

# Klamath Drainage District Infrastructure Modernization Project

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*Draft Watershed Plan-Environmental Assessment*

*Klamath County, Oregon, and Siskiyou County, California*

*Lower Klamath Lake Watershed*

*October 2024*



United States Department of Agriculture, National Resources Conservation Service—Lead Federal Agency in cooperation with the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, and Klamath Drainage District

Prepared by the Natural Resources Conservation Service

## Watershed Plan- Draft Environmental Assessment for the Klamath Drainage District Infrastructure Modernization Project: Klamath County, Oregon and Siskiyou County, California

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

**Cooperating Agencies:** U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service

**Sponsoring Local Organization (SLO):** Klamath Drainage District (KDD or District) (sponsor).

**Authority:** This study and Watershed Plan-Environmental Assessment (Plan-EA) has been prepared under the Authority of the Watershed Protection and Flood Prevention Act of 1954 (Pub. Law No.83-566) and would be implemented under the Pub. L. No. 83-566 authorized purpose of Agriculture Water Management. The Plan-EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, Pub. L. No. 91-190, as amended (42 United States Code [U.S.C.] 4321 et seq.).

**Abstract:** The project seeks to modernize irrigation canals and laterals, improve water quality and energy efficiency within KDD to deliver irrigation water more reliably to farmers. The project would include canal extensions, pump upgrades, a fish screen and upgraded turnouts. Total estimated project costs are \$16,878,000 of which \$4,149,000 would be paid by the sponsors and other nonfederal funding sources. The estimated amount to be paid through NRCS Pub. L. No. 83-566 funds is \$12,729,000.

**Comments:** Comments must be submitted during the allotted Draft Public Review Period (within 30 days of the public release of the Draft Plan-EA) and become part of the Administrative Record. Submit comments and inquiries to: Farmers Conservation Alliance, Attention Watershed Plan-EA, 102 State Street, Hood River, OR 97031, or [klamathdd.comments@gmail.com](mailto:klamathdd.comments@gmail.com).

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## **Office of Management and Budget (OMB) Fact Sheet**

### **Summary Draft Watershed Plan-Environmental Assessment Document for**

#### **Klamath Drainage District Infrastructure Modernization Project**

**Klamath Basin Subwatersheds: Keno Reservoir-Klamath River, Klamath Falls-Klamath River, Klamath Strait Drain, Miller Lake, Sheep Camp Butte, Sheepy Creek-Lower Klamath Lake, Town of Laird Landing, Willow Creek, and -Lower Klamath Lake**

**Klamath County, Oregon & Siskiyou County, California**

**Oregon 2nd Congressional District, California 1st Congressional District**

#### **Authorization**

This watershed study was carried out and the plan prepared under the authority of Public Law No. 83-566 Stat. 666 as amended (16 U.S.C. Section 1001 et. seq.) 1954. The works of improvement would be installed under the Pub. L. No. 83-566 authorized purpose of Agricultural Water Management.

#### **Sponsor**

Klamath Drainage District

#### **Proposed Action**

The Klamath Drainage District (KDD or the District) Infrastructure Modernization Project is an agricultural water conveyance efficiency project. The proposed action would screen the North Canal Diversion on the Klamath River by installing ten 14-foot-diameter conescreens; extend 0.47 miles of the North Canal to connect to the P-1 Lateral; expand the flow capacity of the North Canal at its terminus to hold an additional 100 cubic feet per second (cfs); install a pipeline to recirculate water from the Klamath Straits Drain (KSD) into the Center Canal; upgrade two pump stations; and install 14 monitoring and telemetry systems and four automated gates.

Implementation of the proposed action would meet the Pub. L. No. 83-566 Authorized Project Purpose (v), Agricultural Water Management, and would address the sponsor's goals by improving District irrigation water availability and reliability, improving water quality, and improving the KDD capacity to deliver water to the Lower Klamath National Wildlife Refuge (LKNWR) and patrons.

Federal assistance through Pub. L. No. 83-566 would support the District in addressing the following watershed problems and resource concerns: reduced water quality and quantity and reduced energy efficiency in District infrastructure.

Implementation of the proposed action would address the sponsor's objectives and goals to improve water quality, reduce energy consumption and associated costs, and optimize water resources management to support on-farm use.



## Purpose and Need for Action

The purpose of the proposed project is to reduce District operational inefficiencies affecting water quality and water quantity and improve the ability of the District to deliver the amount of water patrons need at the time they need it.

The District has identified the need to reduce District operational spills that can negatively affect water quality in the Klamath River; more reliably deliver water to patrons and the LKNWR; and to conserve energy throughout District infrastructure.

## Description of the Preferred Alternative

Under the Preferred Alternative, the District would extend the North Canal and connect it to the P-1 Lateral enabling the delivery of water to the LKNWR from this new point of delivery; modify the North Canal to increase flow capacity; upgrade two pump stations for operational efficiency and to reduce water discharge to the Klamath River via the KSD; and install flow monitoring and automated gates throughout the project area to improve water management.

## Project Measures

Under the Preferred Alternative, project sponsors would screen the North Canal Diversion on the Klamath River by installing ten 14-foot-diameter conescreens; extend the North Canal at its terminus by 0.47 miles (approximately 2,500 feet) and connect to the LKNWR's P-1 Lateral; modify five North Canal crossings to increase its maximum flow capacity from 250 to 350 cfs; upgrade the E and F Pump Stations along the KSD to a more common voltage and with variable frequency drives (VFD); install an approximately 200-foot-long recirculation pipeline with a 100 cfs capacity, going from a pump in the E Pumping Station to the Center Canal; and install 14 supervisory control and data acquisition (SCADA) systems and four automated gates distributed across the District.

## Resource Information

Subwatersheds	12-digit Hydrologic Unit Code	Latitude and Longitude	Planning Area Within Subwatershed (acres)	Subwatershed Size (acres)
Keno Reservoir-Klamath River	180102041202	42.117578, -121.893467	121.1	25,130.9
Klamath Falls-Klamath River	180102041201	42.175511, -121.764297	453.1	52,699.2
Klamath Strait Drain	180102041403	42.020108, -121.733376	30,747.9	47,648.7
Miller Lake	180102041404	41.964578, -121.871245	3,186.8	44,375.1
Sheep Camp Butte	180102041401	41.767526, -121.591064	2.4	31,275.7

Subwatersheds	12-digit Hydrologic Unit Code	Latitude and Longitude	Planning Area Within Subwatershed (acres)	Subwatershed Size (acres)
Sheepy Creek-Lower Klamath Lake	180102041406	41.960675, -121.778775	16,459	22,967.6
Town of Laird Landing	180102041402	41.829851, -121.664452	5,173.5	33,467
Willow Creek	180102041303	41.770304, -121.698306	156.7	40,777.4
Lower Klamath Lake	180102041405	41.952053, -121.665021	17,958.6	19,631.1

**Subwatershed Total Size**

317,972.7 acres

**Klamath Drainage District Boundary Size**

28,944 acres (includes both irrigated and nonirrigated acres within District boundary).

**Climate and Topography**

The climate in KDD is dry with an annual average precipitation of 13.4 inches. Summer temperatures are mild with temperatures ranging from an average of 75°F to 85°F with occasional highs above 90°F. Winters are moderately cold with average temperatures in the low to mid 20s and occasional lows below 10°F. Typically, the growing season begins around mid-April and ends in early October (KDD 2015). KDD is located at an elevation of approximately 4,100 feet above mean sea level. The District is relatively flat, with a slope of about one foot per mile from the upper to the lower end of the District.

**Land Use (Planning Area)**

Use	Acres
Irrigated Land	35,224
Nonirrigated Land	39,035

**Land Ownership (Planning Area)**

Owner	Percentage
Private	30%
State-Local	1%
Federal	69%

**Population and Demographics**

The project would be constructed in Klamath County, Oregon, and in Siskiyou County, California. The population in Klamath County in 2020 was 69,413. In 2020, roughly 19.6 percent of the population lived below the poverty level (U.S. Census Bureau 2020). The County's proportion of low-income population (43 percent) is higher than the state average (29 percent) (EPA 2020). In 2020, 74.8 percent of the population was white alone, not Hispanic or Latino, 12.6 percent was Hispanic or Latino, and 3.6 percent was American Indian alone (U.S. Census Bureau 2020).

The population in Siskiyou County in 2020 was 44,076. In 2020, roughly 16.9 percent of the population lived below the poverty level (U.S. Census Bureau 2020). The County's proportion of low-income population (40 percent) is higher than the state average (29 percent) (EPA 2020). In 2020, 72.7 percent of the population was white alone, not Hispanic or Latino, 12.5 percent was Hispanic or Latino, and 4 percent was American Indian alone (U.S. Census Bureau 2020).

**Population and Demographics – Klamath County and Oregon**

	<b>Klamath County</b>	<b>Oregon</b>
Population 2020	69,413	4,237,256
Unemployment Rate	7.0%	5.0%
Median Household Income	\$48,560	\$65,667

**Population and Demographics – Siskiyou County and California**

	<b>Siskiyou County</b>	<b>California</b>
Population 2020	44,076	39,538,223
Unemployment Rate	7.6%	5.8%
Median Household Income	\$47,403	\$78,672

**Relevant Resource Concerns**

Resource concerns identified through scoping are water conservation; drinking water quality; surface water quality issues including sedimentation, temperature, salinity, and nutrient loading; surface water quantity; groundwater quantity; aquatic and fish resources; wetland and riparian resources; terrestrial wildlife; and cultural and historic resources.

**Alternatives*****Alternatives Considered***

Ten action alternatives were initially considered; nine 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, social, or environmental reasons. The No Action Alternative and Modernization Alternative were analyzed in full.

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

Under the No Action Alternative, the District would continue to operate and maintain the existing canal, lateral, drain, and pump systems in their current condition. This alternative assumes that modernization of the District's infrastructure would not be reasonably certain to occur, as funding at the large scale necessary to modernize the District's infrastructure is not anticipated from other sources. The No Action Alternative would be a continuation of the District's standard operations and maintenance (O&M).

***Proposed Action (Modernization Alternative)***

Under the Modernization Alternative, KDD would make the following improvements:

- Upgrade the pump units at the E and F Pump Stations on the KSD to reduce the District's energy consumption and electricity costs and reduce water discharge to the Klamath River via the KSD.
- Install a fish screen at the North Canal Diversion.
- Extend the North Canal 0.47 miles (approximately 2,500 ft) to allow the District to deliver water to the LKNWR P-1 Canal.
- Expand the maximum flow capacity of the North Canal from 250 cfs to 350 cfs by removing bottlenecks at five existing crossings to improve water management across the District and the LKNWR.
- Install a pipeline to enhance recirculation of KSD water via the Center Canal, and install 14 SCADA systems at lateral headgates, canals, drains, and pump stations, and four automated gates to improve the District's control of water diversions and conveyance.

The Modernization Alternative has been identified as the National Economic Development (NED) Alternative and is also the Preferred Alternative.

***Mitigation, Minimization, and Avoidance Measures***

Consultation was initiated between the District; Natural Resources Conservation Service (NRCS) as the lead federal agency; The Klamath Tribes (September 21, 2023; November 28, 2023; December 4, 2023; and September 26, 2023); Modoc Nation (September 21, 2023; December 4, 2023; and January 19, 2024); Oregon State Historic Preservation Office (September 20, 2023); and California State Historic Preservation Office (January 29, 2024), for compliance with Section 106 of the National Historic Preservation Act (NHPA) in accordance with 36 C.F.R. 800.3(c). This ongoing consultation process would occur with the District; NRCS as the lead federal agency; Bureau of Reclamation (Reclamation) as a cooperating agency, and the U.S. Fish and Wildlife Service (USFWS) as a cooperating agency. Consultation would be completed prior to the approval of federal undertakings. Coordination with USFWS was completed on January 18, 2022, as required by provision of Pub. L. No. 83-566 Section 12 (See Appendix A).

Ground disturbances would be limited to necessary areas to minimize effects on soil, vegetation, water quality, and land use. Where possible, construction activities would avoid or minimize effects on agricultural lands by confining construction activities to the existing right-of-way (ROW) and easements. Sedimentation best management practices (BMPs) would be employed during and after construction to protect water quality, and construction schedules would minimize disturbance to wildlife and the public living adjacent to the KDD easement ROW. After construction, disturbed

areas would be returned to pre-construction contours and replanted with a mix of native grasses and forbs to reduce the risks of erosion and spread of noxious weeds.

Prior to construction, the District would complete pre-clearance surveys to verify the presence or absence of golden eagle in the area and all USFWS guidelines would be followed to ensure minimal disturbance to bald or golden eagles nesting near the project area. Surface-disturbing activities would typically not occur during the migratory bird or raptor nesting season, generally from March 1 to August 31. If surface-disturbing activities must occur during this period, qualified avian biologists would conduct pre-construction avian surveys in appropriate habitats not fewer than 3 days and not more than 7 days before surface-disturbing activities begin. The specific area to be surveyed would be based on the scope of the activities. If ground-disturbing activities do not take place within 7 days of the surveys, the work areas would be resurveyed. If nesting migratory birds or raptors are detected during surveys, appropriate buffers would be applied. Buffers would remain in effect until the qualified biologist confirms that either the young have fledged or the nest has failed.

There is potential for wetlands to occur within the project area. A wetland and waters delineation would be conducted prior to the implementation of Modernization Alternative projects to determine the limits of direct and indirect adverse effects on wetlands and waters of the United States. Jurisdictional determination by the U.S. Army Corps of Engineers (USACE) and the Oregon Department of State Lands (DSL) of delineated boundaries of wetlands and waters would be obtained. The project would be designed to minimize, avoid, and mitigate adverse effects on wetlands and waters. Coordination with USACE, DSL, and the Oregon Department of Environmental Quality (DEQ) would be conducted prior to submittal of a joint permit application to these agencies.

### Project Costs

Works of Improvement	Pub. L. No. 83-566 Funds	Pub. L. No. 83-566 Funds Percentage	Other Funds	Other Funds Percentage	Total	Total Percentage
Construction	\$10,336,000	75%	\$3,442,000	25%	\$13,778,000	100%
Engineering	\$373,000	45%	\$462,000	55%	\$835,000	100%
<b>SUBTOTAL COSTS</b>	<b>\$10,709,000</b>	<b>73%</b>	<b>\$3,904,000</b>	<b>27%</b>	<b>\$14,613,000</b>	<b>100%</b>
Technical Assistance	\$1,560,000	100%	\$0	0%	\$1,560,000	100%
Relocation	N/A	N/A	N/A	N/A	N/A	N/A
Real Property Rights	\$0	0%	\$77,000	100%	\$77,000	100%
Permitting	\$0	0%	\$168,000	100%	\$168,000	100%
Project Administration	\$460,000	100%	\$0	0%	\$460,000	100%

<b>Works of Improvement</b>	<b>Pub. L. No. 83-566 Funds</b>	<b>Pub. L. No. 83-566 Funds Percentage</b>	<b>Other Funds</b>	<b>Other Funds Percentage</b>	<b>Total</b>	<b>Total Percentage</b>
Annual O&M	N/A	N/A	N/A	N/A	N/A	N/A
<b>TOTAL COSTS</b>	<b>\$12,729,000</b>	<b>75%</b>	<b>\$4,149,000</b>	<b>25%</b>	<b>\$16,878,000</b>	<b>100%</b>

## Project Benefits

### *Project Benefits*

Implementation of the Preferred Alternative would reduce O&M costs for KDD, avoid carbon emissions, and enhance wetland habitat in the LKNWR by (1) increasing operational flexibility in the distribution of water throughout the LKNWR and (2) increasing the average annual amount of drainage water from KDD available to wetlands in the LKNWR. Overall, in addition to the quantified benefits, implementation of the Preferred Alternative would provide benefits by protecting wildlife, providing water use transparency, improving water quality, and bolstering the reliability and efficiency of KDD. The Project would also help to increase the overall reliability of water necessary to sustain the rural way of life and the Klamath Basin community identity rooted in historical agricultural land uses.

### *Number of Direct Beneficiaries*

Fifteen patrons would directly benefit from the project.

### *Other Beneficial Effects – Physical Terms*

Implementation of the Preferred Alternative would have long-term, beneficial effects on water quality, and fish and wildlife habitat.

<b>Damage Reduction Benefits</b>	<b>Proposed Project</b>
Reduced OMR	\$156,000
Avoided Carbon Emissions	\$1,000
Water Use Transparency	Positive, Unquantified Benefits
Habitat Value	\$150,000
Fish Value	Positive, Unquantified Benefits
Total Quantified Benefits	\$307,000
Benefit to Cost Ratio	0.6

## Period of Analysis

### *Installation Period*

3 years

***Project Life***

100 years

**Funding Schedule**

Year	Pub. L. No. 83-566	Other Funds	Total
0	\$1,028,000	\$360,000	\$1,388,000
1	\$4,156,500	\$1,352,500	\$5,509,000
2	\$7,544,500	\$2,436,500	\$9,981,000

**Environmental Effects**

The Preferred Alternative would be planned, designed, and installed to have long-term net-beneficial effects on agricultural production, water quality, surface water hydrology, wetland functions, fish and wildlife habitat, and ecosystem services within the planning area.

Implementation of the Preferred Alternative would result in minor, unavoidable temporary or short-term adverse effects such as impacts to land use, soils, vegetation, fish, and wildlife habitat within the project area. Most temporary or short-term adverse effects would result from construction activities in the project area. Project sponsors would work closely with partners, contractors, and affected landowners to incorporate measures and BMPs to avoid and minimize short-term adverse effects.

Aquatic and terrestrial vegetation within the project area would be permanently removed because of construction activities, causing a long-term minor adverse effect. However, BMPs would be followed during construction; disturbed areas would be recontoured and seeded with native vegetation following construction. Construction would occur outside the primary nesting period for migratory birds of concern. Should an active nest be found, construction would be paused and coordination with a local USFWS biologist would occur.

According to online data, wetlands, riparian areas, and floodplains occur within the planning area, and there would likely be temporary or long-term minor effects on wetland or riparian habitat within the project area. Wetland delineation would be conducted prior to implementation of the Preferred Alternative. Project activities would be discussed with the US Army Corps of Engineers and Oregon DSL to determine permit and mitigation requirements.

***Major Conclusions***

Implementation of the Preferred Alternative would improve water delivery efficiency and reliability for KDD patrons, improve water quality of the water discharged to the Klamath River, reduce KDD O&M costs, and reduce potential effects on fish habitat.

***Areas of Controversy***

There have been no areas of controversy identified.

***Issues to be Resolved***

None.

***Evidence of Unusual Congressional or Local Interest***

Comments during the scoping period were received from several state and federal government agencies including the California North Coast Regional Water Quality Control Board, DEQ, the U.S. Environmental Protection Agency (EPA), USFWS, as well as the Modoc Tribe and local nongovernmental organizations.

***Compliance***

Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? Yes   X   No



# 1 Introduction

Across the Western United States, aging infrastructure, growing populations, shifting rural economies, and changing climate conditions have contributed to increased pressure on water resources.

In recent years, the Klamath Basin has faced severe droughts that have limited or even stopped the supply of water from Upper Klamath Lake to the Bureau of Reclamation's (Reclamation) Klamath Project and the Lower Klamath National Wildlife Refuge (LKNWR). Klamath Drainage District (herein referred to as KDD or the District), located in the Lower Klamath Lake Watershed of the Lost River Subbasin (see Figure 1-1), is proposing to modernize District infrastructure to address watershed problems. Water shortages and delivery and operational inefficiencies have resulted in farmers being forced to fallow thousands of acres of high-value farmland. The unscreened diversions from the Klamath River risk entraining anadromous fish species which will be present in these reaches now that the four Klamath River dams have been removed. The Klamath Straits Drain (KSD), the main discharge from the Klamath Project to the Klamath River, has been identified as a nonpoint source of pollution. Better management and rerouting of drainage water to wetland cells in the LKNWR could improve agricultural water quality.

Klamath Basin stakeholders have prioritized improved management of agricultural water to address water supply, water quality, and fish protection objectives. The District seeks federal funding through the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Watershed Protection and Flood Prevention Act, Public Law [Pub. L.] No. 83-566, to implement the proposed irrigation infrastructure modernization project (herein referred to as the project) to address the key watershed problems.

Upgrading irrigation infrastructure by modernizing strategic sections of the KDD system would reduce potential entrainment of fish, improve water quality, address water shortages by recirculating irrigation water, and address delivery and operational inefficiencies by more efficiently managing water resources throughout the District.

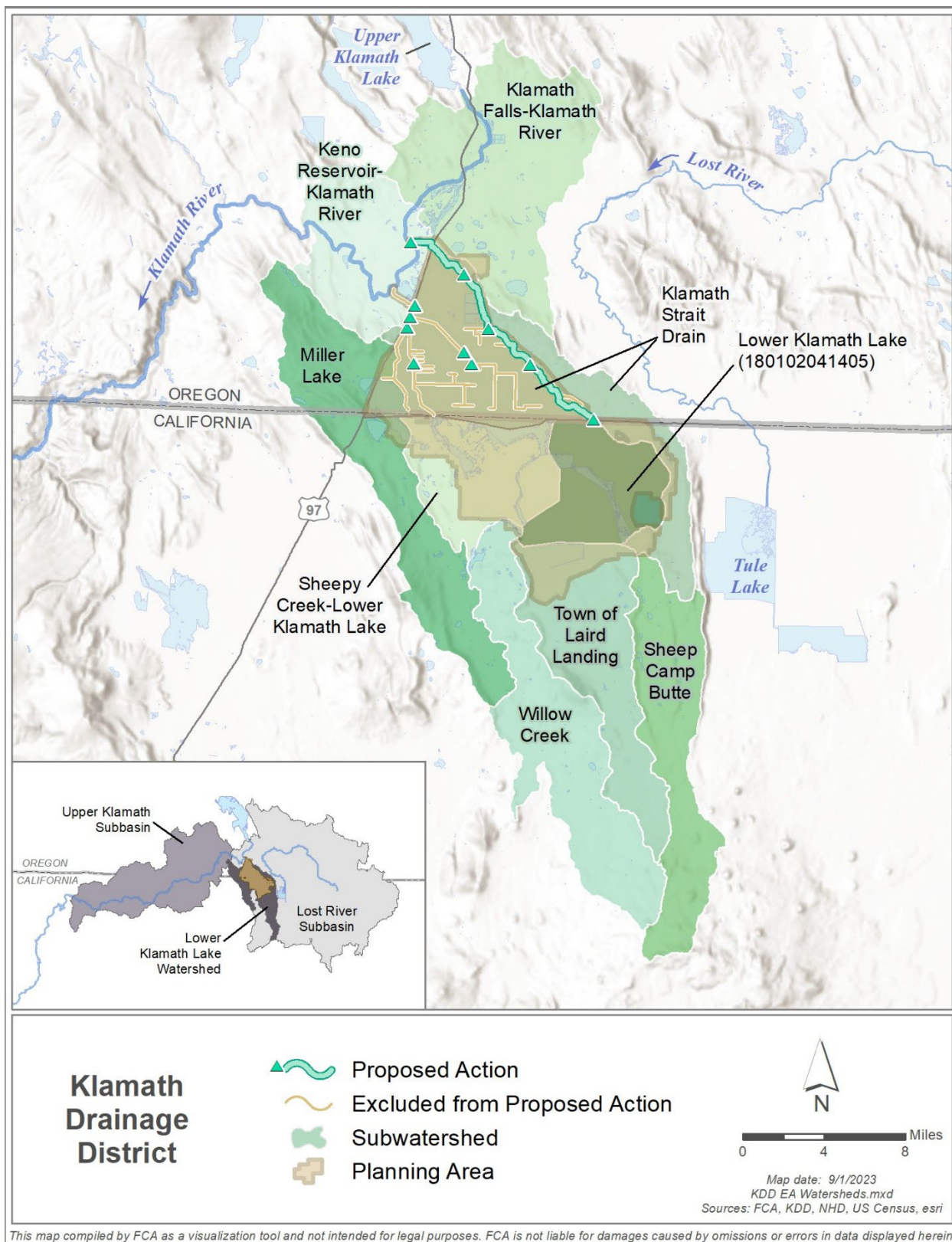


Figure 1-1. Klamath Drainage District watershed context.

## 1.1 Planning Area

The District is located south of Klamath Falls, Oregon. The District delivers water to approximately 20,000 acres of private farmland, 6,250 acres of federally leased lands within the District's boundary, and to LKNWR lands south of the District. In addition, the District has infrastructure and provides irrigation water to some lands outside of the District boundaries. Collectively, these lands make up the planning area, which is a total of 74,259.2 acres (see Table 1-1).

**Table 1-1. Klamath Drainage District Planning Area (HUC 12).**

Subwatershed Name	12-digit Hydrologic Unit Code	Planning Area Within Subwatershed (acres)
Keno Reservoir-Klamath River	180102041202	121.1
Klamath Falls-Klamath River	180102041201	453.1
Klamath Strait Drain	180102041403	30,747.9
Miller Lake	180102041404	3,186.8
Sheep Camp Butte	180102041401	2.4
Sheepy Creek-Lower Klamath Lake	180102041406	16,459.0
Town of Laird Landing	180102041402	5,173.5
Willow Creek	180102041303	156.7
Lower Klamath Lake	180102041405	17,958.6
<b>Total</b>	<b>N/A</b>	<b>74,259.2</b>

## 1.2 Project Area

The project area is the portion of the planning area where the KDD Infrastructure Modernization Project would occur (Figure 1-2). The project area, making up only a small portion of the District's total system, consists of the District infrastructure to be modernized, areas where new infrastructure would be built, and associated right-of-way (ROW) or easements where construction would take place.

