does not consider altering the management of any regional water resources.
Sole Source Aquifers		X	The proposed action would have no effect on sole source aquifers.
Surface Water Quality	X		The proposed action could affect surface water quality by increasing flow in the Deschutes River.
Surface Water Quantity	X		The proposed action could affect surface water quantity by increasing flow in the Deschutes River.
Water Rights	X		The proposed action could affect District water rights.
Wild and Scenic Rivers	X		The proposed action would have no effect on the Wild and Scenic River or State Scenic Waterways designation or the free-flowing condition of the designated reaches downstream from Wickiup Dam (RM 226.8) to Lake Billy Chinook (RM 120.0).
<b>Wetlands and Riparian Areas</b>			
Wetlands and Riparian Areas	X		Wetlands and riparian areas could be affected by project construction activities or changes in water levels.
Floodplain Management		X	Construction and operation of the project would not occur in the 100-year floodplain.

Resource	Relevant to the proposed action?		Justification
	Yes	No	
<b>Fish and Wildlife</b>			
Coral Reefs		X	None present.
Endangered Species	X		Oregon spotted frog, bull trout, steelhead, or their habitats are known to occur in waterbodies (not including ditches/irrigation canals) that could be affected by the proposed project.
Essential Fish Habitat (EFH)		X	Since the proposed project would not adversely affect EFH, consultation under the Magnuson Stevens Act is not anticipated to be required.
Fish and Fish Habitat	X		The proposed action could affect fish habitat within waterbodies associated with District operations.
General Wildlife and Wildlife Habitat	X		Construction and operation of project components could affect wildlife near District operations.
Invasive Animal Species	X		Invasive bull frogs may occur within canal habitats.
Migratory Birds and Eagles	X		Migratory birds and eagles could occur within the project area.
<b>Ecosystem Services</b>			
Provisioning Services	X		Provisioning services supported by water quantity, quality, and availability could be impacted by the proposed action.
Regulating Services	X		Regulating services supported by water quantity, quality, and availability could be impacted by the proposed action.
Cultural Services	X		Cultural services supported by water quantity, quality, and availability could be impacted by the proposed action.

BMP = best management practice; EFH = Essential Fish Habitat; EO = Executive Order; NEE = National Economic Efficiency; NHPA = National Historic Preservation Act; PR&G = Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments; SHPO = State Historic Preservation Office; THPO = Tribal Historic Preservation Officer



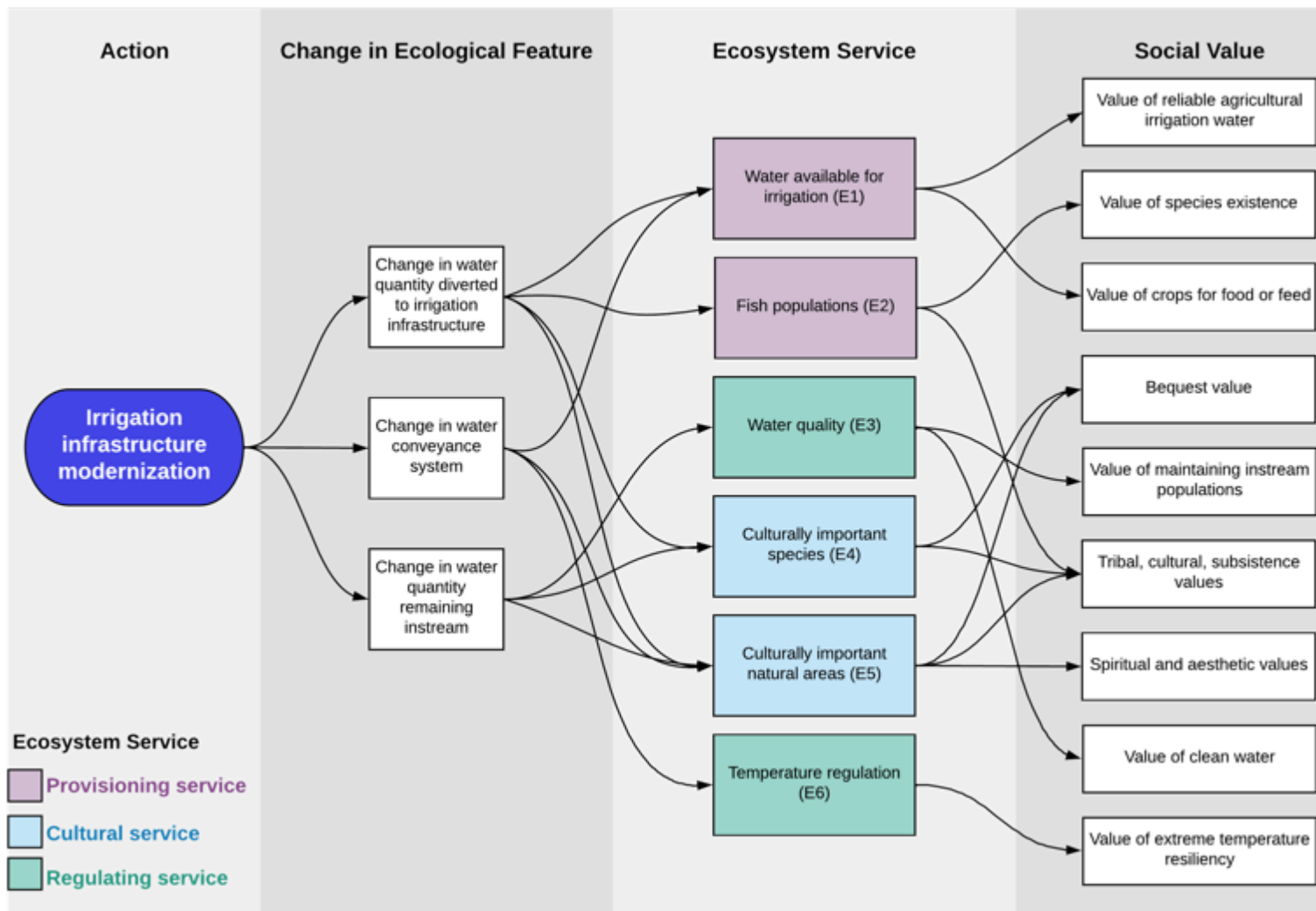
## 4 Affected Environment

The following sections describe the existing ecological, physical, biological, economic, and social resources of the project area and areas that could be affected by the operation of the District system. The project area is defined in Section 1.2. Per requirements of the PR&Gs (USDA-NRCS, 2017a), where applicable, this Plan-EA describes the ecosystem services associated with each resource. Ecosystem services refer to the benefits that people and their communities derive from their natural environment in which they live. Availability of water for consumption, buffering against crop failure through pollination, and providing places in which people value living are all examples of benefits that flow from nature to people. Because these ecosystem services contribute to people’s “health, wealth, and well-being” but often cannot be quantified in the same way as services sold in marketplaces, federal investment into projects that could impact ecosystems and natural resources require an ecosystem services assessment to illuminate how management decisions will enhance, sustain, or degrade the benefits that nature provides (USDA-NRCS, 2017a; Olander et al., 2018). An assessment of links between ecological function and social well-being helps to ensure that beneficial and detrimental ecological impacts of a project are recognized and that detrimental impacts are minimized to the extent possible (European Environment Agency [EEA], 2019).

Per federal guidance, this Plan-EA assesses ecosystem services based on three of the four service categories (USDA-NRCS, 2017a):

1. Provisioning services: Tangible goods provided for direct human use and consumption, such as food, fiber, water, timber or biomass.
2. Regulating services: Services that maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe—examples include flood and disease control, water filtration, climate stabilization, or crop pollination.
3. Cultural services: Services that make the world a place in which people want to live—examples include spiritual, aesthetic viewsheds, or tribal values.
4. Supporting services: Services that refer to the underlying processes maintaining conditions for life on Earth, including nutrient cycling, soil formation, and primary production.

Figure 4-1 shows a concept diagram that highlights the ecosystem services that interact with District operations, and it supports discussion in Section 6. The diagram links an action that would modernize District infrastructure with potentially impacted ecosystem features and the provisioning, regulating, and cultural services that these ecosystems provide to people. Supporting services are not evaluated in this Plan-EA because they give rise to and support the final ecosystem services: provisioning, regulating, and cultural (EEA, 2019; USDA- National Agricultural Statistics Service [NASS], 2017).



Note: 1. E1 through E6 refer to ecosystem services 1 through 6. These services are referenced and explained in more detail throughout Sections 4 and 6.  
 2. Ecosystem services concept diagram developed by Farmers Conservation Alliance

**Figure 4-1. Ecosystem services concept diagram for the Arnold Irrigation District Infrastructure Modernization Project.**

## 4.1 Cultural Resources

Section 106 of NHPA requires federal agencies to consider the effects of federally funded projects on historic properties, commonly referred to as cultural resources, prior to the expenditure of federal funds. NHPA defines a historic property as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places, including artifacts, records, and material remains related to such a property or resource” (Advisory Council on Historic Preservation [ACHP], 2019).

There are no National Register-listed historic properties within the project area based on a review of the Oregon Historic Sites Database. The District hired a cultural resource specialist to complete site surveys for historic and archaeological resources in the project area, which included surveys of the irrigation canals and related infrastructure. Please see Section 6.1.2 for a description of the survey findings and the consultation between NRCS, SHPO, THPO, and affiliated tribes for compliance with Section 106 of NHPA.

## 4.2 Land Use

### 4.2.1 Land Ownership

Ninety-nine percent of the project area is privately owned. The District has a ROW underlying all of the infrastructure in the project area. The District additionally has easements underlying some of the infrastructure in the project area. The District’s ROW was granted under the Carey Desert Land Act of 1894. Under the Carey Act, the District’s ROW extends 50 feet on each side of the canal from the toe of the bank for a total width of 100 feet plus the width of the canal (see Appendix C for a map). Over the course of the last 100 years, there have been re-negotiations in specific areas concerning District easements. AID re-maps and re-surveys its infrastructure and easements on an ongoing basis to track changes over time. The Carey Act ROW underlies all infrastructure that is part of the proposed project.

### 4.2.2 Land Use

Within the project area, land use is entirely related to irrigation conveyance for agriculture. The project area crosses lands both served by and not served by AID. In the eastern half of the District, the project area crosses and is adjacent to rural residential lands; agricultural lands growing alfalfa/grass hay, pasture, and turf; and undeveloped land covered in western juniper (*Juniperus occidentalis*), ponderosa pine (*Pinus ponderosa*), and scrub-shrub species. Deschutes County has zoned a large proportion of the agricultural land and rural land that the project area crosses as Exclusive Farm Use. On the agricultural lands that the project area serves, farmers typically get two to three cuttings per year on hay and pasture grass. Table 4-1 presents information about crops grown in the District.

**Table 4-1. Crops Grown in Arnold Irrigation District.**

Crop	Total Acreage	Percent Acreage
Alfalfa/grass hay	1,600	36%
Grass (pasture, turf, etc.)	1,600	36%
Lawn/garden, misc.	1,184	28%
<b>Total</b>	<b>4,384</b>	<b>100%</b>

Source: AID, 2013

In the western half of the District, the project area crosses more developed land including residential areas such as Deschutes River Woods (DRW), a census-designated place and unincorporated community. Approximately 1.3 miles of the project area crosses land that falls within the Bend urban growth boundary (UGB). This boundary is set to control urban sprawl and encroachment on agricultural and rural lands by mandating that the area inside the UGB be used for higher-density urban development.

The proposed action also has the potential to indirectly affect agricultural lands in NUID as result of potential water savings. NUID serves 961 patrons and approximately 59,000 acres of productive farmland. The primary crop types in NUID are alfalfa, hay, bluegrass seed, winter grain, carrot seed, and pasture. Approximately 55 percent of the U.S. domestic market and 45 percent of the global market carrot seed production is grown in Jefferson County, with most of it occurring in the Culver and Madras areas that fall within NUID (Oregon State University, 2020). In 2012, the Jefferson County’s agricultural commodity sales contributed more than \$260 million to the Central Oregon economy (Headwaters Economics, 2017).

#### **4.2.3 Ecosystem Services**

Agricultural land receiving water from District infrastructure provides ecosystem services categorized as *Provisioning service, Water available for irrigation* (see Figure 4-1 [E1]). As described in Section 1.3, water from the Deschutes River is diverted into the District’s irrigation conveyance system and delivered to patrons for agricultural purposes. Provision of this water allows lands to be maintained for agricultural production. Feed grasses including hay and pasture contribute to the production of meat and dairy products. This water may also be used to grow crops for food for people.

### **4.3 Public Safety**

The open canal in the project area poses a risk to public safety when it carries water. During the summer months when irrigation water is flowing at peak volume in the canal, water depths can reach to 6 feet with water moving through the canal at up to 3 feet per second. These conditions result in areas of deep, swift water that can make it difficult for a child or an adult to get to safety and can result in tragic outcomes. Some area residents use the property alongside the project area for walking; however, it is private property. The District’s ROW and easements are only for maintaining

irrigation infrastructure and conveying irrigation water. Public use of the property alongside the District's canal is not a purpose of the District's ROW and easements, nor does the District have the authority to grant public access.

Within the District, cars have crashed into the canal (C. Wills, personal communication, December 12, 2019). The risk of localized flooding from canal failure caused by sinkholes, rodents, tree roots, and from water breaching the canal banks due to debris blockage is also a concern for AID.

In other districts in Central Oregon, drowning deaths, or near drowning instances, have occurred in 1996, 1997, 2004, 2007, 2008, and 2014 in addition to multiple instances of injury (The Bulletin, 2014; KTVZ, 2014; Chu, 2004; Cliff, 2008; Flowers, 2004; Golden, 2007; Minoura, 2007).

Wildfire in Central Oregon and in the wildland urban interface and rural areas where the project area is located has become an increasing concern to the public over the last decade. Factors that have contributed to the recent wildfires include fire suppression that has led to fuels buildup, increased use of wildlands, altered climate regimes, and expansion of communities into the wildland urban interface (USDA U.S. Forest Service [USFS] Western Wildland Environmental Threat Assessment Center, 2021).

The USFS Oregon Wildfire Risk Explorer defines wildfire risk as “both the likelihood of a wildfire and the expected impacts of a wildfire on highly valued resources and assets.” Data from the USFS Oregon Wildfire Risk Explorer shows that 22 percent of the land in the watershed planning area is considered to have a very high wildfire risk, 20 percent is considered high, and 12 percent is considered to have moderate risk (USFS ODF, 2018). See Appendix E.10 for additional information regarding wildfire risk.

The project area is primarily in the Deschutes County Rural Fire Protection District #2 with a few small sections of the project area falling outside of this fire district. The fire protection district relies on hydrants with reliable water (water available at all times) located on public roads as its primary source of water for fighting fires. The fire protection district considers canals, cisterns, and ponds as secondary sources of water for fighting fires (L. Medina, personal communication, October 21, 2021).

## **4.4 Socioeconomic Resources**

The project area falls within Deschutes County, Oregon, and the socioeconomic region of influence includes the planning area and the communities of Bend and DRW, a census-designated place.

### **4.4.1 Population**

Generally, the socioeconomic region of influence has seen consistent population growth over the past 10 years (2010 to 2020). Table 4-2 provides more information on the population and population growth within the socioeconomic region of influence and Oregon.

Ethnicity and race for the socioeconomic region of influence can be seen in Table 4-3. Deschutes County, Bend, and DRW are majority white (around 95 percent of the population). The socioeconomic region of influence has lower proportions of all other races, as well as people identifying as Hispanic or Latino, as compared with the state of Oregon.

**Table 4-2. Population by State, County, and City.**

<b>Indicator</b>	<b>Oregon</b>	<b>Deschutes County</b>	<b>Bend</b>	<b>DRW</b>
Population in 2020 (number of people)	4,237,256	198,253	99,178	5,532
Population Growth 2010–2020	10.6%	25.7%	29.4%	9%

Source: U.S. Census Bureau, 2021

**Table 4-3. Race by State, County, and City.**

Indicator	Oregon	Deschutes County	Bend	DRW
Total Population in 2020 (number of people)	4,327,256	198,253	99,178	5,532
Two or More Races	4%	2.8%	3.4%	1.4%
One Race	96%	97.2%	96.6%	98.6%
• White	86.7%	94.1%	92.5%	96.2%
• Black or African American	2.2%	0.6%	0.6%	0.3%
• American Indian and Alaska Native	1.8%	1.1%	0.5%	1.2%
• Asian	4.9%	1.3%	1.8%	0.9%
• Native Hawaiian and Other Pacific Islander	0.5%	0.2%	0%	0%
Hispanic or Latino (of any race)	13.4%	8.3%	9.2%	7%
Not Hispanic or Latino	86.6%	91.7%	90.8%	93%

Source: U.S. Census Bureau, 2021

#### 4.4.2 Area Employment and Income

In 2018, health care and social assistance, retail trade, and accommodation and food services were the most common employment sectors in Deschutes County. The county also has more people in agricultural, forestry, and fishing and hunting industries as compared to other counties in Oregon (DataUSA, 2022). In 2017 the market value of agricultural products sold in Deschutes County was approximately \$28.8 million (USDA-NASS, 2017).

Household income and the number of persons living below the poverty level are summarized in Table 4-4. Income in the socioeconomic region of influence is above the Oregon median household income. The percentage of persons in poverty falls both below and above the state values depending on the location. Bend and the broader Deschutes County area have lower percentages of people in poverty, while DRW has a poverty percentage greater than that for the state.

**Table 4-4. Income and Poverty by State, County, and City.**

Indicator	Oregon	Deschutes County	Bend	DRW
Median Household Income (in 2019 dollars), 2015–2019	\$62,818	\$67,043	\$65,662	\$65,361
Persons in Poverty	11%	8.1%	10.3%	16.1%

Source: U.S. Census Bureau, 2021

#### 4.4.3 Environmental Justice Communities

Areas with over 50 percent or “meaningfully greater” representation of minority or low-income communities are considered environmental justice communities (Council on Environmental Quality, 1997), and their propensity to experience disproportionately adverse effects from a given action must be analyzed within NEPA documents per EO 12898.

As seen in Table 4-3 and Table 4-4, the socioeconomic region of influence generally has a lower proportion of minority groups and low-income populations relative to the state. One exception is DRW, which has a greater proportion of persons in poverty as compared to the rest of the state.

#### 4.4.4 Property Value along the Main Canal

Within the watershed planning area, there are approximately 400 tax lots adjacent to the project area. Based on comments received during the scoping period and the public comment period, many of these landowners view the currently open Main Canal as having a direct effect on their property value. Limited literature is available looking at the effects of western agricultural irrigation canals on property value. Review of available literature as well as additional analyses of properties specifically in the planning area and properties in nearby irrigation districts, showed that properties adjacent to canals can have property values higher than properties not on a canal (see the NEE Analysis in Appendix D.1 and Appendix E.12 for additional information).

### 4.5 Soils

The Wanoga Series are the predominant soils in the project area (90 percent of the project area; USDA-NRCS, 2015b). These soils are moderately deep, well drained, and formed from volcanic ash. In 2019, AID found 15 sinkholes in the Main Canal that ranged from softball size to 8 feet by 6 feet (C. Wills, personal communication, December 12, 2019). Sinkholes develop from the seepage of irrigation water and canal soils into the underlying porous rock. Tree roots and burrowing animals have also caused canal failure.



### 4.5.1 Farmland Classification

NRCS developed technical soil groups that are associated with a particular soil type and a soil's rating for agricultural commodity production (USDA-NRCS, 2015b). NRCS soil groupings within the project area are nearly all farmland of statewide importance (97 percent of the project area; see Appendix E.2).

## 4.6 Vegetation

### 4.6.1 General Vegetation

The District lies in the Ponderosa Pine/Bitterbrush Woodland ecoregion Level IV (Thorson et al., 2003). Over the past 100 years, land use changes have altered much of the vegetation within the District. The increased presence of urban development, roads, irrigated agriculture, land management, and livestock grazing are the primary causes of change in the plant communities. The introduction of cheatgrass (*Bromus tectorum*) has also threatened the survival and diversity of native perennial grasses and forbs while increasing the risk of severe wildfire in the project area and adjacent undeveloped lands.

AID allows the establishment of vegetation within its easements and ROW as long as that vegetation does not interfere with operation and maintenance of District infrastructure (AID, 2012). On the side of the canal with the maintenance road, AID mows, grades, and clears its easements and ROW the during the non-irrigation season as needed to maintain access to its irrigation infrastructure. These activities limit vegetation establishment. On the side of the canal without a maintenance road, AID conducts little vegetation management.

Where vegetation has been allowed to grow within the District's easements and ROW, vegetation typically includes ponderosa pine, western juniper, big sagebrush (*Artemisia tridentata*) and low sagebrush (*Artemisia arbuscula*), and bunchgrass (*Poaceae* spp.) (INR Portland & Oregon Biodiversity Information Center, 2014). Some trees within the project area, and in properties adjacent to the project area, may rely on canal seepage as a water source.

In some sections of the project area, hydrophytic (water-loving) vegetation has established along the top of the canal bank; it primarily includes bulrush (*Scirpus* spp.), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and willow (*Salix* spp.).

AID does not allow vegetation to develop long-term within the canal.

### 4.6.2 Special Status Species

Within Deschutes County, three special status vegetation species potentially occur: federal-candidate whitebark pine (*Pinus albicaulis*), Oregon-threatened pumice grape-fern (*Botrychium pumicola*), and federal species of concern, Oregon-threatened Peck's milkvetch (*Astragalus peckii*) (Center for Biological Diversity, 2019; Oregon Department of Agriculture [ODA], 2019). The project area does not support elevation or habitat requirements for these species, and there are no reports of species presence within the project area based on information from the Oregon Biodiversity Information Center database, the Oregon Department of Agriculture identification of species population centers, or AID observations.

### **4.6.3 Common and Noxious Weeds**

The Deschutes Basin Board of Control determines a weed to be noxious if it is “injurious to public health, agriculture, recreation, wildlife, or any public or private property,” and “impacts and displaces desirable vegetation.” Furthermore, it is recognized that certain noxious weeds are so pervasive that they have been classified by Oregon Revised Statute (ORS) 569.350 to be a menace to public welfare (ODA, 2017). The noxious and common weeds known to occur in the project area, along with their corresponding weed categories (Deschutes County, 2017), are listed in Appendix E.3.

### **4.7 Visual Resources**

Within the project area, the Main Canal consists of an open earthen canal that lies flat against the landscape. In some portions of the Main Canal, the water surface in the canal is a few feet lower than the landscape level and the canal banks are part of the landscape.

The project area adjacent to the canal includes a dirt or gravel maintenance road that AID uses for canal and vegetation maintenance (see Section 4.6). Herbaceous vegetation, grasses, shrubs, and trees growing within the project area can obscure the view of the canal from adjacent lands. The open canal and project area are visible from residences as well as at public road crossings (see Figure 4-2).

The view of the canal changes throughout the year. The District’s irrigation season typically extends from April through October; during this time, the canal carries water. From November through March, the canal does not carry water and is typically dry with a few puddles remaining in low-lying areas. AID provides “stock runs,” water delivered through the system to fill patrons’ ponds for livestock, several times outside of the irrigation season.

Although the canal is not a naturally formed waterway, many property owners that live adjacent to the canal consider it an aesthetic amenity and derive enjoyment from the view of the canal and wildlife that occur in the project area. Comments received during the scoping and public comment periods indicate that a view of the canal and surrounding vegetation (e.g., from a yard) enhances the aesthetic value of properties adjacent to the project area. Trees growing in the project area and on land immediately adjacent to the project area were also identified as an important aspect of the scenic quality enjoyed from properties adjacent to the project area. See Section 4.8.6 for information on the cultural services that the Arnold Main Canal provides.



**Figure 4-2. A view of the Main Canal and maintenance road within the project area from Knott Road looking northeast. Some residents have installed fences for safety purposes and do not have direct views of the canal from their property.**

The western side of the project area passes through residential areas in DRW (see Figure 4-3), while the eastern side of the project area passes through agricultural and undeveloped lands. In residential areas where homes are located along the canal, some homes have direct views of the canal. Other homes located along the canal do not have views of the canal because homeowners have installed fences between the canal and their homes (see Figure 4-2).

In agricultural and undeveloped areas, there are a few rural residences adjacent to the project area. Some rural residences have views of the canal, but vegetation obscures the canal in many locations.



**Figure 4-3. The Main Canal passing residential homes in Deschutes River Woods, located west of Brookwood Boulevard.**

## **4.8 Water Resources**

### **4.8.1 Arnold Irrigation District Water Rights and Operations**

AID delivers water to irrigate 4,384 acres. Of that total acreage, 1,475 acres receive water directly from the Main Canal. The remaining irrigated lands receive water through lateral canals that branch off the Main Canal. AID has already piped approximately 22 percent of its system—primarily laterals that are not part of the project area. Patron turnouts from the Main Canal are gate-regulated and weir-measured by AID field staff. Water loss associated with the laterals is detailed in the District’s System Improvement Plan (Crew, 2017). Water loss associated with the Main Canal is discussed in Sections 2.1.1 and 6.8.2 of this Plan-EA, Appendix E.4, and the District’s System Improvement Plan (Crew, 2017).

AID diverts both live flow and stored water from the Deschutes River at the Arnold Canal Diversion (RM 174.5) near Bend to meet its patrons’ water needs. AID’s primary source of water is live flow. AID diverts this water under Certificate 74197, which has a priority date of February 1, 1905, for 25 cfs and a priority date of April 25, 1905, for 125 cfs. The duty<sup>6</sup> under this water right is 15.42 acre-feet per irrigation season (see Appendix E.4 for more information on historical AID diversion rates). AID also holds 5,000 acre-feet of stored-water rights in Crane Prairie Reservoir, which is located upstream from the AID diversion on the Deschutes River (S. Johnson, personal communication, May 12, 2022). AID’s stored-water right can be used throughout the irrigation season and is used on an as-needed basis to supplement the live-flow water right.

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<sup>6</sup> Duty is the maximum volume allowed per acre per irrigation season.

Water for the District is conveyed from Crane Prairie Reservoir, east through the Deschutes River, through Wickiup Reservoir, and then north through the Deschutes River to the Arnold Canal Diversion at RM 174.5 (see Figure 4-4).

AID’s live-flow water right identifies three seasons; each has different delivery rates (see Table 4-5). These delivery rates are lower in season 1 and season 2 than in season 3. To meet demands during the late summer and fall, AID may supplement live flow with stored water to address reduced live-flow availability caused by drought or prolonged heat.

**Table 4-5. Delivery Rates and Irrigation Season Dates per Water Right Certificate 74197.**

Season	Start Date	End Date	Start Date	End Date	Season Duration (days)	Priority Date	Certificated Diversion Flow Rates (cfs)	Percent of Full Certificated Rate
1	April 1	April 30	Oct. 1	Nov. 1	62	2/1/1905	14.33	41%
						4/25/1905	71.63	41%
2	May 1	May 14	Sept. 15	Sept. 30	30	2/1/1905	18.73	53%
						4/25/1905	93.68	53%
3	May 15	Sept. 14	N/A	N/A	122	2/1/1905	25.00	100%
						4/25/1905	125	100%

cfs = cubic feet per second; N/A = not applicable

Historically, AID has diverted water based on water rights, water availability, and patron demand. Table 4-6 demonstrates the 20th percentile, 50th percentile, and 80th percentile of AID’s diversion rates throughout the 2000 through 2021 water years (OWRD, 2022).

**Table 4-6. AID Historical Diversion Rates Throughout the 2000–2021 Water Years.**

Season	Month	20th Percentile (cfs)	50th Percentile (cfs)	80th Percentile (cfs)
1	April	49	64	77
2	May 1–14	76	84	90
3	May 15–31	80	87	93
	June	81	88	93
	July	86	93	98
	August	85	94	98
	Sept 1–14	78	87	93
2	Sept 15–30	71	80	86
1	October	58	66	74

Source: OWRD, 2022.

#### 4.8.2 North Unit Irrigation District Water Rights and District Operations

North Unit Irrigation District (NUID) provides irrigation water to nearly 59,000 agricultural acres in Jefferson County, Oregon. NUID diverts natural flow from the Deschutes River and stored water released from Wickiup Reservoir at its diversion in Bend, Oregon (RM 164.8). Wickiup Reservoir, located on the Deschutes River 60 miles southwest of Bend, has a maximum capacity of 200,000 acre-feet.

NUID also operates a pumping plant on the Crooked River. This pumping plant is located where NUID’s Main Canal crosses the Crooked River. It provides water for both primary and supplemental use in NUID.

NUID historically sourced approximately 70 percent of its annual water supply from storage in Wickiup Reservoir (NUID, n.d.). With the HCP now in effect, winter flow releases from Wickiup Reservoir to meet minimum streamflow requirements set by the HCP in the Deschutes River are expected to result in a decline in storage water availability for NUID patrons (AID et al., 2020). This decline in stored-water availability is estimated to reduce water supply availability to NUID starting year 8 of the HCP (i.e., January 2028) in normal to very dry years and in year 13 of the HCP (i.e., January 2033) in all water-type years. It is estimated that following year 13 of the HCP, the increased winter releases will reduce water supply storage in Wickiup Reservoir in a normal water year by 75,017 acre-feet—a 40 percent reduction (AID et al., 2020).

### 4.8.3 Surface Water Hydrology

Table 4-7 and Figure 4-4 present waterbodies associated with AID operations. The upstream end of Lake Billy Chinook, at the confluence of the Deschutes, Crooked, and Metolius rivers, serves as the downstream boundary of the area associated with AID operations.

**Table 4-7. Waterbodies Associated with AID Operations.**

Name	Reach	Size	Tributary To	Project Nexus
Crane Prairie Reservoir	Not applicable	55,300 acre-feet	Not applicable	AID holds stored-water rights in this reservoir.
Deschutes River	Crane Prairie Reservoir (RM 238.5) to Wickiup Reservoir (RM 233.5)	Not applicable	Not applicable	Releases from Crane Prairie Reservoir affect flows in this reach.
Wickiup Reservoir	Not applicable	200,000 acre-feet	Not applicable	NUID holds stored-water rights in this reservoir. AID irrigation water is conveyed through Wickiup Reservoir.
Deschutes River	Wickiup Reservoir (RM 226.8) to Arnold Canal Diversion (RM 174.5)	Not applicable	Columbia River	Releases from Crane Prairie and Wickiup reservoirs are developed to meet streamflow rates set forth in the HCP in this reach.
Deschutes River	Arnold Canal Diversion (RM 174.5) to Lake Billy Chinook (RM 120.0)	Not applicable	Columbia River	AID's diversion affects flows in this reach.

AID = Arnold Irrigation District; HCP = *Deschutes Basin Habitat Conservation Plan*; NUID = North Unit Irrigation District; RM = River Mile

Historically, the spring-fed Deschutes River had relatively consistent streamflow seasonally and annually (Deschutes River Conservancy [DRC], 2012). Hydrologic conditions in the Deschutes River have changed with the construction and operation of reservoirs, dams, and diversions on the river and its tributaries. Water is now managed for irrigation use; this results in lower flows downstream from reservoirs during the storage season (i.e., late fall, winter, and early spring), higher flows downstream from reservoirs during the irrigation season (April through October), and lower flows downstream from irrigation diversions during the irrigation season (see Appendix E.4 for more information on historical flows in the Deschutes River).

In November 2020, AID, seven other irrigation districts in the Deschutes Basin, and the City of Prineville finalized the Deschutes Basin HCP to support the issuance of incidental take permits by USFWS and NMFS under Section 10(a)(1)(B) of the federal ESA of 1973, as amended. The HCP

identifies streamflow rates that will be maintained in the Deschutes River by the Deschutes Basin irrigation districts (AID et al., 2020; see Appendix E.4.8 for a summary of the operation measures set forth by the HCP). These rates increase over time as discussed in the following subsections.



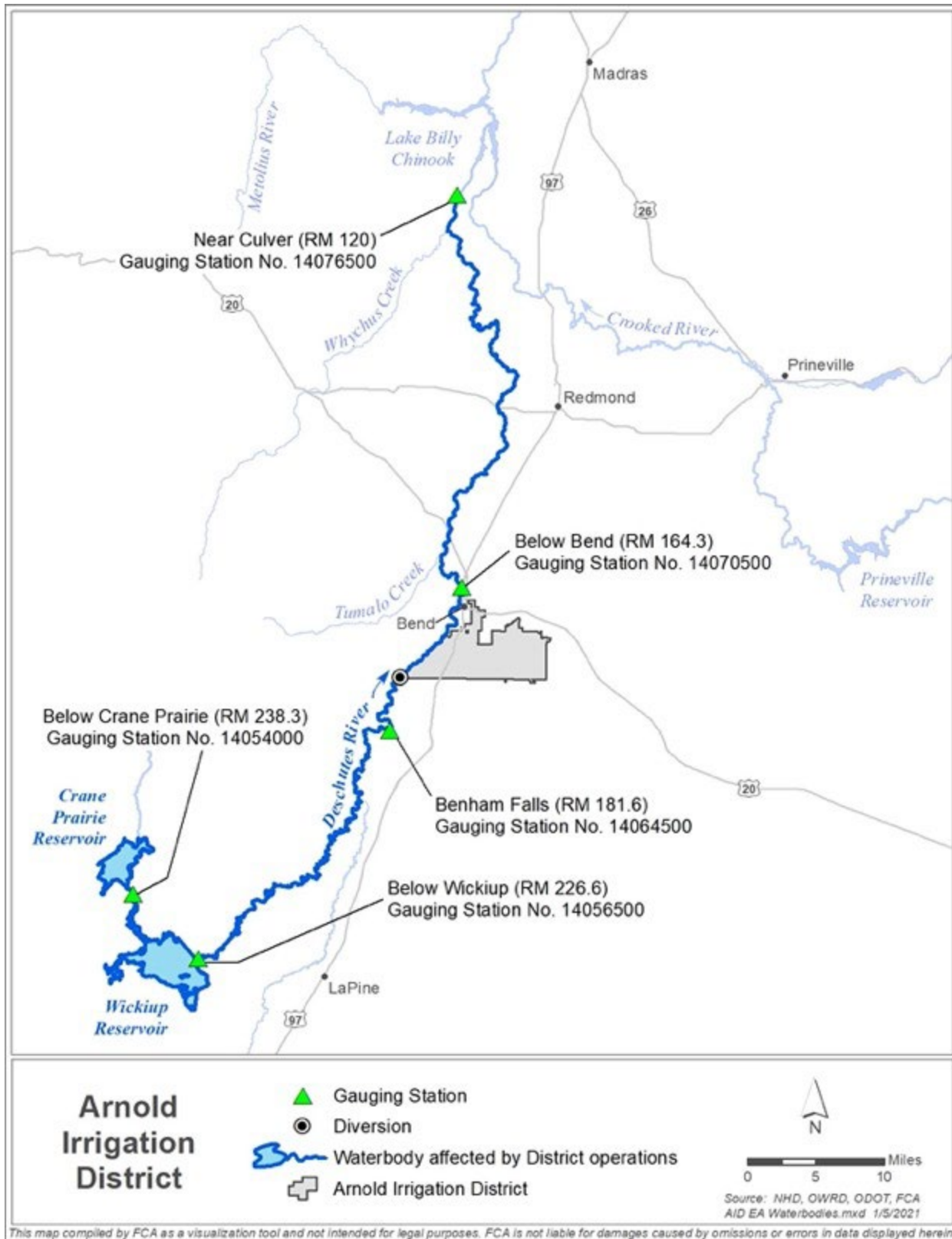


Figure 4-4. Waterbodies and gauging stations associated with District operations.

#### 4.8.3.1 Crane Prairie Reservoir

Crane Prairie Reservoir relies on snowmelt, flows from the Deschutes River (which comes out of Little Lava Lake), and precipitation for inflow. Crane Prairie Dam is operated in coordination with Wickiup Dam and Reservoir, in accordance with the HCP. Storage and releases are directed by the OWRD regional watermaster and executed by Central Oregon Irrigation District (COID) personnel.

#### 4.8.3.2 Wickiup Reservoir

Wickiup Reservoir is 5 miles downstream from Crane Prairie Dam and relies on snowmelt, releases from Crane Prairie Reservoir, and precipitation for inflow. Throughout the year, water is released from Wickiup Reservoir as directed by the OWRD regional watermaster in accordance with the HCP and through an accounting arrangement whereby the storage accounts for COID, NUID, Lone Pine Irrigation District (LPID), and AID are balanced over the course of the irrigation season.

During the irrigation season, water released from Wickiup Dam is conveyed through the Deschutes River to COID's, AID's, and NUID's diversions in Bend (see Figure 4-4). During the non-irrigation season, water released from the dam is conveyed down the Deschutes River to Lake Billy Chinook (RM 120.0). The HCP (AID et al., 2020) limits reservoir operations, and a summary of the operation measures set forth by the HCP can be found in Appendix E.4.8.

#### 4.8.3.3 Deschutes River (RM 238.5) to the Arnold Canal Diversion (RM 174.5)

Reservoir releases, tributary inflows, irrigation diversions, and groundwater interactions drive streamflow in the reaches of the Deschutes River from Crane Prairie Reservoir (RM 238.5) to Wickiup Reservoir (RM 233.5) and from Wickiup Reservoir (RM 226.8) to the Arnold Canal Diversion (RM 174.5). Appendix E.4 provides more information on flows in this reach of the Deschutes River. As described in the prior subsection, streamflow rates in this reach are set forth in the HCP, which are summarized in Appendix E.4.8.

Figure 4-5 and Figure 4-6 display the Deschutes River's daily average baseline streamflow following the 2016 Settlement Agreement.<sup>7</sup> Data for streamflow following the 2016 Settlement Agreement represents the October 2016 through September 2020 water years.

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<sup>7</sup> In 2016, as part of an interim agreement until the finalization of the HCP, AID and other districts that store water in Crane Prairie and Wickiup reservoirs agreed to maintain a minimum of 100 cfs in the Deschutes River outside the irrigation season (*Center for Biological Diversity et al. v. U.S. Bureau of Reclamation* and AID et al. 2016). This agreement is referred to as the 2016 Settlement Agreement and was maintained until the finalization of the HCP in 2020 (AID et al., 2020).

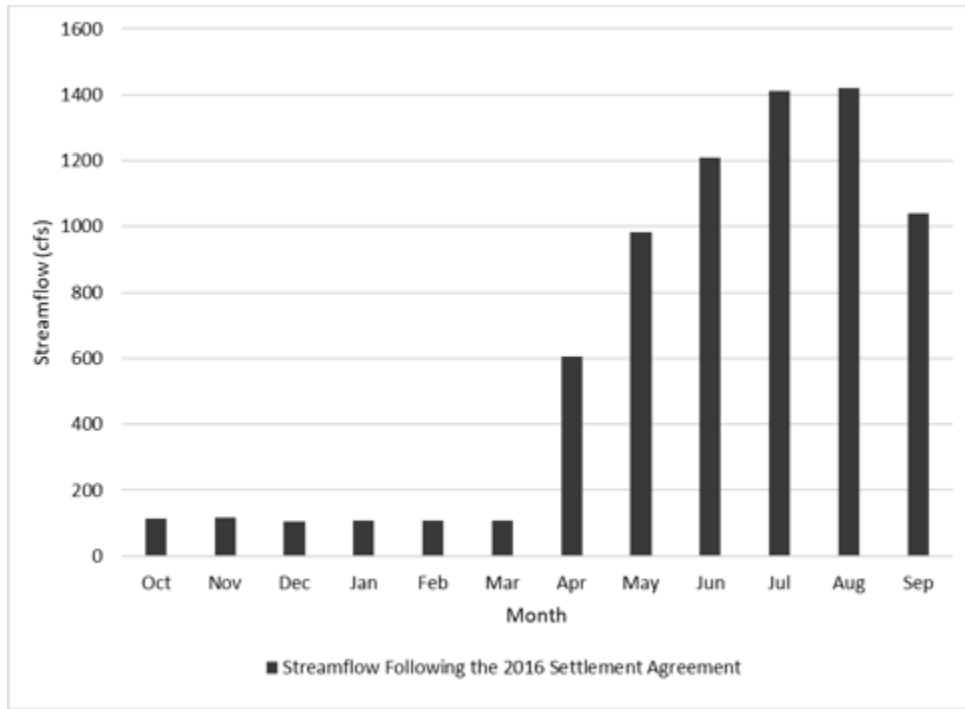


Figure 4-5. Streamflow in the Deschutes River downstream from Wickiup Reservoir at OWRD Gauge No. 14056500.

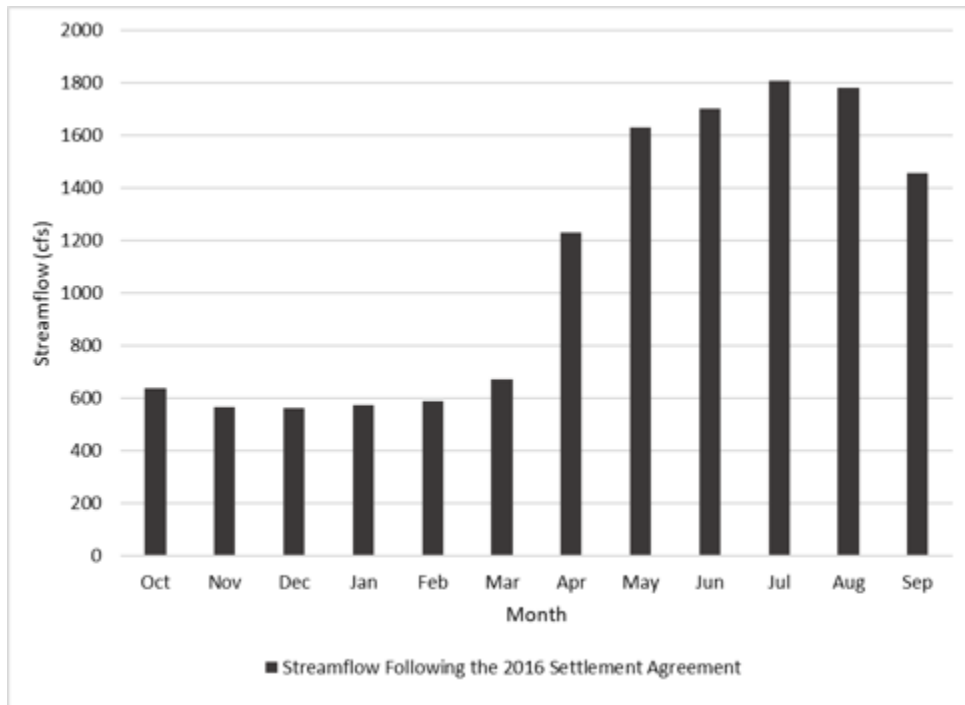
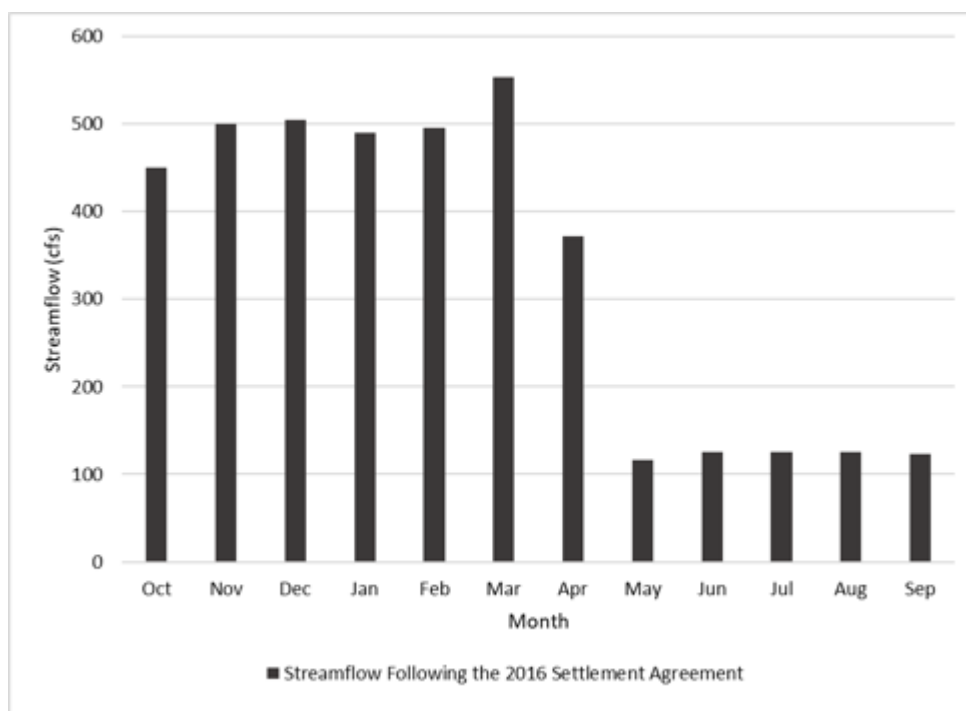


Figure 4-6. Daily average streamflow in the Deschutes River at Benham Falls at OWRD Gauge No. 14064500.

#### 4.8.3.4 Deschutes River, Arnold Canal Diversion (RM 174.5) to Lake Billy Chinook (RM 120.0)

Central Oregon, Arnold, Lone Pine, North Unit, and Swalley irrigation districts divert water from the Deschutes River near Bend; this influences streamflow patterns in the Deschutes River between the Arnold Canal Diversion (RM 174.5) and Lake Billy Chinook (RM 120.0). Historically, these irrigation districts maintained a minimum of 30 cfs instream in this reach during the irrigation season under a voluntary agreement. Extensive conservation efforts by the irrigation districts and their partners starting in the 2000s have enhanced streamflow during the irrigation season, maintaining approximately 130 cfs downstream from their diversions during the summer irrigation season. Appendix E.4 provides more information on flows in this reach of the Deschutes River.

Figure 4-7 displays the Deschutes River streamflow downstream from Bend. The figure demonstrates the daily average baseline streamflow following the 2016 Settlement Agreement (October 2016 to September 2020).



**Figure 4-7. Daily average streamflow in the Deschutes River downstream from Bend at OWRD Gauge No. 14070500.**

The Oregon Department of Fish and Wildlife’s (ODFW) pending water right in this reach requests a year-round flow of 250 cfs; this provides one target for the streamflow that is needed for fish and wildlife and their habitat quality, as well as for recreation from North Canal Dam (RM 164.8) to Lake Billy Chinook (RM 120.0; see Appendix E.4).

#### 4.8.3.5 Drainage Courses

AID does not allow its canal and lateral system to be intentionally used for stormwater management. Any interception of stormwater associated with overland flow in the area adjacent to the AID conveyance system is incidental to the purpose of conveying water for irrigation. Due to the geology and climate of the area, these occurrences are minimal.

#### 4.8.4 Surface Water Quality

The Oregon Department of Environmental Quality (DEQ) maintains a list of all surface waters in the state that are considered impaired because they do not meet water quality standards under Section 303(d) of the CWA (Congressional declaration of goals and policy, 2021). The 2012 Section 303(d) list is effective for CWA purposes. Waterbodies associated with AID operations are included on Oregon’s Section 303(d) list for not meeting state water quality standards for aquatic weeds or algae, temperature, dissolved oxygen, pH, sedimentation, turbidity, chlorophyll a, *E. coli*, and biological criteria (see Table 4-8).

Water management in the Deschutes Basin has altered seasonal streamflow patterns; this has increased streamflow above historical levels in some reaches and decreased streamflow below historical levels in others. Low streamflow impacts water quality in the Deschutes River by exacerbating temperature and dissolved oxygen problems. In addition, water quality often dictates the spread and extent of invasive aquatic species (McCormick et al., 2009), and these problems interact synergistically to degrade wildlife habitat within and around the Deschutes River. The following sections describe existing Section 303(d)–listed impairments in the waterbodies associated with District operations. DEQ is required to develop total maximum daily loads for rivers and streams in the upper Deschutes Basin (these impairments may extend upstream or downstream of the reaches included in Table 4-8).

**Table 4-8. Impaired Waterbodies Associated with District Operations.**

Name	Listed Reach (River Miles)	Parameters Included on Oregon’s Section 303(d) List
Crane Prairie Reservoir	Not applicable	Aquatic weeds or algae
Deschutes River	Crane Prairie Reservoir (RM 238.5) to Wickiup Reservoir (RM 226.8)	Temperature
Wickiup Reservoir	Not applicable	Aquatic weeds or algae
Deschutes River	Wickiup Reservoir Dam (RM 226.8) to North Canal Dam (RM 164.8) <sup>1</sup>	Temperature Dissolved oxygen pH Sedimentation Turbidity Chlorophyll a
Deschutes River	North Canal Dam (RM 164.8) to Lake Billy Chinook (RM 120.0)	Temperature Dissolved oxygen

Source: DEQ, 2012

RM = River Mile

<sup>1</sup> The Arnold Canal Diversion is located at RM 174.5 in the Deschutes River.

#### 4.8.5 Groundwater

AID and its associated operations lie within the upper Deschutes Basin. Within the basin, precipitation in the Cascade Range provides 3,500 cfs of annual groundwater recharge. Inflows from outside the basin provide an additional 850 cfs of recharge. Canal seepage across the region provides approximately 411 cfs of additional recharge based on 2008 data (Gannett et al., 2001; Gannett & Lite, 2013). Since the publication of the Gannett and Lite (2013) groundwater level change analysis, subsequent canal lining and piping projects have reduced recharge from canal seepage.

Due to the highly permeable geology of the area, groundwater levels and stream discharge are associated with movement of water between surface and groundwater systems. The rivers, streams, and irrigation canals in the upper Deschutes Basin all show seepage losses indicative of the area's permeable geology (Gannett et al., 2001). AID's Main Canal loses an estimated 32.5 cfs of water during the irrigation season (11,083 acre-feet annually)<sup>8</sup> due to a combination of seepage related to the condition of the distribution system, the permeable nature of the underlying soil and rock, and evaporation.

Gannett et al. (2001; 2017) mapped stream reaches in the upper Deschutes Basin as either losing reaches or gaining reaches. The reach of the Deschutes River from near Sunriver to Bend was mapped as a losing reach. Thus, canal seepage loss in the District is not returning to this reach of the river. Furthermore, groundwater flow, estimated from simulated 2013 groundwater hydraulic head<sup>9</sup> data, is in a northeasterly direction from the District (Gannett et al., 2017). The model results provide evidence that groundwater underlying the District flows eastward away from the Deschutes River before bending northward where it travels along paths to discharge locations north of Redmond, Oregon.

Cascade Range aquifers in the upper Deschutes Basin have experienced a general drying trend since the 1950s. Climate oscillations remain the primary driver of these declines (Gannett et al., 2001; Gannett et al., 2003). A U.S. Geological Survey study investigated the influence of canal lining and piping, groundwater pumping, and climate on water-level trends in the region between 1997 and 2008 (Gannett & Lite, 2013). The study predicted an approximate 5- to 14-foot decline in groundwater levels in the central part of the basin, which lies north of the proposed project area. The study found that 60 to 70 percent of the measured decline was associated with climate variations, 20 to 30 percent of the measured decline was associated with increased groundwater pumping, and 10 percent was associated with canal lining and piping. At the basin scale, natural climate-induced fluctuations in groundwater discharge largely mask the effects of development on discharge from the regional aquifer (Gannett et al., 2001).

To use groundwater in the Deschutes Basin, a groundwater rights application must be completed under the OWRD Deschutes Basin Groundwater Mitigation program pursuant to Oregon

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<sup>8</sup> This loss is derived from a loss assessment performed in 2016 and is representative of the District's annual losses during the peak irrigation season when diversion rates are typically highest (May 15 to September 14). See Appendix E.4 for information on water loss in the system.

<sup>9</sup> Groundwater hydraulic head is the level to which groundwater will rise in a well and is dependent on both elevation and pressure. Groundwater flows from areas of high hydraulic head to low hydraulic head.

Administrative Rule (OAR) 690-505-0500. The mitigation program is part of OWRD's goal to limit groundwater use by imposing restrictions to new users obtaining groundwater rights and was developed to provide for new groundwater uses while maintaining scenic waterway and instream water right flows in the Deschutes Basin.

#### **4.8.6 Ecosystem Services**

Water flowing through the Deschutes River provides the following ecosystem services.

*Provisioning service, Water available for irrigation (see E1 on Figure 4-1):* As described in Sections 1.3 and 4.8.3, water from the headwaters of the Deschutes Basin is stored, conveyed, and diverted and affects flow in the upper and middle reaches of the Deschutes River. This water provides irrigation for food and feed and maintenance of agricultural lands.

*Regulating service, Water quality (see E3 on Figure 4-1):* The amount of water instream affects water quality including temperature, turbidity, sediment, and pollutants. In general, low streamflow challenges a waterbody's ability to resist warming because less water heats faster than more water. Because of this property, greater instream flow can help to keep water cool—an important factor for temperature-sensitive aquatic species living in these stream habitats (see Section 4.9). In cold winter months, however, the banks of waterbodies with low streamflow are susceptible to freeze-thaw cycles that can increase bank erosion and increase sediment in the water. Section 4.8.4 describes surface water quality in the waterbodies associated with District operations.

Water flowing through the District's Main Canal provides the following ecosystem services.

*Cultural service, Culturally important areas (see E5 on Figure 4-1):* To some residents along the District's Main Canal, the canal brings a sense of tranquility and enjoyment. As identified during the public comment period of this Plan-EA, residents indicated that they receive aesthetic and spiritual enjoyment from the canal. Residents enjoy seeing and hearing the water in the canal during the irrigation season and the wildlife that the canal attracts as a water source. Some residents have built structural and landscape features designed to view the canal.

*Regulating service, temperature regulation (see E6 on Figure 4-1):* Water flowing through the District's Main Canal during the irrigation season may provide a small local cooling effect on the surrounding properties when air temperatures are high, which typically occurs during the day. It is also possible that water in the canal may lead to a small, local warming effect if air temperatures are cooler than the water. Canal temperature regulation is dependent on the relative temperatures of the canal water and air temperature (Jacobs et. al., 2020). Temperature data to assess the temperature-regulating effects of the canal on properties adjacent to the District's Main Canal is unavailable.

### **4.9 Fish and Aquatic Resources**

The affected environment for fish and aquatic species includes waterbodies that are associated with AID operations (see Table 4-7). These waterbodies include Crane Prairie and Wickiup reservoirs, the Deschutes River from Wickiup Reservoir (RM 226.8) to the Arnold Canal Diversion (RM 174.5), and the Deschutes River from the Arnold Canal Diversion (RM 174.5) to Lake Billy Chinook

(RM 120.0). The Pelton Round Butte Dam creates Lake Billy Chinook through the impoundment of the Crooked, Deschutes, and Metolius rivers.

The Deschutes Basin is part of 10 million acres of lands ceded to the United States by the CTWS. Under rights reserved by federal treaty, tribal members harvest salmon and steelhead from the rivers of the Deschutes Basin. Tribal fishing opportunity has become severely restricted because of fish passage barriers, low fish abundance, and the need to protect weak or threatened stocks (CTWS, 2020). CTWS, ODFW, Portland General Electric (PGE), and local partners are actively engaged in efforts to recover fish populations through fish passage barrier removal, habitat restoration, hatchery supplementation, research and monitoring, and harvest management (PGE, n.d.).

#### **4.9.1 General Fish and Aquatic Species**

The District's canals do not support resident or anadromous fish or threatened and endangered aquatic species. Fish screens were installed in 2001 at the Arnold Canal Diversion on the Deschutes River (RM 174.5). These fish screens separate water diverted for consumptive use from debris and water left instream. The screens also prevent any fish from entering the District's irrigation conveyance system by returning fish to the river downstream of the diversion.

Fish and aquatic species documented in the waterbodies associated with District operations are listed in Appendix E.5. The summer steelhead salmon (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), and sockeye salmon (*Oncorhynchus nerka*) in these waterbodies are part of a reintroduction effort that began in 2009 to mitigate for blocked fish passage at the Pelton Round Butte Dam Complex (ODFW & CTWS, 2008). Chinook and sockeye salmon are unable to navigate Steelhead Falls, which creates the uppermost distribution limit for salmon in the Deschutes River at RM 128.0. Summer steelhead are able to pass upstream of Steelhead Falls but are unable to navigate upstream of Big Falls at RM 132.0. Big Falls is considered the uppermost limit of anadromous fish distribution in the Deschutes River (ODFW, 1996).

Low streamflow and water quality impairments are recognized as key limiting factors for fish populations in the basin (NMFS, 2009). Low streamflow and elevated water temperatures in the middle Deschutes River during the irrigation season negatively affect salmonid growth and survival (Recsetar et al., 2012). Availability of cold-water refugia for temperature-sensitive fish species is of key importance when river temperatures rise above acceptable standards. Water temperatures that are out of the normal range for a given fish species can increase physiologic stress, increase susceptibility to predators, and influence growth rates, feeding, metabolism, and development. Water quality impairments, including temperature, in waterbodies associated with District operations are described in Section 4.8.4.