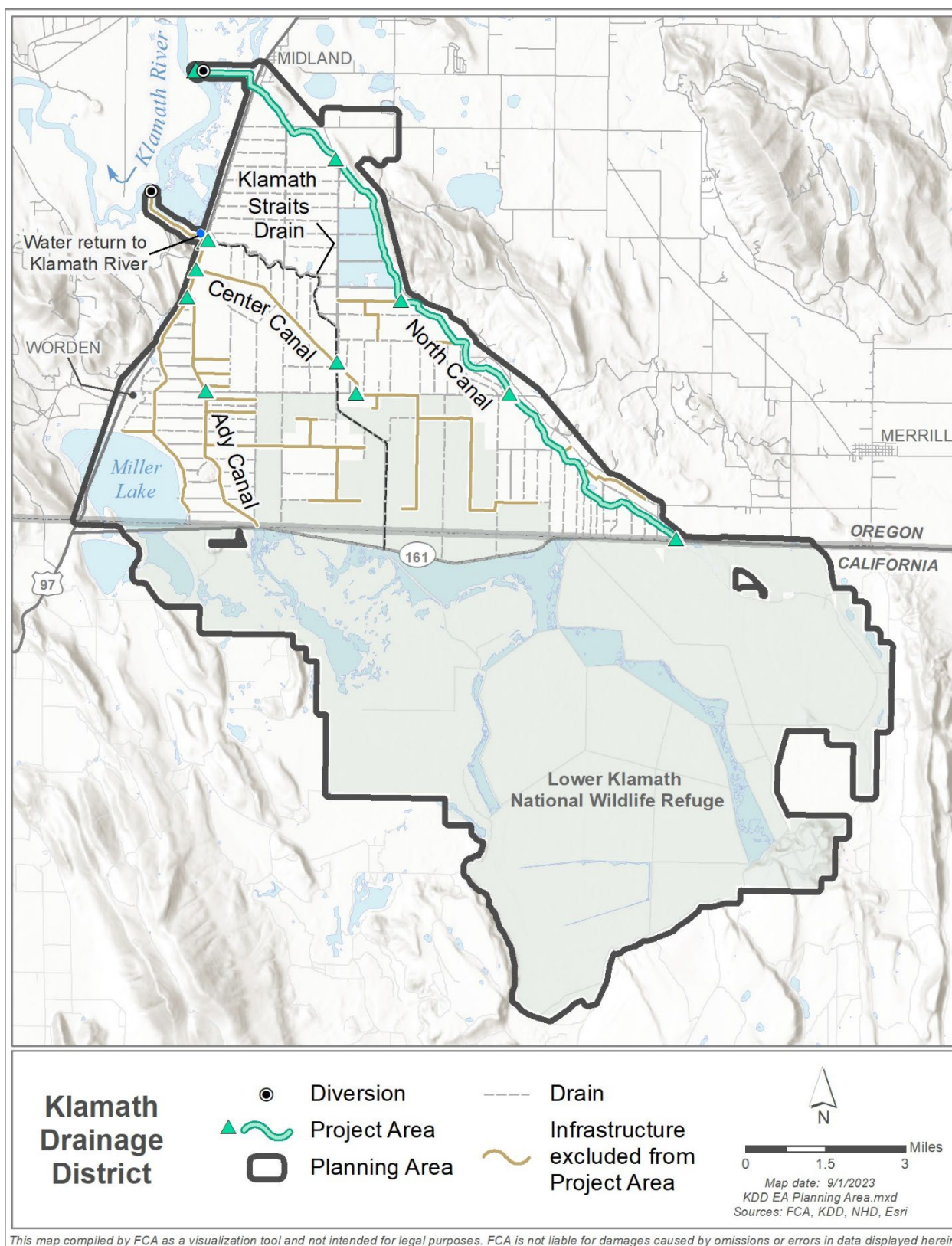


Figure 1-2. Klamath Drainage District planning area and project area.



### 1.3 Current Infrastructure

KDD delivers water to approximately 26,250 acres of farmland within the District's boundary and to the LKNWR south of the District through roughly 30 miles of irrigation canals, 121 gated turnouts from canals and laterals, and 55 lift pumps (Figure 1-3). The District also has an extensive drainage system to keep the water table below the root zone of crops during the growing season. All drains within KDD terminate at the KSD that is located within KDD (KDD 2015).

The KSD also collects the majority of the Klamath Project's tailwater. Tailwater from Klamath Project districts upstream in the system flows south through Tulelake Irrigation District and into the Tule Lake National Wildlife Refuge (TLNWR) in California. Tailwater is then pumped out of the TLNWR, through Sheepy Ridge in California, and into the LKNWR. Excess water is returned to the Klamath River through KDD via KSD and the E/EE and F/FF pumping plants (KDD 2015). Currently, the LKNWR can only receive tailwater and drainage water from KDD through the KSD and Ady Canal.

The North Canal diverts water from a 1-mile-long channel cut through the marsh on the east bank of the Klamath River. Ady Canal is fed from the 1-mile-long Klamath Straits, which historically spilled water from the Klamath River to Lower Klamath Lake. The District must maintain both channels by clearing vegetation regularly. North Canal is 12.5 miles long and flows to the southeast along the eastern boundary of the District, terminating approximately 0.47 miles (approximately 2,500 feet) from the P-1 Lateral at the northern boundary of the LKNWR. There are approximately 40 turnouts to farm laterals directly off North Canal and 36 lift pumps. Drainage water from these farms can be pumped back into the District's delivery canals and be reused. The lift pumps mostly provide water to the Klamath Hills District Improvement Company and the Midland District Improvement Company, both of which are located east of North Canal. The District has contracts to deliver water to both districts. Ady Canal is approximately 5.5 miles long and flows south through the District; it terminates at the Oregon-California border where it delivers water to the LKNWR. Along the way, the District's water users divert water through 29 gated turnouts. KDD personnel regulate and maintain water levels in both the North and Ady canals, and the District's water users divert the water that they need. As such, the system is considered an on-demand system (KDD 2015). See Appendix C for a diagram describing water flow throughout the KDD system.

Ady Canal provides water to three major laterals: Center Canal, Lease Land Canal, and West Canal. Center Canal is approximately 5 miles long and provides water to the middle of the District, flowing across the KSD via a flume. The canal has 13 gated turnouts and three pumps to adjacent fields, all of which are regulated by water users. At its terminus, Center Canal provides water to Area K lands<sup>1</sup> east of the KSD. Lease Land Canal is 3 miles long and supplies water to Area K lands west of the KSD. West Canal is about 4.5 miles long and provides water to the most southwestern portion of KDD through 17 gated turnouts. Most of the District's canals are rock-armor-lined for erosion control (KDD 2015). The District has five pumping plants (Figure 1-3). The E/EE and F/FF pumping plants mentioned above are owned and operated by Reclamation.<sup>2</sup> The other three pumping plants are operated by KDD and are known as the O'Connor Drain Pump, the Westside Pumping Plant, and the Eastside Recirculation Plant. The O'Connor Drain Pump provides

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<sup>1</sup> Of the approximately 26,250 acres of land situated within KDD's boundary, there are 6,253 acres, collectively known as Area K, that the U.S. government never allowed to be homesteaded and are leased by the U.S. for farming.

<sup>2</sup> USFWS also has O&M responsibilities with these pumping plants.

improved deep soil drainage in the lower elevations of the District by directing water from the District's drainage system into the KSD or converting discharge into tailwater recovery. The Westside Pumping Plant was constructed in the 1990s as a tailwater recovery system on the west side of the District. It recirculates tailwater from the northwestern District lands to increase the head in Ady Canal. This benefits a portion of the landowners receiving water from the Ady Canal south of the KSD, who, before the construction of the Westside Pumping Plant, at times did not receive sufficient water through the siphons under the KSD. The Eastside Recirculation Plant was built in 2015 and came online in 2017. It is a tailwater recovery plant on North Canal. The District constructed the plant to improve the head in North Canal and alleviate the low flows at the southeast end of the canal that result from the flatness of the canal and aquatic plant accumulation. Additionally, both pumping plants recirculate drainage and tailwater on both sides of the District, which has proven to be a tremendous benefit during drought and regulatory curtailment (KDD 2015).

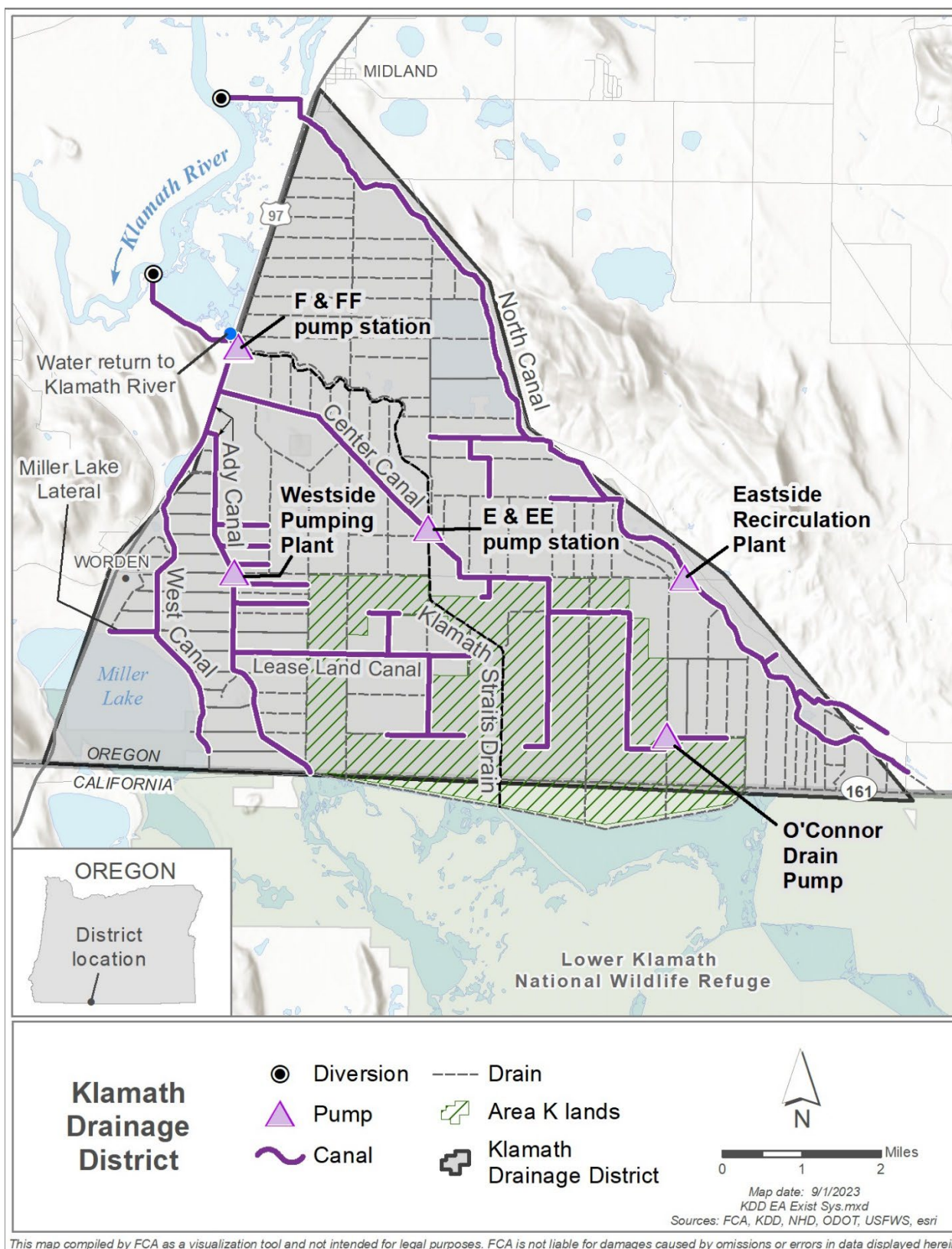


Figure 1-3. Klamath Drainage District infrastructure.

## 1.4 Decision Framework

This Watershed Plan-Environmental Assessment (Plan-EA) was prepared to assess and disclose the potential effects of the proposed action. Once NRCS has approved federal funding through Pub. L. No. 83-566, a Plan-EA is required. Through this program, NRCS provides technical and financial assistance to project sponsors such as states, local governments, and tribes to plan and implement authorized watershed project plans for watershed protection; flood mitigation; water quality improvements; soil erosion reduction; rural, municipal, and industrial water supply; irrigation; water management; sediment control; fish and wildlife enhancement; and hydropower.

NRCS is the lead federal agency for this Plan-EA and is responsible for issuance of a decision in accordance with the National Environmental Policy Act (NEPA). NEPA compliance requires that projects using federal funds be evaluated for potential effects to the quality of the human 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 by the federal agency that the project would result in significant effects to the human or natural environment, an environmental impact statement must be prepared (see 40 Code of Federal Regulations [C.F.R.] 1501.4 and 1508.9; 7 C.F.R. 650.8).

KDD is partnered with NRCS to implement the Infrastructure Modernization Project within the KDD planning area under the watershed authority of the Pub. L. No. 83-566 program. Because Reclamation administers and holds title to many of the assets and real property that are proposed for modification, Reclamation has agreed to be a cooperating agency on this Plan-EA. USFWS also has real property (LKNWR), holds operation and maintenance (O&M) responsibility for the pumping plants that are proposed in this project for modernization, and has agreed to be a cooperating agency on this Plan-EA. Reclamation and USFWS are not providing federal funding for this proposed project, and the costs and benefits of the proposed project are not included in other federal agency accounting.

Additionally, the continued feasibility of a project is monitored and documented in the project files every 5 years in accordance with NEPA requirements in 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 the Plan-EA and project are prepared as necessary.

This Plan-EA was prepared in accordance with applicable Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 C.F.R. 1500–1508), USDA’s NEPA regulations (7 C.F.R. Part 650), NRCS Title 190 General Manual Part 410, and the NRCS National Environmental Compliance Handbook, Title 190 Part 610. This Plan-EA also meets the NRCS program policy of the 2015 NRCS National Watershed Program Manual (NRCS 2015) and guidance of the 2014 NRCS National Watershed Program Handbook (NRCS 2014). This Plan-EA serves to fulfill the NEPA and NRCS environmental review requirements for the proposed action.

In addition to the requirements and policies under NEPA listed above, the USDA has also conducted its analysis of this Plan-EA following the federal Principles and Requirements for Federal



Investments in Water Resources<sup>3</sup> as well as the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies (PR&G; CEQ 2014). USDA has issued guidance for analysis comprised of DM 9500-13 and DR 9500-13, and NRCS uses this guidance as the framework for evaluating water resources investments (USDA 2017).

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<sup>3</sup> Principles and Requirements are established pursuant to the Water Resources Planning Act of 1965 (Pub. L. No. 89-8), as amended (42 United States Code [U.S.C.] 1962a-2) and consistent with Section 2031 of the Water Resources Development Act of 2007 (Pub. L. No. 110-114).

## 2 Purpose and Need for Action

The purpose of the proposed project is to enhance agricultural water management<sup>4,5</sup> by improving District infrastructure, reducing District operational inefficiencies affecting water quality and water quantity, and improving the ability of the District to deliver the amount of water patrons need at the time they need it.

The District has identified the need to reduce District operational spills that can negatively affect water quality in the Klamath River, more reliably deliver water to patrons and the LKNWR, and conserve energy throughout District infrastructure.

To meet NRCS requirements for a federal investment in a water resources project, the 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 PR&G [NRCS 2017]), and be an authorized project purpose under Sections 3 and 4 of Pub. L. No. 83-566.

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” (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 (NRCS 2017).

The proposed project would be eligible for funding under Pub. L. No. 83-566 requirements as an “Authorized Project Purpose (v), Agricultural Water Management,”<sup>6</sup> by focusing on water conservation, improving water quality, irrigation infrastructure operational efficiency, and more reliably delivering irrigation water to farmers and the LKNWR.

### 2.1 Watershed Problems and Resource Concerns

Federal assistance is needed to address the following watershed problems and resource concerns.

#### 2.1.1 Water Shortages

In recent years, the Klamath Project has faced severe droughts. As a result, KDD has received variable water allocations from year to year, which leads to regional agriculture instability. LKNWR is located to the south of the District (see Figure 1-3) and can receive excess drainage or tailwater from the District’s system. The LKNWR is a major bird migration site that hosts colonial nesting birds and a range of ecologically significant species, and it has also faced water shortages along with the rest of the Klamath Project. Due to limited water supply to the LKNWR, wetland acres in the refuge have declined by about 47 percent since 2012 (Donnelly et al. 2020). As identified in the

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<sup>4</sup> A description of Authorized Purposes can be found in 390-NWPM, Part 500, Subpart A, Section 500.3B.

<sup>5</sup> To meet NRCS requirements for a federal investment in a water resources project, the project must meet the Federal Objective set forth in the Water Resources Development Act of 2007 and must be an authorized project purpose under Sections 3 and 4 of Pub. L. No. 83-566.

<sup>6</sup> A description of Authorized Purposes can be found in 390-NWPM, Part 500, Subpart A, Section 500.3B (NRCS 2015).

LKNWR Draft Plan-EA for Water Supply Enhancement, the refuge needs to secure additional water to provide adequate wetland habitat and agricultural land use.

### **2.1.2 Water Delivery and Operations Inefficiencies**

Currently, KDD has no capacity to monitor water levels and adjust the volume of conveyed water in real-time to accurately match water supply with demand across its system. Monitoring water volume is especially important when available water is scarce and precise water management is needed to successfully serve all irrigated lands. The District's inability to control water volume as needed and move water in an efficient manner also leads to higher O&M costs associated with pumping. Currently, the District is limited in how it manages drainage water from North Canal. Additionally, the KDD system has capacity to recirculate water and distribute available water throughout the entire District should modernization measures be implemented.

### **2.1.3 Fish Entrainment**

The KDD North Canal Diversion on the Klamath River is not currently screened. With no screen in place, fish can pass from the river into the District's North Canal system. When fish pass into a canal system, they typically become stranded.

Following a 10-year-long Federal Energy Regulatory Commission relicensing process, stakeholders signed the Klamath Hydroelectric Settlement Agreement in 2010 to provide a framework for the potential removal of PacifiCorp's Klamath River dams including Iron Gate, Copco 1, Copco 2, and J.C. Boyle dams. Now that the dams have been removed, salmon, steelhead, and lamprey will have access to over 400 stream miles of historical spawning habitat upstream of the dams (KRRC 2021; KRRC 2023). Anadromous fish passing the District's unscreened North Canal Diversion would be able to enter and become entrained in the District's North Canal and associated lateral system.

### **2.1.4 Impaired Water Quality**

KSD collects drainage water from KDD and the entire Klamath Project, including water pumped into KSD from the Tule Lake and Lower Klamath national wildlife refuges. Reclamation and the U.S. Geological Survey identified KSD as a contributing nonpoint source of nutrient pollution to the Klamath River (Sullivan et al. 2014). At times, especially during the summer and irrigation season, KSD contributes more than half of the Klamath River's flow above Keno Dam at nutrient concentrations higher than what exist in the river (DEQ 2019a). KSD discharges to the Klamath River between the Link River and Keno Dam via the F/FF pumping plant. At this location, the Klamath River has been Section 303(d)-listed for pH, dissolved oxygen, chlorophyll a, arsenic, harmful algal blooms, and inorganic human health toxics (DEQ 2022). KSD was also listed as water quality impaired for pH, dissolved oxygen, chlorophyll a, temperature, arsenic, and inorganic human health toxics (see Table 4-9.) The Upper Klamath and Lost River Subbasins Nutrient Total Maximum Daily Loads (TMDLs) (see Section 4.6.3) have been approved for waters in those subbasin, including for the Klamath River and the KSD (DEQ 2019a,b).

Ongoing research shows that wetland cells in the LKNWR could remove nutrient loads and potentially be used to treat waters from Upper Klamath Lake and KDD drainage water. Wetlands can naturally remove or deactivate pollutants through a number of physical, biological, and chemical processes. Hydrating wetlands in LKNWR could mimic the natural function of the reclaimed Lower Klamath Lake and improve agricultural water quality prior to being discharged into the Klamath River (Stillwater Sciences 2023).

## **2.2 Watershed and Resource Opportunities**

The PR&G Federal Objective for the project promotes the following Guiding Principles of Healthy and Resilient Ecosystems; Sustainable Economic Development; Floodplains; Public Safety; Environmental Justice; and Watershed Approach. Implementation of the project would contribute to the project's objectives and the Federal Objective and Guiding Principles as follows:

- Reduce fish entrainment in North Canal and associated lateral system – Healthy and Resilient Ecosystems; Watershed Approach
- Comply with Oregon Department of Fish and Wildlife (ODFW) requirements for upgrades to irrigation diversions – Healthy and Resilient Ecosystems; Watershed Approach
- Increase water deliveries to the LKNWR that would improve and expand fish and wildlife habitat – Healthy and Resilient Ecosystems; Watershed Approach; Environmental Justice
- Support and maintain existing agriculture through enhanced water supply reliability and improved water management – Healthy and Resilient Ecosystems; Sustainable Economic Development
- Increase control of KSD and reduce tailwater discharge to the Klamath River for water quality improvement – Healthy and Resilient Ecosystems; Environmental Justice
- Increase operational flexibility and management of North Canal drainage water – Healthy and Resilient Ecosystems; Watershed Approach
- Improve energy efficiency within the irrigation water infrastructure – Sustainable Economic Development; Public Safety; Environmental Justice

### 3 Scope of the Plan-EA

#### 3.1 Agency, Tribal, and Public Outreach

Federal, state, and local agencies and representatives, as well as nongovernmental organizations, received an invitation to participate in scoping for the project. Advertisements announcing the scoping period and the associated scoping meeting were placed in a local newspaper in addition to multiple online locations including the NRCS website and the project website (see Section 7 for more details). Additionally, the District notified patrons of the scoping meeting and invited comments on the scope of the Preliminary Draft Plan-EA.

Consultation and coordination between NRCS, the District, Reclamation, USFWS, the Klamath Tribes, Modoc Nation, and the Oregon State Historic Preservation Office (SHPO) has been initiated, is ongoing, and will be completed prior to implementation. In accordance with 36 C.F.R. 800, the National Historic Preservation Act (NHPA) of 1966 as amended, and its subparts, NRCS has initiated consultation and coordination with the Oregon SHPO (September 20, 2023), California SHPO (January 29, 2024), the Klamath Tribes (September 21, 2023; October 2, 2023; and by phone on November 30, 2023, and December 4, 2023), and Modoc Nation (September 21, 2023; December 4, 2023; and January 19, 2024), and other consulting parties on the Area of Potential Effects (APE) (June 28, 2023, and December 4, 2023) prior to cultural resources survey (Table 7-1 and Appendix A). Input received from these entities will be incorporated into the cultural resource identification survey and completed prior to implementation.

Per Executive Order (EO) 13007, *Indian Sacred Sites*, NRCS coordinated with the Klamath Tribes and Modoc Nation whose ancestral lands are known to have been in the counties of the undertaking prior to conducting cultural resources surveys. Tribal input was meaningfully incorporated into the cultural resource identification survey within the APE. No sacred sites were identified within the APE in consultation with the Tribes, and no evidence of sacred sites was found in the cultural field surveys.

As part of the Reclamation process for granting a Permit for Archeological Investigations (ARPA<sup>7</sup> Permit), Reclamation staff reviewed and approved the APE. The ARPA Permit applications were submitted to Reclamation on August 2, 2023. After completion of the cultural resources identification survey and subsequent NRCS, Reclamation, and USFWS review, a copy of the completed survey report will be furnished to the Oregon SHPO, California SHPO, and tribal governments with ancestral lands within the counties of the APE. Further consultation may take place regarding the resolution of adverse effects (if any) to cultural resources until a Memorandum of Agreement is executed and signed by Oregon NRCS and relevant parties or by comment from the advisory Council of Historic Preservation.

Tribal consultation was conducted in accordance with the NHPA and EO 13175, *Consultation and Coordination with Indian Tribal Governments*, to maintain NRCS government-to-government relationships. NRCS sent a letter to the Yurok Tribe, The Klamath Tribes, and the Karuk Tribe on January 14, 2022, notifying them of the scoping process. Consultation letters regarding the proposed APE were sent to the Oregon SHPO on September 20, 2023, the Klamath Tribes on September 21, 2023, and the Modoc Nation on September 21, 2023 (Table 7-1).

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<sup>7</sup> Archaeological Resources Protection Act

### 3.2 Scoping Meeting

A virtual scoping meeting was held on January 27, 2022. Presenters at the meeting included Scott White, KDD; Gary Diridoni, NRCS; Raija Bushnell, Farmers Conservation Alliance (FCA); and Amanda Schroeder, FCA. The presentations covered the financial assistance available through Pub. L. No. 83-566, the project purpose and need, the Plan-EA process, the modernization projects presented in the scoping document, and the ways in which the public could get involved. After the presentation, attendees asked questions and provided comments for the public record. A total of 28 people attended the meeting, excluding staff from KDD, NRCS, and FCA.

### 3.3 Scoping Comments

Scoping comments were accepted from January 12 to February 25, 2022. Comments were submitted at the public meeting and via email.

Comments generally requested additional analyses during the planning phase. Table 3-1 presents comment topics received and where they are addressed in this Plan-EA.

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

Comment Topic	Section Where Topic is Discussed
Description of KDD.	Section 1, Introduction
Request for additional detail on how the project would address the temperature and nutrient impairments described by the Klamath and Lost River TMDLs.	Section 4.6.3, Surface Water Hydrology Section 6.6.2.2, Surface Water Hydrology and Quality
Estimated time to complete the modernization project.	Section 5.3.2, Alternative 2 – Proposed Action - Modernization Alternative (Future with Federal Investment)
Request for information on how the process to undertake a modernization infrastructure project was initiated.	Section 2, Purpose and Need for Action Section 5.1, Formulation Process
Management of possible increases in salinity concentrations often associated with recirculation of water.	Section 4.6.3, Surface Water Hydrology Section 6.6.2.2, Surface Water Hydrology and Quality
Expected benefits or improvements resulting from the replacement of the E and F pumps other than providing new and upgraded pumps.	Section 6.2, Land Use Section 6.4, Soils Section 6.6, Water Resources Section 6.7, Fish and Aquatic Resources
Request for information on whether FCA would help fund alternative energy projects, such as solar, to help offset the power costs at the E and the F pumps.	Section 5.3.2, Alternative 2 – Proposed Action - Modernization Alternative (Future with Federal Investment)
Discussion on how each project action would achieve requirements of the California and Oregon Klamath and Lost River TMDLs.	Section 4.6.4, Surface Water Quality Section 6.6.2.2, Surface Water Hydrology and Quality

<b>Comment Topic</b>	<b>Section Where Topic is Discussed</b>
Request to discuss the following resources, including an assessment of which waters may be impacted or improved by each project action, and identification of the specific relevant pollutants: sedimentation and water quality; drinking water; surface water; groundwater.	Section 4.6, Water Resources Section 6.6, Water Resources
Identification and discussion of how surface water quality would be protected during the project activities including: A list of BMPs, circumstances under which BMPs would be implemented, explanation of how NRCS or other government entities would ensure BMP monitoring and timely implementation.	Appendix E.11, Supporting Information for Minimization, Avoidance, and Compensatory Mitigation Measures
Recommendation to analyze and avoid impacts to: total wetland area and function; wetland vegetation, riparian habitats, and aquatic biota; wetland erosion or aggradation from floodwater channelization or redirection.	Section 4.7, Fish and Aquatic Resources Section 4.8, Wetlands and Riparian Areas Section 6.7, Fish and Aquatic Resources Section 6.8, Wetland and Riparian Areas
Importance of the North Canal extension and recirculation pumps to improve water delivery options for the LKNWR.	Section 2, Purpose and Need for Action Section 4.2.1, Ecosystem Services Section 4.6.1, Ecosystem Services
Appreciation of FCA's and KDD to address waterbird habitat.	Section 4.9.2, Migratory Bird Treaty Act / Bald and Golden Eagle Protection Act Species Section 6.9.2, Modernization Alternative
Information on how the project would assure improved water quality for water drained from the refuge after use.	Section 6.6.2.2, Surface Water Hydrology and Quality
Description of the plans for Pumping Plant D and for improving water quality if water were to be delivered from Tulelake again in the future.	Not included in the proposed action.
Description of the following state and federal regulatory concerns: KDD's use of the full water right to the Klamath River during years of water shortages; pumping of water back into the Klamath River at levels above the allocated rates.	Not included in the proposed action. No changes to water diversion or water rights are included in the proposed action.
Re-evaluation of the location of the Ady Canal fish screen due to its proximity to the F pump.	The Ady Canal fish screen was removed from the project.
Explanation of how the project would address the salt related build up concerns and of where the water would go when it is no longer usable.	Section 6.6.2.2, Surface Water Hydrology and Quality

<b>Comment Topic</b>	<b>Section Where Topic is Discussed</b>
Request for a description of how the project leads would improve communication and collaboration with state, federal, local and tribal government bodies in the future.	Section 7, Consultation, Coordination, and Public Participation
Provide general support for the KDD project as the installation of fish screens in KDD Klamath River diversions has been identified as a priority restoration action between Iron Gate Dam and the Link River. Reducing entrainment risk through this reach of the Klamath River is incredibly important for the survival and health of the anadromous salmonids expected to return when the four Klamath dams are removed and is also important for the persistence of existing native fishes in the reach.	Section 4.7, Fish and Aquatic Resources Section 5.3.2, Alternative 2 – Proposed Action - Modernization Alternative (Future with Federal Investment) Section 6.7, Fish and Aquatic Resources

BMP = best management practice; FCA = Farmers Conservation Alliance; KDD = Klamath Drainage District; LKNWR = Lower Klamath National Wildlife Refuge; TMDL = total maximum daily load

### 3.4 Identification of Resource Concerns

Table 3-2 provides a summary of resource concerns identified through scoping and their relevance to the proposed action. Resources determined not relevant were eliminated from detailed study; resources determined to be relevant were carried forward for analysis.