In addition to fish, other aquatic species are potentially found within or along waterbodies that are associated with District operations. These other aquatic species include bullfrog (*Lithobates catesbeianus*), western toad (*Anaxyrus boreas*), Pacific treefrog (*Pseudacris regilla*), and long-toed salamander (*Ambystoma macrodactylum*). The western toad, Pacific treefrog, and long-toed salamander are native to Oregon and may be present in open irrigation canals and adjacent banks where there is suitable vegetation (S. Wray, personal communication, November 17, 2017). The bullfrog is an invasive species that was introduced to Oregon in the early 1900s. Bullfrogs are voracious predators



that eat any animal they can swallow. The International Union for Conservation of Nature (IUCN) lists all of these amphibians as species of least concern for Conservation of Nature (IUCN, 2017).

Two species of mollusks may be found in waterbodies associated with District operations: western pearlshell mussel (*Margaritifera falcata*) and western ridged mussel (*Gonidea angulata*). The western ridged mussel is currently ranked as vulnerable by IUCN (2017) and is recognized as a species of greatest conservation need by the State of Oregon (The Oregon Conservation Strategy [OCS], 2016). The western pearlshell mussel is ranked as near threatened by IUCN (2017).

#### **4.9.2 Federally Listed Fish and Aquatic Species**

A list of fish and aquatic species protected under the ESA (Endangered Species Act Amendments of 1982, 2020), as amended in 1998, that are known or expected to occur in waterbodies associated with District operations was obtained using the USFWS Environmental Conservation Online System Information for Planning and Consultation (IPaC) System. IPaC indicated that three federally listed fish and aquatic species—Oregon spotted frog (*Rana pretiosa*), bull trout (*Salvelinus confluentus*), and Middle Columbia River steelhead salmon (*Oncorhynchus mykiss*)—are or may be found in the waterbodies associated with AID operations (USFWS, 2021). None of these species are known to occur within the irrigation canals within the project area.

##### *Oregon spotted frog*

USFWS lists Oregon spotted frog as threatened under the ESA. The Oregon spotted frog and its designated critical habitat occur in the Deschutes River upstream of Bend (RM 173.0) and in Crane Prairie and Wickiup reservoirs (see Figure E-1 in Appendix E.5). USFWS has identified Primary Constituent Elements (PCEs) for Oregon spotted frog critical habitat (Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Oregon Spotted Frog, 2016). They represent the biological and physical features that are essential to the conservation of a species and describe habitat components that support one or more life stages of the species. PCEs for Oregon spotted frog describe areas that have appropriate water depths and refuge from predators, aquatic connectivity, and absence of non-native predators. A detailed list of Oregon spotted frog critical habitat PCEs is provided in Appendix E.5.

##### *Bull trout*

USFWS lists bull trout as threatened under the ESA. Bull trout are known to be present in the Deschutes River from Big Falls (RM 132.0) to Lake Billy Chinook (RM 120.0) (ODFW, 1996, 2005). Designated critical habitat for bull trout also occurs in the Deschutes River from Big Falls (RM 132.0) to Lake Billy Chinook (RM 120.0) (see Figure E-1 in Appendix E.5). The PCEs for bull trout describe habitat that has aquatic connectivity, complex habitat structure, water temperatures ranging from 2 degrees Celsius to 15 degrees Celsius, natural variability in streamflow, a sufficient food base, and the absence of non-native predatory and competing fish (Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout, 2005). A detailed list of critical habitat PCEs for bull trout is provided in Appendix E.5.

### *Middle Columbia River steelhead*

Steelhead populations listed as threatened under the ESA are present within waterbodies affected by District operations (see Figure E-2 in Appendix E.5). However, the population in the Deschutes River (Middle Columbia River steelhead) is classified as a non-essential experimental population under Section 10(j) of the ESA, and critical habitat is not designated (Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead Above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon, 2011). Because of this classification and because the non-essential experimental population is located outside of a National Wildlife Refuge System and a National Park System, the population is treated as “proposed for listing” under ESA Section 7 (Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead Above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon, 2011; Endangered and Threatened Species: Designation of Experimental Populations Under the Endangered Species Act, 2016).

#### **4.9.3 State-Listed Species**

ODFW maintains a list of native wildlife species in Oregon that have been determined to be either threatened or endangered according to criteria set forth by OAR 635-100-0105 (ODFW, 2021). There are no state-listed threatened, endangered, or candidate fish or aquatic species known to occur within the waterbodies associated with District operations or in the irrigation canal within the project area.

#### **4.9.4 Ecosystem Services**

Fish and aquatic species in the Deschutes River provide the following ecosystem services.

*Provisioning service, Fish Populations (see E2 on Figure 4-1):* The waterbodies associated with District operations provide year-round trout fishing opportunities (ODFW, 2019). Brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*) in the Deschutes River provide recreational anglers with opportunities to harvest fish for consumption.

*Cultural service, Culturally important species (see E4 on Figure 4-1):* People’s values for species conservation may arise from personal use (i.e., enjoying seeing the species or its habitat), personal beliefs and moral ethics (i.e., believing protecting a species and its habitat is the right thing to do), altruism (i.e., believing a resource should be protected so that others can use it or benefit from it), or a desire to bequest the resource (i.e., believing a resource should be protected for future generations). To many residents of Central Oregon, the conservation of fish and aquatic life has come to represent the restoration of the Deschutes River ecosystem. In addition, members of the CTWS have fishing rights and rely on the Deschutes River fisheries for subsistence. Culturally important fish and aquatic species in the Deschutes River ecosystem include species such as salmon, bull trout, and steelhead for both subsistence and cultural values, as well as Oregon spotted frog for cultural values.

#### **4.10 Wetlands and Riparian Areas**

Wetlands and riparian areas affected by District operations occur in the project area, and there are 111.8 miles of natural waterbodies associated with District operations.

Wetlands perform a number of valuable functions including water storage, water filtration, and biological productivity. They can also support complex food chains that provide sources of nutrients to plants and animals and provide specialized habitat for a wide variety of aquatic and terrestrial species. Wetlands in the area associated with the proposed action may be subject to federal or state regulations depending on their characteristics. Within the State of Oregon, wetlands are managed under two regulations: the Oregon Removal-Fill Law and the CWA, a federal statute.

The U.S. Army Corps of Engineers (USACE) administers Section 404 of the CWA with the oversight of the U.S. Environmental Protection Agency (EPA). This law regulates the dredge or fill of wetlands and other waters over which the USACE has jurisdiction (or “jurisdictional wetlands”).

Section 404 of the CWA defines wetlands as “those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions” (Final Rule for Regulatory Programs of the Corps of Engineers, 1986).

The Oregon Department of State Lands (DSL) implements the Removal-Fill Law (ORS 196.800-990), which regulates the removal or fill of material in wetlands or waterways and requires any person who plans to remove or fill material within waters of the state to obtain a permit from DSL.

Per the Oregon Removal-Fill statute, OAR 141-085-0515(9), an irrigation ditch is not jurisdictional under Oregon Removal-Fill permitting if it meets both of the following (DSL, 2013):

- The ditch is operated and maintained for the primary purpose of irrigation.
- The ditch is dewatered<sup>10</sup> outside of the irrigation season except for isolated puddles in low areas.

On July 24, 2020, USACE and EPA signed a memorandum providing a clear, consistent approach regarding the application of the exemptions from the regulation under Section 404(f)(1)(C) of the CWA for the construction or maintenance of irrigation ditches and for the maintenance of drainage ditches. An “irrigation ditch” is defined as a ditch that either conveys water to an ultimate irrigation use or place of use or that moves and/or conveys irrigation water away from irrigated lands. Should the irrigation ditch not occur in waters of the United States, the proposed activity is not prohibited by nor regulated under Section 404 of the CWA.

Riparian areas are transition zones between waterbodies and adjacent upland areas, and they support hydrophytic vegetation that is dependent upon the hydrology of the waterbody. Section 404 of the CWA defines riparian areas as “areas next to or substantially influenced by water. These may include areas adjacent to rivers, lakes, or estuaries” (Clean Water Rule: Definition of “Waters of the United States,” 2015). Riparian areas are typically associated with high water tables due to the close

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<sup>10</sup> “Dewatered” means that the source of the irrigation water is turned off or diverted from the irrigation ditch. A ditch that is dewatered outside of the irrigation season may be used for temporary flows associated with stormwater collection, stock water runs, or fire suppression.

proximity to aquatic ecosystems, certain soil characteristics, and a range of vegetation that requires free water or conditions that are moister than normal (Oakley et al., 1985).

#### **4.10.1 Wetland and Riparian Areas along the Project Area**

AID typically delivers water through its system during the irrigation season between April 1 and November 1. AID may also occasionally deliver water through the system outside of the irrigation season for stock water, and water may be present as standing water following rain or snow events. Hydrophytic plants and riparian features can be found along the banks of the Main Canal within the project area as the hydrology provided by the canal can create favorable growing conditions during a portion of the year. This vegetation on the canal banks may provide habitat for wildlife in the area (see Section 4.11). However, AID actively manages vegetation in its easement as part of maintaining its canal and maintenance road; this includes periodically clearing vegetation along its canals and canal banks.

The National Wetland Inventory<sup>11</sup> (NWI) geographic information systems data (USFWS, n.d.) was used as a first-step approach in identifying and evaluating potential wetlands in the project area. Through an analysis of NWI data and examining aerial imagery, no potential sites were identified as Freshwater Emergent Wetlands within or adjacent to the project area that could be affected by implementation of the proposed project. At the time of writing this Plan-EA, this information has not been field-verified.

#### **4.10.2 Wetland and Riparian Areas along Natural Waterbodies Associated with District Operations**

Wetlands are found within and sporadically adjacent to Crane Prairie Reservoir, Wickiup Reservoir, and the 111.8 miles of Deschutes River associated with District operations. The types of wetlands include marshes and wet meadows that are dominated by herbaceous plants and swamps dominated by herbaceous plants, shrubs, or trees (UDWC, 2003). Riparian areas of varying size and quality also occur adjacent to natural waterbodies associated with District operations. Low streamflow in late fall, winter, and early spring, associated with upstream reservoir storage, limit riparian vegetation in the Deschutes River (DRC, 2005). Low streamflow along these reaches can expose the channel bed and riverbanks; this increases erosion and fine sediment delivery following freeze-thaw processes and increases spring streamflow (DRC, 2005). Because streamflow is strongly correlated with critical physical and biological characteristics of the river, it influences the functions of associated riparian areas (National Research Council, 2002). As riparian areas become hydrologically disconnected from their adjacent stream channels with reduced streamflow, they lose many of their ecological functions.

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<sup>11</sup> The NWI code uses the Cowardin classification system. For further information about Cowardin classifications, refer to *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979).

## 4.11 Wildlife Resources

### 4.11.1 General Wildlife

Generally, wildlife present within the project area consists of habitat generalists or edge species with the ability to adapt to or exploit the agricultural environment. These species are tolerant to disturbance and include deer, coyote, skunk, grey squirrel, raccoon, ducks, and red-tailed hawk (Blair, 1996; Ditchkoff et al., 2006; McKinney, 2002; Shochat et al., 2006). Additional species that may be found in the project area include, but are not limited to, mice and other rodents, snakes, lizards, and various avian species (see Section 4.11.2).

Wildlife within the project area may use the canal system as a water source and dispersal corridor. Additionally, where not cleared, vegetation along the canal can provide food, cover, and breeding sites for many wildlife species throughout the year. Interaction between large ungulates and open canals sometimes results in wildlife injury or death if the animal falls into the open canal and is unable to find its way out (G. Jackal, personal communication, November 15, 2019).

### 4.11.2 Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act Species

There are a variety of avian species with the potential to occur within the project area, some of which are protected under the Migratory Bird Treaty Act (MBTA) or the Bald and Golden Eagle Protection Act (BGEPA). Appendix E.6 includes a list of MBTA/BGEPA species potentially occurring within the project area. Although migratory birds are known to travel through the project area and its vicinity, limited habitat is provided within the project area due to AID maintenance activities that remove vegetation on an annual basis.

USFWS maintains a database of known golden and bald eagle nesting sites. One section of the project area near Horse Butte Road is approximately 0.6 mile from a golden eagle nesting area, and a second section of the project area near Knott Road is approximately 1.9 miles from a golden eagle nesting area (E. Weidner, personal communication, December 17, 2019, and February 13, 2020). Coordination with a USFWS biologist regarding MBTA/BGEPA species is ongoing (E. Weidner, personal communication, November 25, 2019, and March 2, 2022).

### 4.11.3 Federally Listed Species

A review of available USFWS data showed that the gray wolf (*Canis lupus*) “is known or expected to be on or near the project area” (USFWS, 2021). Although the gray wolf is listed as federally endangered throughout the species’ range, which includes the project area, only two locations of known wolf activity occur in Oregon: the Rogue area in southern Oregon and areas surrounding La Grande in northeast Oregon. There is no known wolf activity in the project area (E. Weidner, personal communication, November 25, 2019; USFWS, 2021). Federally listed aquatic species are discussed in Section 4.9.2.

### 4.11.4 State-Listed Species

ODFW maintains a list of native wildlife species in Oregon that have been determined to be either threatened or endangered according to criteria set forth by OAR 635-100-0105 (ODFW, 2021). There are no state-listed terrestrial wildlife species known to occur within the project area.

## 4.12 Wild and Scenic Rivers

The affected environment for Wild and Scenic Rivers includes two sections of the Deschutes River that are part of the federal Wild and Scenic Rivers system (PL 90-542; Wild and Scenic Rivers Act, 2020):

- The Deschutes River from Wickiup Reservoir (RM 226.8) to the Bend UGB at the southwest corner of Section 13, T18S, R11E (approximately RM 172.0) is classified as Scenic<sup>12</sup> and Recreational<sup>13</sup> with Outstandingly Remarkable Values (ORVs) including Cultural, Fish, Geologic, Recreation, Scenery, Wildlife, and Vegetation. This section of the Deschutes River has no sections classified as Wild (USDA, 1996).
- The Deschutes River from Odin Falls (RM 139.9) to the upper end of Lake Billy Chinook (RM 120.0) is classified as Scenic with its ORVs including Cultural, Fish, Geologic, Recreation, Scenery, Wildlife, Hydrology, Botanical/Ecological, and Wilderness (U.S. Department of the Interior Bureau of Land Management [BLM], 1992).

Two maps of the Wild and Scenic reaches are provided in Appendix C. Additional information regarding the ORVs is provided in Appendix E.7.

The overall goals of the Wild and Scenic River Management Plans (USDA, 1996; BLM, 1992) are to maintain the current character of the river area and provide long-term protection and enhancement of its ORVs. Additional goals include protecting and enhancing instream and land-based biological, cultural, and physical resources and providing for appropriate recreational use and public access while maintaining the wild and scenic nature of the river (USDA, 1996; BLM, 1992).

The AID diversion is located on the Deschutes River at RM 174.5. This section of the Deschutes River is classified as a Scenic River Area. Within this area, all new structures, improvements, and development shall comply with the Land Management Rules as described in OAR 736-40-035 and OAR 736-40-040(1)(b)(B).

In addition to the federally designated Wild and Scenic River sections, several reaches of the Deschutes River within the area associated with District operations are designated Oregon State Scenic Waterways (ORS 390.826). These locations, with specific exclusions and classifications, are detailed in Table 4-9.

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<sup>12</sup> The section from the north boundary of Sunriver to Lava Island Camp is classified as Scenic: “those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads” (USDA, 1996).

<sup>13</sup> The section from Wickiup Dam to the northern boundary of Sunriver and the section from Lava Island to the Bend UGB are classified as Recreational: “those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past” (USDA, 1996).

**Table 4-9. Designated Oregon Scenic River Waterways Associated with District Operations.**

Waterbody	Classification	Reach
Upper Deschutes River	Scenic River Area <sup>1</sup>	From RM 224.5 to RM 204.0, except for Pringle Falls (RM 217.5 to RM 216.5)
	Scenic River Area	From the Deschutes National Forest boundary in Section 20, T19S, R11E (approximately RM 184.8) to the Bend UGB (approximately RM 172.0)
	River Community Area <sup>2</sup>	From RM 226.4 to approximately RM 224.5; from RM 217.5 to RM 216.8; from RM 204.0 to about RM 199.0; and from RM 172.0 to RM 171.0
	Recreational River Area <sup>3</sup>	From RM 190.6 to approximately RM 184.8
Middle Deschutes River	Scenic River Area	From Deschutes Market Road (approximately RM 157.0) to the south boundary of the Wilderness Study Area (approximately RM 131.0), except for the Clines Falls Dam and powerhouse between State Highway 126 Bridge (RM 144.9) and RM 144.0 and the Crooked River Ranch River Community Area (RM 129.9 to RM 131.5)
	River Community Area	From RM 164.0 to approximately RM 161.0; from RM 131.5 to RM 129.9; and from RM 125.25 to RM 124.3
	Recreational River Area	From the northern Bend UGB (RM 161.0) to Tumalo State Park (RM 158.0)
	Natural River Area <sup>4</sup>	From the south boundary of the Wilderness Study Area at approximately RM 131.0 to Lake Billy Chinook (RM 120.0), except for RM 129.9 to RM 131.5

Source: ORS 390.826

RM = River Mile; UGB = Urban Growth Boundary

<sup>1</sup> Those designated scenic waterways or segments with related adjacent lands and shorelines still largely primitive and largely undeveloped, except for agriculture and grazing, but accessible in places by roads. These classified areas will be administered to maintain or enhance their high scenic quality, recreational value, and fishery and wildlife habitat, while preserving their largely undeveloped character and allowing continuing agricultural uses.

<sup>2</sup> Those designated areas of a scenic waterway where density of structures or other developments already exist and preclude application of a more restrictive classification.

<sup>3</sup> Those designated scenic waterways that are readily accessible by road or railroad and that allow a wide range of compatible, river-oriented, public, outdoor-recreation opportunities to the extent that these do not substantially impair the natural beauty of the scenic waterway or diminish its aesthetic, fish and wildlife, scientific, and recreational values.

<sup>4</sup> Those designated scenic waterways that are generally inaccessible except by trail or the river with related adjacent lands and shorelines essentially primitive. These classified scenic waterways will be administered to preserve their natural, wild, and primitive condition, essentially unaltered by the effects of humans, while allowing compatible recreational uses, other compatible existing uses, and protection of fish and wildlife.

#### **4.12.1 Ecosystem Services**

The Wild and Scenic Deschutes River provides the following ecosystem service:

*Cultural service, Culturally important natural areas (see E5 on Figure 4-1):* People's values for natural areas may arise from personal use (i.e., enjoying the area for recreation, scenic quality, or the environmental value it provides), personal beliefs and moral ethics (i.e., believe protecting a natural area is the right thing to do), altruism (i.e., believing a resource should be protected so that others can use it or benefit from it), and/or a desire to bequest the resource (i.e., believing a resource should be protected for future generations). Similar to the conservation of special status species, to many residents of Central Oregon, the conservation of the Deschutes River has come to represent the restoration of the Deschutes River ecosystem.



## 5 Alternatives

### 5.1 Formulation Process

The Preliminary Investigative Report published during scoping considered multiple alternatives. The formulation of alternatives followed the Council on Environmental Quality's regulations for implementing NEPA and requirements of the PR&Gs. Scoping comments were also incorporated into the alternatives formulation process.

When formulating an alternative, it was first determined whether the alternative met the project purpose and need (see Section 2) and if it met the PR&G requirement of achieving the Federal Objective (see Section 2) and Guiding Principles (see Appendix E.8). The alternative was further analyzed for four criteria: completeness, effectiveness, efficiency, and acceptability (USDA-NRCS, 2017a; see Appendix D.2). The following alternatives were initially considered during formulation but were eliminated from further analysis because they did not meet the formulation criteria: conversion to dryland farming, fallowing farm fields, market-based approaches to include voluntary duty reduction, exclusive or partial use of groundwater, on-farm efficiency upgrades and piping private laterals, and the Piping Alternative with sections of open canal. Appendix D.2 provides further description of the alternatives eliminated during formulation.

### 5.2 Alternative Eliminated from Detailed Study

The following subsection describes an alternative that met the formulation criteria but was not analyzed in detail as a viable alternative after further consideration.<sup>14</sup>

#### 5.2.1 Canal Lining

Under the Canal Lining Alternative, the bottom and sides of 11.9 miles of the Main Canal would be covered with a geomembrane liner and shotcrete to prevent water from seeping into the underlying soils and rock. This alternative would require earthwork with heavy equipment to modify and reshape the existing canal bed to accommodate the lining material. Earthwork would involve removing sharp volcanic rock from the bed of the canal and shaping and smoothing the sides of the canal to ensure that the slope meets NRCS engineering standards (USDA-NRCS, 2017b). Currently, the side slope in some areas of the canal is too steep to meet NRCS engineering standards (USDA-NRCS, 2017b).

After reshaping the canal, a geomembrane liner would be installed to cover the bottom and sides of the canal.

Trees and other vegetation within approximately 7 feet of the edge of the canal on both sides would be removed to install the membrane. An anchor trench approximately 1 foot wide by 1 foot deep would be dug along the canal approximately 7 feet beyond the edge of the canal. The liner would

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<sup>14</sup> Alternatives that do not address the purpose and need for action, do not achieve the Federal Objective (Section 2) and Guiding Principles (Appendix E.8), or become unreasonable because of cost, logistics, existing technology, or social or environmental reasons may be removed from consideration (NWPM 501.37; NRCS, 2015a; NRCS, 2017a).

extend from the canal edge into the trench where the liner would be covered and weighted by fill material to anchor the liner in place. Finally, a layer of shotcrete would be applied on top of the geomembrane liner in the canal. The shotcrete would be 6 inches thick to protect the liner from freeze-thaw movement and damage from animals and debris.<sup>15</sup>

This alternative would increase water velocity in the canal because the shotcrete cover would be a smoother surface than the existing underlying rock and dirt (Scoby, 1939). The smoother surface would make the sides of the canal slippery, and the increased water velocity and decreased friction could make it and more difficult for anyone who might accidentally fall in the water to be able to climb out.

The Canal Lining Alternative would meet the project purpose of conserving water. Water loss in a lined system where the geomembrane liner is covered with a shotcrete cover is estimated to be 5 percent based on studies of canal lining (Swihart & Haynes, 2002).<sup>16</sup> Therefore, lining would reduce water loss from seepage in the Main Canal by up to 95 percent or approximately 10,529 acre-feet annually (see Appendix E.4 for information on how water loss was calculated). Lined canals, however, are vulnerable to tears or cracks in the lining even with a shotcrete cover. Seepage from torn or cracked lined canals is similar to that from unlined canals. The alternative would not meet the project purpose of improving public safety because the canal would still be open and accessible to the public.

Canal lining has a varying lifespan and can require extensive maintenance to continue operating at high efficiency (Swihart & Haynes, 2002). For example, cracks in the shotcrete are likely to develop in the first few years following installation due to freeze-thaw cycles and would require a regular maintenance program to seal the cracks. The District would likely need to hire an extra field staff person for this maintenance, which would include sand blasting, removal of vegetation, and patching the cracks with sealant. This maintenance would require equipment purchases, appropriate training, and recurring materials costs. Additionally, the District would need to continue to remove debris (primarily pine needles and cones) from the canals to prevent blockages and flooding. Due to these additional costs, this alternative assumes a 25 percent increase in equipment, maintenance, and labor costs as compared to AID's current operating budget (S. Johnson, personal communication, November 15, 2021).

In cooperation with the Bureau of Reclamation (Reclamation), the District lined ten 500-foot-long sections of canal with different lining technologies in 1991 and 1992 as part of the Deschutes Canal-Lining Demonstration Project. Reclamation revisited the test sites periodically to inspect their

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<sup>15</sup> Shotcrete thickness was recommended by Kevin Crew, P.E., of Black Rock Consulting based on experience and climate in Central Oregon (K. Crew, personal communication, November 29, 2021). This assumption also aligns with NRCS Conservation Practice Standard 468, Lined Waterway or Outlet (USDA-NRCS, 2017b).

<sup>16</sup> Swihart and Haynes (2002) estimated 5 percent water loss in AID's lined canals in 1998, 6 years after the lining was installed. However, based on existing widespread cracking in the shotcrete cover and holes in the geomembrane liner, current rates of seepage are likely greater. To be conservative, a 5 percent water loss (as compared to the Piping Alternative) was used to calculate potential water savings.

condition. The most recent inspection occurred in 2017—25 years after lining installation. Of the 10 sites, 5 were considered failed and 5 were considered in excellent condition (Baumgarten, 2019). The study did not conduct a water loss assessment.

However, in 2021, 30 years after lining installation, AID determined that the five lined sections considered to be in excellent condition in 2017 have degraded at an accelerated pace and that their lining is no longer effective at conveying water (see Appendix D.3 for photos of the existing lined sections). There is widespread cracking in the shotcrete above and below the waterline. In some areas, the shotcrete is broken in pieces, leaving the underlying membrane exposed. In other areas, there are holes in the exposed lining where silt and sediment has collected, forcing the lining upward and impeding water flow in the canal. Many low-lying areas within these five lined sections do not retain water in the non-irrigation season; this indicates water loss due to seepage. AID determined that many test sections would require significant maintenance or complete replacement of the shotcrete and liner.

Based on the findings from the Reclamation 25-year report and the AID's experience, the design life for the Canal Lining Alternative was estimated to be approximately 30 years. A 30-year design life would require full replacement of the geomembrane liner and shotcrete after every 30 years. These expenses would be the responsibility of AID and its patrons and would likely exceed the AID's financial resources.

The initial capital costs of canal lining were estimated based on the size of the existing open canal, earthwork to reshape the canal, materials, and installation of the liner and shotcrete. The estimated capital cost for canal lining is \$40,853,000.

The estimated capital costs, replacement costs, and annual O&M costs are \$77,629,000 (2022 dollars) over 100 years. Based on this cost, canal lining was eliminated from further study (see Appendices D.3 and D.4 for cost details and assumptions).

## **5.3 Alternatives Description**

Of the project alternatives that were considered for AID's Infrastructure Modernization Project, two were selected for further evaluation and are discussed in the following sections. These alternatives include only AID-owned infrastructure.

### **5.3.1 No Action Alternative (Future without Federal Investment)**

Under the No Action Alternative, AID would continue to operate and maintain its existing system in its current condition. This alternative assumes that modernization of the rest of the AID system would not be reasonably certain to occur. The No Action Alternative is a near-term continuation of AID standard operating procedures under the HCP requirements. See Appendix E.4.8 for further description of what the instream flows would be under the HCP.

The No Action Alternative would not meet the project purpose and need. There would be no improvement to water loss from seepage in District infrastructure, water delivery reliability for patrons, public safety, or streamflow and habitat conditions for fish and aquatic species. Since no water would be conserved or permanently allocated instream, the No Action Alternative would not

achieve the Federal Objective to protect the environment. Similarly, the No Action Alternative would not accomplish the Healthy and Resilient Ecosystem Guiding Principle or the Sustainable Economic Development Guiding Principle (USDA-NRCS, 2017a).

### **5.3.2 Piping Alternative (Future with Federal Investment)**

Under the Piping Alternative, federal funding through PL 83-566 would be available, and AID would pipe 11.9 miles of its Main Canal and install SCADA in two locations (see Figure 5-1). Pipe would range in diameter from 48 to 60 inches, and 88 District turnouts would be upgraded to pressurized delivery that would include a meter (Crew, 2017). Pipe would be laid in the existing canal alignment. The proposed project would not modify the District's existing flume; piping would stop about 1,600 feet from the flume (see Figure 5-1).

A concrete check and pipe inlet structure would be installed at the inlet of the pipe (i.e., the western end of the pipe). The inlet structure would begin with a concrete waterway that is approximately 15 feet long and 17 feet wide. The inlet structure would also include a headwall at the pipe inlet that would be approximately 20 feet wide by 1 foot thick. The waterway and headwall would be approximately 10 feet tall; most of the structure would be situated belowground. Approximately 1 to 2 feet of the concrete structure would be visible aboveground.

To eliminate the potential for overflows, which could occur at the inlet of the pipe due to changes in irrigation demands that may not balance with diversion flows, AID would install SCADA improvements to remotely monitor flows. SCADA would be installed at the inlet of the pipe and at the terminus of the pipe (see Figure 5-1). At both locations, a flow-measuring device and SCADA components would be installed for remote monitoring. These components could include a water-level sensor, programmable logic controller, solar charging station, and radio controller. The programmable logic controller would be protected by an enclosure. The radio controller would report measurements to a computer at the AID office with SCADA software. The programmable logic controller (within the enclosure), solar charging station, and radio controller are expected to require no more than a 5-foot by 5-foot area adjacent to the canal. The tallest piece of equipment would be the radio controller's antenna, which could be 10 to 20 feet tall depending on the topography and line of sight between the SCADA sites to the District office.

Construction of the Piping Alternative would occur over 6 years in four phases. Each phase would take 2 or 3 years to complete with some construction phases overlapping in years (i.e., in 2023 construction would finish on Phase 1 and start for Phase 2). See Section 8.7.2 for a map and estimated timeline of the construction phases. Construction would start on the eastern end of the Main Canal with Phase 1 and generally move toward the west. Construction activities would be limited geographically to one or two phases at a time. Construction would be conducted during the non-irrigation season (October to April), and construction would begin as early as the 2022 non-irrigation season.

Pipe installation would require storage areas for pipe, construction equipment, and other materials. Areas that are within existing District ROW and easements, which have been previously disturbed, and that are accessible through existing access routes would be used when possible. The project area would be accessed from AID's existing maintenance road within the AID ROW. Limited sections of

the existing maintenance road may require some improvements for use during construction. During the project, this road would be used primarily by the project contractors for construction of the phase for that area. A particular section of the maintenance road may be used to access another phase if that is the closest and most accessible area for the type of equipment or material that is needed for continued construction. After the project is complete, AID would continue to use the maintenance road for ongoing operation and maintenance.

The area disturbed during construction would be minimized to the extent practicable. While all construction would occur within existing AID ROW and easements, where practicable, construction would not occur across the full width of the ROW or easement. On the side of the canal with a maintenance road, construction is not foreseen to extend past the outer edge of the maintenance road. On this side of the canal, trees would be removed within the ROW or easement only if there were no other alternative to access the construction site, if the trees posed a safety threat to construction crews, or where the trees' roots could interfere with the pipe. On the side of the canal without a maintenance road, there would be minimal disturbance. Disturbance on the side of the canal without the maintenance road would consist of removing any trees that posed a safety threat to construction crews or trees whose roots could interfere with the pipe. No heavy equipment would be used on the side of canal without a maintenance road.

Construction of the Piping Alternative would include mobilization and staging of construction equipment, delivery of pipe to construction areas, excavation of trenches when necessary, fusing of pipelines, placement of pipe, compaction of backfill, concrete work for the inlet structure, SCADA installation, and restoration and reseeded of the disturbed areas. Pipe would be placed within the existing canal alignment and buried. The depth of cover would adhere to NRCS practice standards and backfill would be graded to meet the surrounding landscape.

Vegetation clearing before construction, vegetation and weed management during construction, and the reseeded after construction would be completed according to AID's current vegetation management practices and the NRCS *Oregon and Washington Guide for Conservation Seedings and Plantings* (USDA-NRCS, 2000).

O&M under the Piping Alternative would consist of an ongoing pipe inspection program that would systematically cover the entire system over a period of several years (most likely a 10-year cycle). During the irrigation season from April through October, maintenance work would be performed on an as-needed basis. SCADA system maintenance would occur on a regular schedule and on an as-needed basis throughout the year. Outside of the irrigation season, AID would perform system component maintenance or repairs to District meters, valves, and air and vacuum infrastructure, as well as to the inlet structure.

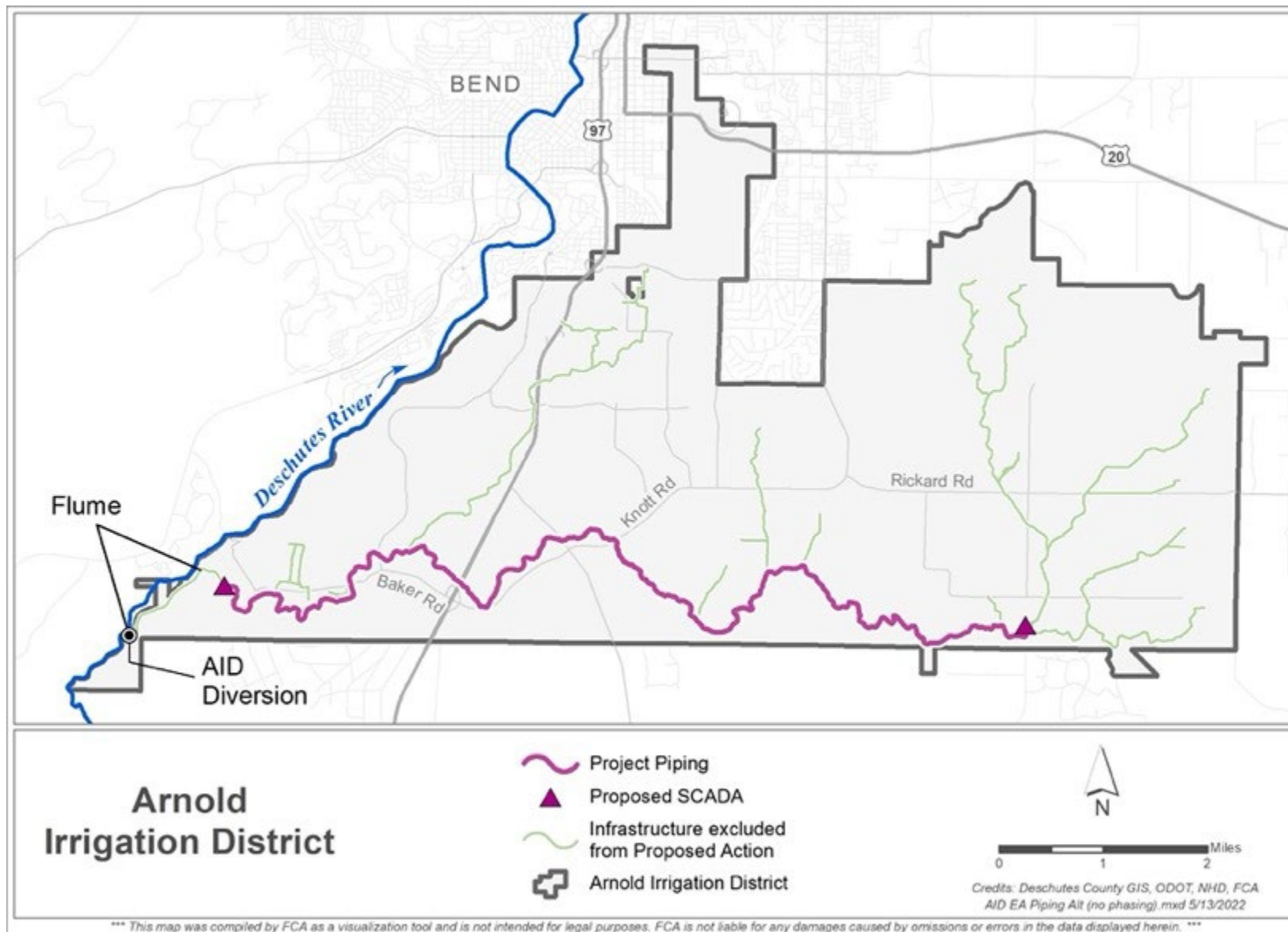


Figure 5-1. Overview of the Piping Alternative for the Arnold Irrigation District Infrastructure Modernization Project.

The Piping Alternative contributes to the project purpose and need as follows:

- **Improve water conservation:** This alternative would reduce water loss from canal seepage and evaporation by an estimated 32.5 cfs (11,083 acre-feet) of water throughout the irrigation season.
- **Increase water delivery reliability to patrons:** A piped system greatly increases conveyance efficiency and allows patrons to adjust their deliveries to take the amount of water that they need when they need it. This alternative would immediately improve water delivery reliability for the patrons directly served by the Main Canal including 1,475 acres of irrigated land.
- **Enhance streamflow and habitat conditions for fish and aquatic species:** Following the completion of the project and verification and measurement of the total water savings, AID would pass up to 10,862 acre-feet per year to NUID through the Deschutes River during the irrigation season.<sup>17</sup> In return, NUID would release an equal volume of water minus losses in the Deschutes River between the AID and NUID diversions<sup>18</sup> (up to 10,446 acre-feet per year) from Wickiup Reservoir into the Deschutes River during the non-irrigation season (see Section 6.8). Streamflow and habitat conditions along the Deschutes River would benefit from this protected water.
- **Improve public safety:** After completion, the project would improve public safety along 11.9 miles of the Main Canal. All open canal in the project area would be converted to buried pipe. This would decrease the risk of drowning, flooding, and other serious accidents associated with the currently open canal.
- **Reduce O&M costs:** A piped system would eliminate the need to inspect, repair, and remove obstructions from the open Main Canal. The Piping Alternative would also reduce the need for staff to manually adjust diversion amounts within the project area.

The Piping Alternative achieves the Federal Objective to protect the environment by protecting and restoring streamflow in the Deschutes River. By improving operational efficiencies and thereby conserving water and improving water quality in the Deschutes River, the Piping Alternative achieves the Federal Objective and Guiding Principle of sustainable economic development. Lastly, this alternative achieves the Guiding Principles of Healthy and Resilient Ecosystems by contributing to a more resilient ecosystem in the face of changing climate. The estimated project installation cost for the Piping Alternative would be \$31,545,700. With additional project administration and

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<sup>17</sup> AID anticipates that 100 percent of the project would be funded through PL 83-566 and other public or public-interest funding sources. If AID were to invest its own funds in the project, AID would pass an amount of conserved water in proportion to the amount of public and public-interest funding to NUID (i.e., if the project was funded with 90 percent public funding, then 90 percent of the conserved water sourced from live flow would be passed to NUID). AID would not apply to create new water rights for out-of-stream uses.

<sup>18</sup> Following estimations by OWRD, a 7 percent loss was accounted for in the Deschutes River between the AID and NUID diversions.

technical assistance costs, the total project cost would be \$34,899,000.<sup>19</sup> Additional information regarding the costs and the net present value of the Piping Alternative can be found in Section 8.9 and Appendices D.3 and D.4.

## 5.4 Summary and Comparison of Alternatives

Table 5-1 compares the No Action Alternative (Future without Federal Investment) and the Piping Alternative (Future with Federal Investment). The table summarizes measures addressed as well as environmental, social, cultural, and economic effects.

**Table 5-1. Summary and Comparison of Alternative Plans.**

Item or Concern Major Features	No Action Alternative (Future without Federal Investment) Main Canal Remains Open	Piping Alternative (Future with Federal Investment) Pipe the Main Canal
<b>Alternative Plans (alternatives are explained in USDA-NRCS [2013])</b>		
Locally Preferred		✓
National Economic Efficiency		✓
Socially Preferred		✓
Environmentally Preferred		✓
<b>Guiding Principles</b> <i>(Checkmarks indicate that the Guiding Principles have been met.)</i>		
Healthy and Resilient Ecosystems		✓
Sustainable Economic Development		✓
Floodplains		Not applicable
Public Safety		✓
Environmental Justice		✓

<sup>19</sup> The Piping Alternative was priced using high density polyethylene as the piping material. The availability of piping materials, prices, and new products change over time. At the time of project implementation, a different piping material could be selected if the material (1) would meet the NEE requirements; (2) meet construction requirements; and (3) result in no change or a minor change to project effects described in Section 6 of this Plan-EA as determined through the decision framework outlined in Section 1.4. The NRCS state conservationist would possess the final discretion to select the appropriate piping material.



Item or Concern Major Features	No Action Alternative (Future without Federal Investment) Main Canal Remains Open	Piping Alternative (Future with Federal Investment) Pipe the Main Canal
Watershed Approach		✓
<b>Provisioning Services – Tradeoffs</b>		
Irrigation Water	No effect. Irrigation water diversions would remain the same.	Piping would help provide more secure and reliable irrigation water for AID patrons. The water saved from the project and passed to NUID would also support agricultural producers in NUID.
Instream Fish Species	No effect. Resident and anadromous fish populations would not be affected. Harvest of anadromous fish would continue to be available only when runs are sufficiently large to sustain fishing.	Up to 10,446 acre-feet of water released instream below Wickiup Reservoir into the Deschutes River during the non-irrigation season would have short-term beneficial effects on resident fish populations and their habitat in years 4–7 of the HCP.  During the irrigation season, up to 10,862 acre-feet of water passed to NUID would secure any long-term beneficial effects on resident fish populations and their habitats in the 9.7 miles of the Deschutes River between the AID and NUID diversions.
<b>Regulating Services – Tradeoffs</b>		
Water Quality	No effect. Riverbanks in the winter would continue to be exposed and vulnerable to freeze-thaw cycles that facilitate bank erosion and sediment deposition into the water.	Up to 10,446 acre-feet of water protected instream below Wickiup Reservoir during the non-irrigation season would help improve water quality in the short term in years 4–7 of the HCP. The addition of this water may help to alleviate bank erosion and sediment deposition from vulnerable riverbanks.

Item or Concern Major Features	No Action Alternative (Future without Federal Investment) Main Canal Remains Open	Piping Alternative (Future with Federal Investment) Pipe the Main Canal
Temperature Regulation	No effect. The canal may continue to have potential local cooling or warming effects depending on the relative temperatures of the canal water and air temperature.	Any potential cooling or warming effect that the canal may have on the local environment would be eliminated.
<b>Cultural Services – Tradeoffs</b>		
Culturally Important Species	No effect on habitat supporting populations of threatened fish species. Habitat limitations for culturally significant anadromous fish would continue to affect fishing, community, health, cultural identity, subsistence, and religious tribal values.	Up to 10,446 acre-feet of water protected instream below Wickiup Reservoir during the non-irrigation season would help improve threatened fish and aquatic species habitat and populations in the short term in years 4–7 of the HCP. Improving populations would benefit cultural values such as tribal and religious values and bequest values.
Culturally Important Areas	Residents would continue to be able to hear and see the water running through the canal during the irrigation season. Any aesthetic or spiritual value that residents derive from the open canal would continue.	Residents would no longer see or hear water running through the open canal during the irrigation season. This action may have an adverse effect on the aesthetic and spiritual services that the open canal brings to some residents.
<b>Installation Costs</b>		
Federal PL 83-566	\$0	\$26,198,000
Local Only or Matching PL 83-566	\$0	\$8,701,000
Total	\$0	\$34,899,000
<b>Average Annual Cost</b>		
Installation <sup>1</sup>	\$0	\$838,000
OM&R <sup>2</sup>	\$0	\$14,000
Total	\$0	\$852,000
Annual Benefits <sup>3</sup>	\$0	\$1,699,000

Item or Concern Major Features	No Action Alternative (Future without Federal Investment) Main Canal Remains Open	Piping Alternative (Future with Federal Investment) Pipe the Main Canal
Annual Costs	\$0	\$852,000
Annual Net Benefits <sup>4</sup>	\$0	\$847,000
<sup>1</sup> The Piping Alternative's average annual cost is the additional average annual installation costs above the No Action Alternative.		
<sup>2</sup> Operation, maintenance, and replacement (OM&R) for the Piping Alternative includes an increase in pumping costs from increased depth to groundwater due to reduced recharge and associated increases in carbon and energy, as well as replacement costs from SCADA and the inlet structure. A decrease in O&M costs of the canals for the Piping Alternative was included in the benefits, rather than the costs.		
<sup>3</sup> Quantified benefits include NUID agricultural damage reduction, reduced O&M costs, instream flow benefits, Oregon spotted frog benefits, and avoided damage from failure of the open canal.		
<sup>4</sup> Annual net benefits shown for the Piping Alternative are the additional net benefits compared with the No Action Alternative.		
<b>Regional Economic Impacts <sup>1</sup></b>		
Annual Jobs from Recreation	Not applicable	Magnitude/direction of recreation visitation impacts not known, so no benefits quantified.
Local Jobs during Construction (including direct/indirect/induced)	Not applicable	75 (average over 6 years of construction)
Change in Annual Jobs from Agriculture (including direct/indirect/induced)	Not applicable	40 (average over 106-year analysis period)
<b>Beneficial Effects Annualized <sup>1,2</sup> (millions, 2021\$)</b>		
Region	Not applicable	\$1.5
Rest of Nation	Not applicable	Some ripple income/employment effects expected but not estimated.
<b>Adverse Effects Annualized <sup>1,3</sup> (millions, 2021\$)</b>		
Region	Not applicable	-\$0.2
Rest of Nation	Not applicable	\$0.8

<b>Item or Concern</b>  <b>Major Features</b>	<b>No Action Alternative</b> <b>(Future without Federal</b> <b>Investment)</b> <b>Main Canal Remains Open</b>	<b>Piping Alternative</b> <b>(Future with Federal</b> <b>Investment)</b> <b>Pipe the Main Canal</b>
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<sup>1</sup> 2022 Water Resources Discount Rate of 2.25 percent.

<sup>2</sup> Beneficial effects include only those related to labor income and do not include the net economic benefits quantified in the NEE.

<sup>3</sup> Includes only direct costs (no indirect/induced costs are included). Negative adverse effect annualized indicates benefit.

AID = Arnold Irrigation District; HCP = *Deschutes Basin Habitat Conservation Plan*; NEE = National Economic Efficiency; NUID = North Unit Irrigation District; OM&R = operation, maintenance, and repair; PL = Public Law

## 6 Environmental Consequences

This section evaluates the environmental consequences of the No Action Alternative and the Piping Alternative. The beneficial and adverse effects of the two alternatives on each resource described in Section 4 were evaluated. The intensity of an adverse effect was classified as negligible, minor, moderate, or major. The duration of an effect was classified as temporary, short-term, or long-term. Appendix E.1 presents the intensity threshold matrix used to categorize and define the range of expected effects.

### 6.1 Cultural Resources

#### 6.1.1 No Action (Future without Federal Investment)

AID's ongoing O&M activities are not expected to affect historic or archaeological resources because these activities are expected to occur in previously disturbed areas.

#### 6.1.2 Piping Alternative

AID hired a cultural resource specialist to complete surveys for historic properties in the project area and develop a final report. As a part of this process, the surveys considered alterations to the historic viewshed that would potentially occur due to the proposed project. The final report states: "The Arnold Irrigation Canal is determined to be eligible in accordance with the National Register guidance under Criteria A and B." Furthermore, "The piping will cause an adverse effect to the canal's physical character of the Arnold Irrigation Main Canal by replacing the current inefficient delivery system wrought with a variety of issues including general water loss through trans- evaporation, seepage and system failures. The proposed piping project will have "No Effect" to the contextual integrity and National Register eligibility associated with Criteria A and B" (Stuemke 2021).

NRCS submitted the final report to SHPO on July 20, 2021 for consultation and concurrence. SHPO and the archaeological contractor hired by the District identified the flume as a major contributing factor of NRHP eligibility; thus, potential mitigation focused on the flume. As a result of these consultations and general public concern, an alternate route for piping that omitted the flume from the project was developed.

On June 21, 2022, NRCS submitted an updated description and map of the proposed project, with the flume omitted, to SHPO and requested concurrence of "no Effect". The tracking number assigned to the project was 21-0990. Per the federal regulations outlined in the NHPA, SHPO was given 30 days to review and provide comment. SHPO did not provide a response during the 30-day review period, which ended on July 20, 2022. According to the federal regulations outlined in the NHPA, NRCS has assumed concurrence of "no Effect" for the proposed project (with the flume omitted). NRCS has completed consultation with SHPO and no mitigation is required.

If archaeological resources were inadvertently discovered during construction, an Inadvertent Discovery Plan would be followed. Construction would stop near the discovery; the area would be secured and protected; a professional archaeologist would assess the discovery; consultation with SHPO, THPO, and NRCS cultural resources staff would occur as appropriate; and consulting

parties including affiliated tribes and ACHP would be notified and have the opportunity to comment. Construction would continue in accordance with applicable guidance and law.

## **6.2 Land Use**

### **6.2.1 No Action (Future without Federal Investment)**

The No Action Alternative would have no direct effect on land use within the project area. The Main Canal would continue to operate as an open system. Irrigated agriculture producers would continue to face increasing water supply uncertainty. Ecosystem services of water for irrigation would not be affected (see Section 6.8.1).

### **6.2.2 Piping Alternative**

There would be no effect on land use from the Piping Alternative. Property ownership, as well as existing ROW, easements, and property lines, would not change. AID would construct the project pursuant to its existing ROW and easements. There would be no change to existing land use within or adjacent to the project area. More reliable water delivery would support existing agricultural land uses. The Piping Alternative would also have no direct effects on agricultural land served by NUID during or after construction. The water that AID would pass to NUID would support existing agricultural land use. Please see the NEE Analysis in Appendix D.1 for more information on how agricultural production would be affected by the proposed project. Ecosystem services of water for irrigation would be supported through the improvement of delivery infrastructure (see Section 6.8.2).

## **6.3 Public Safety**

### **6.3.1 No Action (Future without Federal Investment)**

Under the No Action Alternative, the Main Canal would remain open, and there would be no effect on public safety; the drowning and flooding risk would remain. In some areas, the risk of drowning, flooding, and other serious accidents would increase as urban and suburban areas grow within the District. Wildfire risk would remain the same.

### **6.3.2 Piping Alternative**

During construction of the Piping Alternative, public safety would be affected by vehicle and heavy equipment traffic entering and leaving the project area. Construction traffic could interact with motor vehicles, pedestrians, and bicyclists traveling through farmlands and urban and suburban zones along U.S. Highway 97, as well as along county and community roads that intersect the project area. Standard safety protocols and BMPs would be followed during construction to minimize any risk to public safety; therefore, a minor short-term effect on public safety is anticipated during construction because effects on public safety would only occur in the project area where construction would occur.

Once fully completed, the Piping Alternative would eliminate the drowning risk from the open Main Canal in the project area because it would be converted to buried pipe. This alternative would also decrease any potential flooding risk from canal breaches and sinkholes within the project area, and

the durability of the pipe would increase seismic resiliency. The Piping Alternative would therefore result in beneficial effects on public safety because drowning would no longer be possible in the project area and there would be a decrease in flooding risk within the project area.

Construction would take place during the non-irrigation season when wildfire risk is low. Additionally, any burn bans or other restrictions based on wildfire hazard potential would be followed as appropriate. The fire protection district's primary source of water for fighting fires are hydrants; therefore, access to the primary source of water would not be affected. Ponds, canals, and cisterns are used as secondary water sources. Following completion of the proposed project, the piped Main Canal would no longer be available as a secondary source of water; however, ponds, cisterns, and water traveling through the non-piped sections of the District would remain available as secondary sources of water.

Over time, there has been a buildup of fuels and vegetation has been allowed to become overgrown in the broader landscape surrounding the project area (L. Medina, personal communication, November 12, 2021). The conversion from canal to a buried pipe would result in a narrow vegetated corridor. This vegetated corridor would represent a small area when compared to the broader landscape. Because native grasses and forbs would be used for revegetation, there would not be an increase in the level of fuel available for a wildfire (L. Medina, personal communication, November 12, 2021). Additionally, the fire protection district does not consider the canal a fire beak; therefore, the proposed project would not affect this aspect of wildfire risk (L. Medina, personal communication, October 21, 2021).

During construction, some trees within the AID ROW and easements would have to be removed, which could contribute to defensible space. After construction, based on results of previous piping projects, well-established trees that previously relied on canal water within the project area are expected to survive with active irrigation by the property owner. If trees were to die within the AID ROW or easements and create a safety hazard, AID would remove the hazard trees at its discretion (see Section 6.6.2 for more information). Implementation of the proposed project would not affect a property owner's ability to remove vegetation and trees on their property to maintain defensible space around their house.

Effects of the proposed project as it relates to wildfire are expected to be similar to the other piping projects that have been completed in the area. The fire protection district has indicated that removal of the canal would not create an additional burden on its ability to fight fire and would not increase wildfire risk (L. Medina, personal communication, November 12, 2021). Because this project would have no effect on the ability to fight fires and would not contribute to an increased risk of a wildfire occurring, the proposed project would have no effect on public safety as it relates to wildfire.

## 6.4 Socioeconomic Resources

To estimate the total economic effects of the No Action Alternative and Piping Alternative in terms of jobs and income supported, this analysis used an IMPLAN (2017) economic impact model of Oregon's Deschutes, Jefferson, and Crook counties.<sup>20</sup>

### 6.4.1 No Action (Future without Federal Investment)

Under the No Action Alternative, no construction expenditures are anticipated, although some maintenance and repair activities associated with canal breaches may be required (these are not quantified due to uncertain and sporadic nature). No increases in agricultural production are anticipated under the No Action Alternative.

### 6.4.2 Piping Alternative

Implementation of the Piping Alternative would have a beneficial effect on employment and income in Deschutes County from construction activities, as well as a beneficial effect on agricultural production and related farm household income in Deschutes, Jefferson, and Crook counties. The proposed project would have no effect on any environmental justice communities.

Within the watershed planning area, although property values may be higher when adjacent to an open canal, based on NRCS analysis there was not sufficient market evidence or literature to demonstrate that property values would decrease with the proposed project (see the NEE Analysis in Appendix D.1 and Appendix E.12 for more information).

#### 6.4.2.1 Regional Economic Development

The Piping Alternative construction expenditures of \$34.9 million would support construction sector jobs and income, as well as economic ripple effects increasing jobs and income in other economic sectors in Deschutes and neighboring counties. The \$34.9 million in construction expenditure would support approximately 75 jobs and \$3.4 million in average annual income over the 6-year construction period. Annualized over 106 years, this equates to approximately \$0.5 million in annualized average income benefits. Of these impacts, approximately 50 jobs and \$2.4 million in annual income are in the construction sector (direct impacts) while the remaining 55 jobs and \$1.0 million income are in other sectors.

Water conserved through piping would be passed on to NUID starting in year 6 where it would decrease agricultural damages associated with irrigation water shortages. Water conservation under the Piping Alternative is expected to enhance agricultural productivity in NUID. Annualized average regional economic effects in Jefferson County and neighboring Crook and Deschutes counties are estimated at approximately 40 jobs and \$1.0 million in income annually.

The Piping Alternative would also enhance operational flexibility and water reliability in AID, thereby reducing the likelihood of agricultural damages in AID. However, as the increased water

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<sup>20</sup> Total construction expenditures were modeled in IMPLAN Construction Sector 57—construction of new commercial structures including farm structures (IMPLAN, 2017).



supply is relatively small and the likelihood of water supply disruptions in the No Action Alternative are not known, this economic development benefit is not quantified.

## **6.5 Soils**

### **6.5.1 No Action (Future without Federal Investment)**

Under the No Action Alternative, there would be negligible long-term effects on soils because erosion would continue to occur within the open canal. Continued operation of the District's system would have no effects on prime farmlands.

### **6.5.2 Piping Alternative**

Under the Piping Alternative, soils would be disturbed, vegetation would be cleared, and backfilling and grading would occur in the project area. Clearing, compaction, and construction would increase soil erosion and sedimentation potential. During construction, soils adjacent to the canal would be impacted due to equipment access and staging. Excavation for pipe placement would occur primarily in the existing canal.

BMPs would be implemented throughout the project area to minimize erosion and contain runoff onsite. These could include the installation of silt fencing and straw bales, sequestering of any and all concrete placements and concrete truck cleanouts, and limiting equipment access to existing roads except for strategic access points. To the extent practicable, the upper 2 feet of surface materials and rock would be stored beside the construction impact areas and replaced upon the completion of construction. Existing maintenance roads within AID ROW and easements would provide access to the project area. After construction, disturbed soils would be recontoured and reseeded with a mix of native grasses and forbs in consultation with NRCS.

Overall, minor short-term effects on soils are anticipated because BMPs would be in place, effects would be localized to the project area where construction would occur, and effects would only occur during construction. Over the long term, soil erosion would be reduced where buried pipeline would replace open canal.

#### **6.5.2.1 Farmland Classification**

No long-term effect would be expected on any federal or state-level farmland designations. Minor temporary effects on limited amounts of agriculturally important soils would be expected during construction in the project area, but adherence to BMPs would minimize these effects. There would be a beneficial effect on farmlands in AID and NUID in the long term due to improved irrigation water delivery reliability.

## **6.6 Vegetation**

### **6.6.1 No Action (Future without Federal Investment)**

Under the No Action Alternative, there would be no effect on vegetation. Vegetation associated with the open irrigation canal would persist, and adjacent native upland vegetation would remain in its current condition.

## 6.6.2 Piping Alternative

### 6.6.2.1 General Vegetation

During construction, existing maintenance roads within the ROW and easements would provide access to the project area. Selection of construction areas adjacent to the canal would consider existing vegetation and avoid mature trees to the extent practicable.

Prior to construction, AID would survey and identify trees greater than 2 feet in diameter within its ROW and easement. These trees would be flagged for avoidance during construction. The width of the construction area would be clearly flagged along both sides of the canal prior to beginning construction to ensure that construction would stay within these boundaries (see Section 5.3.2 for more information regarding this footprint).

During construction, herbaceous, shrub, and woody vegetation within the flagged construction area would be disturbed through activities such as clearing, crushing, and digging. Tree removal would be avoided to the extent practicable with special priority given to retaining trees greater than 2 feet in diameter. Trees would be removed only if they prevented construction activities from occurring, if they posed a safety threat to construction crews, or if their roots would interfere with the pipe.