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

<b>Resource</b>	<b>Relevant to the proposed action (Yes/No)</b>	<b>Justification</b>
Air Quality	No	DEQ air quality data indicate 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.
Coastal Zones	No	None present.
Coral Reefs	No	None present.
Cultural and Historic Resources	Yes	Consultation with SHPO, Klamath Tribes, Modoc Nation, and other consulting parties including affiliated tribes is required for compliance with Section 106 of NHPA. Cultural and historic resources are present in the planning and project areas.
Ecologically Critical Areas	No	There are no ecologically critical areas that intersect with the project area.



<b>Resource</b>	<b>Relevant to the proposed action (Yes/No)</b>	<b>Justification</b>
Endangered and Threatened Species: Animals	Yes	ESA-listed threatened and endangered animal species may occur in the project area or its vicinity.
Endangered and Threatened Species: Plants	Yes	Applegate's milkvetch, a federally listed endangered plant, is likely present in the planning area with the most suitable habitat in the southwest corner of the District. No project activities are proposed in that area.
Environmental Justice	Yes	Environmental justice communities exist within the planning area.
Essential Fish Habitat (EFH)	Yes	Stormwater runoff associated with proposed roadway improvements would impact EFH downstream of the project area and consultation under the Magnuson Stevens Act would be required.
Fish and Fish Habitat	Yes	The proposed action could affect fish habitat within waterbodies associated with District operations.
Floodplain Management	Yes	Construction and operation of the North Canal fish screens would occur in the 100-year floodplain.
Forest Resources	No	The proposed action would not affect forest resources.
General Wildlife and Wildlife Habitat	Yes	Construction and operation of project components could affect wildlife near District operations.
Invasive Species/Noxious Weeds	Yes	Noxious weeds are known to occur within the project area.
Invasive Animal Species	No	No invasive animal species are known to occur within the project area.
Land Use	Yes	Construction and operation of the project could affect land use in the project area.
Migratory Birds and Eagles	Yes	Migratory birds and eagles may occur within the project area.
Natural Areas	Yes	The project area crosses natural areas.
National Parks, Monuments, and Parklands	No	The proposed action does not occur in any national parks, monuments, or parklands.
Noise	No	No relevant effect to noise.
Prime Farmlands	Yes	Prime farmlands occur in the project area and could be affected by the project.
Public Safety	No	The proposed action would not affect public safety.

<b>Resource</b>	<b>Relevant to the proposed action (Yes/No)</b>	<b>Justification</b>
Recreation	Yes	The proposed action could beneficially affect recreation.
Regional Water Resource Plans	Yes	The proposed action considers altering the management of regional water resources.
Riparian Areas and Wetlands	Yes	Wetlands and riparian areas could be affected by project construction activities or changes in water levels.
Scenic Beauty and Visual Resources	No	Visual resources in the project area would not be affected by the project.
Scientific Resources	No	Scientific resources would not be affected by the project.
Soils	Yes	Construction of the project could affect soils in the project area.
Socioeconomics	Yes	The proposed action involves an expenditure of public funds that could affect the local and regional economy. An evaluation of the effects of providing NRCS funding is included.
Sole Source Aquifers	No	No sole-source aquifers are present in or near the project area (EPA 2020).
Water: Groundwater Quantity, Aquifer Recharge	Yes	Construction and operation of the project could affect aquifer recharge in the planning area.
Water: Surface Water Quality	Yes	Operation of the project could improve surface water quality of waterbodies and the KSD in the planning area.
Water: Surface Water Quantity	Yes	Operation of the project could improve surface water quantity available for District operations and for delivery to patrons and the LKNWR through recirculation of irrigation water.
Waters of the United States, including special aquatic sites	Yes	Construction and operation of the project could affect waters of the United States.
Wild and Scenic River	No	No Wild and Scenic Rivers or Nationwide Rivers Inventory-listed segments occur within the proposed project area.
National Economic Development (NED)	Yes	An NED analysis has been completed as required by PR&G Interagency Guidelines.

BMP = best management practice; DEQ = Oregon Department of Environmental Quality; EFH = essential fish habitat; ESA = Endangered Species Act; KSD = Klamath Strait Drain; LKNWR = Lower Klamath National Wildlife Refuge; NED = National Economic Development; SHPO = State Historic Preservation Office; NHPA = National Historic Preservation Act; NRCS = Natural Resources Conservation Service; PR&G = Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies.

## 4 Affected Environment

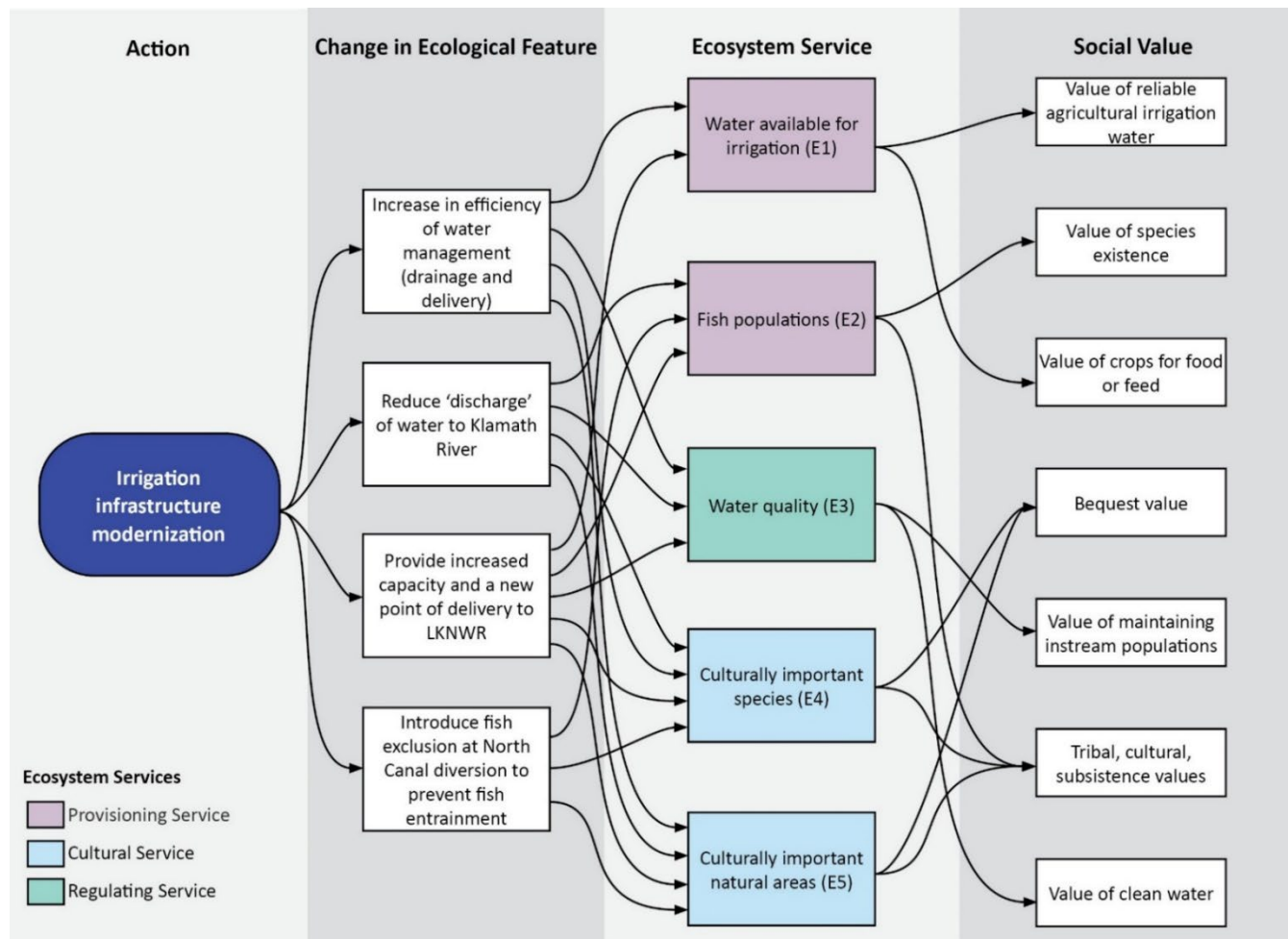
The following sections describe the existing ecological, physical, biological, economic, and social resources of the project area and planning area. The project area is defined in Section 1.2. Per requirements of the PR&Gs, this Plan-EA describes the ecosystem services associated with each resource, where applicable. For this Plan-EA, those resources include land use (Section 4.2), water resources (Section 4.6), fish and aquatic resources (Section 4.7), and wetlands and riparian areas (Section 4.8).

Ecosystem services refer to the benefits that people and their communities derive from the natural environment in which they live. Availability of water for consumption, pollination of crops, 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 would enhance, sustain, or degrade the benefits that nature provides (USDA 2017; 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 (EEA 2019).

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

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 and that provide 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 provides a baseline for 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 2017).



Note: 1) E1 through E5 refer to ecosystem services 1 through 5. These services are referenced and explained in more detail throughout Section 4, Affected Environment, and Section 6, Environmental Consequences.  
2) Ecosystem services concept diagram developed by FCA.

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

The affected environment section considers resource-specific effects at various scales. As described in Sections 1.1 and 1.2, the following analysis area terms are typically used in this section to define scales at which the potential for effects from various project elements may occur (Figure 1-2).

- Planning area – All lands serviced by the District that may be affected by infrastructure improvements, including the following:
  - District boundary – All private farmland and federally leased lands within the drainage district.
  - LKNWR lands – All lands within the LKNWR south of the District.
  - Areas where infrastructure or irrigated lands lie outside of the district boundary.

Some analyses within this section may have been conducted within a geography that extends outside of the planning area, including affected waterbodies (Figure 4-3).

- Project area – Areas within the planning area where the KDD Infrastructure Modernization Project would occur within the District’s total system. The project area consists of the District infrastructure to be modernized, areas where new infrastructure would be built, and associated ROW or easements where construction would take place. The project area is 267.6 acres.

## 4.1 Cultural Resources

NEPA requires federal agencies to consider the effects of federally funded projects on cultural resources (40 CFR 1508.1(g)(4)). While NEPA does not define cultural resources, the term is understood to include “historic properties” as defined by Section 106 of the National Historic Preservation Act (NHPA), as well as sacred sites, archaeological sites not eligible for the National Register of Historic Places (NRHP), and archaeological collections (CEQ Executive Office of the President and Advisory Council on Historic Preservation and Advisory Council on Historic Preservation 2013). Under Section 106 of the NHPA, historic properties are defined as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the NRHP, including artifacts, records, and material remains related to such a property or resource” (36 CFR 800.16(l)(1)). Consideration of historic properties under Section 106 supports NEPA consideration of effects on cultural resources but does not encompass all types of cultural resources under NEPA.

The study area for cultural resources consists of the APE that has been delineated to support consultation with regulatory agencies. This area includes sites where ground-disturbing work would occur under the proposed action, adjacent areas, and construction staging and access areas. See Appendix E.2 for detailed information about the ethnographic and historic context of the District, previous cultural resources investigations that have been conducted in and near the study area, known cultural resources in and near the study area, and the methods and findings of cultural resources investigations conducted for this project.

Analysts reviewed data from the Oregon Archaeological Records Remote Access database to identify previously conducted cultural resource surveys and records of cultural resource records in and near the study area. Nineteen previously conducted cultural resource surveys have been conducted that overlap with or are within 0.5 miles of the APE. Of these 19 surveys, five partially overlap with the APE, while the remaining 14 surveys are located within 0.5 miles of the APE. One cultural resource was identified in the APE, which was designated an NHL in 1965 and listed in the

NRHP in 1966. Additionally, nine cultural resources (eight archaeological resources and one historic built environment resource) were identified within 0.5 mile (Appendix E.2).

Between October 30 and November 1, 2023, Parametrix archaeologists and architectural historians performed cultural resources surveys of the APE.

Pedestrian survey of the entire APE was conducted and a total of 15 shovel probes were excavated within the APE where both subsurface ground disturbance outside of the existing irrigation canals and laterals is proposed. The surveys identified two previously undocumented archaeology sites (temporary designations KL-1 and KL-2) and one subsurface archaeological isolate (temporary designation KL-ISO-01).

Historic built environment survey identified 22 components of KDD infrastructure, including nine specific linear resources, five specific structures, and eight collective categories of irrigation and transportation-related features. These 22 components Klamath Drainage District were evaluated collectively as a potential historic district, the Klamath Drainage District Irrigation System Historic District. While KDD's 22 components are not considered individually eligible for listing in the NRHP, the 22 components were also evaluated collectively as a potential historic district, the Klamath Drainage District Irrigation System Historic District. The Klamath Drainage District Irrigation System Historic District is recommended Eligible for listing in the NRHP under Criterion A and C, with Criteria Consideration G applied. Fifteen of the 22 documented components of KDD are recommended Eligible for listing in the NRHP as contributors to the Klamath Drainage District Irrigation System Historic District, the remaining seven components are recommended Not Eligible as contributors to the historic district. Additionally, the APE overlaps with the boundaries of the Lower Klamath National Wildlife Refuge, which is designated as an NHL and listed in the NRHP. NRCS will recommend a finding of No Adverse Effect, for both the Klamath Drainage District Irrigation System Historic District and the Lower Klamath National Wildlife Refuge NHL.

The Cultural Resource Identification Report has been reviewed by both NRCS, as Lead Agency, and Bureau of Reclamation as of October 2, 2024, and the report is being finalized by the CR contractor. NRCS plans to share the final report with the two state SHPO offices and the six tribes with whom we have initiated consultation.

## **4.2 Land Use**

The land use study area consists of all lands within the planning area.

### **4.2.1 Ecosystem Services**

Lands receiving water from the District provide the following ecosystem services:

*Provisioning service, Water available for irrigation (see Figure 4-1, [E1]).* Agricultural land receiving water from District infrastructure provides provisioning ecosystem services. Irrigated agriculture was introduced to the Klamath Basin in 1882 with the incorporation of the Linkville Water Ditch Company, and by 1903 approximately 13,000 acres were irrigated. Agricultural use of land became an even more important industry in the area as logging activities closed in 1928 due to drought (FCA 2019a). Water for irrigation via the Klamath Project was one of Reclamation's first projects, beginning in 1906 and providing water for many irrigation districts in the area that support the ecosystem services of providing food and crops. As described in Section 5.3.2, water is diverted from the Klamath River and delivered to patrons in the planning area including the LKNWR. This water allows for the cultivation of crops including alfalfa, hay, and forage which supports the

production of livestock for meat and dairy purposes, as well as wheat, barley, potatoes, and other crops for human consumption.

*Cultural service, Culturally important natural areas (see Figure 4-1, [E5]).* The LKNWR receiving water from District infrastructure provides cultural ecosystem services. The LKNWR has been affected by recent water shortages which have limited water deliveries to the LKNWR, the nation's first waterfowl refuge and home to many colonial nesting water birds and other sensitive species. The refuge provides outstanding opportunities for visitors to observe waterfowl and other birds as one of the most biologically productive refuges within the Pacific Flyway that experiences peak waterfowl populations reaching 1.8 million birds (USFWS 2022a). Due to limited water supply to the LKNWR, wetland acres have declined by about 47 percent since 2012 (Donnelly et al. 2020). This is an important cultural resource for wildlife observation, education, and research providing culturally important services.

#### 4.2.2 Land Ownership

Land ownership within the planning area varies, with ownership divided among KDD, private landowners, the State of Oregon, and the federal government (USFWS and Reclamation) (Figure 4-2).

KDD owns approximately 1,000 acres of land within the planning area including Miller Lake and several smaller parcels. USFWS owns the entirety of the LKNWR, including the Area K lands in Oregon (for more information on Area K, see footnote 3 in Section 1.3). Approximately 15 private landowners own property within the planning area (KDD 2022).

Additional publicly owned land in the vicinity of the planning area includes the 1,150-acre Klamath Hills Recreation Area located east of the planning area. The recreation area is owned by the Bureau of Land Management.

Infrastructure ownership associated with the project area or infrastructure affected by the project area is outlined in Table 4-1.

**Table 4-1. Infrastructure Ownership in Project Area and Lands Affected by the Project Area.**

Existing Infrastructure/Areas	Owner	Operations and Maintenance Responsible Party	Existing Easement Owned By
North Canal	Privately owned	Klamath Drainage District	Klamath Drainage District
E and F Pumping Plants	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation <sup>1</sup>	U.S. Bureau of Reclamation
E/EE and F/FF Pumping Plants	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation; U.S. Fish and Wildlife Service <sup>2</sup>	U.S. Bureau of Reclamation
Center Canal	Privately owned	Klamath Drainage District	Klamath Drainage District
P-1 Lateral	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service

Lower Klamath National Wildlife Refuge	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service	N/A
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Notes:

<sup>1</sup> KDD is currently responsible for approximately 60 percent of O&M at the E and F pumping plants. The District is pursuing negotiations with Reclamation to take over full (100 percent) O&M responsibility for these pumps as a parallel effort to this project.

<sup>2</sup> USFWS is responsible for paying a small percentage of the O&M at the E/EE and F/FF pumping plants.

The project area crosses both publicly and privately owned land. Easements exist for most of the project area, with the exception of two sections. One section of the project area without an easement is approximately 1.3 miles of an existing access road north of the North Canal intake. The road is approximately 1.4 miles long and has been used by the District, but there is not a formal easement. The road crosses land owned by the State of Oregon (approximately 0.2 miles) and a private landowner (approximately 1.1 miles). The other section of the project area without an easement is the 105-foot crossing of California State Highway (CSH) 161, extending from the south end of the existing North Canal to the north end of the P-1 Lateral.

The District's existing easements for the rest of the project area primarily cross land that is privately owned, with small areas owned by Reclamation.

#### 4.2.3 Land Use

Land use within the planning area primarily consists of agricultural uses and wildlife habitat. Crops grown within KDD boundaries include cereals (wheat, barley, and oats), forage (alfalfa, hay, and irrigated pasture), and potatoes (Table 4-2). In recent years, there has been a transition away from grains toward potatoes and other row crops (KDD 2022). The LKNWR supports agricultural uses as well as fish and wildlife habitat, with approximately 47 percent of refuge lands in wetlands, 38 percent in rangelands/pasture, and 15 percent in croplands. Crops grown on LKNWR lands consist of grass hay and small grain, primarily barley (USFWS 2016).

**Table 4-2. Crops Grown in Klamath Drainage District.**

Crop	Total Acreage	Percentage Acreage
Cereals (wheat, barley, oats)	9,194	59.3%
Forage (alfalfa, hay, irrigated pasture)	5,313	34.3%
Vegetables (potatoes)	990	6.4%
<b>Total</b>	<b>15,497</b>	<b>100%</b>

Source: U.S. Department of the Interior, Bureau of Reclamation. Crop and Water Data Year 2019 (FCA 2019b). Form 7-2045.

The LKNWR is 50,092 acres in size, including 6,253 acres of Area K lands in the District boundary. The refuge was established in 1908 as the nation's first waterfowl refuge. The refuge provides habitat for many species of migrating birds as they pass through the Klamath Basin during spring and fall migrations. KDD delivers water to the refuge via Ady Canal and provides drainage via the KSD, when necessary.

The LKNWR supports many recreational uses including hunting, birdwatching and wildlife viewing, photography, hiking, canoeing, and an auto tour route. The refuge also hosts educational programs for school groups, summer camps, and youth groups (USFWS 2022). Outside of the refuge, land



within the District boundary is also used for birdwatching and photography. Greg Austin, Klamath Basin National Wildlife Refuge Complex Manager, has noted that visitation numbers and activities are negatively impacted by lack of water in the refuge (Austin 2022).

Additional recreational uses adjacent to the planning area include a gravel boat ramp near the North Canal intake. This boat ramp and the North Canal intake are used by the Tule Smoke Hunt Club to access the Klamath River and adjacent wetlands for hunting.

Irrigation and drainage infrastructure uses in the planning area consist of 30 miles of canals and laterals, 220 miles of drains, and their associated ROW. Additional infrastructure present in the planning area includes pumping stations, culverts, gates, measurement stations, and more. Most of this infrastructure is owned and operated by KDD, except for infrastructure serving the KSD, which is owned by Reclamation (KDD 2015).

A portion of the unincorporated community of Worden, Oregon, is located within the planning area, north of Miller Lake. Land uses in this area include commercial, agriculture, a small number of residential uses: single-family dwellings and at a density typical for rural residential.

Outside of Worden, there are few structures present in the planning area. There are several agricultural buildings, greenhouses, and accessory buildings located along Lower Klamath Lake Road, including Liskey Ranch. Many of these properties access agricultural lands to the west via driveways crossing over KDD canals.

Land in the planning area is zoned primarily for agricultural use. Oregon Statewide Land Use Goal 3 protects agricultural land in the state by requiring counties to identify farmland and zone it for exclusive farm use. Within Klamath County, most of the land is zoned Exclusive Farm Use Cropland/Grazing (EFU-CG), intended to protect and maintain agricultural lands for farm use, consistent with existing and future needs for agricultural products. USFWS-owned lands within the KDD boundary are zoned Open Space and Conservation (OS&C), intended to protect designated areas of scenic and natural resources (Klamath County 2022). Three parcels in Worden are zoned Transportation Commercial (CT), intended to establish and maintain places for sales and services primarily related to transportation and utility industries.

The area within Siskiyou County is zoned Prime Agricultural District (AG-1), intended for areas which are used or suitable for use for intensive agricultural production, and Non-Prime Agricultural District/Combining Zone (AG-2-B-40), intended for areas where general agricultural and agriculturally related activities can occur, with a minimum parcel size of 40 acres (Siskiyou County 2022).

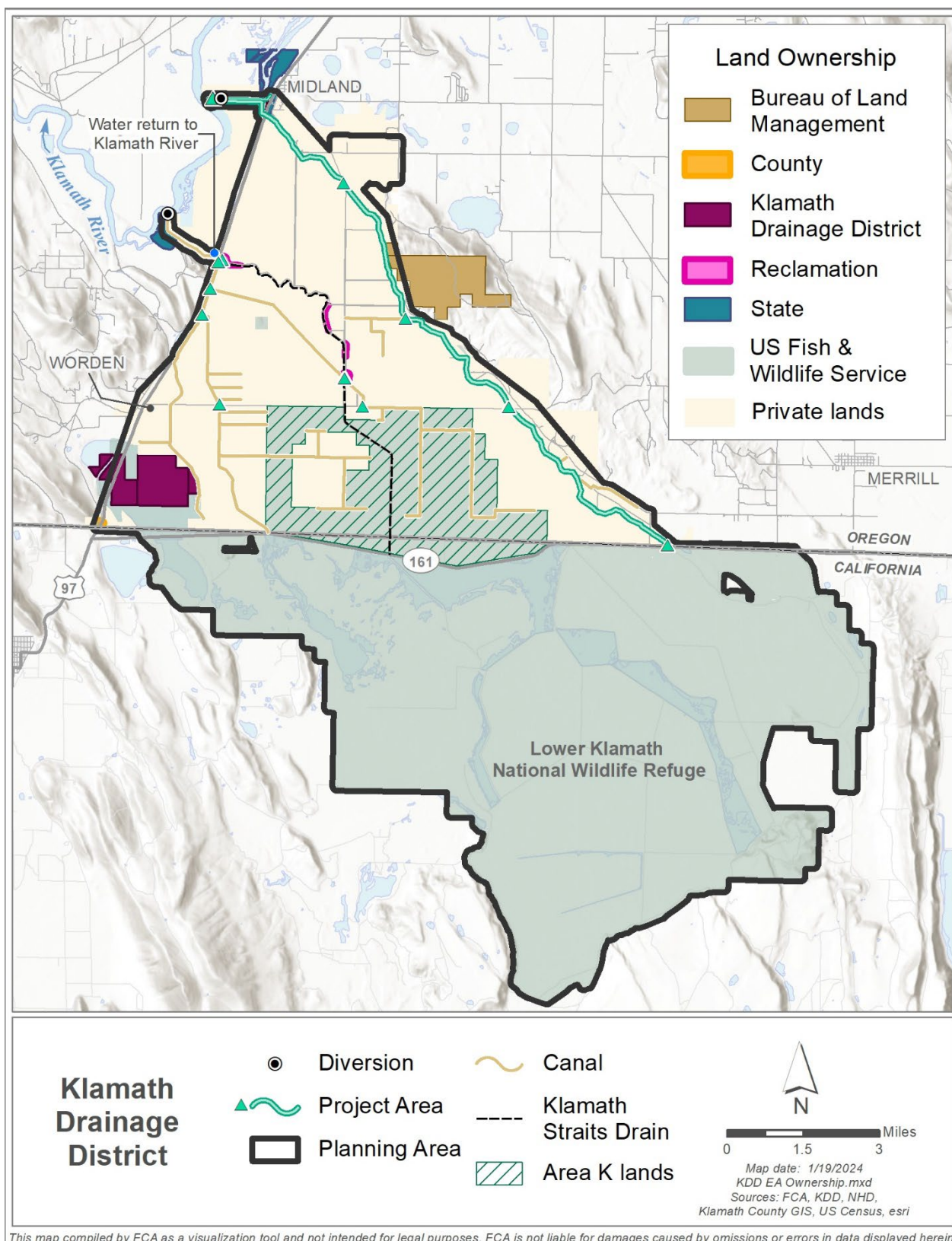


Figure 4-2. Property ownership in the planning area.