After construction, the project area would be recontoured and planted with a seed mix of native grasses and forbs (see Figure 6-1 and Figure 6-2). Planting would be conducted in consultation with NRCS. Vegetation within the ROW and easements would transition to entirely upland species similar to the natural vegetation found in the high desert region where the project area is located.

Some trees and vegetation within and adjacent to the project area may depend on water seeping from the canal, and these trees and vegetation may not survive following implementation of the Piping Alternative without active irrigation by property owners. Following the construction of the proposed project, property owners may water trees and vegetation on their properties with water to which they have a legal right (e.g., municipal water, irrigation water). However, prior experience from piping the nearby Bend Feed Canal in Tumalo Irrigation District showed that the majority of well-established trees survived even without active irrigation by property owners (Reclamation, 2010).

If trees were to die within AID's ROW or easements and create a dead snag that is a safety hazard, AID would remove safety hazard trees at its discretion. On the side of the canal without a maintenance road, AID would limit this removal to trees located approximately 10 feet from the edge of the canal. On the side of the canal with a maintenance road, AID would limit this removal to trees located within a few feet of the non-canal side of the maintenance road.



**Figure 6-1.** A section of nearby Tumalo Irrigation District’s Bend Feed Canal after a piping project.



Source: DRC, 2013

**Figure 6-2.** A section of nearby Tumalo Irrigation District’s Bend Feed Canal after piping.

In the long term, native vegetation would be gained because 11.9 miles of open canal would be piped and then covered with topsoil and seeded. Revegetation practices would follow the NRCS *Oregon and Washington Guide for Conservation Seedings and Plantings* (USDA-NRCS, 2000). Trees would not be allowed to establish above the buried pipe because roots may interfere with future O&M activities.

Overall, the implementation of the Piping Alternative would have a minor long-term effect on vegetation including trees. Although some trees in the project area would be removed during construction, and other trees reliant on canal seepage located near the canal may not survive following construction if seepage is eliminated, the number of trees affected would be proportionally small compared to the number of trees in the surrounding landscape and broader geographic area. Please see the NEE Analysis in Appendix D.1 for additional discussion of trees. During construction, effects on vegetation and trees would be localized to the project area. After construction, effects would be localized to the project area and adjacent properties. BMPs would be implemented before and after construction to minimize effects (e.g., revegetation; additional BMPs are identified in Section 8.3).

#### **6.6.2.2 Noxious Weeds**

During construction, exposed soils would create areas temporarily susceptible to weed establishment. The movement of construction vehicles could provide opportunities to transport weeds to new locations. The contractor would use BMPs such as avoiding unnecessary ground disturbances and using erosion-control measures that are free of weeds and weed seeds.

After construction, weeds would be managed according to the protocol in the NRCS *Oregon and Washington Guide for Conservation Seedings and Plantings* (USDA-NRCS, 2000). The closed system would no longer present an opportunity for aquatic noxious weeds to grow or be washed to other areas of the District.

Implementation of the Piping Alternative would have a negligible short-term effect on noxious weeds because the spread of noxious weeds during construction would be controlled through BMPs. Over the long term, there would be a beneficial effect because the conversion to a piped system would reduce the spread of noxious weeds through the open canal system.

### **6.7 Visual Resources**

#### **6.7.1 No Action (Future without Federal Investment)**

Under the No Action Alternative, there would be no effect on visual resources.

#### **6.7.2 Piping Alternative**

Under the Piping Alternative, construction activities would take place during the non-irrigation season. The Piping Alternative would be constructed in phases; therefore, visual disruptions associated with construction would be limited to the phase or part of the phase that was under construction. Construction activities, such as the use of heavy equipment or pipe laying, would be visible to residents and motorists adjacent to the project area. Visual disruptions from District machinery and trucks occur in the project area when the District is running water during the irrigation season and conducting canal maintenance during the non-irrigation season; they are not an uncommon feature in the landscape.

In residential areas where the open canal is adjacent to the backyards of houses, construction activities would be temporarily pronounced. However, effects would be minimized through BMPs

such as limiting construction to daytime hours (see Section 8.3). Construction activities would be less pronounced in the segments of the project area that pass through agricultural land because there are fewer residences with a direct view of the canal in those areas.

During construction, vegetation clearing would be minimized to the extent practicable (see Section 5.3.2 and Section 6.6.2 for more information). Landscaping would not be disturbed outside of AID ROW or easements. Where practicable, construction would not occur across the full width of the ROW (see Section 5.3.2 for more information). Disturbance to existing mature trees would be minimized to the extent possible, and trees would be removed on an individual basis if necessary. See Section 6.6.2 for more information about potential effects on vegetation and trees.

After construction, the pipe would be buried and not visible. The low-lying concrete pipe inlet structure would be visible to residences adjacent to the structure at the western end of the pipe. The two SCADA locations, which would each include a small enclosure and a radio antenna, would be visible from neighboring properties (see Section 5.3.2 for approximate dimensions of the inlet structure and SCADA system). Areas adjacent to the canal would be restored to near-prior contours, and the area over the pipe would be graded to blend with the surrounding landscape. Disturbed areas, including those areas above the newly buried pipes, would be planted with a seed mix of native grasses and forbs in consultation with NRCS.

The view of the project area would change from an open canal (with or without water depending on the season) to a corridor of native upland vegetation in areas where construction took place. Figure 6-1 and Figure 6-2 show examples of revegetated corridors in neighboring districts. In areas where it would be necessary to remove trees, there would be a decrease in the number and density of trees. While property owners adjacent to the project area would lose any individual trees removed during construction, the other trees present in the area and the habitat that they provide would not be lost.

Overall, the Piping Alternative would have a moderate long-term effect on visual resources. The visual change would be localized to properties adjacent to the project area. Following construction and revegetation, the revegetated corridor would blend in with the natural landscape.

## **6.8 Water Resources**

### **6.8.1 No Action (Future without Federal Investment)**

#### **6.8.1.1 Water Rights**

Under the No Action Alternative, there would be no effect on water rights; AID would maintain its existing water rights. A portion of the water diverted at the AID diversion would continue to seep from the open canal into the ground before reaching any farms. Concerns regarding water availability for agriculture in NUID would not be addressed. Concerns regarding water availability for agricultural use in AID during dry and very dry years would not be addressed.

#### **6.8.1.2 Surface Water Hydrology**

Under the No Action Alternative, conversion of the AID open Main Canal to a modernized, piped system would not be reasonably certain to occur. There would be no effect on water resources in

waterbodies associated with District operations (see Table 4-7). Water loss due to seepage and evaporation would continue in the Main Canal, and AID would continue to divert water at rates and in volumes that account for those losses. No additional water would be available to NUID.

### 6.8.1.3 Surface Water Quality

The No Action Alternative would have no effect on surface water quality in the waterbodies associated with District operations (see Table 4-7).

### 6.8.1.4 Groundwater

The No Action Alternative would have no effect on groundwater in the planning area or the upper Deschutes Basin. Approximately 11,083 acre-feet of water would continue to seep from the Main Canal annually into the surrounding area.

### 6.8.1.5 Ecosystem Services

The No Action Alternative would not affect ecosystem services associated with water resources.

*Provisioning service, Water available for irrigation (see E1 on Figure 4-1):* Under the No Action Alternative, there would be no effect on irrigation water because the amount of irrigation water diverted from the Deschutes River by AID would largely remain the same.

*Regulating service, Water quality (see E3 on Figure 4-1):* Under the No Action Alternative, the quality of water remaining instream during the irrigation season downstream of the AID diversion would not be affected.

*Cultural service, Culturally important areas (see E5 on Figure 4-1):* Under the No Action Alternative, the aesthetic and spiritual enjoyment that the open canal brings to some residents would not be affected. Residents would continue to be able to hear and see the water running through the canal during the irrigation season.

*Regulating service, Temperature regulation (see E6 on Figure 4-1):* Under the No Action Alternative, the canal may continue to have potentially small, localized cooling or warming effects on areas adjacent to the canal depending on the relative temperatures of the canal water and air temperature.

## 6.8.2 Piping Alternative

### 6.8.2.1 Water Rights

Under the Piping Alternative, AID patrons' water rights would not change. AID would incrementally reduce its maximum live-flow diversion rate by the amount of live-flow water saved from piping each construction phase (see Section 8.7 for a map of construction phases). The proposed project is estimated to save a total of 11,083 acre-feet annually. However, hydrological modeling used for the HCP predicts that, on average, 2 percent of AID's future water supply will rely on storage water in Crane Prairie Reservoir (AID et al. 2020). To be consistent with the hydrological model predictions, the District would reduce its maximum live-flow water right by 98 percent of the total water savings associated with the proposed project (10,862 acre-feet per year out of a total water savings of 11,083 acre-feet per year). AID would bypass this saved live-flow water in the Deschutes River for diversion downstream by NUID under NUID's existing water rights. The

remaining 2 percent of total water savings, an estimated 222 acre-feet per year that would be expected to be sourced from stored water per HCP projections, would be used by AID to ensure water availability for its patrons.

In some seasons, AID has not historically diverted the full rate available under its water rights. For example, while AID is allowed to divert up to 150 cfs during season 3 under its water rights, AID has historically diverted a lower rate (see Table 4-5 in Section 4.8.1 for season dates and Appendix E.4 for AID historical diversion rates). Under the Piping Alternative, AID would identify 118 cfs as a pre-project operational maximum rate as a starting point from which AID would reduce its diversion during these seasons (S. Johnson, personal communication, February 9, 2022).

AID has identified a pre-project operational maximum diversion rate of 106 cfs in season 2 and 118 cfs in season 3 (S. Johnson, personal communication, February 9, 2022). AID would work with OWRD to adjust AID water rights certificates to match these rates after the following actions have been completed: NRCS has authorized the Plan-EA; AID has secured match funding for Phase 1; and construction has been completed on Phase 1.

AID would reduce its diversion rates following the completion of each phase of construction to bypass live flow to NUID. If regulatory calls were issued on AID's live-flow water rights, AID would reduce both its live-flow diversion rate and the rate of live flow bypassed to NUID in equal proportions. For example, if a regulatory call required AID to reduce its live-flow diversion rate by 10 percent, then AID would also reduce the rate of water bypassed to NUID by 10 percent. AID would not bypass any stored water to NUID. Hydrologic modeling suggests that regulatory calls on AID's live-flow water rights may occur more frequently in the future due to the implementation of the HCP (AID et al., 2020).

Once water passes the AID diversion, a portion of the 10,862 acre-feet per year passed to NUID would be lost to seepage in the Deschutes River channel between AID and NUID diversions. Approximately 3.8 percent of this water, or up to 416 acre-feet<sup>21</sup> annually, would be lost to seepage, and approximately 96.2 percent of the water, or up to 10,446 acre-feet annually, would reach the NUID diversion (K. Gorman, personal communication, December 15, 2020). As noted above, regulatory calls may reduce the amount of water bypassed by AID and available to NUID during any given year.

Under this alternative, water bypassed to NUID would assist NUID in fulfilling its patrons' existing water rights throughout the irrigation season (up to 10,446 acre-feet per year). There would be no effect on AID patrons' certificated rate and duty. This alternative would provide additional live flow to NUID's patrons and reduce NUID's dependence on water stored in Wickiup Reservoir to fulfill its water rights. Following the completion of each phase, AID would work with OWRD and its partners to verify and measure all water savings prior to increasing the amount of water bypassed to NUID. AID and NUID would work with other irrigation districts in the Basin and OWRD to ensure water bypassed for NUID is protected for NUID use.

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<sup>21</sup> Totals may not sum due to rounding.

When the availability of live flow decreases throughout the irrigation season, AID uses water stored in Crane Prairie to supplement patrons' water supply. Live flow availability may decrease during an irrigation season due to seasonal streamflow declines. Live flow availability may also decrease in the future due to the implementation of the HCP (see above).

When AID diverts both Deschutes River live flow and water released from Crane Prairie Reservoir, the water saved through the proposed action would consist of both Deschutes River live flow and of storage water released from Crane Prairie Reservoir. AID would only bypass Deschutes River live flow to NUID. The portion of the water savings consisting of water released from Crane Prairie Reservoir would be available to AID patrons under their existing water rights (up to 222 acre-feet per year).

Hydrologic modeling projected the frequency and magnitude of which AID would divert water released from Crane Prairie Reservoir following the implementation of the HCP (AID et al., 2020). Modeling suggests that AID would divert stored water released from Crane Prairie Reservoir during very dry years for all years following the implementation of the HCP (years 1 through 30). AID would also divert stored water released from Crane Prairie Reservoir during dry years for years 8 through 30 of the HCP. A corresponding portion of the water saved through the proposed project would consist of saved water and would be available to AID patrons during these years.

AID has historically only diverted and delivered up to the amount of water that its patrons have needed. Correspondingly, the daily diversion rate has varied based on water supply, acreage irrigated, climate conditions, and similar conditions. AID does not expect patrons' water needs to change as a result of the proposed project. AID would continue to divert and deliver only the water that its patrons need, with diversions reduced due to water savings associated with the proposed project. Any live flow that AID does not divert would remain in the Deschutes River and would be available for junior water right holders, including the Deschutes River itself, as it would under the No Action Alternative.

#### *Protecting Water Released by NUID to the Deschutes River*

Following the completion of each phase, NUID would legally protect water released from Wickiup Reservoir (up to 10,446 acre-feet) through an instream lease under Oregon water law (ORS 537.348 [2] and OAR 690-077). If NUID were to release 10,466 acre-feet at a flat rate across the irrigation season, the District would release that water at a rate of 33.8 cfs. The water leased instream would retain the same priority date as NUID's originating water right (Certificate 51229). The instream lease would protect water in the Deschutes River downstream from Wickiup Reservoir during the non-irrigation season (i.e., in the late fall, winter, and early spring). Once an instream lease was approved by OWRD, the leased portion of NUID's water right would be unavailable for use by NUID or its patrons.

The State of Oregon allows for NUID's storage water rights to be leased instream. However, OWRD does not have the authority to permanently transfer storage water rights instream (S. Henderson, personal communication, May 24, 2022). An agreement would be established specifying that these instream leases would be renewed in perpetuity until the State of Oregon has



the authority needed to permanently transfer the associated storage water rights instream. At that time, the associated storage water rights would be permanently transferred instream.

Water released by NUID during the non-irrigation season would be in addition to the HCP-required minimum winter flow rate of 100 cfs<sup>22</sup> in the Deschutes River downstream from Wickiup Reservoir. This additional flow would be beneficial to the Deschutes River until year 8 of the HCP (January 2028) when the minimum winter flow rate is increased to 300 cfs. Starting in year 8 of the HCP, the water released by NUID would be a part of, rather than in addition to, the streamflow required under the HCP.

#### 6.8.2.2 Surface Water Hydrology and Water Quality

Effects on individual reaches are identified below.

##### **6.8.2.2.1 CRANE PRAIRIE RESERVOIR**

###### *Surface Water Hydrology*

Implementation of the Piping Alternative would have no effect on Crane Prairie Reservoir.

###### *Surface Water Quality*

Implementation of the Piping Alternative would have no effect on water quality in Crane Prairie Reservoir.

##### **6.8.2.2.2 WICKIUP RESERVOIR**

###### *Surface Water Hydrology*

Up to 10,446 acre-feet of NUID's stored water in the reservoir would be dedicated to and released for instream use during the non-irrigation season. This volume represents about 5 percent of the reservoir's capacity.<sup>23</sup> As a result of the Piping Alternative, releases during the non-irrigation season would reduce pool levels in Wickiup Reservoir and result in a slight change in active storage volume at the start of the irrigation season. Because of Wickiup Reservoir's total storage capacity, this change would have negligible effects on Wickiup Reservoir. All effects of the Piping Alternative would be short-term because the minimum winter flow rate downstream from Wickiup Reservoir will increase to 300 cfs in year 8 of the HCP (January 2028).

###### *Surface Water Quality*

The Piping Alternative would result in negligible short-term effects on water quality in Wickiup Reservoir as storage volumes are reduced throughout the irrigation season and reservoir water temperatures increase in late summer and early fall. The effects would be negligible because effects

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<sup>22</sup> Other water conservation projects are occurring in the Deschutes Basin that will also allocate water instream in addition to the HCP-required minimum flow rate of 100 cfs. These cumulative effects are discussed in Section 6.13.

<sup>23</sup> Wickiup Reservoir has an active storage capacity of 200,000 acre-feet.

on water quality would be below or at the level of detection. These effects could include decreased oxygen levels and increased phosphorus levels, which in turn could increase intensity and duration of algae and cyanobacteria blooms in the reservoir during the summer and into early fall (AID et al., 2020).

### **6.8.2.2.3 DESCHUTES RIVER FROM WICKIUP RESERVOIR (RM 226.8) TO THE ARNOLD CANAL DIVERSION (RM 174.5)**

#### *Surface Water Hydrology*

The Piping Alternative would have short-term beneficial effects on this reach of the Deschutes River during the non-irrigation season and no effect on this reach during the irrigation season. This alternative would increase streamflow in the Deschutes River during the non-irrigation season by up to 33.8 cfs<sup>24</sup> below Wickiup Reservoir and up to 29.5 cfs<sup>25</sup> at Benham Falls. This additional flow would be beneficial to the Deschutes River until year 8 of the HCP (January 2028) when the minimum winter flow rate is increased to 300 cfs under the HCP. After January 2028, there would be no effect on this reach; the water from the proposed project would be released as part of the 300 cfs maintained instream under the HCP.

The Piping Alternative would have no effect on this reach during the irrigation season as releases from Wickiup Reservoir would continue as they have historically to meet patron demand in both AID and NUID.

#### *Surface Water Quality*

The proposed action would increase late fall, winter, and early spring streamflow during the non-irrigation season in the Deschutes River from Wickiup Reservoir (RM 226.8) to the Arnold Canal Diversion (RM 174.5) until year 8 of the HCP (January 2028) when the minimum winter flow rate will be increased to 300 cfs. Water quality in the Deschutes River downstream of Wickiup Reservoir is greatly influenced by water quality in Wickiup Reservoir itself, and higher winter flows are typically associated with improved water quality.

However, as storage volumes in Wickiup Reservoir are reduced throughout the irrigation season and reservoir water temperatures increase, late summer and early fall reservoir releases would result in increased temperatures and reduced water quality in the Deschutes River below Wickiup Reservoir (AID et al., 2020). These effects would be short-term and negligible and would be below or at the level of detection (until year 8 of the HCP [January 2028]). Effects would diminish downstream as a result of tributary inflows and groundwater discharge (AID et al., 2020). Following year 8, additional

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<sup>24</sup> If spread evenly across the non-irrigation season (November 1 to March 31), 10,446 acre-feet of water would allow for 33.8 cfs to be released from Wickiup Reservoir. Due to the geology of the upper Deschutes Basin, OWRD accounts for water losses in certain river reaches. Water losses are described in these sections with loss adjustments incorporated into the flow rates.

<sup>25</sup> Losses were accounted for along the Deschutes River following OWRD's estimations. These losses include a 12.5 percent channel loss from Wickiup Reservoir to Benham Falls and a 7 percent channel loss from Benham Falls to the City of Bend.

water resulting from the proposed action would be used to meet the minimum streamflow rate specified in the HCP, and there would be no effect on surface water quality in this reach.

#### **6.8.2.2.4 DESCHUTES RIVER FROM ARNOLD CANAL DIVERSION (RM 174.5) TO NORTH CANAL DAM (RM 164.8)**

##### *Surface Water Hydrology*

The Piping Alternative would have short-term beneficial effects in this reach of the Deschutes River during the non-irrigation season and long-term beneficial effects during the irrigation season. This alternative would increase streamflow in the Deschutes River during the non-irrigation season by up to 27.5 cfs<sup>25</sup> at North Canal Dam. This additional flow would be beneficial to the Deschutes River until year 8 of the HCP (January 2028) when the minimum winter flow rate is increased to 300 cfs. After January 2028, there would be no effect on this reach during the non-irrigation season; the water from this project would be released as part of the 300 cfs maintained instream under the HCP.

During the irrigation season, live flow saved by the proposed project would be allowed to pass AID's diversion; this would increase flows in this reach. In the spring when live flow is available, AID would pass up to 32.5 cfs. This rate would, however, decrease during the irrigation season due to seasonal streamflow declines; therefore, the rate of water passing AID's diversion would also decrease throughout the irrigation season. Live-flow availability may also decrease in the future due to the implementation of the HCP (see Section 6.8.2.1). This water would then be diverted at the NUID diversion (RM 164.8). Increases to streamflow in this reach would be beneficial and long term.

##### *Surface Water Quality*

The Piping Alternative would increase late fall, winter, and early spring streamflow in the Deschutes River from the Arnold Canal Diversion (RM 174.5) to North Canal Dam (RM 164.8) until year 8 of the HCP (January 2028) when the minimum winter flow rate will be increased to 300 cfs. Effects on water quality during the non-irrigation season are the same as those described in Section 0.

The Piping Alternative would have long-term benefits to water quality during the irrigation season as the District increases streamflow in this reach by up to 32.5 cfs.

#### **6.8.2.2.5 DESCHUTES RIVER FROM NORTH CANAL DAM (RM 164.8) TO LAKE BILLY CHINOOK (RM 120.0)**

##### *Surface Water Hydrology*

The Piping Alternative would have short-term beneficial effects on this reach of the Deschutes River during the non-irrigation season and no effect during the irrigation season. This alternative would increase streamflow in the Deschutes River during the non-irrigation season by up to 27.5 cfs<sup>25</sup> at North Canal Dam. This additional flow would be beneficial to the Deschutes River until year 8 of the HCP (January 2028) when the minimum winter flow rate is increased to 300 cfs. After January 2028, there would be no effect on this reach during the non-irrigation season; the water from this project would be released as part of the 300 cfs maintained instream under the HCP.

ODFW has a pending instream water right for this reach, which is usually met during the non-irrigation season.

The Piping Alternative would have no effect on this reach of the Deschutes River during the irrigation season as the additional streamflow allowed to pass the AID diversion would be diverted at the NUID diversion at North Canal Dam (RM 164.8).

#### *Surface Water Quality*

The Piping Alternative would increase late fall, winter, and early spring streamflow in the Deschutes River from the Arnold Canal Diversion (RM 174.5) to North Canal Dam (RM 164.8) until year 8 of the HCP (January 2028) when the minimum winter flow rate will be increased to 300 cfs. Effects on water quality during the non-irrigation season are the same as those described in Section 0.

The Piping Alternative would have no effect on water quality in this reach during the irrigation season as the additional streamflow allowed to pass the AID diversion would be diverted at the NUID diversion at North Canal Dam (RM 164.8).

#### **6.8.2.2.6 DRAINAGE COURSES**

Although the canal was never intended as a drainage course and the District does not allow its canal and lateral system to be intentionally used for stormwater management,<sup>26</sup> the Piping Alternative would eliminate the opportunity for the canals to be indirectly used for stormwater conveyance or disposal. The conversion of the open canal to a piped system would return the landscape along the canal to its original grade and to the natural surface runoff patterns that existed prior to the presence of the open canal. AID would coordinate with landowners directly down-gradient of the new pipelines to mitigate potential unintended consequences. The elimination of the proposed canal section as a drainage course would result in a minor long-term adverse effect on drainage courses. Effects would be localized to where the project had occurred and could include potential flooding on landowner properties and increased use of stormwater drains.

#### **6.8.2.2.7 IRRIGATION WATER QUALITY SUPPLIED TO PATRONS**

The Piping Alternative would have long-term beneficial effects on the water quality of irrigation water delivered to AID patrons. Piping the Main Canal would prevent contaminants such as herbicides, pesticides, animal waste, and stormwater runoff from entering the water supply for AID patrons down-gradient.

#### **6.8.2.3 Groundwater**

No groundwater resources would be extracted or consumptively used as part of this project; however, piping the Main Canal would affect groundwater hydrology associated with canal seepage.

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<sup>26</sup> The District does not allow for its canal and lateral system to be used for stormwater management to avoid risk of contaminating irrigation water with potential stormwater pollutants.

Canal piping would reduce seepage in this area by up to 11,083 acre-feet annually during the irrigation season.

On average, for this part of the Deschutes Basin, this decrease in recharge translates into a decreased groundwater elevation of approximately 0.026 foot annually (see Section 2.3.1 of Appendix D.1 for calculation details). An important caveat is that localized effects on groundwater would differ throughout the area. Over the course of 106 years (the life of the project plus the construction period), this annual drop would result in a cumulative decreased average groundwater elevation of 2.6 feet. These effects would be most prominent at shallow depths closest to canals and attenuate with increasing depth (Gannet & Lite, 2013).

As described in Section 4.8.5, changes in canal seepage account for only a small portion of historical changes in groundwater recharge in the area. Climate remains the primary factor affecting groundwater levels in the region. The U.S. Geological Survey estimated that the combined effects of climate and groundwater pumping accounted for approximately 90 percent of the observed decrease in groundwater levels in the region and that canal piping and lining accounted for 10 percent of that observed decrease (Gannett & Lite, 2013). This 2013 study was used for the analysis of effects on groundwater and in the NEE benefit-cost analysis and is based on data at the Deschutes Basin scale.

A NEE benefit-cost analysis was completed for the Piping Alternative (see Section 8.9 and Appendix D.1). The cost of increased groundwater pumping was included in this analysis (see Appendix D.1.2.3.1). The analysis combined the decreased groundwater elevation for each year in the 106-year analysis period with the estimated volume of groundwater pumping to estimate the total increased costs of groundwater pumping in the basin over time (Sussman et al., 2017).

Overall, effects on groundwater would occur on the basin scale and would be long-term and minor. Reduced canal seepage following piping would lead to measurable groundwater declines. However, the effects from piping would be small relative to the reduced groundwater recharge from climate factors and groundwater pumping. Effects on groundwater wells adjacent to the project and in close proximity to the project area are possible but have a high level of uncertainty. Due to this uncertainty, effects on groundwater wells are not quantified (see Appendix D.1.2.3.1).

#### 6.8.2.4 Ecosystem Services

The Piping Alternative would affect ecosystem services provided by water flowing through the Deschutes River in the following ways.

*Provisioning service, Water available for irrigation (see E1 on Figure 4-1):* Implementation of the Piping Alternative would have a beneficial effect on irrigation water deliveries. Water conveyance through closed pipe would improve efficiency by eliminating water loss due to seepage and evaporation, which in turn would allow AID to deliver adequate and reliable water to patrons while diverting less water from the Deschutes River. By passing AID-conserved water to NUID during the irrigation season, NUID would have access to more irrigation water to help fulfill its patrons' irrigation needs. Modernizing AID irrigation infrastructure would enable AID to be more resilient to environmental changes and maximize the efficiency of water conveyance.

*Regulating service, Water quality (see E3 on Figure 4-1):* Following implementation of the Piping Alternative, NUID would release an equivalent volume of water in the non-irrigation season that AID saved through modernization and passed to NUID.

*Cultural service, Culturally important areas (see E5 on Figure 4-1):* Because implementation of the Piping Alternative would replace the open canal with a covered pipe, residents would no longer see or hear water running through the open canal during the irrigation season. This action may have an adverse effect on the aesthetic and spiritual services that the open canal brings to some residents.

*Regulating service, temperature regulation (see E6 on Figure 4-1):* Implementation of the Piping Alternative would eliminate the potentially small cooling or warming effect that the canal may have on the local environment. No local data was available to evaluate the effect of piping the canal on temperature regulation; therefore, it is unknown if the elimination of this service would be beneficial or adverse. Based on data about irrigation and temperature regulation in general (see Section 4.8.6), the effect is anticipated to be negligible.

## **6.9 Fish and Aquatic Resources**

### **6.9.1 No Action (Future without Federal Investment)**

#### **6.9.1.1 General Fish and Aquatic Species**

Under the No Action Alternative, AID's Main Canal would remain open and there would be no effect on fish and aquatic species in the waterbodies associated with District operations (see Table 4-7). The District would continue to divert water from the Deschutes River for consumptive use at the current rate. This would continue to alter the hydrologic pattern of the Deschutes River streamflow similar to the last 50 years. The Main Canal would continue to leak water. The same amount of water would continue to be stored in Crane Prairie Reservoir and routed along the Deschutes River to the AID diversion. The low streamflow in the Deschutes River downstream of the AID diversion during the irrigation season would continue to reduce the potential fish habitat and compromise water quality for fish and aquatic species.

#### **6.9.1.2 Federally Listed Fish and Aquatic Species**

There would be no effect on current habitat supporting Oregon spotted frog under the No Action Alternative. Because bull trout and steelhead populations reside in downstream waterbodies where instream flow changes would have little to no effect on habitat (RM 132.0 to Lake Billy Chinook, Section 4.9.2), the habitat supporting these populations would likely not change from its current state.

#### **6.9.1.3 Ecosystem Services**

The No Action Alternative would have no effect on fish and aquatic resources related ecosystem services.

*Provisioning service, Fish populations (see E2 on Figure 4-1):* Harvest of resident and anadromous fish would not be affected. Anadromous fish would be available when runs are sufficiently large to sustain fishing. Although ODFW and CTWS are working to restore anadromous fisheries in the basin, the pace is likely to be slow and limited to available instream habitat.

*Cultural service, Culturally important species (see E4 on Figure 4-1):* There would be no effect on habitat supporting populations of culturally important fish species. Habitat limitations for culturally significant anadromous fish would continue to affect fishing, community, health, cultural identity, subsistence, and religious tribal values.

## 6.9.2 Piping Alternative

### 6.9.2.1 General Fish Species

During and following project construction, there would be no direct or indirect effects on any fish in the project area. However, common aquatic species such as western toad, Pacific treefrog, and long-toed salamander have been known to use open canals. Implementation of the Piping Alternative would have a direct effect on these species during construction because habitat in the open canal would be lost. However, the habitat is low quality and is not considered critical to the long-term survival of these species (S. Wray, personal communication, November 17, 2017). Open canal habitat used by invasive bullfrog species would also be removed as a result of piping.

During the irrigation season, up to 10,862 acre-feet of water saved by the project would pass the AID diversion and would be diverted 9.7 miles downstream by NUID (RM 164.8) for consumptive use (see Section 6.8.2 for how water saved by the project would be allocated). In the spring, when live flow is available, AID would pass up to 32.5 cfs.<sup>27</sup> However, this rate would decrease throughout the irrigation season as live-flow availability in the Deschutes River decreases. The Piping Alternative would secure any beneficial effects that water in this reach provides to fish and aquatic species during the irrigation season. Following implementation, any beneficial effects on this reach would be long-term (see Section 6.8.2).

In return for passing water to NUID, NUID would release an equal volume of water minus losses in the Deschutes River between the AID diversion and the NUID diversion (up to 10,446 acre-feet) from Wickiup Reservoir into the Deschutes River in the non-irrigation season continuing in perpetuity (see Section 6.8.2). The effect that this activity would have on fish and aquatic species is evaluated in the context of the HCP requirements adopted December 31, 2020.

In years 4 through 7 of the HCP (January 2024 through December 2027), any water released instream in the Deschutes River below Wickiup Reservoir during the non-irrigation season would be in addition to the HCP-required minimum winter flow rate of 100 cfs. If the water were released at a flat rate for the duration of the non-irrigation season, NUID would release up to 33.8 cfs from Wickiup Reservoir. This action would improve the Deschutes River streamflow regime and water quality, which would have an indirect beneficial effect on fish and aquatic species and their habitats.

Of the 33.8 cfs<sup>28</sup> of conserved water released from Wickiup Reservoir into the Deschutes River, 27.5 cfs would pass through North Canal Dam in the Deschutes River (see Section 6.8.2.2) during the non-irrigation season. However, because winter streamflow in this section of the Deschutes

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<sup>27</sup> Conserved water would be released incrementally as the project is completed. See Section 6.8.2.2.

<sup>28</sup> This calculation accounts for water loss along the Deschutes River. According to OWRD, these losses include a 12.5 percent channel loss between Wickiup Reservoir and Benham Falls and a 7 percent channel loss between Benham Falls and the City of Bend.

River ranges between 450 and 1,200 cfs due to the contributions of tributaries and natural springs, the addition of 27.5 cfs would not likely affect fish and their habitats.

Beginning in year 8 of the HCP (January 2028), base instream flow requirements during the non-irrigation season would be increased to 300 cfs. At this point, the release of up to 33.8 cfs (10,446 acre-feet per year) of water into the Deschutes River by NUID as a result of the AID Piping Alternative would support the HCP instream flow requirements. No additional effects on fish and aquatic species are anticipated.

#### 6.9.2.2 Federally Listed Fish and Aquatic Species

Within and adjacent to waterbodies associated with District operations, federally listed Oregon spotted frog occurs in Crane Prairie Reservoir, Wickiup Reservoir, and the Deschutes River (see Section 4.9.2). Water released from Wickiup Reservoir as a result of the Piping Alternative would slightly decrease reservoir storage and increase streamflow during the non-irrigation season (see Section 6.8.2.2). The decrease in reservoir storage and associated effects on water quality (see Section 6.8.2.2) would have a negligible effect on Oregon spotted frog and its habitat in Wickiup Reservoir. Increase in non-irrigation season streamflow in the Deschutes River below Wickiup Reservoir as a result of the Piping Alternative is anticipated to slightly improve overwintering habitat conditions; however, because the increase in streamflow during the non-irrigation season would be insufficient to reach emergent wetlands, Oregon spotted frog would continue to overwinter in unvegetated backwater areas and side channels of the river (AID et al., 2020). Under the proposed action, Oregon spotted frog breeding conditions are anticipated to improve in the Deschutes River below Wickiup Reservoir during the non-irrigation season due to the increased streamflow and reduced fluctuation in flow during the breeding season (AID et al., 2020). All effects are consistent with those described in the HCP.

In years 4 through 7 of the HCP, this action would increase streamflow conditions during the non-irrigation season, which would have a small improvement on Oregon spotted frog critical habitat for overwintering. Breeding conditions would also be expected to have variable improvements from Wickiup Reservoir to Arnold's diversion (RM 174.5) as a result of the Piping Alternative. PCEs of Oregon spotted frog critical habitat would benefit from the Piping Alternative in this reach (see Appendix E.5). Beginning in year 8 of the HCP, the conserved water allocated instream as a result of this Piping Alternative would support the instream flow requirements for restoration and no additional benefits for Oregon spotted frog or its critical habitat would be observed. Informal consultation has been initiated.<sup>29</sup> USFWS concurrence with a "may affect-not likely to adversely affect" determination was signed on July 29, 2022 and received by NRCS on August 1, 2022.

Bull trout critical habitat is located within the waterbodies associated with District operations (see Figure E-1 in Appendix E.5), and bull trout are known to forage in the Deschutes River from Big Falls (RM 132.0) to Lake Billy Chinook (RM 120.0) during the non-irrigation season. In this reach, however, increased streamflow during the non-irrigation season under the Piping Alternative would have no effect on bull trout; the amount of increased streamflow would not be sufficient to produce a discernable effect on bull trout populations or PCEs identified in the critical habitat designations

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<sup>29</sup> Coordination with USFWS and NMFS has been completed as required by the provision of PL 83-566 Section 12.



(70 Federal Register 56211, 2005). Consequently, NRCS determined that there would be no effect on federally designated critical habitat for bull trout and Section 7 consultation under the ESA is not warranted for this species. Technical assistance from USFWS provided no additional information that would warrant reconsideration of this determination (P. Lickwar, personal communication, March 10, 2021).

The Middle Columbia River steelhead population can potentially access the Deschutes River as far upstream as Big Falls (RM 132.0; Figure E-2 in Appendix E.5). Similar to the effects on bull trout, changes to streamflow or water quality as a result of the Piping Alternative would have no effect on the steelhead population. Middle Columbia River steelhead are considered a non-essential experimental population until January 2025. Non-essential experimental populations are treated as “proposed for listing” under Section 10(j) of ESA (Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead Above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon, 2011). Because changes to streamflow or water quality would not affect the population and because implementation of the Piping Alternative is not likely to jeopardize the continued existence of the species (Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead Above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon, 2011; Endangered and Threatened Species: Designation of Experimental Populations Under the Endangered Species Act, 2016; Section 4.9.2; Section 8.5.3), NRCS determined that Section 7 consultation with NMFS under the ESA is not warranted (see Section 8.5.3).

### 6.9.2.3 Ecosystem Services

The Piping Alternative would affect the ecosystem services provided by fish and aquatic resources in the following ways.

*Provisioning service, Fish populations (see E2 on Figure 4-1):* Over the long term, increased streamflow under the Piping Alternative would improve habitat for resident fish species during the non-irrigation season. Bolstering fish populations may allow more consistent fishing for harvest and consumption.

*Cultural service, Culturally important species (see E4 on Figure 4-1):* Following the modernization project, up to 33.8 cfs would be allocated instream during the non-irrigation season (see Section 6.8.2.2). The allocated water would have a beneficial effect on instream habitat for culturally important fish, which would positively affect Central Oregon community member values and contribute to CTWS goals including enhanced fishing, community, health, cultural identity, subsistence, and religious tribal values.

## 6.10 Wetlands and Riparian Areas

### 6.10.1 No Action (Future without Federal Investment)

Under the No Action Alternative, there would be no effect on wetlands and riparian areas. Wetland and riparian vegetation associated with the open irrigation canal would persist. Although the canal

within the project area is mechanically managed to clear vegetation, seepage supporting wetland and riparian features adjacent to the canal would remain in its current condition.

### **6.10.2 Piping Alternative**

#### *Wetland and Riparian Areas along the Project Area*

The Main Canal within the project area is managed mechanically to clear vegetation. NWI<sup>30</sup> geographic information systems data (USFWS, n.d.) was used as a first-step approach in identifying and evaluating potential wetlands in the project area. Through an analysis of NWI data and examining aerial imagery, no potential wetland sites within the project area were identified.

Generally, project canals and laterals are not considered wetlands or waters of the United States by state or federal agencies (see Section 4.10); however, prior to project implementation, consultation with DSL and USACE would occur to determine exemption applicability to canals in the project area. If wetlands within or adjacent to the project area were identified, they would be avoided to the extent practicable.

Construction would result in the permanent fill of the canal in the project area. Seasonal opportunistic hydrophytic plants that sporadically occur within and directly adjacent to the canal would be removed or buried during excavation, fill, placement of pipe, or other construction activity, and AID would follow appropriate reclamation procedures to revegetate disturbed areas as uplands. In locations where piping would occur, seepage losses would be eliminated and potentially limit the water available to adjacent wetlands if they are dependent upon canal seepage for hydrology. If wetland sites adjacent to the project area are dependent on seepage losses, they would permanently change to upland areas after project construction.

Because eliminating seepage losses could reduce water available to potential wetlands adjacent to the project area and hydrophytic vegetation occurring in places near or adjacent to the project area, this alternative could have minor long-term effects on wetlands and hydrophytic vegetation.

The Piping Alternative would have no effect on excavated water storage ponds adjacent to the project area, and the hydrophytic vegetation along these ponds would not be disturbed.

#### *Wetland and Riparian Areas along Natural Waterbodies Associated with District Operations*

The proposed action would result in slight improvements in water quality and habitat function in the 111.8 miles of natural riverine systems along the Deschutes River downstream of Wickiup Reservoir (RM 238.8) as a result of increased streamflow during the non-irrigation season. Restablishing a more natural hydrologic regime in these reaches could allow the river channel to supply water to wetlands and riparian areas via infiltration through channel banks; this would enhance wetland and riparian functions by facilitating processes such as surface and groundwater exchange and physical

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<sup>30</sup> The NWI code uses the Cowardin classification system. For further information about Cowardin classifications, refer to *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979).

and chemical transformations, and it would support riparian plant communities. However, these benefits would be short-term and only realized prior to the year 8 HCP flow increase to 300 cfs.

#### **6.10.2.1 Permitting and Compliance**

Construction and maintenance of the irrigation ditches located outside waters of the United States are generally exempt from regulation under Section 404(f)(1)(C) of the CWA (USACE & EPA, 2020). Under this exemption, it is anticipated that no permit would be required for the disturbance to wetlands within the existing AID canal and lateral system. However, coordination and consultation with DSL and USACE would occur prior to implementation of each site-specific project to ensure that the project either meets exemption criteria or that the proper permitting and construction activities are conducted.

EO 11988 requires federal agencies to avoid to the extent possible the long- and short-term effects associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The proposed action would not occur within the 100-year floodplain, and therefore, it would have no effect on the floodplain elevation.

### **6.11 Wildlife Resources**

#### **6.11.1 No Action (Future without Federal Investment)**

Under the No Action Alternative, no effect on wildlife along the Main Canal is anticipated because District activities would remain in their current condition.

#### **6.11.2 Piping Alternative**

During construction, terrestrial wildlife could experience noise disturbance due to heavy equipment operation, habitat removal due to tree cutting and other vegetation removal, or injury due to collision with construction equipment or habitat removal. AID regularly uses trucks and other construction equipment for canal operation and maintenance; therefore, most wildlife in the area are accustomed to noise. These disturbances are anticipated to be negligible.

As the canal is piped and the water source is removed, the distribution patterns of wildlife within the project area could change. Although some species may use the canal as a water source, the canal can have an adverse effect on wildlife due to the risk of drowning and the barrier that the canal presents to terrestrial movement (Beier et al., 2008; A. Walch, personal communication, September 17, 2021). As this alternative would be implemented over time, ungulates and other terrestrial wildlife would have time to adjust and find new water sources. Furthermore, this alternative would have no effect on excavated water storage ponds served by the project or on sub-laterals (some of which are open) that intersect the Main Canal. The storage ponds and sub-laterals would still provide summer drinking water and habitat for wildlife. In the winter, icy water storage ponds that are lined would continue to pose a risk to large ungulates.

For wildlife that use the canal as a water source or as a part of their home range, there would be a greater effect on species that have small ranges than on those species with larger ranges. Generally,

species with larger ranges, such as mule deer, would be able to more easily find alternate sources of water or habitat; species with smaller ranges would have more limited options. Because other water nearby would not be affected, such as laterals that intersect the Main Canal, ODFW does not anticipate that wildlife would need to travel to the Deschutes River for water (A. Walch, personal communication, February 20, 2022).

Implementation of the Piping Alternative would potentially reduce human the presence throughout the project area, as fewer trips to maintain ditches and headgates would be necessary. This would result in fewer human-wildlife conflicts and improved seclusion for wildlife. In addition, the Piping Alternative could remove barriers to ungulates and other terrestrial wildlife within the project area as the open canal is converted to buried pipeline.

Project implementation would provide increased streamflow in the Deschutes River downstream from Wickiup Dam, and this increased streamflow could enhance riparian habitat. Improved streamflow would provide more consistent access to water for hydrophytic plants, and this would, in turn, enhance riparian wildlife habitat.

During construction, the Piping Alternative would have short-term negligible effects on general wildlife in the project area. Following implementation, the effects on general wildlife species would be negligible and long-term because although local wildlife distribution patterns would be altered, implementation would not have a perceptible effect on the species at the population scale. Unavoidable effects on wildlife would be minimized using BMPs.

#### 6.11.2.1 MBTA/BGEPA

Wintering or migrating birds would be minimally affected by construction disturbance because they have the flexibility to move away from disturbances to other suitable areas. There would be no expected effect on breeding migratory songbirds or waterbirds as construction activities would occur outside the nesting season. Coordination with USFWS regarding birds covered under MBTA is ongoing. Site-specific analysis would occur prior to implementation of each project phase.

AID would follow USFWS guidelines to ensure minimal disturbance to bald or golden eagles nesting near the project area. The critical nesting period for bald and golden eagles is January 1 through August 31. Sections of the project area near Horse Butte Road and Knott Road are approximately 0.6 mile and 1.9 miles, respectively, from golden eagle nesting areas (E. Weidner, personal communication, December 17, 2019). Because of the proximity of the project area to nesting sites, a seasonal restriction for the use of hydraulic hammers is in effect for these segments of the project area. Clearance surveys would be completed prior to implementation, and coordination with USFWS is ongoing (E. Weidner, personal communication, November 25, 2019 and March 2, 2022).

The effects on birds covered under MBTA and BGEPA would be negligible and short-term because effects would primarily occur during the construction phase and be limited to the nesting sites within proximity of the project area. Effects would be mitigated through BMPs and coordination with USFWS.

### 6.11.2.2 State and Federally Listed Species

The Piping Alternative would have no effect on federally or state-designated terrestrial species within the project area because none are known to exist in the project area (see Sections 4.11.3 and 4.11.4). Effects on federally listed threatened and endangered species and state-listed species are discussed in Sections 6.9.2 and 6.11.2 in this Plan-EA. Effects on federally listed species are also considered in the Biological Assessment developed for the project. USFWS concurred with the NRCS determination that the project may affect but is not likely to adversely affect Oregon spotted frog (signed on July 29, 2022; received by NRCS on August 1, 2022).

## 6.12 Wild and Scenic Rivers

### 6.12.1 No Action Alternative (Future without Federal Investment)

The No Action Alternative would have no effect on the values that support the designation of Wild and Scenic Rivers or on State Scenic Waterways in the waterbodies associated with District operations. The No Action Alternative would also have no effect on the ORVs listed in Section 4.12.

#### 6.12.1.1 Ecosystem Services

The No Action Alternative would have no effect on ecosystem services provided by the Wild and Scenic Deschutes River resources.

*Cultural service, Culturally important natural areas (see E5 on Figure 4-1):* There would be no effect on Deschutes River ORVs or on Central Oregon community member values.

### 6.12.2 Piping Alternative

Implementation of the Piping Alternative would have no effect on the Wild and Scenic River or State Scenic Waterway designations or on the free-flowing condition of the designated reaches downstream from Wickiup Dam (RM 226.8) to Lake Billy Chinook (RM 120.0).

Increased streamflow would be consistent with Wild and Scenic River management goals (BLM, 1992) and enhance fish, recreation, scenery, wildlife, hydrological, and botanical/ecological values.

#### 6.12.2.1 Ecosystem Services

The Piping Alternative would affect the ecosystem services provided by the Wild and Scenic Deschutes River resources in the following way.

*Cultural service, Culturally important natural areas (see E5 on Figure 4-1):* Following the modernization project, up to 33.8 cfs would be allocated instream during the non-irrigation season (see Section 6.8.2.2). The allocated water would have a beneficial effect on several Deschutes River ORVs including fisheries and hydrology (see Appendix E.7) and would positively affect Central Oregon community member values.

## **6.13 Cumulative Effects**

### **6.13.1 Past Actions**

Past actions over the last 120 years that have affected resources in the Deschutes River watershed are generally land development activities that include irrigated agriculture (consisting of canal system construction, previous piping projects, and diversions), urban and suburban development, industrial land and water uses, commercial development, water diversions for non-agricultural uses, and transportation infrastructure. Section 4 describes the nature and extent of these past actions and how they have influenced the existing environment for each resource.

The AID delivery system was constructed between 1907 and 1919 to provide water to surrounding farms and ranches for crops and livestock. Seven other irrigation districts were developed within the Deschutes Basin during the early twentieth century, and they collectively altered the hydrology of the Deschutes River and its tributaries. Over time, there has been increasing pressure to reduce the effects of irrigation needs on the natural water cycle in the Deschutes Basin.

Since the early 1990s, there has been increasing interest in improving instream flows and conserving water in the Deschutes River. AID and other Deschutes River–area irrigation districts have completed various water conservation projects. These recent past efforts have included piping existing irrigation canals, on-farm conservation, water management changes, and changes to crop production; these efforts have resulted in increased streamflow in the Deschutes River (see Section 4.8.3) and decreased seepage into the groundwater table (see Section 4.8.5). AID has piped approximately 22 percent of its system to date—all laterals and sub-laterals.

### **6.13.2 Current and Reasonably Foreseeable Future Actions**

Current actions are those projects, developments, and other actions that are presently underway either because they are under construction or are occurring on an ongoing basis. Reasonably foreseeable future actions generally include those actions formally proposed or planned or that are highly likely to occur based on available information. Various sources including local, state, and federal agency websites and city and county staff were consulted to obtain information about current and potential future development in the project area. The following sections describe these current actions and reasonably foreseeable future actions. This list is not comprehensive, and other actions may be taking place or may take place in the future.

#### **6.13.2.1 Land Use and Development**

Ongoing agricultural activities including farming and grazing in the project area are not expected to change from current conditions. Land use development in the project area would continue to be managed according to the Deschutes County Comprehensive Plan and Deschutes County zoning regulations. Land development activities are expected to continue into the future.

#### **6.13.2.2 Habitat Conservation Plan**

AID, other irrigation districts in the Deschutes Basin, state and federal agencies, local municipalities, and environmental groups have developed a multispecies HCP for the upper Deschutes Basin for listed species and those that may become listed during the 20- to 50-year life of the HCP; these

include Oregon spotted frog, bull trout, Chinook salmon, steelhead salmon, and sockeye salmon. The Final HCP was published in the Federal Register on November 6, 2020 (Final Environmental Impact Statement and Final Deschutes Basin Habitat Conservation Plan; Klamath, Deschutes, Jefferson, Crook, Wasco, and Sherman Counties, Oregon, 2020) and a final decision by USFWS was made on December 31, 2020. Covered activities include:

- Storage and release of irrigation water from:
  - Crane Prairie Reservoir
  - Wickiup Reservoir
  - Crescent Lake Reservoir
  - Prineville Reservoir
  - Ochoco Reservoir
- Diversion of irrigation water
- Conveyance and delivery of irrigation water
- Irrigation return flows
- Existing hydropower
- City of Prineville water use activities

The majority of the conservation measures set forth in the HCP are commitments to maintain HCP instream flow requirements (AID et al., 2020). The changes to instream flows will be phased over time to allow the permittees to accomplish the needed conservation projects and water movements. Phasing also provides opportunity for channel restoration activities, supported by the HCP through funds provided by the permittees, to be completed. Channel restoration activities will be focused on restoring channels and floodplains and eventually enable lower summer flows to provide habitats comparable to those that exist today (AID et al., 2020).

#### 6.13.2.3 Deschutes Basin Irrigation District Modernization

Other irrigation districts in the Deschutes Basin are working to pipe their infrastructure using PL 83-566 funding and would implement projects similar to those proposed by AID in this Plan-EA. Five districts—(Tumalo Irrigation District [TID], Swalley Irrigation District [SID], COID, LPID, and Ochoco Irrigation District [OID])—have authorized Plan-EAs. TID plans to pipe approximately 68.8 miles of its canals and laterals over the course of 11 years. SID plans to pipe approximately 16.6 miles of its canals and laterals over the course of 7 years. COID plans to pipe approximately 7.9 miles of its system over the course of 4 years. LPID plans to pipe approximately 10.9 miles of its system over the course of 3 years. OID plans to pipe approximately 16.8 miles of its system over the course of 3 years. The other district most likely to obtain necessary funding and permitting in the next 2 years is NUID. NUID has initiated the Plan-EA process, but the extent of

the projects are still being determined. These six modernization projects are contingent on the availability of funding. In the future, the irrigation districts may also pursue other irrigation efficiency projects using funding through other federal, state, and local funding sources.

### **6.13.3 Cumulative Effects by Resource**

Cumulative effects are considered for each resource in combination with past, present, and reasonably foreseeable future actions.

#### **6.13.3.1 Cultural Resources**

Although the canal system has undergone changes in the past (e.g., improvements from 1905 to the present), the basic operations of the District would not be altered due to the proposed improvement efforts.

Cumulative impacts to cultural resources would occur if other past, present, or reasonably foreseeable actions or projects affect the same historic properties and/or cultural resources as the proposed action. Cumulative impacts can result from individually minor but collectively significant actions that occur over a period of time. Where impacts to historic properties including any previously recorded, unevaluated, or not yet documented resources such as archaeological sites, architectural sites, cultural landscapes, or traditional cultural properties would be unavoidable, measures to mitigate the adverse effects would be identified in a Section 106 agreement document (e.g., memorandum of agreement, programmatic agreement). This document would be developed in consultation with SHPO, THPO, and other consulting parties including affiliated tribes.

Any cumulative impacts to the District's conveyance system by future actions such as new piping would be analyzed in light of the conveyance system NRHP eligibility status. Cumulative impacts would not be expected if the conveyance system were determined not eligible for the NRHP; however, if the conveyance system were determined to be eligible and a future action would result in adverse effects under Section 106 of the NHPA, these effects would be addressed in consultation with SHPO, THPO, and other consulting parties, including affiliated tribes, to mitigate adverse impacts. The cumulative impact analysis would consider whether the impact and proposed mitigation are adverse or beneficial for the human environment.

All other projects considered in this cumulative impact analysis, including other PL 83-566 projects occurring in the area, would likely be required to comply with Section 106 of the NHPA, which requires federal agencies to assess and mitigate adverse effects, including cumulative effects, on historic properties or cultural resources. AID has developed a plan to address unanticipated discoveries of cultural resources and human remains during construction of the proposed action. Other federal projects would implement similar plans and measures. These cultural resource studies, agreement documents, and plans ensure proper documentation, protection, and avoidance, minimization, or mitigation of important cultural resources.

#### **6.13.3.2 Land Use**

The project area has been substantially altered over the past century by a variety of human activities including agricultural development, livestock grazing, urban and suburban development, and road



construction. Implementation of the proposed action would support existing land uses as recent water conservation projects have, and as would implementation of current and reasonably foreseeable future actions and additional irrigation district modernization. Therefore, together with the proposed action, these activities would cumulatively support existing agricultural land uses.

#### **6.13.3.3 Public Safety**

Past, current, and future piping projects in the Deschutes Basin all serve to improve public safety by eliminating the risk of drowning in open irrigation canals. Implementation of the proposed project would contribute to these cumulative effects by further reducing cumulative risk to public safety of open irrigation canals.

#### **6.13.3.4 Socioeconomic Resources**

Past actions, including agricultural and other land development, and recently completed projects have established the socioeconomic setting of the Deschutes Basin by supporting development and agriculture. Current and reasonably foreseeable future actions would continue to support agriculture through improved infrastructure. Since the proposed action would also support the local economy through construction expenditures and intensified agricultural production, it would contribute to a cumulative benefit to socioeconomic resources in the area.

#### **6.13.3.5 Soils**

Past, ongoing, and future actions in the surrounding area that affect soils include agricultural uses, land development, and water management activities. The amount of soil affected by the proposed action is small and localized to the project area compared to the area affected by other past, present, and reasonably foreseeable future actions in the area; the proposed action would, therefore, have a minor contribution to cumulative effects on soils.

#### **6.13.3.6 Vegetation**

Agricultural activities, livestock grazing, vegetation control along roads, and urban and suburban development are responsible for most of the past and ongoing effects on vegetation in the project area and the region. The amount of vegetation that would be affected by the proposed action is small compared to the area affected by past and ongoing agricultural activities, livestock grazing, vegetation control along roads, and other utility corridors in the area. Current and reasonably foreseeable future actions, such as irrigation infrastructure piping projects in other Districts, would have relatively minor effects on vegetation because effects would be localized to each individual District's ROW or easement and these areas are proportionally a limited area compared to the region. Other actions such, as the HCP, will have beneficial effects on vegetation along the Deschutes River. Ongoing effects of past actions are not expected to change measurably from current conditions, and additional effects from the proposed action would be minor because they are localized to the project area and would result in a minor contribution to cumulative effects on vegetation.

#### **6.13.3.7 Visual Resources**

The visual quality of lands in the Deschutes Basin has changed due to past and present development, and these changes are expected to continue. The impact to visual resources from the

Piping Alternative would be a moderate long-term effect localized to the project area. The impact would be similar in character to the natural landscape and development; therefore, combined with other actions, the cumulative effects on visual resources would be minor.

### 6.13.3.8 Water Resources

Past actions over the last 120 years that have affected water resources include urban and agricultural development, road construction, road maintenance, and other irrigation projects. Since the early 1990s, there has been increasing interest in conserving water and restoring streamflow to the Deschutes River. AID and other Deschutes Basin irrigation districts have implemented various water conservation projects. These recent, past efforts have included piping existing irrigation canals, on-farm conservation, water management changes, and changes to crop production, which have resulted in increased streamflow in the Deschutes River (see Section 4.8) and decreased seepage into the groundwater table (Section 4.8.5).

Ongoing and reasonably foreseeable future actions that could affect waterbodies associated with District operations include additional irrigation piping projects being considered by other Deschutes Basin irrigation districts that divert water from the Deschutes River (see Table 6-1), on-farm water conservation work, and HCP requirements. These actions accompanied by the proposed action would cumulatively increase streamflow in the Deschutes River and its tributaries and result in beneficial cumulative effects on water resources.

**Table 6-1. Potential Water Conserved Instream from Projects<sup>1</sup> Approved or Proposed in the Deschutes Basin.**

Irrigation District	Total Water Protected Instream (cfs)	Reach Affected <sup>1,2</sup>
Tumalo Irrigation District	48	Approximately 30 cfs would be allocated to Tumalo Creek during the irrigation season, and 18 cfs would be allocated to Crescent Creek during the non-irrigation season. Both creeks are tributaries of the Deschutes River.
Swalley Irrigation District	15.2	The entire 15.2 cfs would be allocated to the Deschutes River from RM 164.8 to RM 120.0 during the irrigation season.
Central Oregon Irrigation District	30.3	Up to 30.3 cfs would be protected in the Deschutes River below Wickiup Reservoir (RM 226.8) during the non-irrigation season through an instream lease.