### 4.3 Socioeconomic Resources

This section describes the socioeconomic conditions for the areas associated with the proposed action, which include Klamath County, the city of Klamath Falls, and city of Altamont in Oregon and Siskiyou County in California.

#### 4.3.1 Population

Table 4-3 shows the population characteristics of Klamath County, Siskiyou County, the City of Altamont, the City of Klamath Falls, and the census tracts<sup>8</sup> that intersect the planning area. Klamath County and Siskiyou County have both experienced a slight growth in population from 2015 to 2020. Altamont lost population between 2015 and 2020, while Klamath Falls has grown during the same time. The census tracts that intersect the planning area reflect the population near the KDD boundary. The census tracts decreased in population between 2015 and 2020.

**Table 4-3. Population Characteristics.**

Area	Population 2015	Population 2020	Percentage Change 2015 to 2020
Klamath County (Oregon)	65,972	69,413	+5.2%
Siskiyou County (California)	43,895	44,076	+0.4%
Census Tracts	6,241	6,092	-2.4%
Altamont (Oregon)	19,502	18,982	-2.7%
Klamath Falls (Oregon)	21,261	21,509	+1.2%
Census Tracts	6,241	6,092	-2.4%

Source: U.S. Census Bureau (2020).

#### 4.3.2 Area Employment and Income

Klamath and Siskiyou counties have both a lower labor force participation rate and higher unemployment rate than their resident states (Table 4-4). Agriculture, forestry, fishing and hunting, and mining workers make up 5.9 percent of Klamath County's labor force and 10 percent of Siskiyou County's labor force (U.S. Census Bureau 2020).

**Table 4-4. Labor Force Characteristics.**

Indicator	Klamath County	Siskiyou County	Oregon	California
Labor Force Participation Rate	69.5%	69.2%	77.9%	77.3%
Employed	63.3%	63.9%	73.9%	72.3%

<sup>8</sup> The census tracts that intersect the planning area include Census Tracts 9707 and 9708 in Klamath County, Oregon, and Census Tract 2 in Siskiyou County, California.

Indicator	Klamath County	Siskiyou County	Oregon	California
Unemployment Rate	7.0%	7.6%	5.0%	5.8%

Source: U.S. Census Bureau (2020).

Median household income and poverty rate are summarized in Table 4-5. Median income in Klamath County is below that of the State of Oregon. Income in Siskiyou County is lower than both the State of California and Klamath County. The poverty rate in Klamath County is higher than in the State of Oregon and the poverty rate in Siskiyou County is higher than that in the State of California.

**Table 4-5. Income and Poverty.**

Indicator	Klamath County	Siskiyou County	Oregon	California
Median Household Income	\$48,560	\$47,403	\$65,667	\$78,672
Poverty Rate	19.6%	16.9%	12.4%	12.6%

Source: U.S. Census Bureau (2020).

### 4.3.3 Environmental Justice Communities

Approximately 25 percent of the population of Klamath County identifies as a minority, less than that of the State of Oregon. Approximately 27 percent of the population of Siskiyou County identifies as a minority, less than that of the State of California. Approximately 43 percent of households in Klamath County and 40 percent of households in Siskiyou County are low income, a higher percentage than each of their respective states. See Appendix E.4 for more information on environmental justice communities.

## 4.4 Soils

The predominant soil unit in the planning area is Capjac silt loam, 0 to 1 percent slopes (29 percent). These soils are poorly drained and formed from deposits derived from volcanic rock. Other common soil types in the planning area include Tulana silt loam (15 percent), Lamath silt loam, 0 to 1 percent slopes (15 percent), and Algoma silt loam (9 percent) (NRCS 2022b). These soils are on the hydric soils list for Klamath County.

There are 19 soil types within the project area; the following 5 comprise the majority of the project area: Teeters silt loam (21 percent); Sherrard clay loam (16 percent); Tulana silt loam (15 percent); Algoma silt loam (13 percent); and Calimus loam (13 percent). Sherrard clay loam, Tulana silt loam, and Teeters silt loam are on the hydric soils list for Klamath County. The remaining soil types, not listed here, make up less than 10 percent of the project area each (NRCS 2022a).

### 4.4.1 Farmland Classification

NRCS developed farmland classifications for soil groups that are associated with a particular soil type and a soil's rating for agricultural commodity production (NRCS 2022b). NRCS farmland classifications within the project area are 66 percent farmland of statewide importance, 15 percent prime farmland if irrigated and drained, 14 percent prime farmland if irrigated, and 6 percent not prime farmland (NRCS 2022a).

## 4.5 Vegetation

### 4.5.1 General Vegetation

Common vegetation types found within the northern half of the planning area include pastures or hay fields, cultivated crops, and weedy species including Russian thistle (*Salsola tragus*), cheatgrass (*Bromus tectorum*), Russian olive (*Elaeagnus angustifolia*), and other nonnative plants. Typical vegetation types in the southern half of the planning area include wetlands, few agricultural fields, and weedy areas. Wetlands, marshes, and open waters are present along the Klamath River.

Crop species planted within the agricultural portions of the planning area include grains, garlic, potatoes, peas, carrots, alfalfa, and pasture grasses. Scattered western juniper (*Juniperus occidentalis*), big sagebrush (*Artemisia tridentata*), rubber rabbitbrush (*Chrysothamnus nauseosus*), and other plant species commonly found in the arid Oregon steppe environment are present in small fragmented areas along undeveloped roadsides, railroad berms and canal berms, and in hillsides in the northern portion of the planning area.

Emergent herbaceous wetlands interspersed with open water occur along the lakes, ponds, and perennial and ephemeral canals, and consist of Russian olive, reed canary grass (*Phalaris arundinacea*), yellow flag iris (*Iris pseudacorus*), and other hydrophytic (water-loving) plants. Aquatic vegetation within the canals and laterals consists of coon's tail (*Ceratophyllum demersum*) and a few other algae species. Aquatic moss is abundant. The District maintains and controls vegetation within the canals and removes aquatic vegetation.

Plant species found or likely to be found within the planning area are described in Appendix E.6.

### 4.5.2 Special Status Plant Species

A list of species protected under the federal Endangered Species Act (ESA), Oregon State Law (ORS<sup>9</sup> 496.171-496.192), or California Endangered Species Act (§ 2050 Added by Stats.1984, c. 1240, § 2.) that may be potentially present within the planning area was compiled using the Information for Planning and Consultation (IPaC) resource list (USFWS 2024), Oregon Biodiversity Information Center (ORBIC) data report (ORBIC 2022), Oregon Department of Agriculture website (ODA 2022), and California Natural Diversity Database (CDFW 2022). A survey for species' presence and presence of suitable habitat was not conducted; the presence of suitable habitat was evaluated during a site visit in May 2022 (KDD 2022).

One federally listed endangered plant, Applegate's milkvetch (*Astragalus applegatei*), may occur in the planning area (USFWS 2022; ORBIC 2022). Additionally, Oregon-listed threatened Peck's milkvetch (*Astragalus peckii*) and Oregon-listed threatened pumice grape-fern (*Botrychium pumicola*) may occur in Klamath County and in the planning area. The California Natural Diversity Database does not list any California-listed threatened, endangered, or special status plant species as occurring in the planning area.

Applegate's milkvetch is a narrow endemic plant restricted to the Lower Klamath Basin of southern Oregon, near the city of Klamath Falls. Applegate's milkvetch occurs in seasonally moist alkaline soils in meadows and along wayside ditches at approximately 4,100 feet in elevation. Applegate's milkvetch frequently occurs with rubber rabbitbrush, yellow rabbitbrush, greasewood, squirreltail, saltgrass, common yarrow, and mountain rush, but it can also grow with various weeds such as quackgrass, prickly lettuce, rye brome, mouse barley, and many more. It has been found both in

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<sup>9</sup> Oregon Revised Statute

undisturbed sagebrush habitat and on roadsides, berms, and along irrigation canals. ORBIC records indicate that Applegate's milkvetch occurs to the west and east of U.S. 97 in the southwest corner of the District. This area, especially Miller Lake and its surrounding area, appears to provide suitable habitat; therefore, Applegate's milkvetch is likely present in the planning area.

Peck's milkvetch usually grows in natural openings of sagebrush-juniper woodlands, lodgepole pine forests, and ponderosa pine forests. There is no suitable habitat within the planning area, and therefore, Peck's milkvetch was determined to be absent from the planning area.

Pumice grape-fern inhabits loose volcanic soils, which range from fine to coarse in texture. It occurs in two main habitat types—alpine and montane—at elevations ranging from 4,240 to 9,065 feet. There is no suitable habitat for pumice grape-fern within the planning area, and therefore this species was determined to be absent from the planning area.

#### **4.5.3 Common and Noxious Weeds**

Common upland weeds are abundant in the planning area. Among the common weeds are wild rye (*Secale cereale*), tall tumble mustard (*Sisymbrium altissimum*), jointed goatgrass (*Aegilops cylindrica*), and other annuals.

Noxious weeds are also present. The spread of noxious weeds is regulated at the county and state levels. The Klamath County Weed Control program in Oregon is dedicated to protecting public and private lands, agriculture, forestry, human health and wildlife from the negative impacts of noxious weeds. The Klamath County Weed Control program performs the County's required duties under ORS 569.355 to control noxious weeds.

The California Department of Food and Agriculture (2021) reviews potential invasive weeds, and if a weed poses a substantial threat to the state's agriculture and environment, proposes to add them to Section 4500 of the Food and Agricultural Code as a noxious weed species.

Appendix E.6 lists the noxious weeds, and their corresponding rating, known to occur in the project area and across the planning area (iMapInvasives 2022; CalIPC 2022; KDD 2022).

### **4.6 Water Resources**

All irrigation water for KDD is diverted from the Klamath River. Irrigation water is sourced from both surface water flow and stored water. KDD generally relies on the surface water flow of the Klamath River, but when these flows are not available, the District draws on releases of stored water in Upper Klamath Lake. Groundwater is not used for irrigation in the planning area. KDD is a drainage district, and as such, its canals are predominantly level to allow water to flow in both directions. Due to high groundwater levels, an extensive drainage system throughout the District exists to lower the water table sufficiently to grow crops in the summer months. Surface water quality within the planning area includes impaired waterbody conditions on the Klamath River from Keno Dam to Upper Klamath Lake (Lake Ewauna; RM 241 to RM 253) and in the KSD from the Klamath River (RM 241) to the Oregon-California border due to exceedances of Oregon water quality standards for temperature, dissolved oxygen, pH, chlorophyll a, and ammonia and in the LKNWR due to high pH levels. The following section discusses water used for District operations, surface water hydrology, surface water quality, and groundwater potentially affected by the proposed action.

#### **4.6.1 Ecosystem Services**

Water associated with the Klamath River, either flowing through the river or flowing through part of the District system, provides the following ecosystem services.

*Provisioning service, Water available for irrigation (Figure 4-1, [E1]):* Agricultural land receiving water from District infrastructure provides provisioning ecosystem services. Irrigated agriculture was introduced to the Klamath Basin in 1882 with the incorporation of the Linkville Water Ditch Company, and by 1903 approximately 13,000 acres were irrigated. Agricultural use of land became an even more important industry in the area as logging activities closed in 1928 due to drought (FCA 2019a). Water for irrigation via the Klamath Project was one of Reclamation's first projects, beginning in 1906 and providing water for many irrigation districts in the area that support the ecosystem services of providing food and crops. As described in Section 5.3.2 and Section 4.2.1, water from the Klamath River is diverted into the KDD irrigation system and delivered to properties within the district for agricultural purposes, including the production of crops and livestock.

*Regulating service, Water quality (Figure 4-1, [E3]):* The quality of water flowing within District infrastructure and within the Klamath River is a regulating ecosystem service important to protecting public health, habitat for fish, and the quality of irrigation water. Section 4.6.4 provides details of existing water quality within the planning area. Water within KDD canal and drainage infrastructure influences water quality within both the LKNWR and the Klamath River. The amount of water traveling through the irrigation and drainage systems can impact water quality. Lower water flows tend to warm water faster and can cause water to become warmer than surrounding waterbodies. Drainage water returned to the Klamath River via the KSD is currently identified as a source of pollution within the Klamath River.

*Cultural service: Culturally important natural areas (Figure 4-1, [E5]):* The LKNWR receiving water from District infrastructure provides support to LKNWR as a culturally important natural area providing a cultural ecosystem service. Recent water shortages have limited water deliveries to the LKNWR. Please see Section 4.2.1 for a full description of the cultural service provided by the LKNWR. Surface water management and the water provided to the LKNWR supports refuge operations and therefore the cultural value of the refuge itself.

#### **4.6.2 Water Rights and Operations**

##### **4.6.2.1 Klamath Drainage District**

KDD delivers water to approximately 26,250 acres of farmland owned by approximately 15 landowners within the District's boundary and to additional lands on the LKNWR through roughly 30 miles of irrigation canals, 121 gated turnouts from canals and laterals, and 55 lift pumps. Of the 26,250 acres, 6,253 acres are known as Area K; these lands were never allowed to be homesteaded, and they have remained the property of the United States (see Figure 4-2). The United States leases a portion of these lands to private landowners for farming and ranching and retains most water rights for LKNWR wildlife management activities. KDD has an agreement with USFWS to deliver water to the LKNWR in California and a contract with Reclamation for its Area K lands stating that Reclamation will be treated like every other landowner.

The KSD, located within the District, collects the majority of the tailwater from all of the Klamath Project districts. Tailwater from the Klamath Project districts upstream in the system flows south into the TLNWR. The tailwater is then pumped out of the TLNWR, through Sheepy Ridge in California, and into the LKNWR. Excess water is returned to the Klamath River through KDD via the KSD and to two lift stations. These pumping plants, E/EE and F/FF, lift excess water and

discharge it to the Klamath River (KDD 2015). KDD generally relies on Klamath River flows, but when these flows are not available, the District draws on releases of the stored water in Upper Klamath Lake made available through the Klamath Project.

KDD initially entered a contract with Reclamation in 1917. This 1917 contract was superseded by the District's 1921, 1929, 1940, 1943 and 1947 contracts with Reclamation (Contract No. I1r-402). KDD's 1921 contract with Reclamation entitles the District to water made available by the Klamath Project, including water stored in Upper Klamath Lake. The 1921 contract and subsequent contracts make water available to KDD for agricultural use to the extent that water is available. The contracts do not specify an annual entitlement to the water; the only limitation is the amount that can be beneficially used to irrigate 27,500 acres of land during the irrigation season, which runs from March 1 to September 30. When requested by the District, and when approved by the United States, the District is also entitled under the 1943 contract to water delivery during the winter irrigation season, or from October 1 to February 28/29. These deliveries include reasonable allowances for losses due to evaporation, seepage, and other causes.

The Klamath Basin Adjudication (KBA) is the legal process in which water rights vested before adoption of Oregon's water code in 1909 are established through a proceeding in the Klamath County Circuit Court. The Oregon Water Resources Department (OWRD) managed the initial phases of this process and issued a Final Order of Determination on March 7, 2013. The Circuit Court is responsible for resolution of exceptions and issuance of the water right decree. The District was awarded certain water rights in the KBA, or the Amended and Corrected Findings of Fact and Order of Determination. The District participated in the KBA as a member of the Klamath Project Water Users (KPWU) Joint Prosecution. KPWU filed consolidated claims, and specifically KDD was awarded water rights under Claim 321-1 (KA 1002 in the Oregon Water Rights Information System [WRIS]) to live flow for natural irrigation of 117.3 acres from March 1 through July 15 with an 1883 priority; Claim 321-17/293/323-3 (KA 1000 in WRIS) for a project wide water right for 570,100 acre-feet of live flow for irrigation, stock water, and domestic use on 154,955.9 acres, with a 1905 priority date.

In addition to the adjudicated water rights and KDD's federal contracts for delivery, the District also holds an Oregon State appropriated water right, Permit 43334 (Application 55748), which entitles KDD to 480.46 cubic feet per second (cfs) for beneficial use to be used on 19,234.3 acres of land lying within the boundaries of the District, excluding the Area K lands. Permit 43334 limits KDD to 1 cfs per 40 acres or the equivalent of 3 acre-feet per acre from March 1 through September 30. Permit 43334 also authorizes KDD to divert 1 acre-foot per acre from October 1 to March 1 for winter irrigation. Table 4-6 and Table 4-7 summarize KDD water rights associated with the planning area.

KDD has agreed to provide water to the Klamath Hills District Improvement Company (KHDIC) and the Midland District Improvement Company (MDIC) under those companies' respective water rights and/or water contracts (see Appendix E.7). KDD does not supply water to those districts from its allocation. The agreements are merely carrying agreements to use KDD's facilities. Water is lifted from the North Canal to MDIC lands through four pumps and to KHDIC through over 30 pumps.

Although points of diversion along North Canal do not have measurement devices installed on them, water quantity can be closely estimated based upon the pump output rating and the time it is operating. MDIC is relatively small and provides water to 565 acres of land comprised of five water users. KHDIC is located on the uphill lands east of KDD. These lands were not originally covered



under a federal contract to receive project water. These lands later formed KHDIC to execute a contract with Reclamation, under which KDD has agreed to supply the water. The lands of KHDIC served by KDD are 955 acres and are comprised of 10 water users.

**Table 4-6. District Water Rights Associated with the Planning Area.**

<b>Certificate</b>	<b>Source</b>	<b>Priority Date</b>	<b>Uses</b>	<b>Start Date</b>	<b>End Date</b>	<b>Max Diversion Rates (cfs)</b>	<b>Acreage and/or Duty</b>
Claim 321-1 (KA 1002)	Klamath River	2/1/1883	Irrigation	3/1	7/15	2.93	117.3 acres
Claim 321-17/293/323-3 (KA 1000) [Klamath Basin Project-wide water right]	Klamath River	5/19/1905	Irrigation, stockwater, domestic use	N/A	N/A	N/A	570,100 acre-feet across 154,955.9 acres
Contract No. I1r-402	Klamath River	8/24/1921	Irrigation	3/1	9/30	N/A	27,500 acres
Contract No. I1r-402	Klamath River	1943	Irrigation	10/1	2/28(29)	N/A	N/A
Permit 43334 (Application 55748)	Klamath River	4/25/1977	Irrigation (excludes Area K)	3/1	9/30	480.46	3 acre-feet/acre
Permit 43334 (Application 55748)	Klamath River	4/25/1977	Irrigation (excludes Area K)	10/1	2/28(29)	480.46	1 acre-foot/acre (not to exceed 3 acre-feet per acre per year)

cfs = cubic feet per second; N/A = Not Applicable

#### 4.6.2.2 Lower Klamath National Wildlife Refuge

The LKNWR receives water from the Klamath River and Upper Klamath Lake. USFWS owns the water rights on the LKNWR for wildlife use. The water rights claims (KA 312 [not year-round] and KA 313, 314, 315, and 316), which have a year-round period of use on 16,000 acres for a total of 49,902 acre-feet of water based on the TLNWR 1905 project water right. In 1997, USFWS filed two sets of claims in the adjudication, including irrigation claims for a 1905 priority date and federal reserved claims based on the dates in which the refuges were established. To provide a complete matrix of permanent wetlands, seasonal wetlands, uplands, and agricultural habitats, the LKNWR requires a minimum of 108,229 acre-feet of water on a yearly basis, not including Area K which requires an additional 19,000 acre-feet per year (USFWS 2016). In addition to water quantity, the timing of water delivery is critically important to fully meet habitat needs of wildlife, including for nesting and migrating birds in the spring through fall.

USFWS claimed 75,000 acre-feet on 25,000 acres for the LKNWR as part of the KBA process. In March 2013, OWRD released its Final Order of Determination (FOD). In the FOD, USFWS received Klamath Reclamation Project water rights with a 1905 priority date (Claim KA 312) for irrigation uses for the leased and cooperative farmlands on both refuges, totaling nearly 85,000 acre-feet, and federal reserved rights with a priority date of 1925, including for the LKNWR (108,229 acre-feet). Additional federal reserved water right claims for later dates and smaller quantities were also awarded (Claims KA 313 through 316). The refuges' Klamath Reclamation Project water rights are overlapped by a portion of the federal reserved water right; however, the quantities provided for the two claim types are not additive. In March 2014, the parties to the adjudication had the opportunity to file exceptions (objections) to the FOD in Klamath County Circuit Court. In the interim, until the Circuit Court issues a final decree, the FOD is enforceable. For the first time, all water rights in the Klamath Basin are subject to enforcement. Prior to issuance of the FOD, the adjudication claims were not subject to enforcement, but permitted or certificated water rights were. USFWS and Reclamation continue to work toward a common understanding of the within-project priority for irrigated lands on the LKNWR that is consistent with both Reclamation's water delivery contracts and the Klamath Project Operations 2013 Biological Opinion (NOAA NMFS and USFWS 2013).

USFWS is actively seeking water transfers that could allow for additional water deliveries. One water right transfer in progress would allocate about 3,500 acre-feet from the Wood River Valley to the refuge (the North Canal Diversion is listed as the secondary diversion point); however, the LKNWR is developing a consumptive use analysis prior to approval of the transfer.

**Table 4-7. District Water Rights Associated with the Lower Klamath National Wildlife Refuge.**

<b>Certificate</b>	<b>Source</b>	<b>Priority Date</b>	<b>Uses</b>	<b>Start Date</b>	<b>End Date</b>	<b>Acres</b>	<b>Max Diversion Rate (acre-feet per year)</b>
Claim 312	Klamath River	5/19/1905	Irrigation	1/1	11/15	25,881.7	35,000
Claim KA 313	Upper Klamath Lake, Klamath River	12/31/1925	Wildlife	1/1	12/31	27,057.35	108,229.4
Claim KA 314	Upper Klamath Lake, Klamath River	9/2/1964	Wildlife	1/1	12/31	1,226.7	3,680.1
Claim KA 315	Upper Klamath Lake, Klamath River	11/30/1944	Wildlife	1/1	12/31	258.39	1,141.7
Claim KA 316	Upper Klamath Lake, Klamath River	7/14/1949	Wildlife	1/1	12/31	21.9	87.6

#### **4.6.3 Surface Water Hydrology**

The planning area and the waterbodies affected by District operations are within the Lost River subbasin (Hydrologic Unit Code [HUC] 8 #18010204) and more specifically, District operations are

located within the Lower Klamath Lake watershed (HUC 10 #1801020414) with points of diversion and discharge located along the Klamath River. The points of diversion are within the Lake Ewauna-Klamath River watershed (HUC 10 # 1801020412). Table 4-8 lists waterbodies associated with District operations, including a portion of the LKNWR in California immediately south of the District boundary. Figure 4-3 shows waterbodies and gauging stations associated with District operations.

The KSD is Reclamation infrastructure and not a natural waterbody; therefore, it is not included in Table 4-8. The KSD is 8.5 miles in length and discharges tailwater from the District and adjacent lands directly to the Klamath River.

**Table 4-8. Waterbodies Associated with District Operations in the Planning Area.**

<b>Name</b>	<b>Associated River Miles</b>	<b>Size</b>	<b>Project Nexus</b>
Upper Klamath Lake	255.0	61,543 acres	Stored water has been used to support the federal Klamath Project for irrigation, including for KDD lands.
Klamath River	From North Canal Diversion at RM 244.25 downstream to Keno Dam at RM 233.3.	10.95 miles	KDD has two points of diversion: (1) North Canal through a 1-mile-long channel to the North Canal headworks, and (2) via the Klamath Straits which connects the Klamath River to the District at the Ady headworks.
Lower Klamath Lake	N/A	N/A (Note: LKNWR is 50,912.68 acres in size.)	KDD operates within the former lakebed of Lower Klamath Lake. The proposed action would improve KDD's capacity to deliver water to the lake and LKNWR via the North Canal extension.
Miller Lake	N/A	N/A	KDD owns a portion of Miller Lake. Water from West Canal may be conveyed into the Miller Lake Lateral and to Miller Lake.
Sheepy Lake	N/A	N/A	The primary water supply to the LKNWR is from the Klamath River through Ady Canal draining into Sheepy Lake.

KDD = Klamath Drainage District; LKNWR = Lower Klamath National Wildlife Refuge; RM = river mile

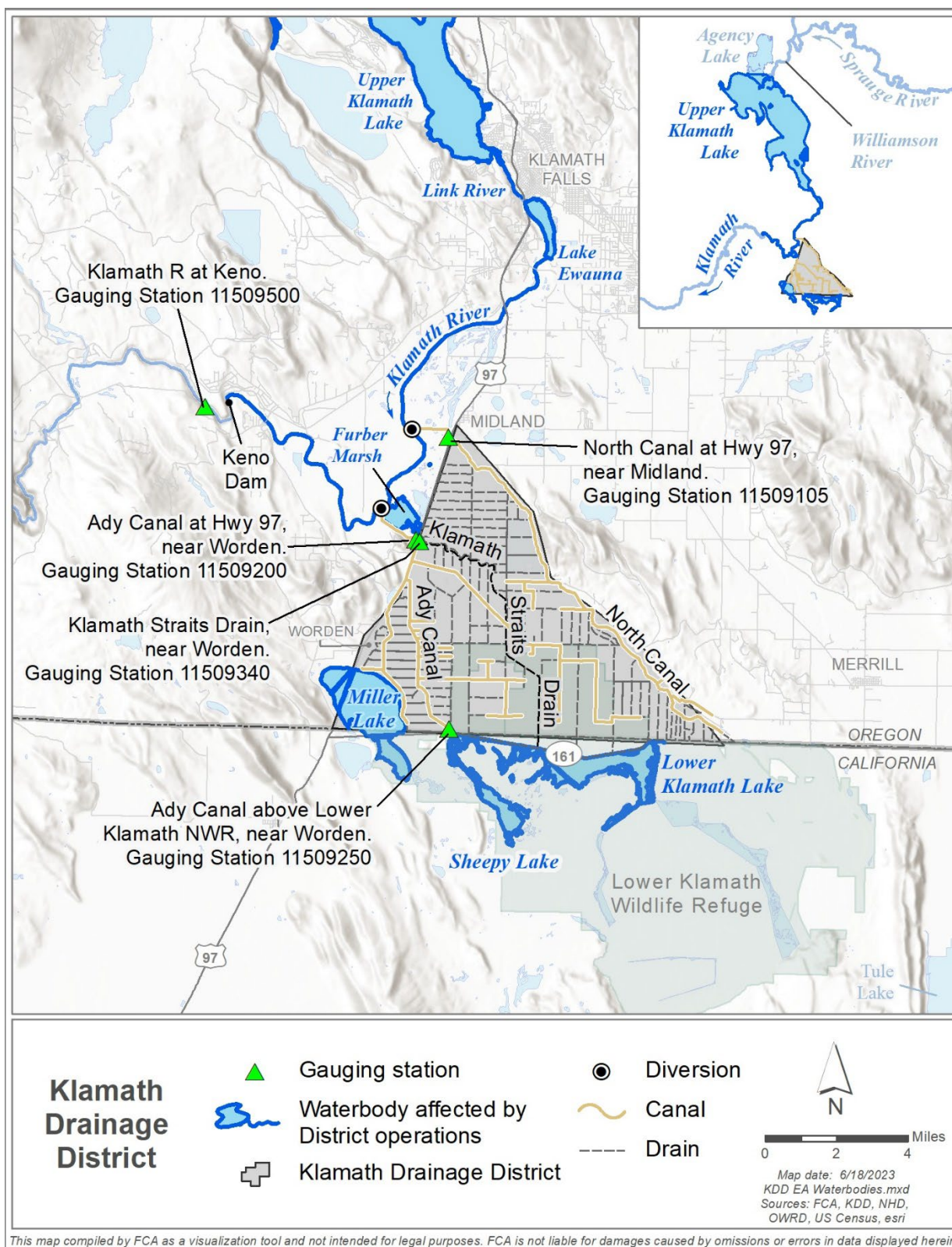


Figure 4-3. Waterbodies and gauging stations associated with District operations.

The following sections summarize surface water hydrology in each waterbody associated with District operations in the planning area (Table 4-8).

#### 4.6.3.1 Upper Klamath Lake

Upper Klamath Lake is a large, shallow hypereutrophic (high biological productivity) lake with extensive wetlands, numerous shoreline springs, and several tributaries. This lake is the largest body of fresh water in Oregon, varies from 6 to 14 miles wide, and is about 25 miles long. Upper Klamath Lake has a surface area of approximately 61,000 acres and a total capacity of more than 650,000 acre-feet. Net inflow for the entire year averages 1.2 million acre-feet but ranges from 576,000 to 2.4 million acre-feet. Regulation of the lake for irrigation purposes has caused lake stage fluctuations to be both higher and lower than natural levels at different times of the year. Lake flushing patterns have also changed because of reservoir regulation and stream diversions.

The Sprague River is tributary to the Williamson River, which empties into Upper Klamath Lake; the Sprague River drains the central and eastern parts of the Upper Klamath River Basin. Upper Klamath Lake empties to the Link River. The Link River connects Upper Klamath Lake to the reach of the Klamath River between the Link River and the Keno Dam (referred to as Lake Ewauna). OWRD Gauge No. 11507500, located on the Link River, measures streamflow between Upper Klamath Lake and the Klamath River upstream from the planning area. See Appendix E.7 for streamflow graphs.

#### 4.6.3.2 Klamath River

The Klamath River flows southwest for 257 miles through Oregon and northern California before emptying into the Pacific Ocean. By average discharge, the Klamath is the second largest river in California after the Sacramento River. The almost 16,000-square-mile drainage basin is 35 percent in Oregon and 65 percent in California and stretches from the arid country of south-central Oregon to the temperate rainforest of the Pacific Coast. The Klamath River begins at Lake Ewauna just downstream of Upper Klamath Lake and the Link River Dam. Snowmelt contributions from the Klamath Mountains (Marble Mountains, Salmon Mountains, Scott Bar Mountains, Siskiyou Mountains, and Trinity Alps) provide year-round flow in the Klamath River. Since the volume of water diverted to KDD would not increase with the proposed project, the reach of the Klamath River that would be directly affected by this project extends from the North Canal Diversion at RM 244.25 downstream to Keno Dam at RM 233.3, including where water is diverted from and discharged to the river and downstream to the Keno Dam.

KDD has two points of diversion that are located along the west side of the planning area: (1) the North Canal through a 1-mile-long channel that connects the Klamath River with the District at the North Canal headworks; and (2) via the Klamath Straits which connect the Klamath River to the District at the Ady headworks. These points of diversion are on the main stem of the Klamath River about 10 miles downstream of Upper Klamath Lake. The North Canal takes water from a channel that has been cut through the marsh on the left bank of the Klamath River. This channel is approximately 1 mile long. Farther downstream on the Klamath River, Ady Canal obtains its water from the 1-mile-long Klamath Straits channel through the marsh which historically spilled water from the Klamath River into Lower Klamath Lake. See Appendix E.7 for streamflow graphs.

Flow for the entire Upper Klamath River Basin is recorded at OWRD Gauge No. 11509500 that is located on the Klamath River at Keno, Oregon, downstream of both KDD diversion points. Here, the river has peak flows in winter (December through February) with flows reaching their lowest in

March through May. Klamath Project releases, including to KDD through the North and Ady canals, occur primarily between April 15 and October 15. Diversions for winter flooding, under the District's supplemental state water right, occur approximately between October 15 and April 15, with January, February and March being the heaviest months. Additionally, tailwater from the Klamath Project is discharged to the river through the KSD. At times, the KSD contributes more than half of the Klamath River's flow above Keno Dam (DEQ 2019a).

#### 4.6.3.3 Lower Klamath Lake

Lower Klamath Lake is located primarily on LKNWR lands managed by USFWS. Maintained primarily for waterfowl and water-dependent species, this 53,600-acre refuge contains 12 wetland units that are supplied with water on either a seasonal or a permanent basis. Unit 2 (about 2,200 acres), with an average depth of about 3 feet, is the only unit that is maintained as a permanently flooded lake. Private agricultural lands are within the boundary of LKNWR in the vicinity of Lower Klamath Lake as well.

Lower Klamath Lake also provides vital habitat for wildlife, particularly migratory birds. To help create and preserve wildlife habitat, KDD coordinates with USFWS to provide water deliveries to Sheepy Lake which is then conveyed across refuge lands through Ady Canal.

#### 4.6.3.4 Miller Lake

Miller Lake, adjacent to Lower Klamath Lake on its western shore, historically likely received water by overflow from Lower Klamath Lake only during high-water years. Most of the time, however, Miller Lake was separated from Lower Klamath Lake by a narrow berm that defined the eastern margin of the open water surface of Miller Lake (Reclamation 2005). Miller Lake is very shallow and only wet ephemerally in the springtime. Because of evaporation, the water and soils within Miller Lake are highly alkaline. KDD owns a portion of Miller Lake which is connected to the KDD irrigation system by the Miller Lake Lateral to the West Canal in the southwestern portion of KDD.

#### 4.6.3.5 Sheepy Lake

Sheepy Lake is in Unit 2 of the LKNWR. KDD measures the flows delivered to the lake from Ady Canal based on measurements from a USGS gage just north of CSH 161. See Appendix E.7 for streamflow graphs.

### 4.6.4 Surface Water Quality

DEQ and the California North Coast Regional Water Quality Control Board maintain lists of all surface waters in the Klamath Basin, including in California and Oregon, that are considered impaired because they do not meet water quality standards under Section 303(d) of the Clean Water Act (CWA) (33 United States Code [U.S.C.] 1251 et seq.). Given the interstate nature of these waterbodies, the Regional Water Quality Control Board and DEQ with the support of the U.S. Environmental Protection Agency (EPA), have agreed and jointly developed TMDLs for both the Lower Lost River and Klamath River. The states and EPA have signed a Memorandum of Agreement for completing the TMDLs and associated implementation planning.

The District diverts irrigation water and returns tailwater from the KSD to the Klamath River between the Link River and Keno Dam. Water quality in this reach of the Klamath River is typically poor with TMDLs established for elevated chlorophyll a, ammonia and pH levels, low dissolved oxygen levels, and temperature in Oregon (see Table 4-9; DEQ 2019b; CWRCB 2010). In 2010, TMDLs for the Klamath River basin were developed for dissolved oxygen, chlorophyll a, pH,

ammonia toxicity, and temperature (DEQ 2019a). All the nutrient TMDLs were approved, except those for temperature, but were subsequently revised and were issued by DEQ and approved by EPA in 2019 (DEQ 2019b). In California, waterbodies of the Klamath River hydrologic unit (HU), Tule Lake, and LKNWR are listed as impaired for pH (high); the Klamath River HU, Lost River hydrologic area, Tule Lake, and Mt. Dome hydrologic subarea waterbodies, including the KSD and LKNWR lands, are listed as impaired for nutrients (CWRCB 2010).

KSD is listed as impaired for nutrients and pH (high) (CWRCB 2010). Reclamation and the U.S. Geologic Survey identify the KSD as a contributing nonpoint source of pollution to the Klamath River (Sullivan et al. 2014). KSD collects drainage water from KDD and the entire Klamath Project, including water pumped into the KSD from TLNWR and LKNWR. KSD discharges to the Klamath River above Keno Dam via the F/FF pumping plants. At times, KSD contributes more than half of the Klamath River's flow above Keno Dam at nutrient concentrations higher than what exist in the river (DEQ 2019a).

Implementation of the District's Water Management and Conservation Plan is intended to protect the quality of irrigation and drainage water and reduce degradation by reducing erosion and siltation through measures such as rock armor lining of irrigation canal and drainage ditch banks, restricting livestock use of District canal and drainage ditch banks, and stabilizing canal and drainage ditch banks (KDD 2015).

**Table 4-9. Impaired Waterbodies Associated with District Operations.**

<b>Name</b>	<b>Listed Reach (river miles)</b>	<b>Parameters Included on California and Oregon's Section 303(d) Lists</b>
Klamath River <sup>1</sup>	Keno Dam to Upper Klamath Lake (Lake Ewauna; RM 241 to RM 253)	Dissolved oxygen, pH, chlorophyll a, arsenic, harmful algal blooms, and inorganic human health toxics
Klamath Straits <sup>1</sup> Drain	Klamath River (RM 241) to Oregon-California border	Temperature, dissolved oxygen, pH, chlorophyll a, arsenic, and inorganic human health toxics
LKNWR <sup>2</sup>	Lakes	pH (high)
Klamath River and LKNWR	Waterways and agricultural lands	Nutrients (nitrogen and biochemical oxygen demand to address dissolved oxygen and pH impairment)

Source:

<sup>1</sup>DEQ 2022

<sup>2</sup>California Water Resources Control Board (CWRCB). 2010.

LKNWR = Lower Klamath National Wildlife Refuge; RM= river mile

The KSD transports nutrient loads into and out of the Klamath River. The KSD is designated as a nonpoint source in the Klamath River TMDL. Recirculation of tailwater within the District results in accumulation of total dissolved solids and salt within the refuge and farmlands, but generally



decreases the amount of nutrients returned to the KSD (Sullivan et al. 2014). Occasional flushing of the system helps to limit accumulation of nutrients and salinity within District lands.

#### **4.6.5 Groundwater**

The District does not use groundwater for irrigation or drinking water supply in the planning area. The hydraulic head gradient is minimal on the floor of the Lower Klamath Lake subbasin, including within District lands (Gannett et al. 2010). The lake basin hydrogeologic unit is comprised of quaternary sedimentary deposits that are predominantly fine grained and have low permeability (Gannett et al. 2010). Seepage and subsurface flows do not enter groundwater but are instead captured by toe drains and returned to the Klamath River via District drains and the KSD.

In 2002, the District contracted with three geophysicists to conduct geophysical surveys within District boundaries using three different methods (gravity, magnetic, seismic) in an effort to determine the potential for locating groundwater. Based upon the results of these studies, a geologist identified six sites with the greatest potential for finding groundwater. Funding was obtained and six test wells were drilled.

Groundwater use for irrigation purposes currently accounts for approximately 90 percent of permitted groundwater allocation in the state (OWRD 2021). OWRD tracks groundwater data to identify subbasins that are vulnerable to groundwater resource concerns and to assist in Oregon's management of groundwater resources. The northeast portion of the District is mapped within a groundwater area of significant concern as rated by OWRD (Township 4 S Range 9 E), and the rest of KDD is within yield-limited-rated areas (OWRD 2021). Groundwater resources of significant concern are those areas for which groundwater pumping for new irrigation is prohibited by an area-specific rule, has been proposed for a use beyond the capacity of the resource, or has caused significant declines in groundwater levels. Yield-limited wells occur where typical well yield is insufficient to meet typical irrigation demand.

#### **4.6.6 Floodplains**

The Federal Emergency Management Agency Flood Insurance Rate Map community panel number 410109 1195 B and panel number 410109 1350 B show that one portion of the project area—the area of proposed installation of a fish screen on the diversion point of the North Canal, improvements to an existing dirt and gravel access road, and improvements to the canal west of the Southern Pacific Railroad—is within the 100-year floodplain of the Klamath River (FEMA 1984). No other activities that would occur under the Modernization Alternative are within a floodplain.

### **4.7 Fish and Aquatic Resources**

The affected environment for fish and aquatic species includes waterbodies that are associated with District operations (see Table 4-8 and Figure 4-3).

#### **4.7.1 Ecosystem Services**

Fish and aquatic resources in the Klamath River, LKNWR, and other waterbodies in the planning area provide the following ecosystem services.

*Provisioning service, Fish populations (Figure 4-1, [E2]):* Waterbodies associated with the District's operations support populations of native trout, suckers, and lamprey and introduced species such as crappie, perch, and bass. A list of fish and aquatic species protected under the ESA (16 U.S.C. 1531 et seq.), as amended in 1998, that are known or expected to occur in waterbodies associated with District operations was compiled using the USFWS IPaC (USFWS 2024), ORBIC (2022), NOAA



Fisheries Protected Resources App (NOAA NMFS 2022), and the California Natural Diversity Database (CDFW 2022). Historically, anadromous fish populations supported important commercial, recreational, and tribal fisheries in the Klamath River Basin, and the removal of four Klamath River dams downstream from the planning area would allow salmon and steelhead to return to the area. These fish populations provide fishing opportunities for both recreation and consumption through a tangible, harvestable good.

*Cultural service, Culturally important species (Figure 4-1, [E4]):* People's values for species conservation may arise from personal use (i.e., enjoying seeing the species and/or its habitat), personal beliefs and moral ethics (i.e., believe 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), and/or a desire to bequest the resource (i.e., believing a resource should be protected for future generations). Some fish species have cultural significance to the Klamath and Modoc tribes. These include salmon, steelhead, lamprey, and the endangered Lost River sucker and shortnose sucker. Both species of sucker were traditionally used by the Klamath and Modoc tribes as a food source and in cultural and spiritual practices.

#### **4.7.2 General Fish and Aquatic Species**

The Klamath River reach associated with District operations hosts a number of native and nonnative fish species including warmwater and coldwater species. Native fish persisting in this area of the basin include lamprey, trout, and sucker species including the endangered shortnose and Lost River suckers. Introduced fish include various sunfish, catfish, and perch species. A list of fish species present within waters associated with District operations are listed in Appendix E.8.

Anadromous species including Chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*Oncorhynchus mykiss*), Pacific lamprey (*Entosphenus tridentatus*), and ESA listed Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*) currently occur only in the Klamath River downstream from Iron Gate dam, southwest of and outside of the planning area (ORBIC 2022; StreamNet 2023). However, with the completion of the removal of the four Klamath River dams in fall 2024, these anadromous species are expected to recolonize upstream habitats. Chinook salmon, steelhead, and Pacific lamprey are anticipated to recolonize habitats upstream of Upper Klamath Lake and thus may occur in the planning area. SONCC coho salmon is only anticipated to recolonize habitats up to Spencer Creek, which is 13.3 miles downstream of the planning area (ODFW and The Klamath Tribes 2021; NOAA NMFS 2021). The planning area within the Klamath River is anticipated to be designated as Essential Fish Habitat for Chinook and coho salmon by the regional fishery management councils and by NMFS due to the removal of the four dams and upstream recolonization by these species.

-Because there are no fish screens on the District's points of diversion from the Klamath River at North Canal and Ady Canal, fish may enter the District's irrigation conveyance system and become trapped in the District's irrigation system. The District's irrigation system, and particularly North Canal, does not provide suitable habitat for fish and wildlife species due to poor water quality, high water temperature, no flow variability, and lack of proper food and shelter.

ODFW considers agricultural diversions to be an artificial obstruction that may prevent or significantly delay the migration of native migratory fish passage (OAR 635-412-0005(4)). ODFW requires that fish screening and bypass devices be installed when an artificial obstruction such as a diversion creates a discontinuity between upstream and downstream water surface or streambed elevations (OAR 635-412-0035(2)(m)(D)). To protect migrating fish, these structures must be

designed to meet ODFW design requirements, while also taking into account federal design requirements set forth in ODFW fish passage criteria per OAR 635-412-0035.

Low streamflow and water quality impairments are recognized as key limiting factors for fish populations in the Klamath River Basin (DEQ 2019a,b). Endemic fish, such as the endangered shortnose sucker and Lost River sucker, face critical population decreases that threaten the survival of the species. Water quality conditions in the Klamath River and District-operated canals are influenced by climate, runoff, and tailwater, resulting in impaired waters because of temperature, dissolved oxygen, dissolved solids, sediments, turbidity, nutrients (primarily nitrogen and phosphorus), and bacteria (EPA 2022).

In addition to fish, other aquatic species are potentially found within or along waterbodies that are associated with District operations. These aquatic species include northwestern pond turtle (*Actinemys marmorata*), western toad (*Anaxyrus boreas*), Pacific treefrog (*Pseudacris regilla*), long-toed salamander (*Ambystoma macrodactylum*), and bullfrog (*Lithobates catesbeianus*).

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 habitat. The northwestern pond turtle is present in the LKNWR. The invasive bullfrog is present as well. The bullfrog was introduced to Oregon in the early 1900s. Bullfrogs are voracious predators that eat any animal they can swallow.

#### 4.7.3 Federally Listed Fish and Aquatic Species

A list of fish and aquatic species protected under the ESA (16 U.S.C. 1531 et seq.), as amended in 1998, that are known or expected to occur in waterbodies associated with District operations was compiled using the USFWS IPaC (USFWS 2024), ORBIC (2022), the NOAA Fisheries Protected Resources App (NOAA NMFS 2022), the California Natural Diversity Database (CDFW 2022), and information provided by ODFW biologists (K. Adkins, ODFW, personal communication, January 12, 2024). Table 4-10 provides a summary of federally and state-listed and sensitive species that may occur in waterbodies associated with District's operations. Federally protected species and designated critical habitat protected under the ESA and EFH protected under the Magnuson Stevens Act downstream of the planning area that are impacted from stormwater runoff from impervious surfaces within the DistrictKDD are also discussed below.

**Table 4-10. Federally and State-Listed and Sensitive Fish and Aquatic Species in the Planning Area and Downstream from the Planning Area.**

<b>Fishes Common Name (<i>Scientific Name</i>)</b>	<b>Federal Listing</b>	<b>State Listing</b>
Shortnose sucker ( <i>Chasmistes brevirostris</i> )	Endangered	OR – Endangered CA – Endangered
Lost River sucker ( <i>Deltistes luxatus</i> )	Endangered	OR – Endangered CA – Endangered
Northwestern pond turtle ( <i>Actinemys marmorata</i> )	Proposed Threatened	OR – Sensitive-Critical CA – Species of Special Concern

<b>Fishes Common Name (<i>Scientific Name</i>)</b>	<b>Federal Listing</b>	<b>State Listing</b>
Southern Oregon/Northern California Coast coho salmon ( <i>Oncorhynchus kisutch</i> )	Threatened	OR – Threatened CA - Threatened
Southern Distinct Population Segment eulachon ( <i>Thaleichthys pacificus</i> )	Threatened	Not listed

#### 4.7.3.1 Lost River Sucker and Shortnose Sucker

USFWS lists both the Lost River sucker and shortnose sucker as endangered under the ESA. They are also listed as endangered in California and Oregon. These two endemic fish species are found in only a few lakes and reservoirs in the Klamath Basin and Lost River subbasin, including the Klamath River, Upper Klamath Lake, and Lost River. Lost River and shortnose suckers are very similar in ecology. Adults occupy lakes and reservoirs throughout the year, except during spawning season when they migrate to tributary streams and rivers (78 F.R. 22556, April 16, 2013; 53 F.R. 27130, July 18, 1988; Desjardins and Markle 2000; Buettner and Scoppettone 1991).

Even though Lost River and shortnose suckers were never widely distributed, they were extremely abundant until populations began to decline sometime in the late 1960s. Continued declines resulted in closure of the recreational fishery (USFWS 2019a). Threats to the Lost River sucker and shortnose sucker populations include habitat loss, with restricted access to spawning and rearing habitat, severely impaired water quality, low streamflow, and increased rates of mortality resulting from entrainment in water management structures (78 F.R. 22556, April 16, 2013; 53 F.R. 27130, July 18, 1988). Although the rate of habitat loss has slowed in recent years and habitat restoration and screening of water diversion structures has occurred, large amounts of historical sucker habitat remain unavailable or altered. Entrainment of larvae and small juveniles through diversion structures continues to introduce individuals from productive populations into extremely poor habitats, from which return is unlikely (USFWS 2019a; Desjardins and Markle 2000).

USFWS has issued several biological opinions on the Klamath Project and its effect to Lost River and shortnose suckers. These biological opinions have mandated Reclamation to incorporate conservation measures such as fish screen installations, dam removal, fish passage improvements, increasing wetland and lake habitat, captive rearing, population monitoring, and annual salvage of suckers from canals. USFWS most recently issued a biological opinion on the Effects of the Proposed Interim Klamath Project Operations Plan on the Lost River Sucker and the Shortnose Sucker (effective January 13, 2023, through September 30, 2023). This biological opinion includes conservation measures for the continuation of annual salvage operations, captive rearing, and population monitoring. The Klamath River within and adjacent to the planning area is designated as critical habitat for Lost River sucker and shortnose sucker (USFWS 2023c).

#### 4.7.3.2 Northwestern Pond Turtle

Northwestern pond turtle is proposed to be listed federally listed as threatened and is state-listed by Oregon as a sensitive-critical species. The USFWS's listing determination for this species is anticipated to occur imminently (fall 2024). It is known to occur in ponds, streams, and wetlands in the LKNWR within the planning area and in Furber Marsh associated with the Klamath River near

and outside the planning area (ORBIC 2022; USFWS 2023a). This species is facing a number of threats to its populations and habitats. The threats include invasive species such as bullfrog, largemouth bass, and opossums that prey on baby turtles; destruction of habitat from wetland draining; modified flooding regime; and expansion of agriculture. Fragmentation of habitat has isolated turtle populations, leading to inbreeding and loss of genetic diversity.

#### 4.7.3.3 SONCC Coho Salmon

NMFS lists SONCC coho salmon as threatened under the ESA and the species is also listed as threatened by Oregon and California. Critical habitat for SONCC coho salmon includes all accessible waterways, substrates, and adjacent riparian zones between the Elk River in Oregon and the Mattole River in California (64 F.R. 24049). SONCC coho salmon were historically numerous and widespread throughout the Klamath River Basin. Activities cited as responsible for the decline of this species include logging, road building, grazing, mining, stream channelization, wetland loss, artificial propagation, over-fishing, water withdrawals, unscreened diversions for irrigation, and dams (62 F.R. 24588). Since 1962, the upper limit to SONCC coho salmon habitat within the Klamath River Basin has been at Iron Gate dam. However with the removal of Iron Gate dam along with three other upstream dams, SONCC coho salmon are anticipated to recolonize at least as far as Spencer Creek (13.3 miles downstream of the planning area). Although SONCC coho salmon are not anticipated to be in the planning area, impacts to water quality in the Klamath River associated with KDD, such as stormwater runoff, may influence the species occurring in the Klamath River from the project area downstream to the mouth of the Klamath River at the Pacific Ocean.

#### 4.7.3.4 Eulachon

NMFS lists Southern Distinct Population Segment (DPS) eulachon as threatened under the ESA. Southern DPS eulachon migrate, rear, and spawn within the lower reaches of the Klamath River. Critical habitat for the species extends from the mouth of the Klamath River to river mile 10.6 (76 FR 65324). Although southern DPS eulachon are not anticipated to be in the planning area, impacts to water quality in the Klamath River associated with KDD, such as stormwater runoff, may influence the species occurring in the Klamath River from the project area downstream to the mouth of the Klamath River at the Pacific Ocean.

#### 4.7.3.5 Essential Fish Habitat

EFH can include all streams, lakes, ponds, wetlands, and other viable waterbodies and most of the habitat historically accessible to Pacific salmon and Pacific coast groundfish necessary for spawning, breeding, feeding or growth to maturity. Although Pacific salmon and Pacific coast groundfish EFH are not in the planning area, impacts to water quality in the Klamath River associated with KDD, such as stormwater runoff, may influence these habitats from the project area downstream to the mouth of the Klamath River at the Pacific Ocean. Furthermore, the planning area within the Klamath River is anticipated to be designated as EFH for Pacific salmon by the regional fishery management councils and by NMFS due to the removal of the four dams and upstream recolonization by coho and Chinook salmon.

### 4.7.4 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 rule (OAR 635-100-0105; ODFW 2021). California Department of Fish and Wildlife identified state-listing in accordance with the California Endangered Species Act (§ 2050 Added by Stats.1984, c. 1240, § 2.). State-listed species that may be present within the waterbodies affected by District operation was compiled using ORBIC data

(ORBIC 2022), ODFW habitat mapping (ODFW 2022), and California Natural Diversity Database occurrence data (CDFW 2022). Table 4-10 presents a list of protected species that are listed for the planning area and vicinity.

## **4.8 Wetlands and Riparian Areas**

### **4.8.1 Ecosystem Services**

Wetlands and riparian areas receiving water from the District provide the following ecosystem services.

*Regulating service, Water quality (Figure 4-1, [E3]):* The quality of water flowing within District infrastructure to wetlands is a regulating ecosystem service important to protecting public health, habitat for fish and wildlife, and the quality of surface water. Section 4.6.4 provides details of existing water quality within the planning area. Water within KDD canal and drainage infrastructure influences water quality within both the LKNWR wetlands and the Klamath River. The amount of water traveling through the irrigation and drainage systems can impact water quality. Lower water flows tend to warm water faster and can cause water to become warmer than surrounding waterbodies. Drainage water returned to the Klamath River via the KSD is currently identified as a source of pollution within the Klamath River. Wetlands provide beneficial services including improving water quality by removing sediments and other pollutants. They filter and process excess nutrients from agriculture and other development (NPS 2016).

*Cultural service, Culturally important natural areas (Figure 4-1, [E5]):* The LKNWR receiving water from District infrastructure provides support to LKNWR as a culturally important natural area that provides a cultural ecosystem service. The LKNWR has been affected by recent water shortages which have limited water deliveries to the LKNWR. Please see Section 4.2.1 for a full description of the cultural service provided by the LKNWR. Wetlands and riparian areas provide habitat for plants and animals that contribute to the value and importance that people place on these areas. Additionally, wetlands and riparian areas provide residents and the visitors with source of enjoyment, nature interaction, and inspiration for creativity.

### **4.8.2 Wetlands and Riparian Areas**

Based on an analysis of the National Wetland Inventory (NWI) geographic information systems (GIS) data (USFWS 2022b; USFWS 2023b) and aerial imagery, freshwater herbaceous wetlands occur in the planning area (see Appendix E.9). This includes Furber Marsh which is located at the diversion channels from the Klamath River to the Ady Canal and North Canal diversion points; freshwater emergent wetlands in the LKNWR and along fringes of canals and ditches; freshwater ponds; and riparian habitat associated with open waterbodies that include Sheepy Lake, Miller Lake, Lower Klamath Lake, and the Klamath River. The NWI data were used as the first step in identifying and evaluating potential wetlands and waters of the United States in the project area. A wetland and waters delineation would be conducted prior to the implementation of project actions to determine the limits of wetlands and waters of the United States and the state. A wetland delineation for the North Canal Fish Screen project would be completed prior to authorization. Jurisdictional determination by USACE and concurrence by DSL of delineated boundaries of wetlands and waters would be obtained.