Irrigation District	Total Water Protected Instream (cfs)	Reach Affected <sup>1,2</sup>
	2	The District's current Regional Conservation Partnership Program project includes piping part of the J lateral and the L lateral, which would protect up to 2 cfs in the Deschutes River below Wickiup Reservoir (RM 226.8) during the non-irrigation season through an instream lease.
Lone Pine Irrigation District	5.3	Up to 5.3 cfs would be protected in the Deschutes River below Wickiup Reservoir (RM 226.8) during the non-irrigation season through an instream lease.
Ochoco Irrigation District	16.02	Up to 11.2 cfs of McKay Creek live-flow water rights would be transferred instream and increase flow in McKay Creek and the Crooked River downstream of RM 44.9.  Up to 4.82 cfs would be allocated instream in the Crooked River downstream of Prineville Reservoir.
North Unit Irrigation District		NUID has initiated the PL 83-566 planning process, but the extent of the projects is still being determined.

cfs = cubic feet per second; RM = river mile

Notes:

<sup>1</sup> The water protected instream from projects in TID, SID, COID, LPID, and OID are from authorized Plan-EAs and are reasonably foreseeable to occur. NUID has started the Plan-EA process, but water savings are still being determined.

<sup>2</sup> Flows allocated instream during the irrigation season are shown as maximum flows and may be reduced during the shoulder season depending on the district's water right. Flows allocated instream during the non-irrigation season are shown as a flat rate (cfs). See each district's Plan-EA for more information regarding the timing and location of instream flows.

Reasonably foreseeable irrigation canal and lateral piping projects throughout the Deschutes Basin may contribute to a reduction in groundwater levels. On the eastern side of the Deschutes River, seepage from SID's canals most likely percolates to shallow aquifers where it may be extracted for groundwater consumption or it may ultimately discharge into the Deschutes River (Gannett et al., 2017). Because AID is up-gradient in the groundwater system, its proposed projects could affect groundwater within COID. Ongoing and reasonably foreseeable projects in TID, LPID, and OID are not proximal to AID and therefore would have no effect on groundwater levels in AID. For reference, the TID project is located on the west side of the Deschutes River and LPID and OID are located on the north side of the Crooked River (see Figure 1-1). In the next 100 years, if AID, SID, and COID irrigation piping projects are implemented fully, average groundwater levels in the

central basin could decline approximately 7.0 feet.<sup>31</sup> In conjunction with the effects of climate variability, the AID proposed project would have a minor cumulative effect on basin groundwater levels (see Section 4.8.5; Gannett & Lite, 2013). The effects of local groundwater reduction due to piping would be mitigated by increased streamflow during the non-irrigation season, some of which would likely infiltrate into the regional aquifer.

Water quality could be affected due to nonpoint source pollution such as erosion and runoff associated with ongoing and potential construction and land development activities including the proposed irrigation piping projects. The proposed action would be constructed when there is no water in the canal system; construction practices for similar proposed projects are anticipated to be comparable. Proposed cumulative actions would contribute to water quality improvements anticipated from the reduction in erosion from AID canals and increasing streamflow in waterbodies affected by AID operations.

Implementation of the proposed action, HCP requirements, and other reasonably foreseeable future actions would have a moderate cumulative effect on water resources, as implementation of irrigation piping projects could reduce groundwater infiltration, increase streamflow, and improve water quality.

#### 6.13.3.9 Fish and Aquatic Species

Past and ongoing land uses, water diversions, and reservoir operations are responsible for most of the past and ongoing direct and indirect changes in water availability, seasonality, and access to habitat that has cumulatively affected aquatic communities and habitat in the Deschutes Basin.

Past and ongoing land use activities in the project area are not expected to change from current conditions. Future land developments and irrigation district modernization projects may cause short-term and temporary effects on fish, such as sediment inputs or aquatic habitat disturbance, and could potentially affect waters within the same watershed as the proposed action. However, the ongoing and reasonably foreseeable future actions described above, including irrigation modernization activities and the HCP requirements, are all proposed for improving aquatic habitat conditions in the Deschutes Basin. The proposed AID project, along with other current or reasonably foreseeable Deschutes Basin irrigation modernization projects, support the ODFW Conservation Strategy Overall Goal for Water Quality and Quantity. The Water Quality and Quantity goal is defined as maintaining and restoring water quality and quantity to support native fish and wildlife habitats in balance with the economic and social needs of rural and urban communities (ODFW, 2016).

Implementation of the proposed action when combined with other future actions is anticipated to have a beneficial cumulative effect on fish, aquatic species, and available habitat for these species. Implementation of other irrigation piping projects could have an additive effect on the amount of water conserved.

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<sup>31</sup> This assumes that SID's and COID's respective projects would reduce local groundwater recharge by 6,172 acre-feet per year and 10,280 acre-feet per year, respectively.

### 6.13.3.10 Wetlands and Riparian Areas

Past actions that have affected wetlands, riparian areas, and floodplains in the Deschutes Basin include land development, agricultural activities and infrastructure, water diversions, and reservoir operations. These activities are expected to continue. Effects on wetlands from the proposed action and any effects from other current and reasonably foreseeable irrigation modernization projects are anticipated to be localized to the linear areas where proposed projects would occur, which is a proportionally small area compared to the area that wetlands cover in the region. For the five authorized watershed plans in the Deschutes Basin, analysis of the NWI database identified the following:

- About 23 wetland features within or adjacent to the TID project area.
- No natural wetland resources within the SID project area; however, 65.6 acres of seasonal wetland features were identified within or adjacent to the SID project area.
- Two potential sites as Freshwater Emergent Wetlands within or adjacent to the COID project area.
- One site as a Forested/Shrub Wetland in the LPID project area at the site of the proposed river crossing.
- Forty-two potential sites as either Freshwater Emergent Wetlands, Freshwater Forested/Shrub Wetland, or Riparian within or adjacent to the OID project area.

At the time when the Plan-EAs for TID, SID, COID, LPID, and OID were written, verification of NWI-identified sites had not yet been completed. Coordination and consultation with DSL and USACE are in process or will occur prior to implementation of each site-specific project to ensure that the project either meets exemption criteria or that the proper permitting and construction activities are conducted in accordance with the permits' requirements.

Because wetlands occur infrequently within or adjacent to the project areas, implementation of the proposed action is anticipated to have a minor cumulative impact to wetlands in the project areas of the Deschutes Basin.

Wetland and riparian areas along natural waterbodies associated with the districts' operations are anticipated to experience improvements due to the increased instream flow that is expected from implementation of ongoing and future actions (see Table 6-1). Coupled with the proposed AID action, wetland and riparian areas along natural waterbodies would be anticipated to experience a short-term<sup>32</sup> cumulative benefit and improved hydrology for riparian vegetation in the Deschutes Basin. The effects of the project on wetlands and riparian areas along natural waterbodies associated with districts' operations are consistent with the ODFW Conservation Strategy Overall Goal for Water Quality and Quantity to maintain and restore water quality and quantity to support native fish

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<sup>32</sup> These benefits would be realized until year 8 of the HCP when minimum flow rates are increased to 300 cfs.

and wildlife habitats in balance with the economic and social needs of rural and urban communities (OCS, 2016).

#### **6.13.3.11 Wildlife**

Past and ongoing land use activities including agriculture, urban, and suburban development have affected wildlife and wildlife habitat in the Deschutes Basin starting in the late 1800s. Agricultural activities have substantially altered the habitat in the region by removing native vegetation in some areas and diverting streamflow. Livestock grazing occurs in much of the region around the project area and can result in the introduction and spread of weed species, the degradation of native habitat, and trampling of riparian and wetland areas. Some native habitats have been replaced with disturbance-tolerant or introduced species assemblages that may support different wildlife than previously existed. These ongoing activities would continue to affect wildlife and wildlife habitat in the project area.

Although current and future irrigation modernization projects in addition to the proposed action are taking place across the Deschutes Basin, the cumulative effects on wildlife due to the projects would be localized to the linear area where the projects would be occurring, limited to disturbance during construction, and affect wildlife that use open canals as a water source. Implementation of the proposed action and other irrigation modernization projects would cause wildlife to find other water sources as they did prior to installation of the canals. Since the effects on wildlife have occurred and would occur over a period of time in which the animals would be able to adapt, the cumulative effect on wildlife from the implementation of the proposed action would be minor.

In addition, current vegetation-control activities, including mechanical cutting of vegetation, are ongoing actions that contribute to wildlife habitat changes. The amount of wildlife habitat that would be affected by the proposed action is small compared to the area affected by past and ongoing agricultural activities, livestock grazing, vegetation control, and urban and suburban development in the area. In addition, the intensity of these ongoing actions is not anticipated to change measurably in the future; this would result in minor additional cumulative effects.

#### **6.13.3.12 Wild and Scenic Rivers**

Sections of the Deschutes River have been designated as Wild and Scenic under the National Wild and Scenic Rivers Act, and a section of the Deschutes River is designated as an Oregon State Scenic Waterway. These designations aim to protect these areas from changes that generally alter the scenic, recreational, and ecological qualities of these areas. The proposed action would have no effect on the Wild and Scenic River or State Scenic Waterways designations or the free-flowing condition of the designated reaches downstream from Wickiup Dam (RM 226.8) to Lake Billy Chinook (RM 120.0). These Wild and Scenic and State Scenic waterways would continue to be managed by federal and state agencies, respectively.

#### **6.13.3.13 Ecosystem Services**

All reasonably foreseeable actions regarding the modernization of irrigation infrastructure in the Deschutes Basin would work in concert to conserve water and improve water availability to irrigators. Past and ongoing actions described in the sections above have also contributed to water availability for irrigations and instream flow. Past, ongoing, and reasonably foreseeable actions in the

Deschutes Basin could all impact ecosystem services. However, implementation of the proposed action when combined with other future actions is anticipated to have a beneficial cumulative effect on all ecosystem services assessed.

## 7 Consultation, Coordination, and Public Participation

AID and its partners planned and conducted numerous agency coordination and public involvement activities throughout the development of this Plan-EA. These activities included a public scoping meeting, presentation, press announcements, and frequent correspondence with federal, state, and local resource agencies, agriculture interests, and other interest groups and individuals. The project development process was designed to work collaboratively with partners, agencies, tribes, and stakeholders to ensure transparency and cooperation toward a solution that fits within the framework of the purpose and need for action.

A Preliminary Investigative Report (FCA, 2018) was prepared to provide sponsors, local partners, agencies, and the public with information to evaluate the goals and objectives of the proposed project. During the development of the report, project sponsors conducted initial consultation with natural resource agencies and stakeholders in the Deschutes Basin.

Public participation activities prior to release of the Draft Plan-EA included the following.

### Public Announcements

- NRCS public notice (April 3, 2019)  
[nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/pnotice/?cid=nrcseprd1450046](https://nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/pnotice/?cid=nrcseprd1450046)
- Bend Bulletin—three public notices (April 3, 10, and 17, 2019)
- District website notice (April 3, 2019)
- Postcard to District patrons (April 3, 2019)
- NRCS news release (April 3, 2019)  
[nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/releases/?cid=NRCSEPRD1450047](https://nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/releases/?cid=NRCSEPRD1450047)

### Public Involvement Website

Information about the proposed project was added to a website to inform the public. [Oregonwatershedplans.org](https://oregonwatershedplans.org) includes the following information:

- Overview of the NRCS PL 83-566 funding program
- Overview of NEPA and the EA public participation process
- Frequently asked questions about the EA process
- Background on the District, the Draft Plan-EA and appendices, the Preliminary Investigative Report and appendices, and presentations and handouts from public meetings
- Contact information and how to submit public comments



- Email signup option for more information; subscribers receive updates over the course of project development

## Public Scoping Meeting

A public scoping meeting was held April 17, 2019, from 6:30 p.m. to 7:30 p.m. at the Elk Meadow Elementary Gymnasium, 60880 Brookwood Boulevard in Bend, Oregon. Participants had an opportunity to learn more about the proposed irrigation improvements and discuss their comments, ideas, and concerns. Public scoping comments were accepted from April 3 through May 15, 2019.

## 7.1 List of Persons and Agencies Consulted

Table 7-1 describes communications with agency personnel that were consulted during development of this Plan-EA. This includes agencies that provided formal or required consultation or individuals who were conferred with and who provided substantial input. Coordination with state and local agencies has been ongoing since project inception.

**Table 7-1. Agency Consultation and Communication Record.**

Date	Contact, Agency	Communication
November 14, 2019	Scott McBride, USFS	Discussion of Newberry National Volcanic Monument northern boundary
November 25, 2019	Emily Weidner, USFWS	Discussion about federally listed species, migratory birds, and bald and golden eagles in the area
February 26, 2020	Kyle Gorman, OWRD	Water rights discussion
April 6, 2020	Bridget Moran, USFWS Jennifer O'Reilly, USFWS	Discussion of Oregon spotted frog habitat
May 6, 2020	Bridget Tinsley, Oregon Parks and Recreation Department	Discussion about the State Scenic Waterway Corridor
June 1, 2020	Alicia Underhill, USFS Kevin Larkin, USFS Michelle King, USFS	Discussion about Wild and Scenic Section 7
October 14, 2020	Scott McBride, USFS	Discussion of the proposed project
January, 2021	Joni Cain, USFS Alicia Underhill, USFS	Discussion about land ownership
February 17, 2021	Peter Lickwar, USFWS	Discussion about potential beneficial effects on bull trout

Date	Contact, Agency	Communication
September 17, 2021	Andrew Walch, ODFW	Discussion about the effects that piping or canal lining may have to wildlife and their migration patterns
February 20, 2022	Andrew Walch, ODFW	Discussion about the effects that piping may have to wildlife
March 2, 2022	Anna Soens, USFWS Emily Weidner, USFWS Jennifer O'Reilly, USFWS Peter Lickwar, USFWS	Discussion about Threatened and Endangered species potentially affected by the project including Oregon spotted frog, steelhead, and bull trout  Discussion about species covered by MBTA and BGEPA and site clearance surveys
May 26, 2022	Meaghan Walter, NRCS Gary Diridoni, NRCS Damon Brosnan, NRCS Molly Dawson, NRCS Scarlett Vallaire, NRCS Kathy Ferge, NRCS Bobby Brunoe, CTWS Brad Houselt, CTWS	Discussion of the AID Irrigation Modernization Project as well as other PL 83-566 projects occurring in the Deschutes Basin and elsewhere
June 24, 2022	Anna Soens, USFWS Bridget Moran, USFWS USFWS staff	Providing USFWS with a draft of the AID Biological Assessment for review.
July 26, 2022	Bridget Moran, USFWS Emily Weidner, USFWS	Review draft Biological Assessment with USFWS
July 27, 2022	Bridget Moran, USFWS	NRCS initiated informal consultation with USFWS

AID = Arnold Irrigation District; BGEPA = Bald and Golden Eagle Protection Act; CTWS = Confederated Tribes of Warm Springs; MBTA = Migratory Bird Treaty Act; NRCS = Natural Resources Conservation Service; ODFW = Oregon Department of Fish and Wildlife; OWRD = Oregon Water Resources Department; USFS = U.S. Forest Service; USFWS = U.S. Fish and Wildlife Service

## 7.2 Review of the Draft Plan-EA

NRCS published the proposed Draft Plan-EA on [Oregonwatershedplans.org](https://Oregonwatershedplans.org) for public review on June 8, 2021, for an initial 30-day comment period. In response to public comments, on July 8, 2021, NRCS extended the public comment period to end on July 23, 2021. During the comment period, NRCS hosted a virtual public outreach meeting on June 23, 2021, using Zoom online meeting software. Specific public outreach activities for the Draft Plan-EA included:

- NRCS public notice (June 8, 2021)  
[nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/pnotice/?cid=nrcseprd1788239](https://nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/pnotice/?cid=nrcseprd1788239)
- NRCS news release (June 8, 2021)  
[nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/releases/?cid=NRCSEPRD1788245](https://nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/releases/?cid=NRCSEPRD1788245)
- AID postcard to patrons and landowners adjacent to the proposed project (June 8 and July 8, 2021)
- NRCS letters to tribes and agencies (June 16, 2021)
- Bend Bulletin public notice (June 8, 15, and 22, July 8 and 15, 2021)
- FCA emails to stakeholder list (June 8 and 21, July 8 and 23, 2021)
- Virtual public outreach meeting hosted via Zoom webinar (June 23, 2021) at 6:00 p.m. A recording of the meeting is available at [oregonwatershedplans.org/arnold-id](https://oregonwatershedplans.org/arnold-id)

NRCS sent a letter on June 16, 2021 to the CTWS providing a link to the Draft Plan-EA and outlining the public comment period. CTWS provided no comments on the Draft Plan-EA. NRCS followed up with a meeting with CTWS on May 26, 2022, to complete tribal consultation.

Comments on the Draft Plan-EA were submitted by email to [arnold.id.comments@gmail.com](mailto:arnold.id.comments@gmail.com), online at [oregonwatershedplans.org](https://oregonwatershedplans.org), and by mail to Farmers Conservation Alliance, 101 State Street, Hood River, Oregon 97031.

During the review period, 451 comments on the proposed Draft Plan-EA were received. NRCS has reviewed all public comments and has made changes, as appropriate, to this Final Plan-EA based on those comments and internal review. Each comment received consideration in the development of the final rule. According to the NEPA Handbook 6.9.2.1, substantive comments do one or more of the following:

- Question, with reasonable basis, the accuracy of information in the environmental impact statement or EA.
- Question, with reasonable basis, the adequacy of, methodology for, or assumptions used for the environmental analysis.
- Present new information relevant to the analysis.
- Present reasonable alternatives other than those analyzed in the environmental impact statement or EA.
- Cause changes or revisions in one or more of the alternatives.

For a full list of comments and responses, see Appendix A.

## 8 Preferred Alternative

### 8.1 Selection and Rationale for the Preferred Alternative

NRCS has selected the Piping Alternative as the Preferred Alternative<sup>33</sup> based on its ability to meet the project purpose and need, meet the Federal Objective and Guiding Principles (USDA-NRCS, 2017a), and provide the most beneficial effects on environmental, social, and economic resources. The Preferred Alternative is the only alternative that meets the purpose and need, funding requirements, and NEE Analysis benefit-cost ratio requirements. The Piping Alternative is the alternative that would maximize net economic benefits.<sup>34</sup> The District and project sponsors have agreed that the Piping Alternative is the Preferred Alternative.

Per requirements of the PR&Gs when selecting a preferred alternative, tradeoffs were considered. Although the Piping Alternative would have minor effects on various resources, those effects would be minimized or mitigated through BMPs and other compliance measures. As a tradeoff to those effects, the Piping Alternative would increase instream flows in the Deschutes River and support ecological resources in and along the Deschutes River system. Additionally, as described in the NEE Analysis, there would be positive economic benefits including NUID agricultural benefits, reduced O&M costs, instream flow benefits, Oregon spotted frog benefits, and avoided damage from failure of the open canal. When compared with the No Action Alternative in the face of current conditions and future environmental changes, the Piping Alternative would support the health and resiliency of the ecosystem downstream of Wickiup Reservoir, as well as agricultural land use within the District and within NUID.

### 8.2 Measures to be Installed

AID would pipe up to 11.9 miles of its Main Canal. Pipes would range in diameter from 48 to 60 inches. In total, 88 turnouts would be upgraded to pressurized delivery systems.<sup>35</sup> A concrete check and pipe inlet structure would be installed at the inlet of the pipe (i.e., the western end of the pipe). AID would install SCADA at the inlet of the pipe and at the terminus of the pipe. More details on construction and O&M of the Preferred Alternative are in Section 5.3.2.

### 8.3 Minimization, Avoidance, and Compensatory Mitigation Measures

Project design features and BMPs that would be applied during and after construction of the Preferred Alternative to avoid and minimize effects on environmental and social resources are described below.

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<sup>33</sup> The “Preferred Alternative” is defined in the National Watershed Program Handbook as “the option and course of action that the Sponsoring Local Organization and NRCS agree best addresses the stated purpose and need” (NRCS 2014).

<sup>34</sup> Net economic benefits are benefits minus costs and are not the same as the “benefit-cost ratio.”

<sup>35</sup> Modifications to each turnout would include an appropriately sized tee from the mainline or lateral, a pressure-relief valve, a non-rising stem, a resilient-seat gate valve, a magnetic meter, a combination air and vacuum relief valve, another gate valve for throttling flows, and spool-pipe segments.

### **8.3.1 Construction Limits and Schedule**

All construction would occur within the AID existing ROW and easements. If any temporary staging or construction access areas were required, AID or the contractor would communicate directly with the landowner to ask for permission. In addition, construction limits would be clearly flagged to preserve existing vegetation and private property. Prior to construction, AID would survey and identify trees greater than 2 feet in diameter within its ROW and easement. These trees would be flagged for avoidance during construction and retained to the extent possible. Access to residences, farms, and businesses would be maintained during construction. Construction would occur during the daytime to minimize disturbance to any landowners or other individuals in the vicinity.

### **8.3.2 Staging, Storage, and Stockpile**

Mechanized equipment and vehicles would be selected, operated, and maintained in a manner that minimizes adverse effects on the environment. Appropriate emission-control devices would be required for all construction equipment. Construction staging areas would be selected and used to minimize effects on vegetation and avoid tree removal. Construction equipment and vehicles would be parked a minimum of 150 feet away from streams, wetlands, and other waterbodies at the end of each workday. Fueling and maintenance operations would be performed on a flat surface away from moving equipment and at least 150 feet away from any water source.

### **8.3.3 Roads and Traffic Control**

Standard construction safety procedures and traffic-control measures would be employed to reduce the risk of collisions between construction vehicles and other vehicles, pedestrians, or bicyclists while construction is ongoing. Lane closures on roadways would be avoided during peak travel periods where possible to reduce potential traffic delays from construction vehicles. When needed, water or other dust suppressants would be used on unpaved roads and areas of ground disturbance to minimize dust and any effects on air quality.

### **8.3.4 Erosion Control**

Silt fencing, straw wattles, geotextile filters, straw bales, or other erosion-control measures would be used to minimize soil erosion and prevent eroded soil from entering waterbodies during construction. Erosion-control measures would be free of weeds and weed seeds.

### **8.3.5 Noise Control and Spill Prevention, Control, and Countermeasure**

Construction activities would comply with Chapter 8.08, Noise Control, of the Deschutes County Code (Deschutes County, 2022). Prior to beginning construction, properties adjacent to the construction area would be notified regarding the timing and duration of construction. During construction, the contractor would ensure that all equipment has the manufacturers' recommended noise abatement measures such as mufflers, engine enclosures, and engine vibration isolators, all construction equipment is regularly inspected to ensure proper maintenance and presence of noise-control devices (e.g., mufflers and shrouding); and when not in use, equipment is turned off and not idling.

Spill kits would be located at fuel storage areas, and the construction crew would have adequate absorbent materials and containment booms on hand to clean up spills quickly. In times of burn bans or wildfire concerns, each crew would have a fire suppression kit.

### **8.3.6 Invasive Species Control**

The following measures would be followed to avoid introduction of invasive plants and noxious weeds into project areas:

- Limit ground disturbance to areas necessary to safely implement the Preferred Alternative.
- Begin activities in areas un-infested with invasive plants or noxious weeds before operating in infested areas.
- Use un-infested areas for staging, parking, and cleaning equipment. Avoid or minimize all types of travel through infested areas and restrict work to those periods when the spread of seed or plant reproductive parts is least likely.
- When it is necessary to conduct soil work in infested roadsides or ditches, schedule activity when seeds or propagules are least likely to be viable or spread.
- Inspect material sources at their site of origin to ensure that they are free of invasive plant material before use. If possible, treat contaminated material before any use.

### **8.3.7 Revegetation**

Areas disturbed during access or construction would be regraded to their original contours. When necessary, compacted areas such as access roads, staging, and stockpile areas would be loosened to facilitate revegetation and improve infiltration. Disturbed areas would be planted with a native seed mix appropriate to the habitat and the seed mix would be certified as weed-free. Revegetation practices would follow the NRCS *Oregon and Washington Guide for Conservation Seedings and Plantings* (USDA-NRCS, 2000). Pruning would occur entirely within AID ROW and easement and would not exceed what is required for equipment clearance.

### **8.3.8 Wildlife Mitigation**

Construction would occur outside the primary nesting period for migratory birds of concern (April 15 through July 15) and raptors (April through July). If construction were scheduled to occur during the primary nesting period, construction would occur outside the USFWS-approved buffer distance of any known nests. Should an active nest be found, construction would be paused and a consultation with a local USFWS biologist would occur to determine the following steps.

### **8.3.9 Cultural Resources Mitigation**

Since the proposed project avoids all NRHP eligible resources, no mitigation is required. If archaeological resources were inadvertently discovered during construction, an Inadvertent Discovery Plan would be followed. Construction would stop near the discovery, the area would be

secured and protected, a professional archaeologist would assess the discovery, and consultation with SHPO, NRCS cultural resources staff, THPO, and other consulting parties including affiliated tribes and ACHP would be notified and have the opportunity to comment. Construction would continue in accordance with applicable guidance and law.

### **8.3.10 Water Resources Mitigation**

Following the completion of each phase, AID would work with OWRD and its partners to verify and measure all water savings. More information on how AID and NUID would protect the saved water is in Section 6.8.2. Additionally, to reduce effects on junior water right holders, AID would voluntarily reduce its maximum diversion rate and identify 118 cfs as the District's season 3 pre-project maximum diversion rate and 106 cfs as the District's season 2 pre-project maximum diversion rate for the purposes of any water right administrative actions (S. Johnson, personal communication, February 9, 2022).

## **8.4 Land Rights and Easements**

AID ROW and easements underly its entire infrastructure in the project area, and AID would not need to acquire any additional easements for installation of the proposed project. The AID ROW was granted under the Carey Act (2020); it extends 50 feet on each side of the canal from the toe of the bank for a total easement width of 100 feet plus the width of the canal (see Appendix C for a map of the Carey Act ROW). In places where AID has other easements separate from the Carey Act, the widths of the easements vary. All construction would occur within existing AID ROW and easements, and construction would not necessarily use the full width of the ROW or easement (see Section 5.3.2 for additional information). Prior to construction, the contractor would identify if temporary staging or construction access areas outside of AID ROW and easements were required. If any temporary areas were required, AID or the contractor would communicate directly with the landowner to ask for permission. No land would be acquired for construction of the Preferred Alternative.

## **8.5 Permits and Compliance**

### **8.5.1 Local and County**

**Deschutes County Planning:** Under OAR Chapter 340, Division 18, a Land Use Compatibility Statement would be submitted for County approval prior to construction.

### **8.5.2 State**

**Department of Environmental Quality:** The National Pollutant Discharge Elimination System program implemented by DEQ would require a permit for construction activities including clearing, grading, excavation, materials or equipment staging, and stockpiling that would disturb 1 or more acres of land and have the potential to discharge into a public waterbody.

**Oregon Water Resources Department:** To change the place of use, character of use, and/or point of diversion/appropriation of a water right, a water right transfer application must be approved by OWRD.

**Department of State Lands:** A wetland removal-fill permit from DSL would not be required for work in existing canals. Prior to initiation of construction of the project, surveys would be conducted to confirm the lack of wetlands in the project area as indicated by review of NWI and aerial imagery. If a wetland is identified, a wetland determination and/or delineation would be conducted. Wetlands would be avoided to the extent practicable.

**Oregon Fish Passage Law:** Laws regarding fish passage are found in ORS 509.580 through ORS 509.910 and in OAR 635, Division 412. Functioning fish screens are present at AID's irrigation diversion, and no fish are present within existing canals and laterals; therefore, no additional consultation or permitting is required.

**Oregon State Scenic Waterways:** The Oregon Scenic Waterway Act (ORS 390.805 – 390.925) was passed in 1970 to enable federal, state and local agencies, individual property owners and recreational users to work together to protect and wisely use Oregon's special rivers. The act specifies that all fill and removal in a state scenic waterway requires an individual removal-fill permit from the Department of State Lands. No fill or removal would occur within an Oregon scenic waterway, so no permit would be required.

### 8.5.3 Federal

**National Historic Preservation Act Section 106:** Pursuant to 36 CFR Part 800 of NHPA (Protection of Historic Properties, 2012) and regulations of the ACHP implementing Section 106 of the NHPA (Effect of undertaking on historic property, 2020), federal agencies must take into account the potential effect of an undertaking on "historic properties," which refers to cultural resources listed in, or eligible for listing in, the NRHP. Consultation with SHPO, NRCS, THPO, and other consulting parties including affiliated tribes to fulfill Section 106 obligations would be completed for the proposed project prior to implementation.