Wetlands perform several 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 specialized habitat for a wide variety of aquatic and terrestrial species. Wetlands and

waters 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 federal CWA and the Oregon Removal-Fill Law.

USACE administers Section 404 of the CWA with oversight of the EPA. This law regulates the dredge or fill of wetlands over which USACE has jurisdiction. 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” (33 C.F.R. Part 328 – Definition of Waters of the United States).

DSL implements the Removal-Fill Law (ORS 196.800-990) which regulates the removal or fill of material in wetlands or waterways; it 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:

- The ditch is operated and maintained for the primary purpose of conveying water for irrigation.
- The ditch is dewatered for the nonirrigation season except for the water incidentally retained in isolated low areas.

DSL considers a ditch dewatered if the source of irrigation water is turned off or diverted from the irrigation ditch. A ditch that is dewatered outside the irrigation season may be used for temporary flows associated with stormwater collection, stock water runs, or fire suppression.

On July 24, 2020, USACE and EPA signed a memorandum providing a clear, consistent approach regarding the application of exemptions from regulation under Section 404(f)(1) of the CWA for construction or maintenance of irrigation ditches and the maintenance of drainage ditches. As defined in this memorandum, an “irrigation ditch” is 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. Further, the construction and maintenance of irrigation ditches is considered an exempt activity under Section 404 of the CWA. However, if construction or maintenance of irrigation ditches “represents a *new use* of the water, and the activity would result in a *reduction in reach or impairment of flow or circulation* of regulated waters, including wetlands,” the activity does not meet this exemption.

Riparian areas are transition zones between waterbodies and adjacent upland areas; they support hydrophytic vegetation that is dependent upon the hydrology of the waterbody. Riparian areas as defined by Section 404 of the CWA are “a vegetated ecosystem along a waterbody through which energy, materials, and water pass. Riparian areas characteristically have a high-water table and are subject to periodic flooding and influence from the adjacent waterbody. These systems encompass wetlands, uplands, or some combination of those two landforms.” They will sometimes, but not in all cases, have all the characteristics necessary for them to be also classified as wetlands (EPA 2005).

Wetland and riparian areas affected by District operations are found within and adjacent to natural waterbodies within the Klamath River, the LKNWR, and occurring in and along irrigation canals and laterals within the project area.

Wetlands adjacent to irrigation ditches are generally not regulated under Section 404 of the CWA, as long as the canal was not constructed through previously existing jurisdictional waters. Hydrophytic

plants are sometimes found along the banks of irrigation canals and laterals within the project area or in adjacent low-lying areas outside the project area, as the hydrology provided by the canals and laterals can create favorable growing conditions during a portion of the year. However, the District actively keeps the canal and lateral banks clear from vegetation; therefore, riparian vegetation is limited.

In recent years, sizeable parcels of land within KDD have been placed in the U.S. Department of Interior Working Wetlands Program (USFWS 2021). This program promotes productive wetlands and sustainable agriculture by inserting wetlands into commercial crop rotations. This program has yielded both agricultural and environmental benefits, and it has increased wetland and wildlife habitat. Farmers have reported yield increases of more than 25 percent, a reduction in the need for pesticides and fertilizers, and the ability of some farmers to convert to organic production on those lands that were under the wetland program for 1 to 4 years.

## **4.9 Wildlife Resources**

### **4.9.1 General Wildlife**

Wildlife within the District's agricultural lands consists of habitat generalists or edge habitat species that are able to adapt to or exploit the agricultural environment. These species are tolerant to disturbance and include species such as mule deer (*Odocoileus hemionus*), blacktail deer (*O. hemionus columbianus*) and coyotes (*Canis latrans*) (Blair 1996; Ditchkoff et al. 2006; McKinney 2002; Shochat et al. 2006). Some other common species include muskrat (*Ondatra zibethicus*), yellow-bellied marmot (*Marmota flaviventris*), and other non-game small mammals.

Wildlife within the planning area may use the canal and lateral system as a water source and dispersal corridor. Additionally, where not cleared, vegetation along canals and laterals can provide food, cover, and breeding sites for many wildlife species throughout the year. Appendix E.10 contains a list of wildlife species that are likely to occur in the planning area.

Irrigation and farming practices, primarily winter flooding, within the planning area promote and create wildlife habitat (KDD 2015). Winter flooding reduces soil erosion and has proven to benefit to wildlife by offering foraging and diurnal resting habitat for waterfowl. It also creates a forage base for eagles, earning KDD land the designation of "Oregon Feeding Area" for eagles (Keister et al. 1987).

### **4.9.2 Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act Species**

Migratory birds are known to travel through the project area and its vicinity; however, it provides limited habitat due to maintenance activities that remove vegetation on an annual basis. Appendix E.10 includes a list of Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA) species in the project area. Bald eagle was removed from the List of Endangered and Threatened Species as of August 8, 2007. In May 2007, USFWS issued the National Bald Eagle Management Guidelines that provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagle and to avoid "disturbance," which is prohibited under the BGEPA.

USFWS maintains a database of known golden eagle (*Aquila chrysaetos*) and bald eagle (*Haliaeetus leucocephalus*) nesting sites. Eagles prefer open country, they are relatively tolerant of human presence, and they are common in the area. North Canal in the northern half of the project area is adjacent to known golden eagle nesting sites located to the north of the planning area (ORBIC 2022).

It is estimated that about 80 percent of the waterfowl in the Pacific Flyway migrate through or breed in the Klamath River Basin. The LKNWR is one of the major areas that supports large numbers of water birds. Peak numbers of water birds—mostly ducks, geese, and swans—occur from late October to early November. These species may also use similar habitats within the District. Waterfowl may also use favorable habitat in the ODFW Klamath Game Management Area near the Klamath River adjacent to the northern corner of the planning area.

During the summer, the planning area is used by various species of ducks and mallards, snow geese (*Anser caerulescens*), doublecrested cormorant (*Nannopterum auritum*), American white pelican (*Pelecanus erythrorhynchos*), American coot (*Fulica americana*), several terns, great egret (*Ardea alba*), grebes, and black-crowned night-heron (*Nycticorax nycticorax*) (Puchy and Marshall 1993). Other common species include great blue heron (*Ardea herodias*), sandhill cranes (*Antigone canadensis*), long-billed curlew (*Numenius americanus*), and killdeer (*Charadrius vociferus*).

#### **4.9.3 Federally Listed Species**

A list of wildlife species protected federally under the ESA that may be present in the planning area or its vicinity was compiled using the IPaC resource list (USFWS 2024), ORBIC data (ORBIC 2022), and California Natural Diversity Database data (CDFW 2022). There are no critical habitats in the planning area (USFWS 2023c). Table 4-11 provides a summary of federally and state-listed and sensitive species in the planning area and its vicinity. Federally listed aquatic species are discussed in Section 4.7.3.

#### **4.9.4 State Listed Species**

A list of species protected by the State of Oregon (ORS 496.171-496.192) and the California Endangered Species Act (§ 2050 Added by Stats.1984, c. 1240, § 2.) that may be present within the planning area and project area was compiled using ORBIC data (ORBIC 2022) and California Natural Diversity Database data (CDFW 2022). Table 4-11 presents a list of protected species that are listed for the planning area and vicinity.

State-listed aquatic species are discussed in Section 4.7.4.



**Table 4-11. Summary of Federally and State-Listed and Sensitive Species in the Planning Area and its Vicinity.**

<b>Class</b>	<b>Common Name (<i>Scientific Name</i>)</b>	<b>Federal Listing</b>	<b>State Listing</b>
Mammal	Gray wolf ( <i>Canis lupus</i> )	Endangered	OR – Delisted CA – Endangered
Mammal	North American wolverine ( <i>Gulo gulo luscus</i> )	Threatened	OR – Threatened CA – Threatened
Bird	Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Delisted	OR – Delisted CA – Endangered
Bird	Northern spotted owl ( <i>Strix occidentalis caurina</i> )	Threatened	OR – Threatened CA – None
Bird	Yellow-billed cuckoo ( <i>Coccyzus americanus</i> )	Threatened	OR – Not Listed CA – None
Bird	Tricolored blackbird ( <i>Agelaius tricolor</i> )	Species of Concern	OR – Not Listed CA – Threatened
Bird	Western snowy plover ( <i>Charadrius nivosus nivosus</i> )	Partial Status for Species: Threatened	OR – Threatened CA – None
Bird	Bank swallow ( <i>Riparia riparia</i> )	None	OR – None CA – Threatened
Bird	Swainson’s hawk ( <i>Buteo swainsoni</i> )	None	OR – None CA – Threatened
Bird	Greater sandhill crane ( <i>Antigone canadensis tabida</i> )	None	OR – None CA – Threatened
Insect	Monarch butterfly ( <i>Danaus plexippus</i> )	Candidate	OR – Not Listed CA – None

## 5 Alternatives

### 5.1 Formulation Process

Ten action alternatives and one No Action Alternative were initially considered during the scoping process. The formulation of alternatives followed CEQ regulations for implementing NEPA and requirements of the PR&Gs. Scoping comments were also incorporated into the formulation process as alternatives.

When formulating an alternative, it was first determined whether the alternative met the project purpose and need (Section 2) and if it met the PR&G requirement of achieving the Federal Objective (Section 2) and Guiding Principles (Appendix E.12). The alternative was further analyzed for four criteria: completeness, effectiveness, efficiency, and acceptability (NRCS 2017; Appendix D.6). The alternatives of treated wastewater reuse, on-District storage, North Canal piping, rerouting the KSD, pumped storage via the KSD, improving water supply to Ady Canal via the F/FF pumping plants, and upgrading the Eastside Recirculation Plant were initially considered during formulation but were eliminated from further analysis because they did not meet the formulation criteria (Appendix D.6).

### 5.2 Alternatives Eliminated from Detailed Study

The following subsection describes alternatives that met the formulation criteria but were not analyzed in detail as a viable alternative after further consideration.<sup>10</sup>

#### 5.2.1 Canal Lining

Canal lining is a common solution to address seepage and reduce maintenance to earthen canals. However, KDD operates within the former lakebed of Lower Klamath Lake where lining is not a practical solution to address these issues. As a drainage district, one of KDD's goals is to lower the area's shallow groundwater table below the root zone of crops to enable agriculture (KDD 2013). Still, the groundwater table often remains higher than the bottom of KDD's canals. Currently available lining materials, such as geomembrane and concrete liners, cannot withstand hydrostatic pressures from shallow groundwater when canals are not kept at capacity. As such, if canals were lined, the District would have to keep water in the canals year-round to prevent the lining material from failing, which is unfeasible because the District drains its canals periodically for maintenance, repairs, and new construction. Additionally, soils within the former lakebed of Lower Klamath Lake are unstable. If the canals were drained, groundwater pressure could crack, lift, or buckle a canal liner (KDD 2013). The combined forces of the shallow groundwater and shifting soils in KDD eliminated lining canals from detailed study.

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<sup>10</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.12), or become unreasonable because of cost, logistics, existing technology, or environmental reasons may be removed from consideration (NWPM 501.37; NRCS 2015; NRCS 2017).

## 5.3 Alternatives Description

Of the project alternatives that were considered for the KDD Infrastructure Modernization Project, two were selected for further evaluation and are discussed in the following sections. These alternatives include infrastructure owned by KDD and Reclamation.

### 5.3.1 Alternative 1 – No Action Alternative (Future without Federal Investment)

Under Alternative 1 – No Action Alternative (the No Action Alternative), federal funding through Pub. L. No. 83-566 would not be available to implement the project. The District would continue to operate and maintain its existing system in its current condition. This alternative assumes that modernization of the District's system to meet the purpose and need of the project would not be reasonably certain to occur. The No Action Alternative is a near-term continuation of the standard operating procedures.

The No Action Alternative would not meet the purpose and need of the project. There would be no improvement to District operational inefficiencies affecting water quality and quantity, the number of entrained fish in District canals and laterals, energy use, and water delivery reliability. Water delivery and operation inefficiencies would remain the same and could potentially worsen over time. By not modernizing the District's current management of water, the No Action Alternative would not accomplish the Federal Objective to protect the environment.

### 5.3.2 Alternative 2 – Proposed Action – Modernization Alternative (Future with Federal Investment)

Under Alternative 2 – Proposed Action – Modernization Alternative (the Modernization Alternative), federal funding through Pub. L. No. 83-566 would be available. The District would perform the following actions (see Figure 5-1):

- Improve North Canal by extending it 0.47 miles (approximately 2,500 feet) from Fugate Rd. to CSH 161, thus connecting North Canal to the P-1 Lateral and adding a point of delivery to the LKNWR. This project action would also include the modification of five road crossings and one railroad crossing along North Canal to accommodate an additional flow of 100 cfs. The exact location of the railroad crossing can be found in Appendix C. Surveys from Adkins Engineering indicate that replacing the existing 48-inch corrugated metal pipe culverts indicated on the construction documents with 4-foot by 5-foot concrete box culverts would support the increase in total capacity throughout from 92 cfs to 100 cfs.
- Upgrade the Reclamation E and F pumping plants along KSD to a more common voltage and with variable frequency drives (VFDs).
- Install a fish screen at the North Canal Diversion.
- Install a recirculation pipeline going from the outlet of the westernmost pump in the E Pumping Plants to Center Canal.
- Install 14 supervisory control and data acquisition (SCADA)<sup>11</sup> systems at 12 locations distributed across the District.

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<sup>11</sup> SCADA systems allow real-time monitoring of pump operating hours, flow rates throughout the District conveyance system, and the remote operation of pumps and gates.

- Upgrade 76 turnouts across District infrastructure.

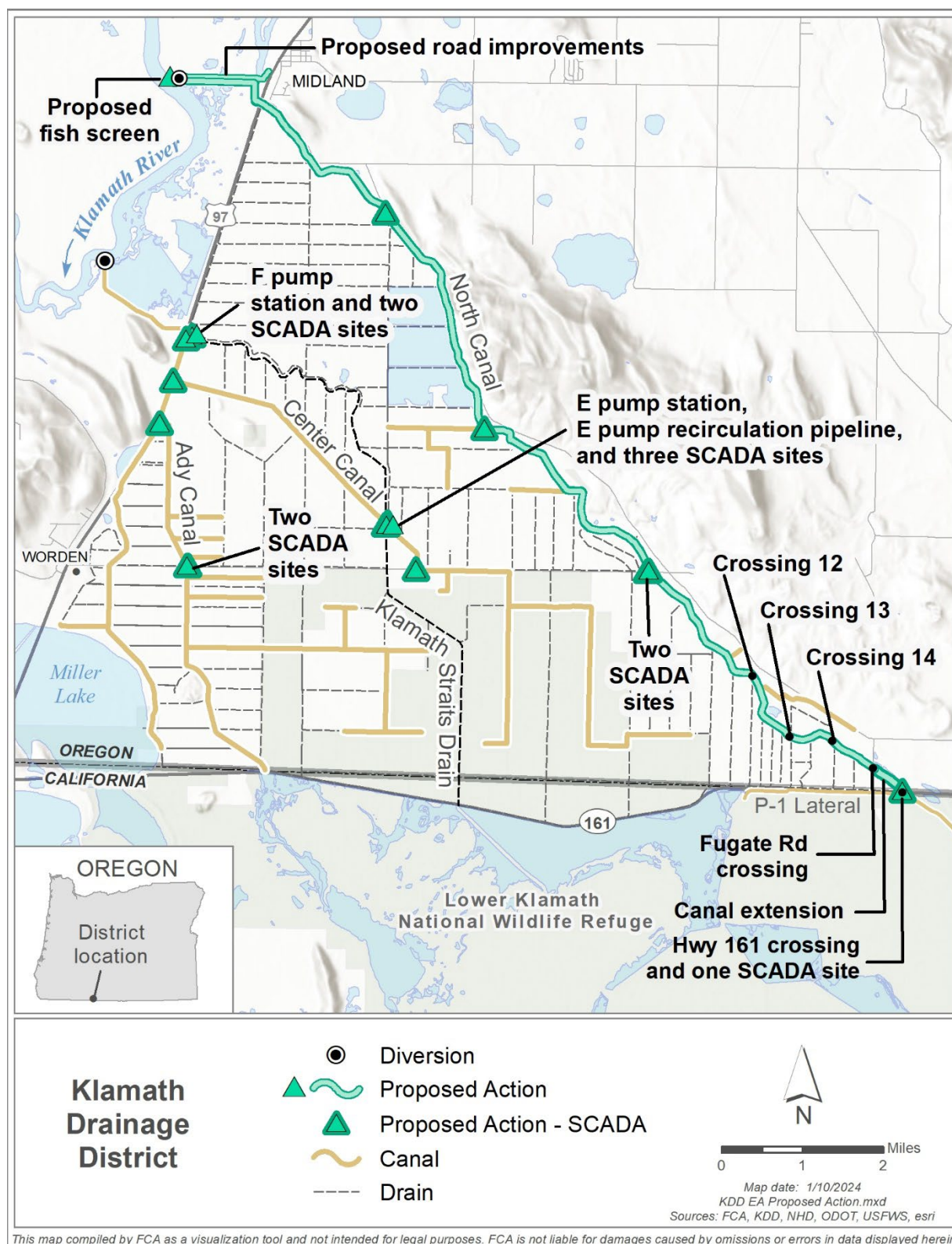


Figure 5-1. District Infrastructure Modernization Alternative.

The District has determined that this alternative is technically feasible and addresses the project's purpose and need. In addition, this alternative would provide stability and resilience for agriculture, the environment, and local communities as climate change continues to cause an increasing amount of uncertainty within the Klamath Basin.

Construction of the Modernization Alternative would occur in six project groups over the course of 3 years (Table 8-3). Construction would begin as early as the 2025 nonirrigation season and would occur at different times of the year depending on the project action (see below in project action subsections for estimated implementation schedules and Section 8.6.2 for a project timeline). Implementation schedules are being determined to reduce effects on patron deliveries, and BMPs during project implementation would be followed (see Appendix E.11 for information on BMPs).

Project areas would be accessed from existing KDD maintenance roads, public roads, and private roads for which easements would be needed. In some cases, new overland travel routes within existing KDD easements could be necessary to access certain portions of the project area that do not have established maintenance roads. The most direct route possible would be used to access the construction area. Any work needed to facilitate equipment access would occur prior to, or concurrently with, project construction. Temporarily rerouting CSH 161 would be necessary during some construction activities; coordination with the California Department of Transportation would occur as necessary during planning.

Following completion of the Modernization Alternative, O&M on new infrastructure would be performed on an as-needed basis.

The Modernization Alternative contributes to the sponsors' objectives and the Federal Objective and Guiding Principles by improving the efficiency and reliability of water delivery to patrons and the LKNWR; improving water quality; reducing O&M costs; and protecting fish populations.

The following subsections provide additional detail describing the construction and implementation of the different actions that would be taken under the Modernization Alternative.

#### 5.3.2.1 North Canal Improvements

The North Canal improvements would extend the canal by 0.47 miles (approximately 2,500 feet) from the Fugate Road crossing to the CSH 161 crossing. At its terminus, North Canal would be connected to the LKNWR P-1 Lateral. Current engineering designs identified a total of five road crossings—two paved and three unpaved—that would be modified to increase the maximum flow capacity of the canal from 250 to 350 cfs. However, other bottlenecks along North Canal could be identified in more advanced engineering designs; therefore, the entire length of North Canal is included as part of the North Canal improvements (Figure 5-1). Should additional crossings need to be improved, pertinent studies on cultural resources would also be undertaken.

The canal extension construction would remove existing material from the center alignment and construct embankments along each side of the canal. Due to the makeup of the native soil, the project would likely require additional embankment material which would be collected from the surrounding areas or transported from another location. Crossing 12, Fugate Road, and CSH 161 would each require two additional 48-inch-diameter culverts to meet the design flow volume. Crossings 13 and 14 would each require three 48-inch culverts to meet the 92 cfs design flow volume. To achieve 100 cfs flow, two 4-foot by 5-foot box culverts would need to be placed instead of the 48-inch culverts at the Fugate Road and CSH 161 crossings only. Additionally, an inlet structure and a flow measurement device would be installed at CSH 161. The amount of increased delivery to the wildlife refuges is not known exactly, but water savings would support a greater

capacity. All activities would occur within a 75-foot buffer extending from the center of North Canal to each side. The estimated total footprint that would include all construction activities would be 250.5 acres.

North Canal improvement construction would begin between January and April before the spring irrigation season. Should other work occur once the spring irrigation season begins, the District would be able to accommodate those activities without affecting water delivery to patrons. The North Canal improvements would take roughly 12 months to complete.

#### 5.3.2.2 E and F Pumping Plant Upgrade

Upgrades to the E and F pumping plants along KSD would include installing VFDs, upgrading motor controls, installing panels, and upgrading transformers. Three new pumps would be installed at each of the E and F plants. Except for the transformer upgrades, which would likely occur at the location of the current transformers, all other activities would occur within the existing footprint of the pumping plants. Renewable energy (i.e., solar panels) to offset District costs are not included in this project. The estimated construction footprint of the E and F pumping plants transformer upgrades would be 2,198 and 3,512 square feet, respectively (see Appendix C for a more detailed map of the proposed pumping plant upgrades).

Upgrades to the E and F pumping plants would occur between February and May, and between August and December, respectively, and are expected to be completed within one calendar year.

While some District pumps would be fully replaced, and others upgraded, each pump conversion to a more common voltage and with VFDs would make pump operation more efficient. Retrofitting existing pumps with VFDs would allow pumps to operate at a range of speeds rather than at only “on” or “off” settings, giving KDD the capacity to match water demand with pumped water supply, thereby reducing over-pumping and energy overconsumption.

#### 5.3.2.3 North Canal Fish Screens

The proposed design consists of 10 cone screens that would be installed at the entrance of the North Canal Diversion on the Klamath River (see Appendix C for more a detailed map of the proposed fish screen), parallel to the flow of the Klamath River and perpendicular to the flow of North Canal. Water would enter each screen though gravity and travel to the bottom of the cone and through the plenum into North Canal. Based on a technical assessment performed by Adkins Engineering (2022), cone screens were identified as optimal for operating in shallow, silty waters and in waterbodies with low head. Each cone screen would be 14 feet in diameter, with a height of 8 feet. Each would allow a total maximum flow of 579.2 cfs with a 0.33 feet/second approach velocity. This capacity exceeds the proposed maximum 350 cfs and would provide additional safety. Each cone screen would be mounted on a concrete foundation with four anchor bolts. Due to the type of deep silty soil that prevails in the area, fish screens must be set on pile foundations; the pile cap would be 180.75 feet long and approximately 19 feet wide. The pile length would be approximately 20 feet.

The project would upgrade an existing private dirt road that runs parallel to North Canal on the northern side to allow access for maintenance. The proposed access road would be a 14 -foot-wide gravel road, approximately 1.3 miles (6,900 feet) long. A power line would also need to be extended roughly 0.87 miles (4,600 feet) to power the screens. To keep fish from entering North Canal at other locations farther inland, the south side of the North Canal levee would be repaired by sealing all areas of inflow from adjacent lands with 24-inch sheet pilings. Approximately seven breaches in the levee would be sealed by sheet pilings that would vary from approximately 20 to 70 feet in

length. In total, approximately 135 sheet piles would be permanently installed for a total length of 265 feet to repair the levee. Installation of sheet pilings to repair the levee would be conducted within the in-water work window. Roughly, the construction footprint including all activities related to the North Canal fish screens would be 16.6 acres.

Construction would begin between July 1 and January 31, based on the Oregon guidelines for timing of in-water work to protect fish and wildlife resources (ODFW 2023), and would be expected to take approximately 18 months.

#### 5.3.2.4 Installation of Recirculation Pipeline at E Pumping Plant

A pipeline going from the westernmost pump at E Pumping Plant to Center Canal would be installed to recirculate water from the KSD to Center Canal. This pipeline would allow for up to 100 cfs to be pumped into Center Canal to increase the amount of water available for delivery to agricultural lands served by Center Canal, including Area K. A manifold would be installed on the north side of the pump, and the pipeline would go southwest to Center Canal (see Appendix C for detailed map). The pipeline would be roughly 200 feet long, and construction activities would occur within 10 feet on each side. The total construction footprint would be approximately 3,933 square feet.

Construction of the recirculation pipeline would begin after on-farm flooding activities between January 1 and April 1; it would take approximately 6 months to complete.

#### 5.3.2.5 Installation of SCADA, Automated Gates, and Upgraded Turnouts

The District would install SCADA components at selected locations in District canals, turnouts to farm laterals, drains, and at lift pumps to improve the efficiency of irrigation water management (see Figure 5-1 for locations of SCADA sites). Depending on the site and the District's needs, each of the SCADA sites would require specific components and the installation of solar panels and/or radio antenna. Three of the proposed sites would need electricity established at the site. Future engineering would determine site-specific electrical load requirements and whether solar power is feasible. See Table 8-1 for more details on the equipment needed and ground disturbance at each SCADA site. A ground disturbance of approximately 313 square feet would be expected at each of the SCADA sites where a single SCADA system would be installed. In the sites where two SCADA systems would be installed and paired, specifically the Township Pump Station and Ady Canal pair, and the Eastside Pump Station and the North Canal pair, the construction footprint would be approximately 1,634 and 3,118 square feet, respectively.

Additionally, each District turnout would be upgraded with flow-monitoring capabilities. The construction footprint of each upgraded turnout would be approximately 200 square feet.

Installation of flow-monitoring equipment and automated gates would occur anytime during the year. Work to upgrade turnouts would take place from January to April.

#### 5.3.2.6 Modernization Alternative Costs Overview

The estimated project cost for the Modernization Alternative including NRCS technical assistance, program administration, and permitting would be \$16,878,000 (2023 dollars). Additional information regarding the costs and the present value of the costs of the Modernization Alternative can be found in Appendices D.4 and D.5.

## 5.4 Summary and Comparison of Alternatives

Table 5-1 compares Alternative 1, No Action Alternative (Future without Federal Investment), and Alternative 2, Modernization 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 Alternatives.**

<b>Alternative Plans</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b>  North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b>  Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Locally Preferred	No	Yes
National Economic Development	No	Yes
Socially Preferred	No	Yes
Environmentally Preferred	No	Yes
<b>Guiding Principles</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b>  North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b>  Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Healthy and Resilient Ecosystems	No	Yes
Sustainable Economic Development	No	Yes
Floodplains	No	Not Applicable



Public Safety	No	Not Applicable
Environmental Justice	No	Yes
Watershed Approach	No	Yes
<b>Provisioning Services – Trade-Offs</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Irrigation water	No	Yes
Instream fish species	No	Yes
<b>Regulating Services – Trade-Offs</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Water quality	No	Yes

<b>Cultural Services – Trade-Offs</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Culturally important species	No	Yes
<b>Installation Costs</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Federal Pub. L. No. 83-566	\$0	\$12,729,000
Local only or Matching Pub. L. No. 83-566	\$0	\$4,149,000
Total	\$0	\$16,878,000
Average Annual Cost Installation <sup>1</sup> OM&R <sup>2</sup> Total	 \$0 \$0 \$0	 \$445,000 231,000 \$676,000
Annual Benefits <sup>3</sup>	\$0	\$307,000
Annual Costs	\$0	\$552,000
Annual Net Benefits	\$0	-\$245,000

<b>Regional Economic Impacts<sup>1</sup></b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
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, and induced)	Not applicable	40 (average over 3 years)
Change in Annual Jobs from agriculture (including direct, indirect, and induced)	Not applicable	Possible long-term benefits to agricultural employment if any water savings or operational advantage is used to avoid any future irrigation water shortages, not quantified.
<b>Beneficial Effects Annualized<sup>2</sup> (millions, 2023\$)</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Region	Not applicable	\$0.2
Rest of Nation	Not applicable	Some ripple income or employment effects expected, but not estimated.

<b>Adverse Effects Annualized<sup>3</sup> (millions, 2023\$)</b> Item or Concern and Major Features	<b>No Action Alternative (Future without Federal Investment)</b> North Canal Diversion remains unscreened, North Canal improvements are not implemented, and the North Canal is not connected to the P-1 Lateral, E and F pumping plants are not upgraded, flow is not recirculated from E Pumping Plant to Center Canal, and SCADA systems are not installed.	<b>Modernization Alternative (Future with Federal Investment)</b> Screen the North Canal Diversion, implement the North Canal improvements and connect the North Canal to the P-1 Lateral, upgrade E and F pumping plants, install pipe to recirculate flow from E Pumping Plant to Center Canal, and install SCADA systems.
Region	Not applicable	\$0 (increased OM&R is nearly equal to OM&R cost savings)
Rest of Nation	Not applicable	\$0.4

Note: Some values may not sum due to rounding.

Prepared November 2023

<sup>1</sup> Price base: 2023\$, 2023 Water Resources Discount Rate of 2.5%

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

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

OM&R = operation, maintenance, and replacement.

## 6 Environmental Consequences

This section evaluates the environmental consequences of the No Action Alternative and the Modernization 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

A cultural resources Section 106 review is underway, and all surveys have been completed. A cultural resources report has been developed and a draft document submitted to Oregon SHPO for review (see Appendix E.2). Early results from the contractor's survey have identified two archaeological sites which would not be physically impacted by the project. A historic built resources evaluation has been completed for the District, and the expected findings are that a historic district consisting of KDD components may be eligible for the NRHP but that the project would not result in impacts to the character-defining features of the historic district or its contributing components. The North Canal railroad crossing would also not be directly impacted by project-related activities. At this time, a finding of No Adverse Effect to Historic Properties is recommended.

#### 6.1.1 Alternative 1 – No Action Alternative (Future without Federal Investment)

The No Action Alternative would maintain existing conditions and activities in the study area. As such, the potential for impacts on cultural resources from the No Action Alternative is limited. However, impacts on unknown cultural resources remain possible through the inadvertent disturbance of these resources from current irrigation and agricultural activities in the study area.

#### 6.1.2 Alternative 2 – Proposed Action - Modernization Alternative

##### 6.1.2.1 Built Environment Resources

The cultural resources report is currently under review (see Appendix E.2). Recommendations in the assessment include a finding of No Adverse Effect to historic properties in the APE, including the Klamath Drainage District Irrigation System Historic District and Lower Klamath National Wildlife Refuge NHL, and a finding of No Adverse Effect to historic built environment resources in the APE.

##### 6.1.2.2 Archaeological Resources

The two previously undocumented archaeology sites and one subsurface archaeological isolate will be avoided by the Modernization Alternative, so no impacts are anticipated.

### 6.2 Land Use

#### 6.2.1 Alternative 1 - No Action Alternative (Future without Federal Investment)

The No Action Alternative would have no direct adverse effect on land use or land ownership within the project area or on lands served by canals and laterals in the planning area.

##### 6.2.1.1 Ecosystem Services

Under the No Action Alternative, ecosystem services of providing water for irrigation that supports agricultural productions would not be adversely affected.

## **6.2.2 Alternative 2 – Proposed Action - Modernization Alternative**

### **6.2.2.1 Land Ownership and Land Use**

Overall, the Modernization Alternative would have negligible to minor adverse effects on land use and land ownership within the project area. Most construction and associated activities would occur in the District's and Reclamation's existing ROW and easements (see Table 6-1). Prior to construction, the District would obtain all necessary easements and agreements to build new infrastructure in areas with no existing easements or ROW. If required, specific actions related to obtaining necessary easements are outlined under each proposed action below. Landowners adjacent to areas of construction would be notified before construction begins. Implementation of the Modernization Alternative would support existing zoning designations and land use in the planning area through more efficient and reliable delivery of water.

#### *6.2.2.1.1 North Canal Improvements*

Most work related to North Canal improvements would occur within an existing easement. The District would work with USFWS to obtain a 105-foot easement from the south end of North Canal to the north end of P-1 Lateral.

Construction of the five crossing improvements along North Canal would temporarily disturb ground and would create short-term adverse effects on access across the canal for properties that use the crossings to access land within the District. The District has existing agreements with landowners in the locations of the five crossings. Construction of the crossing improvements on Fugate Road and CSH 161 would cause temporary minor adverse traffic effects along those roadways. Long-term effects on land uses surrounding the crossing improvements would be negligible.

Short-term minor adverse effects on surrounding land uses would occur during excavation and construction of the canal extension. Construction of the extension would convert the 0.47-mile alignment from existing agricultural uses to irrigation infrastructure use, a minor long-term effect on land use and land ownership.

The Modernization Alternative would increase the capacity of the KDD system to deliver water flows to the LKNWR which would support wildlife habitat and the recreation opportunities that wildlife supports including birdwatching, photography, hunting, and education programming. These potential outcomes would have a long-term beneficial effect on wildlife and recreational uses within the planning area and help address water shortages discussed in Section 2.1.1.

The entirety of the North Canal alignment and a 75-foot buffer surrounding the center line of the canal has been identified as an area for potential additional improvements. Construction activities for additional North Canal improvements would consist of a maximum disturbance footprint of 250.6 acres. These improvements would cause temporary minor adverse effects on lands currently used for agriculture and on irrigation infrastructure. Construction would occur outside of the irrigation season and would not result in long-term adverse effects or changes to land use and land ownership.

#### *6.2.2.1.2 E and F Pumping Plant Upgrades*

All construction activities related to pumping plant upgrades would occur in District ROW. Most construction would take place within the existing pump footprints, except for the transformer upgrades, which would occur at the location of the transformers currently in use to supply power to

the pumping plants. The pumping plant upgrades would not have short- or long-term adverse effects on land use or land ownership within the planning area.

#### 6.2.2.1.3 North Canal Fish Screens

Upgrading the dirt road adjacent to North Canal to provide access to maintain the fish screens would occur on property that is currently owned by a private landowner (approximately 1.1 miles) and ODFW (approximately 0.2 miles). The District is working to obtain easements for the access road within the project area and would procure these easements prior to project construction. See Appendix C for a map of the tax lots associated with the North Canal Fish Screen. Land use would not be modified in the areas adjacent to the fish screen construction site; these areas consist of privately owned natural vegetation. Repairing breaks in the levee (see Appendix C, Figure C-9 for general levee location) would remove the access point used by the Tule Smoke Hunt Club to access the Klamath River and adjacent wetlands for hunting based on the location of their existing gravel boat ramp. This would create a minor long-term adverse effect on existing recreation uses in the planning area. Removing this access would not preclude all access to this recreation area.

#### 6.2.2.1.4 Installation of Recirculation Pipeline at E Pumping Plant

Construction activities for the new pipeline would occur in Reclamation-owned land and infrastructure, except for work occurring in Center Canal for which the District has ROW. Excavation and construction of the new pipeline would disturb the ground temporarily and would block the dirt road running south on the west side of KSD during construction, which could temporarily limit access to nearby lands.

Redirecting water to Center Canal would create a long-term benefit for agricultural lands in the planning area by allowing more water to be delivered to lands across the District.

#### 6.2.2.1.5 Installation of SCADA, Automatic gates, and Upgraded turnouts

Except for the SCADA installation at E/EE and F/FF pumping plants that would occur on Reclamation land, all other activities related to SCADA and control structure installation would take place in District ROW or with permissions from the respective landowner(s). Minor short-term ground disturbance would occur during the construction of the concrete slabs needed to support monitoring and SCADA equipment. No long-term adverse effects on land use or land ownership would result from these activities in the project area.

**Table 6-1. Real Property Acquisition under the Modernization Alternative.**

Proposed Action	Property to be Acquired	Current Owner	Acquiring Party
North Canal Fish Screen	Approximately 30-foot by 1.1-mile easement of an existing access road.	Privately owned	Klamath Drainage District
North Canal Fish Screen	Approximately 30-foot by 0.3-mile easement of an existing access road.	Oregon Department of Fish and Wildlife	Klamath Drainage District
North Canal Improvements	105-foot easement extending from the south end of North Canal to the north end of the P-1 Lateral.	California Department of Transportation	U.S. Fish and Wildlife
E and F Pumping Plants	None.	Reclamation	N/A

Proposed Action	Property to be Acquired	Current Owner	Acquiring Party
Installation of Recirculation Pipeline at E Pumping Plant	None.	N/A	N/A
Installation of SCADA, Automated gates, and Upgraded turnouts	None.	N/A	N/A

### 6.2.2.2 Ecosystem Services

*Provisioning service, Water available for irrigation (Figure 4-1, [E1]):* Under the Modernization Alternative, ecosystem services of water for irrigation would be supported through the improvement of delivery infrastructure and increased efficiency and reliability of water delivery to District patrons. Water deliveries would not be interrupted as construction would take place predominantly outside of the irrigation season, and the District would have capacity to reroute water should construction occur during the irrigation season. Minor long-term adverse effects on agricultural land use would result from the expansion of irrigation infrastructure along the North Canal extension alignment. The Modernization Alternative would have an overall beneficial effect on water for irrigation.

*Cultural service, Culturally important natural areas (Figure 4-1, [E5]):* Ecosystem services of culturally important natural areas would be supported through gains in efficiency and reliability of water delivery to LKNWR, which would support habitat for wildlife and provide recreation opportunities. The Modernization Alternative would have an overall beneficial effect on culturally important natural areas.

## 6.3 Socioeconomic Resources

### 6.3.1 Alternative 1 - No Action Alternative (Future without Federal Investment)

#### 6.3.1.1 Regional Economic Development

There is no construction expenditure associated with the No Action alternative, and therefore there would be no construction economic development benefits.

### 6.3.2 Alternative 2 – Proposed Action - Modernization Alternative

#### 6.3.2.1 Regional Economic Development

The Modernization Alternative construction expenditures of \$16.9 million would support construction sector jobs and income, as well as economic ripple effects increasing jobs and income in other economic sectors in Klamath County. Economic ripple impacts would result from the construction sector spending more on labor, materials, and services, which would spur increased sales and economic activity in other sectors (such as hardware stores and construction equipment businesses supplying construction businesses). Impacts of construction sector spending in these other sectors are known as indirect impacts. As household income rises in construction and indirectly impacted economic sectors, household spending would also increase and generate increased economic activity in sectors such as retail, wholesale trade, personal services industries, and real estate (known as induced impacts). Total job and income impacts of the economic activity supported by the proposed project are the sum of the direct impacts (construction sector) and the indirect/induced impacts (in other economic sectors).



The \$16.9 million in construction expenditure would be spread over 3 years (see Table 8-3). Some project groups are primarily for new equipment (such as pumps and SCADA) that would be manufactured elsewhere and would be installed by current district personnel; as such, installation of these project groups is expected to result in minor economic impacts in Klamath County (see Table 8-2). The two project groups with expected local economic impacts from construction spending are Project Group 1 (North Canal Improvements) and Project Group 3 (Fish Screen), which together cost \$11.9 million. Spread over 3 years, construction of these project groups is expected to support approximately 40 jobs and \$2.2 million in average income over the 3-year construction period (annualized over 103 years;<sup>12</sup> this equates to approximately \$0.2 million in annualized average income benefits as presented in Table 5-1. Of these impacts, approximately 30 jobs and \$1.7 million in annual income would be in the construction sector (direct impacts), while the remaining 10 jobs and \$0.5 million income would be other sectors.

The Modernization Alternative would also result in a slight increase in operations, maintenance, and repair expenses for KDD and its patrons. However, there are not anticipated effects on District wages and employment. As such, there are expected to be limited regional economic development effects of this reduced expenditure (i.e., less than the rounding margin of error) so effects are not quantified in this regional economic development analysis.

To the extent that increased water to LKNWR enhances recreation and supports additional recreation visitation and spending in Klamath County, the long-term positive regional economic contribution of the project would be larger, and vice versa.

Finally, the Modernization Alternative may result in the long-term preservation of agricultural production (avoided crop damages) due to improved water supply management, but this potential benefit is not quantified due to uncertainty in how total irrigated water deliveries may change.

#### 6.3.2.2 National Economic Development Benefits

A National Economic Development (NED) benefit-cost analysis was performed to evaluate the benefits of the Modernization Alternative (Appendix D). This evaluation identified the costs and benefits associated with the No Action Alternative and Modernization Alternative. The analysis used NRCS guidelines for the evaluation of NED benefits as outlined in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (CEQ 2014) and the NRCS Water Resources Handbook for Economics.

## 6.4 Soils

### 6.4.1 Alternative 1 – No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, the continued operation of the District's conveyance system would have negligible or no adverse effects on soils within the planning area.

### 6.4.2 Alternative 2 – Proposed Action - Modernization Alternative

Under the Modernization Alternative, soil disturbance, vegetation clearing, backfilling, and grading would occur in the project area where infrastructure upgrades or new infrastructure are proposed. Clearing, compaction, and construction would increase soil erosion and sedimentation potential. BMPs would be implemented to minimize erosion and contain runoff on-site. BMPs implemented

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<sup>12</sup> Note that each project has a 100-year life, but since construction takes 3 years, benefits extend from year 0 to year 102, so the analysis period across all project groups is 103 years.

during construction activities could include the use of silt fencing, straw wattles, or geotextile filters, and/or applying water to disturbed soils to prevent wind erosion. Disturbed areas would be reseeded after construction in accordance with KDD management practices and NRCS guidance. During construction, soils adjacent to new and upgraded District infrastructure would be impacted due to construction equipment and staging. Existing maintenance roads and access routes would be used, when possible, to minimize soil disturbance. Temporary overland access routes would be used where no maintenance roads currently exist. These routes would be returned to their existing condition following construction.

Adverse effects on soil resources would be primarily minor and temporary. Many construction activities would take place in areas where the soil has previously been disturbed. BMPs would be used to ensure that adverse effects would be localized to the project area.

#### 6.4.2.1 North Canal Improvements

The North Canal extension would require the excavation of soil from the 14.47-mile canal alignment and construction of embankments along each side of the canal. Embankment construction may require fill material in addition to the material that would be excavated from the canal expansion alignment. Fill material could be brought in from the surrounding area or another location. The five crossing improvements would require excavation of soils to accommodate the construction and installation of culverts. Because additional specific improvement activities (such as crossing improvements) along the North Canal alignment could be identified in more advanced engineering designs, the full project area surrounding North Canal, estimated at 250.6 acres, could potentially be disturbed by construction impacts. Disturbances would have a minor temporary adverse effect on soils near and adjacent to North Canal. As noted in Section 4.7.2, the District's irrigation system—and particularly North Canal—is not identified as a stream, but rather is classified as an Artificial Path/Canal Ditch by the National Hydrography Dataset (USGS 2024) that does not provide suitable habitat to fish and wildlife species due to poor water quality, high water temperature, no flow variability, and a lack of proper food and shelter.

Excavation of existing soils and construction of embankments in the project area of the North Canal extension would have moderate, localized long-term adverse effects on soils.

#### 6.4.2.2 E and F Pumping Plant Upgrades

Upgrades to E and F pumping plants would require approximately 5,700 square feet of ground disturbance for upgrades to pumping plant transformers. There would be temporary minor adverse effects to soils within the footprint during construction.

#### 6.4.2.3 North Canal Fish Screens

Fish screen installation would include the construction of a 14-foot-wide, 6,900-foot-long gravel access road in the same location as an existing dirt road that runs parallel to North Canal on the northern side of the canal. Construction of this road would result in minor temporary adverse effects to soils during construction and minor long-term adverse effects in the location of the new gravel road.

Additional construction activities associated with fish screen installation—including cone screen installation, power line extension, sheet pile installation, and levee extension—would result in minor temporary adverse effects to soils during construction. The total estimated construction footprint for the North Canal fish screen installation is 16.6 acres.

#### 6.4.2.4 Installation of Recirculation Pipeline at E Pumping Plant

Installation of the E Pumping Plant recirculation pipeline would require approximately 3,933 square feet of ground disturbance. There would be temporary minor adverse effects to soils within the construction footprint.

#### 6.4.2.5 Installation of SCADA, Automated Gates, and Upgraded Turnouts

Altogether, the 14 proposed SCADA installation sites would require a total of approximately 7,878 square feet of ground disturbance. There would be temporary minor adverse effects to soils within the construction footprint.

#### 6.4.2.6 Farmland Classification

No long-term adverse effects would be expected on any federal or state-level farmland designations including prime farmland or farmland of statewide importance. Minor, temporary adverse effects on limited amounts of agriculturally important soils would be expected during construction.

Implementation of BMPs would minimize these adverse effects, and construction would primarily be limited to areas within existing easements and ROW. An easement for the North Canal extension would be required prior to construction. There would be a beneficial effect on prime farmland and farmland of statewide importance due to improved irrigation water delivery efficacy and reliability.

### 6.5 Vegetation

#### 6.5.1 Alternative 1 – No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, vegetation within the network of open irrigation canals and laterals, pastures, and cultivated fields, and the LKNWR would remain in its current condition within the planning area.

#### 6.5.2 Alternative 2 – Proposed Action - Modernization Alternative

Completing the Modernization Alternative would involve terrestrial and aquatic vegetation clearing and weed management in the project area before and during construction. Overall, the Modernization Alternative would have a minor, temporary direct effect on terrestrial and aquatic vegetation in the planning area. The Modernization Alternative would have long-term beneficial effects on crops grown within the project area. In the long-term, the Modernization Alternative might potentially alter habitat for aquatic vegetation that is adapted to warm and stagnant water in the planning area.

##### 6.5.2.1 North Canal Improvements

Extension of North Canal would require excavation of the canal alignment and bank construction; therefore, vegetation would be permanently removed from the construction area, causing a long-term, minor adverse effect.

Modification of five road crossings and the extension of North Canal would involve permanent terrestrial vegetation removal within the footprint of construction-related activities, causing a long-term, minor adverse effect. Installation of additional culverts at each crossing would involve permanent removal of aquatic vegetation, causing a long-term, minor adverse effect. Additionally, there would be a temporary minor adverse effect on vegetation surrounding the footprint from construction work area disturbance.

Because additional specific improvement activities (such as crossing improvements) along the North Canal alignment could be identified in more advanced engineering designs, the full project area surrounding North Canal, estimated at 250.6 acres, could potentially be disturbed by construction impacts. Disturbances would have a minor to moderate temporary adverse effect on aquatic and terrestrial vegetation.

In the long-term, increasing the flow capacity from 250 cfs to 350 cfs would have a potential indirect beneficial moderate effect to aquatic vegetation in the planning area outside of the District, specifically in the LKNWR.

#### 6.5.2.2 E and F Pumping Plant Upgrades

Ground and vegetation disturbance would occur at areas proposed for the transformer upgrades, causing minor, short-term adverse effects on vegetation. All other construction activities would occur within the existing footprint of the pumping plants and would have no adverse effect on existing vegetation.

#### 6.5.2.3 North Canal Fish Screens

Ground disturbance and both terrestrial and aquatic vegetation disturbance would occur at areas proposed for fish screen installation and construction access. Temporary, minor effects due to disturbance of aquatic vegetation in the canal and wetland vegetation adjacent to the fish screen construction would occur. Contractors would reestablish vegetation in temporarily impacted areas after construction.

#### 6.5.2.4 Installation of Recirculation Pipeline at E Pumping Plant

Ground and vegetation disturbance would occur within the construction footprint. Vegetation within the footprint could be temporarily or permanently adversely affected by construction activities and installation of the pipeline.

#### 6.5.2.5 Installation of SCADA, Automated Gates, and Upgraded Turnouts

Ground and vegetation disturbance would be expected at each monitoring site where SCADA and automated gates would be installed; however, adverse effects would be minor and temporary.

#### 6.5.2.6 Special Status Plant Species

Applegate's milkvetch is likely present in the planning area in dry and moist habitats. The most suitable habitat is located in the southwest corner of the District. No project activities are proposed in that area. Therefore, there might be negligible indirect adverse effects to the Applegate's milkvetch individuals and its suitable habitat.

#### 6.5.2.7 Noxious Weeds

During construction, exposed soils would be susceptible to weed invasion. The movement of construction vehicles could provide opportunities to spread weeds by transporting their seeds to new locations. During construction, the contractor would use BMPs such as avoiding unnecessary ground disturbances, minimizing ground disturbance, and using erosion-control materials that are free of weeds and weed seeds. With the use of BMPs, the Modernization Alternative would have a moderate, short-term adverse effect, and likely a minor, long-term adverse effect on noxious weeds.

After construction, revegetated areas would no longer present opportunities for new noxious weeds to invade. After construction, weeds would be regularly managed by the landowners. The Modernization Alternative would have a negligible long-term adverse effect on noxious weeds.

## **6.6 Water Resources**

### **6.6.1 Alternative 1 – No Action Alternative (Future without Federal Investment)**

#### **6.6.1.1 Water Rights**

Under the No Action Alternative, KDD would maintain its existing water rights. Improvement to water management would not occur, and there would be no changes in available water for agricultural production. The new point of water delivery from North Canal to LKNWR would not be installed, and there would not be an opportunity for delivery of LKNWR water rights to the P-1 Lateral. There would be no effect on District water rights.

#### **6.6.1.2 Surface Water Hydrology**

Under the No Action Alternative, there would be no change in effect on waterbodies associated with District operations in the project area or to the LKNWR, nor would there be a change in adverse effect on drainage courses in the project area.

#### **6.6.1.3 Surface Water Quality**

The No Action Alternative would have no change in adverse effect on surface water quality or Oregon's Section 303(d) listings in the waterbodies associated with District operations in the planning area (see Table 4-8). Operational spills along the KSD and the Klamath River would continue to occur at the current rate, likely contributing continued nonpoint source pollutants into the Klamath River, the KSD, and waterbodies of the LKNWR.

#### **6.6.1.4 Groundwater**

The No Action Alternative would have no effect on groundwater. Seepage and subsurface flow do not enter groundwater but are instead captured by toe drains and returned to the Klamath River via District drains and the KSD.

#### **6.6.1.5 Floodplains**

The No Action Alternative would have no effect on floodplains.

#### **6.6.1.6 Ecosystem Services**

The No Action Alternative would not affect ecosystem services associated with water resources (Section 4.6.1).

### **6.6.2 Alternative 2 – Proposed Action – Modernization Alternative**

#### **6.6.2.1 Water Rights**

##### **6.6.2.1.1 Klamath Drainage District**

Under the Modernization Alternative, there would be no adverse effect to the District's water rights, but modernization activities would improve the District's and its patrons' ability to use water rights. The locations of the District's points of diversions would not change under this alternative.

##### **6.6.2.1.2 Lower Klamath National Wildlife Refuge**

The extension of North Canal to the LKNWR P-1 Lateral would provide a new point of water delivery and provide the capacity for KDD to deliver that water. Following implementation, USFWS would amend LKNWR water rights to include the existing point of diversion to Sheepy Lake and to list North Canal as a secondary point of diversion for LKNWR.

### 6.6.2.2 Surface Water Hydrology and Quality

The Modernization Alternative would either have a range of effects on surface water hydrology and water quality in waterbodies associated with District operations (Table 4-8 in Section 4.6.3). Effects on individual waterbodies are identified below.

#### 6.6.2.2.1 Upper Klamath Lake

Implementation of the Modernization Alternative would have no adverse effect on surface water hydrology or water quality of Upper Klamath Lake, as all project actions would occur downstream from Upper Klamath Lake.

#### 6.6.2.2.2 Klamath River

Portions of the Klamath River that would be affected by the project include the reach from the North Canal diversion point downstream to the Keno Dam.

Implementation of the Modernization Alternative would allow the District to better manage the water in the conveyance system through improved pumping that would result in more circulation and reuse of water throughout the District and a minor reduction of discharge to the Klamath River. Implementation of the Modernization Alternative would have a long-term, minor adverse effect on surface water hydrology and water quantity discharged to the Klamath River through a reduction in tailwater discharge to the Klamath River due to the improvements on KDD's capacity to recirculate water.

The Modernization Alternative project actions—including recirculation and pumping plant improvements and new SCADA controls and automated gates—would have a long-term, minor beneficial effect on the water quality of discharge to the Klamath River resulting in an overall improvement of water quality within the river. Benefits to the water quality of the Klamath River would include cooler temperatures of tailwater within the KSD prior to discharge due to improved circulation. Reducing the temperature of tailwater being delivered to the Klamath River would help reduce temperatures in the river, benefiting salmonids and other fish that depend on cool water (EPA 2003). Additionally, with proper management of seasonal recirculation operations, improved recirculation of drainage water should generally benefit water quality parameters for both temperature and nutrients in Ady Canal, the Klamath River downstream of KSD, and KSD. Sullivan et al. (2014) found that with recirculation, the total annual loads of nitrogen and phosphorus in Ady Canal and KSD would decrease, and that total nitrogen and phosphorus loads imported to the Klamath River from KSD would decrease. However, at some times of the year, Ady Canal, KSD, and Klamath River would experience decreased water quality and would have differing water quality effects compared to each other.

There is ongoing research which shows that wetlands in LKNWR could remove nutrient loads offering the potential to treat waters from Upper Klamath Lake and KDD drainage water. Wetlands can naturally remove or deactivate pollutants through several physical, biological, and chemical processes. Irrigating wetlands in LKNWR could mimic the natural function of the reclaimed Lower Klamath Lake and improve the water quality of agricultural runoff prior to its discharge to the Klamath River (Stillwater Sciences 2023).