#### Clean Water Act:

- **Section 404:** Under Section 404(f)(1)(C) of the CWA, discharges of dredged or fill material associated with construction or maintenance of irrigation ditches, or the maintenance (but not construction) of drainage ditches, are not prohibited by or otherwise subject to regulation under Section 404. Discharges of dredged or fill material associated with siphons, pumps, headgates, wingwalls, weirs, diversion structures, and such other facilities—as are appurtenant to and functionally related to irrigation ditches—are included in the exemption for irrigation ditches. Under 33 CFR 323.4(a)(1)(iii)(C)(1)(i), "[c]onstruction and maintenance of upland (dryland) facilities such as ditching and tiling, incidental to the planting, cultivating, protecting, or harvesting of crops, involve no discharge of dredged or fill material into waters of the United States, and as such never require a Section 404 permit." The construction and maintenance of irrigation ditches and maintenance of drainage ditches may require the construction and/or maintenance of a farm road. The Subsection 404(f)(1)(E) exemption for discharges of dredged or fill material associated with the construction or maintenance of farm roads applies where such related farm roads are constructed and maintained in accordance with BMPs. However, as stated in 33 CFR 323.4(a)(6) and 40 CFR



232.3(c)(6), there must be assurance that flow and circulation patterns and chemical and biological characteristics of waters of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment would be otherwise minimized (Discharges not requiring permits, 2021; Activities not requiring permits, 2021). Prior to construction activities, coordination and consultation with USACE would occur and measures would be taken as required to identify and mitigate impacts to potential jurisdictional wetlands and waters of the United States.

- **Section 401:** Implemented by DEQ, see above.

**Farmland Protection Policy Act:** The Farmland Protection Policy Act (2020) directs federal agencies to identify and quantify adverse impacts of federal programs to farmlands. The Act's purpose is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses. All work would be done within existing easements and the ROW. The Preferred Alternative would support agricultural productivity and the intention of the Act.

**Endangered Species Act:** The ESA establishes a national program for the conservation of threatened and endangered species and the preservation of the ecosystems on which they depend. The ESA is administered by USFWS for wildlife and freshwater species and by NMFS for marine and anadromous species. The ESA defines procedures for listing species, designating critical habitat for listed species, and preparing recovery plans. It also specifies prohibited actions and exceptions. Section 7 of the Act, Interagency Cooperation, is the mechanism by which federal agencies ensure that the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. Under Section 7, federal agencies must consult with USFWS when any action the agency carries out, funds, or authorizes (such as through a permit) *may affect* a listed endangered or threatened species.

- Due to the location of bull trout populations at the very downstream end of the area affected by District operations, bull trout would not be affected by implementation of the Preferred Alternative under consideration. Consequently, Section 7 consultation under the ESA as amended is not warranted for this species. Additionally, it has been determined that the project would not affect the PCEs identified for critical habitat for bull trout (Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout, 2005). Therefore, it has been determined by NRCS that no effect would occur to federally designated critical habitat for bull trout.
- Implementation of the Preferred Alternative may affect, but is not likely to adversely affect, the Oregon spotted frog. Informal consultation with USFWS under Section 7 of the ESA has been initiated and was completed on August 1, 2022 when the Letter of Concurrence was received by NRCS (2022-0062518-S7).
- The Middle Columbia River steelhead population present in the Deschutes River is classified as a non-essential experimental population under Section 10(j) of the ESA and is treated as “proposed for listing” because the population is located outside of a National Wildlife Refuge

System or a National Park System. Federal agencies are not required to consult with NMFS because the proposed project's effects are entirely beneficial and would not likely jeopardize the continued existence of the species proposed to be listed. NRCS, therefore, has determined that engagement with NMFS to obtain a conference report is not necessary (Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead Above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon, 2011; Endangered and Threatened Species: Designation of Experimental Populations Under the Endangered Species Act, 2016).

**Magnuson Stevens Act:** The Magnuson Stevens Act requires that Essential Fish Habitat (EFH) descriptions are included in federal fishery management plans, and it requires that federal agencies consult with NMFS on activities that may adversely affect EFH (PL 104-297). EFH can include all streams, lakes, ponds, wetlands, other viable waterbodies, and most of the habitat historically accessible to salmon necessary for spawning, breeding, feeding or growth to maturity. As the Preferred Alternative would not adversely affect EFH, consultation under the Magnuson Stevens Act is not required.

**Safe Drinking Water Act:** Since the Preferred Alternative would have no direct or indirect discharge to groundwater, permitting under the Safe Drinking Water Act is not required.

**Migratory Bird Treaty Act:** The MBTA implements various treaties and conventions between the United States and other countries including Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds (Protection of Migratory Game and Insectivorous Birds, 2020). Under the Act, taking, killing, or possessing migratory birds or taking, destroying, or possessing their eggs or nests is unlawful.

**Bald and Golden Eagle Protection Act:** The BGEPA prohibits anyone from "taking" bald and golden eagles (including their eggs or nests) without a permit from the secretary of the interior (BGEPA, 2020). Sections of the project area near Horse Butte Road and Knott Road are approximately 0.6 mile and 1.9 miles, respectively, from golden eagle nesting areas. Because of the proximity of the project area to nesting sites, BGEPA requirements would be implemented appropriately. Site clearance surveys would be conducted prior to implementation.

**National Wild and Scenic Rivers Act:** The National Wild and Scenic Rivers Act (2020) preserves and protects selected free-flowing rivers of the United States that, with their immediate environments, possess outstandingly remarkably scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values.

## 8.6 Costs

Total estimated project costs are \$34,899,000 for the Preferred Alternative. PL 83-566 funds would support \$26,198,000 of the total project cost, which includes \$23,310,000 for construction costs, \$2,412,000 for technical assistance, and \$476,000 for project administration. The \$8,701,000 remainder of the total cost would be contributed by the sponsors and other non-federal funds. Table

8-3 itemizes the costs for each project feature and the distribution of how the costs would be shared by the sponsors and NRCS for each cost item.

- Construction costs account for all material, labor, and equipment necessary for the installation of piping associated with the Preferred Alternative. These costs were estimated based on similar installations at irrigation districts in Central Oregon. The planning construction costs were estimated using the best available information about the project without having detailed design information.
- Engineering costs were estimated as a percentage of the construction cost.
- The costs presented are planning-level estimates and do not reflect final costs. Detailed designs and construction cost estimates would be completed prior to initiating the proposed project. Final construction costs would only reflect the time and materials to perform the work.

## **8.7 Installation and Financing**

The following subsections present further details regarding installing and financing the Preferred Alternative.

### **8.7.1 Framework for Carrying out the Plan**

The Preferred Alternative would be implemented in a planned sequence as discussed in Section 8.7.2. NRCS and sponsor responsibilities for the proposed project are outlined in Section 8.7.3. No cost-shared, on-farm measures are involved with the proposed project; therefore, the responsibilities of individual participants do not need to be described. No preconditions are anticipated for installing the proposed project.

### **8.7.2 Planned Sequence of Installation**

AID would obtain all approvals and permits for the proposed project prior to the start of construction. The entire project would be completed over a 6-year period commencing in 2022 and ending by 2028. AID developed a construction phasing schedule that prioritizes sections of the system with high loss; AID also worked within engineering and funding constraints to meet District, patron, and community development needs (see Table 8-1 and Figure 8-1).

**Table 8-1. Expected Construction Timeline for the Piping Alternative.**

<b>Construction Phase</b>	<b>Expected Construction Years</b>
1	2022–2024
2	2023–2026
3	2025–2027
4	2026–2028

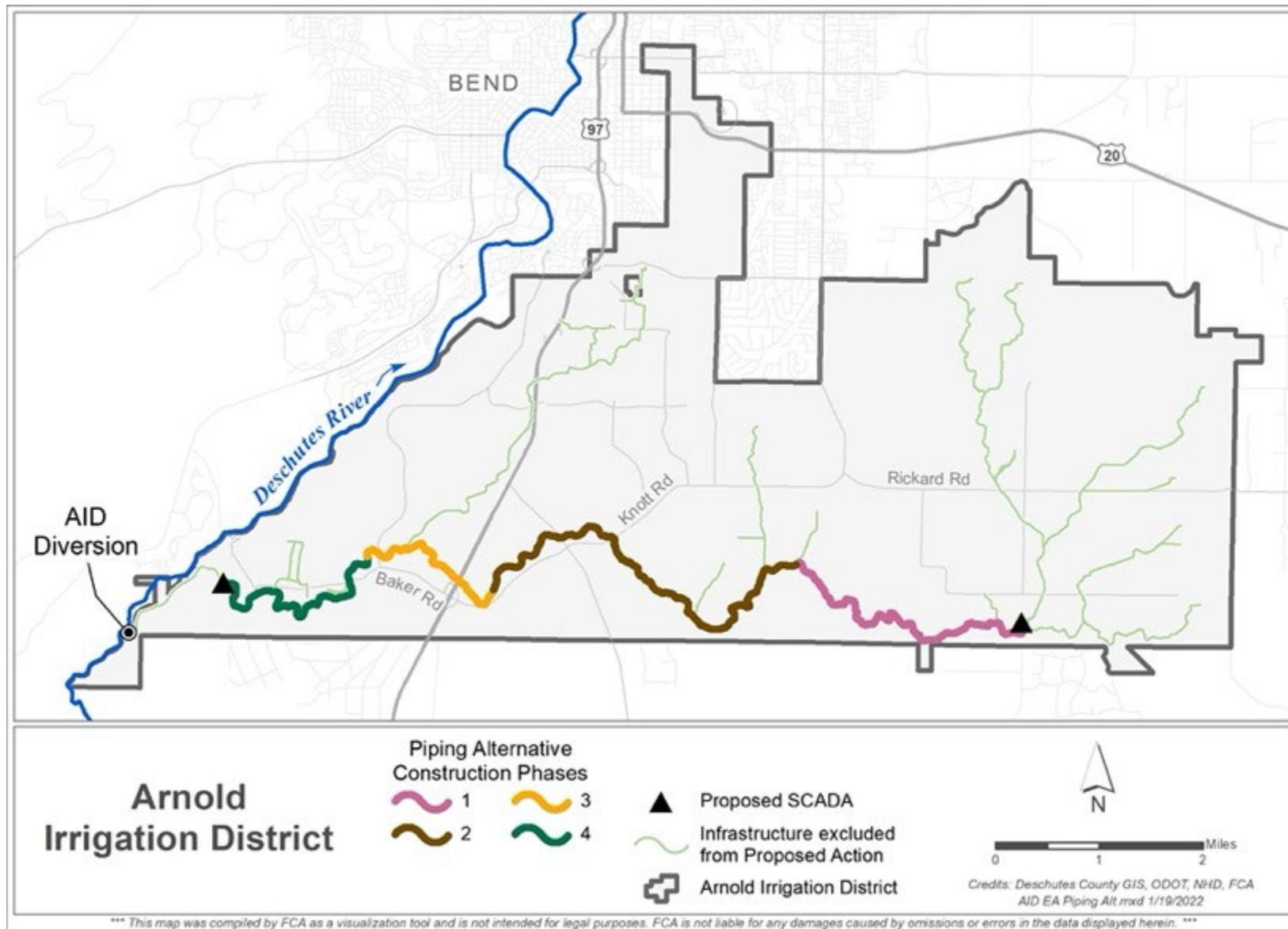


Figure 8-1. Preferred Alternative construction phase map.

### **8.7.3 Responsibilities**

NRCS is responsible for leading the planning efforts, providing engineering design and construction oversight assistance, and certifying project completion. AID would be responsible for engineering design, project administration, environmental permitting, contracting, and construction implementation. AID has the needed authorities as an irrigation district organized under ORS 545 and has agreed to exercise those authorities to implement the actions described in this Plan-EA.

### **8.7.4 Contracting**

Piping of the delivery system would be completed using NRCS funding mechanisms. AID would be primarily responsible for overseeing and administering project construction in coordination with NRCS.

### **8.7.5 Real Property and Relocations**

Real property acquisition or relocations would not be required for the Preferred Alternative. All construction would be completed under either AID existing ROW or easements.

### **8.7.6 Financing**

NRCS would provide funding for 75 percent of the total project cost for the Preferred Alternative through PL 83-566. AID is responsible for the remaining 25 percent of the costs including funds that are not eligible under the National Watershed Program. AID would not initiate construction of a project phase until federal and match funding for that phase has been secured. Table 8-2 presents installation costs and the proportion of funding through PL 83-566 and AID.

The required match funding would be expected to be provided through a mix of grants, loans, and patron assessments. To the extent possible, AID would strive to fully fund the match funding from grants through entities such as the Oregon Watershed Enhancement Board and OWRD. If financing were necessary, AID would apply for low interest financing through the DEQ Clean Water State Revolving Fund. Financing costs are not included in the NEE Analysis. AID does not anticipate changing per-acre annual rates or the overall base assessment fee due to any capital improvement project that is fully funded through grants.

O&M costs after project completion would be provided through AID revenues. O&M costs would not increase due to the proposed project and would be budgeted on an annual basis.

NRCS reserves the authority and right to discontinue or reduce program benefits based on changes in agency priorities, funding availability, or the failure of AID to fulfill the provisions of its agreement.

### **8.7.7 Conditions for Providing Assistance**

Conditions for AID to receive program funds for the implementation of the proposed project include completion of a Final Plan-EA, NRCS issuing a Finding of No Significant Impact, and authorization of funding by the chief of NRCS. The chief of NRCS acts on behalf of the secretary

of the interior to ensure that the proposed project meets 16 U.S.C. 1005 (Works of improvement, 2020).

## 8.8 Operation, Maintenance, and Replacement

AID would be responsible for the O&M of the proposed project for the extent of its design life, as well as for any associated replacement costs and activities that could occur. Prior to construction, a separate O&M agreement based on the NRCS *National Operation and Maintenance Manual* (USDA-NRCS, 2003) would be made between NRCS and AID. The agreement would continue through the design life of the proposed project and could be modified with NRCS approval.

Project sponsors and NRCS would conduct annual inspections of project measures to ensure the quality of ongoing O&M. AID would be responsible for scheduling O&M inspections and for any necessary work. AID O&M would consist of a pipe inspection program that would systematically cover inspection of the entire system over a period of several years.

The proposed system would continue its current operation schedule of April through October, in which maintenance work would be performed on an as-needed basis. SCADA system maintenance would occur on a regular schedule and on an as-needed basis throughout the year. Outside of the irrigation season, AID would perform system component maintenance and/or repairs to District meters, valves, and air and vacuum infrastructure, as well as to the inlet structure. AID would expand its current vegetation and weed management to include the areas on top of the newly piped system. All procedures would be followed as specified in the O&M agreement between the project sponsors and NRCS.

## 8.9 Economic and Structural Tables

The PR&Gs require that an economic analysis be completed. A summary of the economic analysis of the Preferred Alternative (NEE Alternative) and No Action Alternative is provided in Section 5.4. The full NEE Analysis can be found in Appendix D.1. The Piping Alternative represents the future with federal funding through PL 83-566. The No Action Alternative represents the future if AID was not to receive federal funding.

Table 8-2 (NWPM 506.11, Economic Table 1) and Table 8-3 (NWPM 506.12, Economic Table 2) present the proportions of PL 83-566 funding and other funding sources. The average annual NEE costs are shown in Table 8-4 (NWPM 506.18, Economic Table 4). The costs shown are the annual costs for the Piping Alternative above the No Action Alternative, which is discussed further in the NEE Analysis in Appendix D.1.

Table 8-5 (NWPM 506.20, Economic Table 5a) presents the average annual watershed protection damage reduction benefits. The Preferred Alternative damage reduction benefits include NUID agricultural benefits, reduced O&M costs, instream flow benefits, Oregon spotted frog benefits, and avoided damage from failure of the open canal.

Using the resulting benefits and costs from Table 8-4 and Table 8-5, Table 8-6 (NWPM 506.21, Economic Table 6) presents a comparison of the NEE Analysis average annual benefits and average annual costs.



**Table 8-2. Economic Table 1 – Estimated Installation Cost of the Piping Alternative, Water Resource Project Measures, Deschutes Watershed, Oregon, 2021\$.<sup>1,2</sup>**

Works of Improvement	Unit	Number			Estimated Cost (dollars)						
					PL 83-566 Funds			Other Funds			Total
		Federal Land	Non-Federal Land	Total	Federal land NRCS	Non-Federal Land NRCS <sup>3</sup>	Total	Federal Land	Non-Federal Land	Total	
Piping Alternative	Feet	0	62,966	62,966	\$0	\$26,198,000	\$26,198,000	\$0	\$8,701,000	\$8,701,000	\$34,899,000
<b>Total</b>	<b>Feet</b>	<b>0</b>	<b>62,966</b>	<b>62,966</b>	<b>\$0</b>	<b>\$26,198,000</b>	<b>\$26,198,000</b>	<b>\$0</b>	<b>\$8,701,000</b>	<b>\$8,701,000</b>	<b>\$34,899,000</b>

Notes: Totals may not sum due to rounding.

Prepared: June 2022

<sup>1/</sup> Price base: 2021 dollars.

<sup>2/</sup> Project cost as identified in Crew (2017) and by communications with Black Rock Consulting in 2021, updated to 2021 dollars with additional engineering considerations, project administration, and technical assistance costs based on NRCS-OR guidance.

<sup>3/</sup> Federal agency responsible for assisting in installation of works of improvement.

**Table 8-3. Economic Table 2 – Estimated Piping Alternative Cost Distribution, Water Resource Project Measures, Deschutes Watershed, Oregon, 2021\$.<sup>1,2</sup>**

Works of Improvement	Installation Costs – PL 83-566 Funds				Installation Cost – Other Funds				Total
	Construction	Engineering	Project Admin <sup>3</sup>	Total PL 83-566	Construction	Engineering	Project Admin <sup>3</sup>	Total Other	
Piping Alternative	\$23,088,000	\$222,000	\$2,888,000	\$26,198,000	\$7,695,000	\$74,000	\$932,000	\$8,701,000	\$34,899,000
<b>Total</b>	<b>\$23,088,000</b>	<b>\$222,000</b>	<b>\$2,888,000</b>	<b>\$26,198,000</b>	<b>\$7,695,000</b>	<b>\$74,000</b>	<b>\$932,000</b>	<b>\$8,701,000</b>	<b>\$34,899,000</b>

Notes: Totals may not sum due to rounding.

Prepared: June 2022

<sup>1/</sup> Price base: 2021 dollars.

<sup>2/</sup> Project cost as identified in Crew (2017) and by communications with Black Rock Consulting in 2021, updated to 2021 dollars with additional project administration and technical assistance costs. Of total estimated costs, 75 percent has been allocated for construction and 25 percent for engineering.

<sup>3/</sup> Project Admin includes project administration, technical assistance costs, and permitting costs.

**Table 8-4. Economic Table 4 – Estimated Average Annual NEE Costs for Piping Alternative Over the No Action Alternative, Deschutes Watershed, Oregon, 2021\$.<sup>1</sup>**

<b>Works of Improvement</b>	<b>Project Outlays (Amortization of Installation Cost)</b>	<b>Other Direct Costs <sup>2</sup></b>	<b>Total</b>
Piping Alternative	\$838,000	\$14,000	\$852,000
<b>Total</b>	<b>\$838,000</b>	<b>\$14,000</b>	<b>\$852,000</b>

Note: Totals may not sum due to rounding.

Prepared June 2022

<sup>1/</sup> Price base: 2021 dollars amortized over 100 years at a discount rate of 2.25 percent.

<sup>2/</sup> Other direct costs include the uncompensated economic losses due to changes in resource use or associated with installation, operation, or replacement of project structures, per PR&G guidance (USDA-NRCS, 2017a). Other direct costs are presented for an increase in pumping costs from increased depth to groundwater due to reduced recharge and associated increases in carbon and energy and replacement costs from SCADA and the inlet structure.

**Table 8-5. Economic Table 5a – Estimated Average Annual Watershed Protection Damage Reduction Benefits for Piping Alternative Over the No Action Alternative, Arnold Irrigation District Watershed Plan, Deschutes Watershed, Oregon, 2021\$.<sup>1</sup>**

Item	Damage Reduction Benefit, Average Annual	
	Agricultural-Related <sup>1</sup>	Non-Agricultural-Related <sup>1</sup>
<b>Onsite Damage Reduction Benefits</b>		
NUID Reduced Agricultural Damage	\$1,407,000	\$0
Other – Reduced O&M	\$211,000	\$0
Other – Avoided Damage from Infrastructure Failure	\$3,000	\$0
<b>Subtotal</b>	<b>\$1,621,000</b>	<b>\$0</b>
<b>Offsite Damage Reduction Benefits</b>		
Other – Social Value of Carbon (Avoided Carbon Emissions) <sup>2</sup>	\$0	\$0
Instream Flow Value	\$0	\$41,000
Support to Oregon Spotted Frog	\$0	\$37,000
<b>Subtotal</b>	<b>\$0</b>	<b>\$78,000</b>
<b>Total Quantified Benefits</b>	<b>\$1,621,000</b>	<b>\$78,000</b>

Note: Totals may not sum due to rounding.

Prepared June 2022

<sup>1/</sup> Price Base: 2021 dollars amortized over 100 years at a discount rate of 2.25 percent.

<sup>2/</sup> These benefits would also accrue to local residents, but the majority of the value would be experienced outside the proposed project area.

**Table 8-6. Economic Table 6 – Comparison of Average Annual NEE Costs and Benefits of the Piping Alternative Over the No Action Alternative, Arnold Irrigation District Watershed Plan, Deschutes Watershed, Oregon, 2021\$.<sup>1</sup>**

Works of Improvement	Agriculture-Related			Non-Agricultural		Average Annual Benefits	Average Annual Cost <sup>2</sup>	Benefit-Cost Ratio
	NUID Agricultural Damage Reduction	Reduced O&M	Avoided Infrastructure Failure Damage	Instream Flow Value	Oregon Spotted Frog			
Piping Alternative	\$1,407,000	\$211,000	\$3,000	\$41,000	\$37,000	\$1,699,000	\$852,000	2.0
<b>Total</b>	<b>\$1,407,000</b>	<b>\$211,000</b>	<b>\$3,000</b>	<b>\$41,000</b>	<b>\$37,000</b>	<b>\$1,699,000</b>	<b>\$852,000</b>	<b>2.0</b>

Note: Totals may not sum due to rounding.

Prepared June 2022

<sup>1/</sup> Price Base: 2021 dollars amortized over 100 years at a discount rate of 2.25 percent.

<sup>2/</sup> From Economic Table 4 (see Table 8-4).

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Works of improvement, 16 U.S.C. § 1005. (2020).

**<https://www.govinfo.gov/app/details/USCODE-2020-title16/USCODE-2020-title16-chap18-sec1005>**



## 10 List of Preparers

Under the direction of NRCS, FCA and its subcontractor Highland Economics primarily developed the Final Watershed Plan-EA. The staff responsible for preparation of the Final Watershed Plan-EA are included in Table 10-1.

**Table 10-1. List of Preparers.**

Name	Title	Education	Professional Experience	Area Responsible For
<b>FCA Watershed Plan-EA Team</b>				
Kristin Alligood	Program Specialist	Ph.D. Biology B.A. Neuroscience	5 years	Fish and Aquatic Species, Vegetation
Raija Bushnell	Program Specialist	M.P.A. Natural Resource Policy M.S.E.S Natural Resource Management B.A. Political Science	7 years	Land Use, Visual
Brett Golden	Program Manager	M.E.M Environmental Management A.B. Environmental and Evolutionary Biology	15 years	General
Kate Hart	Program Specialist	M.S. Earth Science B.S. Earth Science	5 years	Purpose and Need, Soils, Public Safety, Alternatives, Preferred Alternative, General
David McKay	Program Specialist	M.P.A. Environmental Policy B.A. Political Science	7 years	Cultural Resources, Public Scoping
Amanda Schroeder	Program Specialist	B.S. Natural Resource Management	6 years	Water Resources, Wetlands, Wildlife, Socioeconomics, Wild and Scenic Rivers

Name	Title	Education	Professional Experience	Area Responsible For
<b>NRCS - Oregon</b>				
Gary Diridoni	Natural Resource Specialist	Fisheries Management Graduate Certificate B.S. Wildlife Management B.S. Interdisciplinary Studies, Ecosystem Conservation	18 years	General
Scarlett Vallaire	Watershed Planner	M.S. Ecology B.S. Biology	12 years	General
Louis Landre	Agricultural Economist	M.S. Applied Economics B.S. Biology	23 years	Economic and Socioeconomic Analysis
Lakeitha Ruffin	Agricultural Economist	M.S. Agricultural Economics B.S. Agricultural Economics	9 years	Economic Analysis
Tom Makowski	Assistant State Conservationist- Watershed Resources and Planning	Ph.D. Rural Sociology M.S. Social Psychology B.S. Recreation Resource Management	31 years	General
<b>Employees from Firms Under Contract with FCA</b>				
Barbara Wyse	Principal and Senior Economist, Highland Economics	M.S. Environmental and Natural Resource Economics B.A. Environmental Sciences and Policy	14 years	Economic Analysis

Name	Title	Education	Professional Experience	Area Responsible For
Winston Oakley	Research Economist, Highland Economics	M.S. Applied Economics  B.S. Environmental Sciences, Policy, and Management	5 years	Economic Analysis
Jason Keller	GSA Analysis	B.S. Environmental Geoscience  M.S. Soil, Water, Environmental Science	19 years	Groundwater
Becky Mellinger	Technical Editor, Parametrix	M.S. Geosciences  B.A. Geology	20 years	Final Technical Edit
Jill McLain	Publications Specialist, Parametrix		34 years	Final Technical Edit

## 11 Distribution List

A Notice of Availability for this Final Plan-EA will be distributed to federal, state, and local agencies, community representatives, and area non-governmental organizations. The agencies, representatives and organizations on the mailing list include the following:

- Bend Parks and Recreation
- Business Oregon
- Central Oregon Land Watch
- City of Bend
- Coalition for the Deschutes
- Deschutes County
- Deschutes River Conservancy
- Deschutes Soil and Water Conservation District
- National Marine Fisheries Service
- Oregon Department of Agriculture
- Oregon Department of Energy
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Department of State Lands
- Oregon Department of Transportation
- Oregon Governor's Office
- Oregon Water Resources Department
- Oregon Watershed Enhancement Board
- State Historic Preservation Office
- Trout Unlimited
- U.S. Army Corps of Engineers
- U.S. Bureau of Land Management
- U.S. Department of Agriculture, U.S. Forest Service, Deschutes National Forest
- U.S. Fish and Wildlife Service
- Upper Deschutes Watershed Council
- WaterWatch of Oregon

In accordance with EO 13175, Consultation and Coordination with Indian Tribal Governments, NRCS will contact CTWS regarding the availability of the Final Plan-EA.

The names of private stakeholders and members of the public who will receive notice of the Final Plan-EA are not listed for privacy.

## 12 Acronyms, Abbreviations, and Short-Forms

ACHP	Advisory Council on Historic Preservation
AID	Arnold Irrigation District
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
cfs	cubic feet per second
CFR	Code of Federal Regulations
COID	Central Oregon Irrigation District
CTWS	Confederated Tribes of Warm Springs
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DRW	Deschutes River Woods
DSL	Oregon Department of State Lands
EA	Environmental Assessment
EE	Environmental Evaluation
EFH	Essential Fish Habitat
EO	Executive Order
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FCA	Farmers Conservation Alliance
HCP	Deschutes Basin Habitat Conservation Plan
IPaC	Information for Planning and Consultation
LPID	Lone Pine Irrigation District
MBTA	Migratory Bird Treaty Act
N/A	not applicable
NEPA	National Environmental Policy Act
NEE	National Economic Efficiency
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NUID	North Unit Irrigation District

NWI	National Wetland Inventory
NWPM	National Watershed Program Manual
O&M	operation and maintenance
OAR	Oregon Administrative Rule
ODFW	Oregon Department of Fish and Wildlife
OID	Ochoco Irrigation District
OM&R	operation, maintenance, and replacement
ORS	Oregon Revised Statute
ORV	Outstandingly Remarkable Value
OWRD	Oregon Water Resources Department
PCE	primary constituent element
PGE	Portland General Electric
PL	Public Law
PL 83-566	Watershed Protection and Flood Prevention Program, Public Law 83-566
Plan-EA	Watershed Plan-Environmental Assessment
project	Arnold Irrigation District Infrastructure Modernization Project
PR&G	Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies
Reclamation	United States Bureau of Reclamation
RM	river mile
ROW	right-of-way
SHPO	State Historic Preservation Office
SID	Swalley Irrigation District
THPO	Tribal Historic Preservation Office
TID	Tumalo Irrigation District
UGB	urban growth boundary
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
U.S.	United States

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## 14 Appendix A-E

Appendices are provided in a separate document.

- Appendix A. Comments and Responses
- Appendix B. Project Map
- Appendix C. Supporting Maps
- Appendix D. Investigation and Analysis Report
- Appendix E. Other Supporting Information