The North Canal fish screen in the Modernization Alternative includes the upgrading of existing private dirt roads that will redevelop approximately 2.2 acres and create an additional 0.02 acre of new contributing impervious surfaces. Stormwater runoff from these roads would convey pollutants to the Klamath River. These pollutants include but are not limited to PAHs, metals, 6PPD-quinone,

and sediment. Many of these pollutants are persistent in the aquatic environment, travel long distances in solution or adsorbed onto suspended sediments, and may become remobilized or re-enter solution as they move through the system. Water quality treatment will be provided for 100% of redeveloped and new contributing impervious surfaces likely through a combination of biofiltration swale, compost-amended vegetated filter strips, or other similar treatment BMPs to treat roadway stormwater before interception with the Klamath River. Despite treatment, stormwater runoff does contain some level of pollutants and will have a small incremental effect on pollutant levels in the entirety of the Klamath River because of the sustained and chronic nature of stormwater discharge.

#### *6.6.2.2.3 Lower Klamath Lake*

Implementation of the Modernization Alternative would have a potential indirect, beneficial major long-term effect on surface water hydrology of Lower Klamath Lake because the North Canal improvements would improve the efficiency of irrigation water management for receiving lands in LKNWR, including Lower Klamath Lake. The North Canal extension would allow for another point of delivery to LKNWR via North Canal, in addition to water currently delivered to Sheepy Lake through Ady Canal. There would also be a moderate long-term beneficial effect to Sheepy Lake because of improvements to Ady Canal, including installation of SCADA controls. Water delivery to LKNWR would provide water for wildlife habitat year-round including during spring migration and the nesting season. Although additional water delivery to LKNWR is not part of this project, in the future, water delivered at the new point of delivery would be able to reach most of LKNWR lands (G. Austin, Manager, Klamath Basin National Wildlife Refuge Complex, personal communication, March 22, 2023; Austin, 2023).

North Canal improvements would have an indirect, moderate long-term beneficial effect on water quality in the LKNWR through enabling a new point of delivery to LKNWR which would support water quality functions that wetlands provide including removing nitrogen, phosphorus, and pesticides from agricultural runoff.

#### *6.6.2.2.4 Miller Lake*

Implementation of the Modernization Alternative would have no effect on surface water hydrology or water quality of Miller Lake. Changes in the quantity or quality of water provided to this lake are not anticipated to result from the project and no project actions would occur there.

#### *6.6.2.2.5 Sheepy Lake*

Implementation of the Modernization Alternative would have a beneficial moderate long-term effect on surface water hydrology of Sheepy Lake since project actions along the Ady Canal, including installation of SCADA controls and recirculation and pumping improvements, would improve the efficiency of irrigation water management for receiving lands in Sheepy Lake and the LKNWR.

Implementation of the Modernization Alternative would have a moderate, beneficial long-term effect on water quality of Sheepy Lake because improved circulation and pumping in the District would provide moderate improvement in water quality parameters.

#### *6.6.2.2.6 Drainage Courses*

Implementation of the Modernization Alternative would have a beneficial effect on surface water hydrology of the KSD since improved pumping through pumping plant upgrades and the installation of the recirculation pipeline would enhance surface water management of drainage water. Implementation of the Modernization Alternative would also have a potential indirect beneficial

effect on surface water hydrology of North Canal by increasing its flow capacity from 250 to 350 cfs.

Implementation of the Modernization Alternative project actions including pumping plant upgrades and installation of a recirculating pipeline would have a beneficial, moderate long-term effect on water quality of KSD through improved circulation. Improved recirculation of drainage water on District lands generally should decrease the amount of nutrients returned to KSD, with the assumption that wetlands and agricultural use both remove nutrients. Improved circulation would allow for more efficient conveyance of water and would result in an overall reduction in water temperature and improvements to other water quality parameters (turbidity, sediment, and pollutants). Additionally, improved pumping would allow the District to conduct flushing events that may help to manage concentrations of nutrients and salinity on District and LKNWR lands.

#### 6.6.2.3 Groundwater

Groundwater is not used for irrigation by the District. Aside from drainage, there is limited interaction between surface water and groundwater. Project actions are not expected to result in changes to groundwater conditions. Therefore, the Modernization Alternative would have no adverse effects on groundwater resources.

#### 6.6.2.4 Floodplains

Fish screen installation within the 100-year floodplain of the Klamath River would include the construction of a 14-foot wide, 6,900-foot-long gravel access road in the same location as an existing dirt road that runs parallel to North Canal on the northern side of the canal. Construction of this road would result in minor temporary adverse effects during construction.

Additional construction activities associated with fish screen installation—including cone screen installation, power line extension, sheet pile installation, and levee extension—would result in minor temporary adverse effects to floodplain conditions during construction. Compliance with local floodplain permits would be required to ensure no long-term impacts to floodplain functions.

#### 6.6.2.5 Ecosystem Services

The Modernization Alternative would affect ecosystem services provided by water in the Klamath River and wildlife habitat at LKNWR in the following ways.

*Provisioning service, Irrigation water (Figure 4-1, [E1]):* Implementation of the Modernization Alternative would have a beneficial effect on irrigation water deliveries to District patrons through the installation of SCADA systems and automated gates and the E Pump Recirculation pipeline from KSD into Center Canal. There would be a potential indirect beneficial effect to LKNWR through the North Canal improvements (canal extension and improvements in road crossings). Modernizing District irrigation infrastructure—including pump station upgrades, recirculation improvements, and SCADA controls—would enable the District to be more resilient to environmental changes and maximize the efficiency of water conveyance and use over time.

*Regulating service, Water quality (Figure 4-1, [E3]):* Implementing the Modernization Alternative would result in improvements in water use efficiency in the District and associated improvement to water resulting from lower temperatures of water returned to the Klamath River. The District's increased capacity to deliver more water to LKNWR would support wetlands thereby improving the water quality functions these wetlands provide. Overall, the Modernization Alternative would have a long-term beneficial effect on water quality.



*Cultural service, Culturally important fish and aquatic species (Figure 4-1, [E4]):* Following the modernization project, the improved water quality of water returned to the Klamath River and the potential for additional water delivery to LKNWR via the North Canal connection to P-1 would have a beneficial effect on wetland and instream habitat for culturally important fish; this would positively affect community member values and contribute to the enhancement of fishing, community, health, cultural identity, subsistence, and tribal values.

## **6.7 Fish and Aquatic Resources**

### **6.7.1 Alternative 1 – No Action Alternative (Future without Federal Investment)**

#### **6.7.1.1 General Fish and Aquatic Species**

The No Action Alternative would have no new adverse effects to fish and aquatic species because the North Canal Fish screen would not be constructed. Adverse effects to fish and aquatic species would continue to occur from entrainment into the District's North Canal and associated lateral system in addition to insufficient water deliveries to the LKNWR. The No Action alternative would have no new adverse effect on fish and aquatic species or their habitats in the waterbodies affected by District operations because discharges to the Klamath River and deliveries to LKNWR would not change.

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

The No Action Alternative would have no direct or indirect adverse effects on federally listed fish and aquatic species or their habitat in the waterbodies affected by District operations for reasons stated in Section 6.7.1.

In the long-term, fish larvae and juvenile fish entering the KDD conveyance system would continue to become stranded. The No Action Alternative would have no new adverse effects to endangered shortnose and Lost River sucker populations.

#### **6.7.1.3 Ecosystem Services**

The No Action Alternative would not affect ecosystem services provided by fish and aquatic species in waterbodies associated with District operations and LKNWR (Section 4.7.1).

### **6.7.2 Alternative 2 – Proposed Action – Modernization Alternative**

#### **6.7.2.1 General Fish and Aquatic Species**

During the construction of the fish screens at the North Canal Diversion on the Klamath River, there would be minor direct temporary adverse effects on fish and aquatic species within the planning area. Installation of the fish screens might require temporary dewatering in the construction zone; therefore, the construction area would be temporarily unavailable for aquatic organisms. After the Modernization Alternative is complete, the fish screens would directly benefit fish species by keeping resident fish from entering North Canal. In the long-term, the North Canal fish screens would be especially important to both anadromous and resident now that the J.C. Boyle, Copco 1, Copco 2, and the Iron Gate dams on the Klamath River are removed.

During construction at the five North Canal crossings, there would be minor direct short-term adverse effects on fish and other aquatic organisms in the planning area due to temporary dewatering and installing a bypass system. Common aquatic species such as western toad, northwestern pond turtle, Pacific treefrog, long-toed salamander, and invasive bullfrog have been

known to use District canals and laterals. Impacts to fish and aquatic species would be minimized using appropriate BMPs. Specific measures that could be used for avoiding and minimizing the effects to fish and other aquatic organisms are presented in Appendix E.11.

Extension of North Canal from Fugate Road to CSH 161 would have none to negligible adverse effects on fish and aquatic species in the project area during construction since BMPs would be in place to exclude them from entering the construction work area. Completion of the extension along with modifications at five canal crossings would create a new point of water delivery to LKNWR which would have a potential indirect beneficial effect for fish and aquatic habitat within the refuge if the refuge obtains additional water rights to be delivered through this connection.

Installation of the recirculation pipeline to recirculate water from KSD to Center Canal would allow for pumping of up to 100 cfs into Center Canal for delivery to agricultural lands including Area K. The adverse effect of the recirculation pipeline installation to fish and aquatic species in the planning area would be negligible.

The Modernization Alternative project actions including recirculation and pumping plant improvements, and SCADA controls and automated gates would have a long-term minor beneficial effect on water quality discharging to the Klamath River resulting in an overall improvement of water quality within the river. Faster moving water may improve water quality parameters such as temperature and dissolved oxygen. Adverse effects on chlorophyll a, ammonia and pH levels, and other nutrient concentrations would be negligible.

#### 6.7.2.2 Federally Listed Fish and Aquatic Species

A biological assessment is being prepared to evaluate the potential effects of the Modernization Alternative on federally listed and proposed fish, other aquatic species, designated critical habitat, and EFH. Coordination with USFWS and NMFS<sup>13</sup> is ongoing.

A list of protected species that may occur within the planning area identified in Section 4.7.3 was used to initiate coordination with USFWS. Further, shortnose sucker, Lost River sucker, northwestern pond turtle, and SONCC coho salmon were considered for evaluation of potential effect.

##### 6.7.2.2.1 *Lost River Sucker and Shortnose Sucker*

The Modernization Alternative is likely to adversely affect the Lost River sucker and shortnose sucker in the short-term during construction, specifically from dewatering, vibratory sheet pile installation for the cofferdam, and repairs to the North Canal levee.

The Modernization Alternative elements such as the fish screen installation and alterations to water quality and quantity of water discharging to the Klamath River from KSD would have long-term beneficial impacts on Lost River sucker and shortnose sucker present within the Klamath River. Although fish screen installation would result in a minor loss of critical habitat for suckers, beneficial impacts of the Modernization Alternative will result in an overall net benefit to critical habitat. Additionally, alterations to water management within KDD as a result of the proposed Modernization Alternative would improve water quality within the KDD conveyance network, Sheepy Lake, and LKNWR. Suckers would still be able to be entrained into KDD via Ady Canal, and alterations to flow and water quality improvements within conveyance infrastructure would affect entrained suckers.

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<sup>13</sup> National Oceanic and Atmospheric Administration National Marine Fisheries Service.

#### 6.7.2.2.2 *Northwestern Pond Turtle*

The Modernization Alternative is likely to have minor short-term effects on northwestern pond turtle during construction, specifically from ground disturbance adjacent to canals, dewatering, and vibratory sheet pile installation for the cofferdam. Best management practices such as vibratory driving of piles and exclusionary fencing will avoid and minimize impacts to the species.

The Modernization Alternative elements such as North Canal extension and improvement to Ady Canal would have potential moderate indirect, beneficial long-term effects to northwestern pond turtle in Sheepy Lake and LKNWR. An additional point of delivery to LKNWR via North Canal and SCADA installation on Ady Canal may increase water delivery to Sheepy Lake and LKNWR which would increase habitat quality for northwestern pond turtles in these areas.

#### 6.7.2.2.3 *SONCC Coho Salmon*

Construction of the Modernization Alternative would have no effect on SONCC coho salmon in the planning area as the species is not present in this reach of the Klamath River. However, increase in stormwater runoff associated with upgrading of existing private dirt roads would result in small incremental effect on pollutant levels in the entirety of the Klamath River. Thus, the Modernization Alternative would have a minor, long-term adverse impact on SONCC coho salmon due to the small increase in pollutant levels in the Klamath River.

#### 6.7.2.2.4 *Eulachon*

Construction of the Modernization Alternative would have no effect on southern DPS eulachon in the planning area as the species is absent from this reach of the Klamath River. However, the Modernization Alternative would have minor, long-term adverse impact on southern DPS eulachon due to the small increase in pollutant levels downstream in the entirety of the Klamath River as discussed above for SONCC coho salmon.

#### 6.7.2.2.5 *Essential Fish Habitat*

Construction of the Modernization Alternative would have no effect of Pacific salmon or Pacific coast groundfish EFH within the planning area as these habitats are not designated with the planning area. However, the Modernization Alternative would have minor, long-term adverse impact on Pacific salmon and Pacific coast groundfish EFH due to the small increase in pollutant levels downstream in the entirety of the Klamath River as discussed above for SONCC coho salmon.

If Pacific salmon EFH is designated for the Klamath River upstream of the dam removals, the Modernization Alternative will overall provide a long-term net benefit due to project elements such as the fish screen installation and alterations to water quality and quantity of water discharging to the Klamath River from KSD. Although fish screen installation would result in a loss of EFH for Pacific salmon, the loss of habitat is minor and beneficial impacts of the Modernization Alternative would result in an overall net benefit to Pacific salmon EFH.

#### 6.7.2.3 *Ecosystem Services*

Ecosystem services provided by fish and aquatic species living in the Klamath River would be affected by the Modernization Alternative in the following ways.

*Provisioning service, Instream fish populations (Figure 4-1, [E2]):* Over the long-term, the efficient use of water would improve the water quality of discharged tailwater to the Klamath River thereby benefitting fish and aquatic species habitat in the river downstream from the planning area.

Installation of the North Canal fish screen would benefit fish populations in the planning area by preventing their entrainment in irrigation canals and laterals. Improvements in river habitat conditions may contribute to more consistent fishing for harvest and consumption.

*Cultural service, Culturally important fish and aquatic species (Figure 4-1, [E4]):* Following the modernization project, the improved water quality of returned water and installation of the North Canal fish screen would have a beneficial effect on instream habitat for culturally important fish, which would positively affect community member values and contribute to enhancement of fishing, community, health, cultural identity, subsistence, and tribal values.

## **6.8 Wetland and Riparian Areas**

### **6.8.1 Alternative 1 – No Action Alternative (Future without Federal Investment)**

Under the No Action Alternative, there would be no adverse effect on wetland and riparian vegetation associated with the network of irrigation canals and laterals. Wetlands in and near the canals and laterals would remain in their current condition and would be regularly managed for algae, vegetation control, and access.

#### **6.8.1.1 Ecosystem Services**

The No Action Alternative would not adversely affect ecosystem services associated with wetland and riparian areas (Section 4.8.1).

### **6.8.2 Alternative 2 – Proposed Action – Modernization Alternative**

Based on NWI mapping, wetlands and riparian areas occur in the project area; therefore, there would likely be temporary and/or permanent direct and indirect effects on wetlands and riparian areas in the project area (Appendix E.9). The exact extent of impact on aquatic resources would be determined after the permitting phase of the project. Appropriate BMPs would be used to avoid or minimize adverse effects (Appendix E.11). Permitting and compliance requirements are discussed in Section 6.8.2.1

Overall, in the long-term the increase in water supply may lead to a beneficial effect on wetland functions such as water storage, groundwater recharge, organic matter accumulation, and habitat diversity (Adamus and Verble 2020).

Improved quality of tailwater returning to the Klamath River via the Center Canal would have minor indirect beneficial effects on wetland water quality and wetland functions within the Klamath River floodplain outside of planning area.

The potential effects to wetlands and riparian areas from specific proposed actions are described below.

#### **6.8.2.1 North Canal Improvements**

During the construction of improvements along North Canal, there would be disturbance to wetland plants and hydric soils. The construction of the North Canal improvements at five road crossings, construction of the extension from Fugate Road to LKNWR, and construction of embankments along each side of the canal would cause direct long-term moderate adverse effects on wetlands in the construction footprint.

Temporary disturbance to wetlands would also be expected due to temporary dewatering, sedimentation, or construction access.

The North Canal extension and crossings would have moderate, direct adverse effects on wetlands located in the construction footprint. Completion of the extension along with modifications at the five canal crossings would create a new point of water delivery to LKNWR, which would have a potential indirect beneficial effect on wetlands and riparian areas within the refuge if the refuge obtains additional water rights to be delivered through this connection. Currently, wetlands in LKNWR are experiencing stress and a decline in habitat quality due to water shortages.

#### 6.8.2.2 E and F Pumping Plant Upgrades

Wetland and riparian area disturbance would occur at areas proposed for the transformer upgrades. All other construction activities would occur within the existing footprint of the pumping plants and would have negligible adverse effects to wetland and riparian areas.

#### 6.8.2.3 North Canal Fish Screens

NWI mapping indicates there are wetlands adjacent to North Canal, next to the existing private dirt road on the northern side of North Canal and located between North Canal and the dirt road (Appendix E.9). Therefore, during the construction of the North Canal fish screens, upgrade of an access road, and the upgrade and extension of the power line, there would be direct long-term adverse moderate effects to wetlands located in the construction footprint.

The effects would result from permanent fill and loss of wetland vegetation and hydric soil within the 16.6 acres of the construction footprint. Due to an abundance of the herbaceous type of wetlands in the planning area and in the vicinity of planning area, the localized impacts to the wetlands in the project footprint would not cause the loss of unique or irreplaceable habitat. See Section 6.2.2 for a discussion of impacts to recreation uses from these improvements.

Minor, localized temporary indirect impacts to adjacent wetlands are also expected to occur from temporary water isolation and potential sedimentation. Because temporary impacts would not change the area hydrology, temporarily disturbed wetlands and riparian areas would return to pre-construction conditions.

As described in Section 5.3.2, repairing breaks in the levee would reduce channel-floodplain connectivity, limiting the natural exchange of sediment, nutrients, and organisms between the river and adjacent wetland and riparian areas. The flood storage benefits of the wetlands would be reduced.

#### 6.8.2.4 Installation of Recirculation Pipeline at the E Pumping Plant

There are no wetlands mapped by NWI in the recirculation pipeline at E Pumping Plant area (Appendix E.9). There would be no effect to wetlands unless wetlands were determined to be present during a field wetland delineation. If wetlands are present, the proposed action would have minor short-term and minor long-term effects due to a small footprint.

#### 6.8.2.5 Installation of SCADA, Automated Gates, and Upgraded Turnouts

All but two proposed SCADA locations have herbaceous and shrub-scrub wetlands mapped by the NWI (Appendix E.9). On the ground determination of jurisdictional wetlands within the planning area is needed. Wetland vegetation and hydric soil disturbance would be expected at each monitoring site where SCADA and automated gates would be installed; the adverse effects would be moderate, unless each SCADA and automated gate installation site could be located outside of wetlands.

#### 6.8.2.6 Permitting and Compliance

A wetland and waters delineation would be conducted prior to the implementation of Modernization Alternative projects to determine the limits of direct and indirect adverse effects on wetlands and waters of the United States. Jurisdictional determination by USACE and DSL of delineated boundaries of wetlands and waters would be obtained.

The project would be designed to minimize, avoid, and mitigate adverse effects on wetlands and waters. Coordination with USACE, DSL, and DEQ would be conducted prior to submittal of a Joint Permit Application to these agencies. Their authorizations would be required prior to implementation of each site-specific action to ensure the Modernization Alternative either meets exemption criteria (see Section 4.8) or that the proper permitting is completed. Permits from USACE and DSL for effects on wetlands and waters, consultation with ODFW for fish screening, and a Section 401 Water Quality Certification from DEQ would be required to confirm that the project meets federal and state regulatory requirements. During the construction, contractors would be required to follow BMPs to ensure that adverse effects on wetlands and waters are avoided and minimized. Unavoidable impacts to jurisdictional wetlands would likely require mitigation.

If the permitting agencies determine that compensatory mitigation is necessary to offset unavoidable impacts to aquatic resources, the amount of required compensatory mitigation must be, to the extent practicable, sufficient to replace lost aquatic resource functions. An appropriate functional assessment tool and methods would be used to determine how much compensatory mitigation is required. There are no USACE- or DSL-approved compensatory mitigation banks in the Lower Klamath Lake watershed. Therefore, a permittee-responsible mitigation could be provided on-site or off-site.

After construction, temporarily disturbed areas affecting wetlands, waters, and riparian habitats would be restored to pre-construction conditions and would be replanted with native vegetation.

#### 6.8.2.7 Ecosystem Services

The Modernization Alternative would affect ecosystem services provided by wetlands and riparian areas within and adjacent to the planning area in the following ways.

*Cultural service, Culturally important natural areas (Figure 4-1, [E5]):* Implementation of the Modernization Alternative would result in increased water supply to LKNWR and improvements in water use efficiency that would help improve water quality in the Klamath River. These effects would provide benefits to wetland and riparian areas in and adjacent to the planning area, including those within the LKNWR. Overall, the Modernization Alternative would have a long-term beneficial effect on culturally important natural areas.

### 6.9 Wildlife Resources

#### 6.9.1 Alternative 1 – No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, wildlife communities in the project area would continue to use the wetland, riparian, and upland habitats established in the fields and along the District's canal and lateral system. Wildlife and bird species would continue to use managed habitats within LKNWR.

#### 6.9.2 Alternative 2 – Proposed Action – Modernization Alternative

During construction, terrestrial wildlife could experience noise disturbance due to heavy equipment operation and habitat disturbance due to vegetation and soil clearing and grading. Most construction

would occur in agricultural areas where heavy equipment use is commonplace; therefore, most wildlife in the area is accustomed to noise and these disturbances are anticipated to be minor.

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 temporary moderate adverse effect on breeding migratory songbirds or water birds due to construction activities occurring withing the nesting season, which lasts from March 1 to August 31. To minimize adverse effects, prior to starting construction the construction zone would be surveyed for active nests by a biologist qualified to follow USFWS and ODFW survey protocols. If nesting is occurring in or near the construction area, the biologist would work with the contractor to monitor the nest and confirm that chicks have fledged. Construction would commence after young chicks have fledged or construction clearance has been received from ODFW.

The District 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 in the planning area and vicinity is December 1 through August 31. North Canal in the northern half of the project is adjacent to known golden eagle nesting sites located to the north of the planning area. Therefore, a seasonal restriction on the use of high noise equipment is in effect for construction in the northern part of the planning area. Additionally, pre-clearance surveys would occur prior to construction to verify the presence or absence of golden eagles in the area. These surveys would be consistent with USFWS survey guidelines. Post-project monitoring would also occur if needed via coordination between USFWS and USDA in accordance with Pub. L. No. 83-566, Section 12.

Additionally, implementation of the Modernization Alternative would make it possible for increased flows via an additional point of delivery to LKNWR, which is in critical need of receiving more water to support aquatic habitat for migratory birds. Improved water flow would allow more consistent access to water for hydrophytic plants and aquatic organisms, and this could in turn enhance riparian wildlife habitat of LKNWR. Overall, the Modernization Alternative would potentially have indirect long-term beneficial effect on general wildlife if the LKNWR obtains additional water rights to be delivered through the North Canal.

#### 6.9.2.1 North Canal Improvements

Construction activities would cause short-term minor direct adverse effects on wildlife due to increased human presence and initial clearing and grubbing of habitat. Construction may cause species to move away from the construction zone and pursue other areas to inhabit.

#### 6.9.2.2 E and F Pumping Plant Upgrades

Construction activities would cause short-term minor adverse effects on wildlife due to increased human presence and initial clearing and grubbing of habitat. In the long-term, upgrades to the pump stations at multiple locations across the District systems would potentially reduce human presence through the project area, as fewer trips to maintain ditches and headgates would be necessary. This would result in fewer human-wildlife conflicts and increased seclusion for wildlife, creating a beneficial effect.

#### 6.9.2.3 North Canal Fish Screens

Wetlands surrounding the fish screens and access road portion of the project area do not experience high levels of disturbance associated with agriculture; therefore, wildlife in this area may be more susceptible to adverse effects of disturbance associated with construction and operation.

Construction activities would cause short-term negligible adverse effects on wildlife due to increased

human presence and initial clearing and grubbing of habitat. Maintenance of the fish screens would result in increased vehicular use of the improved access road, and regular maintenance visits would have long-term minor adverse effects on wildlife in that area.

#### 6.9.2.4 Installation of Recirculation Pipeline at E Pumping Plant

Construction activities would cause short-term minor adverse effects on wildlife due to increased human presence and initial clearing and grubbing of habitat.

#### 6.9.2.5 Installation of SCADA, Automated Gates, and Upgraded Turnouts

Construction activities would cause short-term minor adverse effects on wildlife due to increased human presence and initial clearing and grubbing of habitat. In the long-term, installation of SCADA and automated gates at multiple locations across the District systems would potentially reduce human 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 increased seclusion for wildlife, creating a beneficial effect.

#### 6.9.2.6 Federally Listed Wildlife Species

A list of protected species that may occur within the planning area identified in Section 4.7.3 was used to initiate coordination with USFWS. During the coordination between the District, USFWS (Ann Gray), NMFS (Tom Hausmann), and ODFW (Jeremy Thompson), the proposed project and its potential effects on ESA-listed species and critical habitat were discussed, and it was determined that the proposed action would have No Effect on the gray wolf, North American wolverine, and yellow-billed cuckoo. A draft biological assessment prepared by Parametrix biologists documents the species considered, effects analysis, and effects determination.

## 6.10 Cumulative Effects

Cumulative effects are defined by CEQ regulations in 40 C.F.R. 1508.1(g)(3) as “effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.”

Cumulative effects may be additive or interactive. Additive effects are the sum of the effects on a resource. For example, diversions from surface water sources for agricultural irrigation and domestic consumption contribute incrementally and additively to surface water flow reductions. Interactive effects may be either countervailing—where the net adverse cumulative effect is less than the sum of the individual effects—or synergistic—where the net adverse cumulative effect is greater than the sum of the individual effects. This section includes a description of past, current, and reasonably foreseeable future actions, and cumulative effects organized by resource.

### 6.10.1 Past Actions

Past actions are summarized as land development activities that include irrigated agriculture (consisting of construction of the canal and drainage system, diversions, and associated infrastructure), commercial development, rural residential development, water diversions for nonagricultural uses, and transportation infrastructure. The nature and extent of these past actions and how they have influenced the existing environment are described for each resource in Section 4.

KDD development dates to 1907 when two railway companies constructed an embankment across the marshes connecting the northern end of Lower Klamath Lake with the Klamath River. KDD



was formed in 1915 after the passage of the Warren Act in 1911. KDD entered a contract with the secretary of the interior in 1917, which authorized closing the Klamath Straits gates, draining the land, and allowing for farming. Construction of North Canal, Ady Canal, drains, dikes, and pumping stations began shortly thereafter. In the years that followed, KDD made several improvements to its facilities to increase water deliveries within its boundary and worked with Reclamation to enlarge Ady Canal, allowing for increased water deliveries to LKNWR (KDD 2015).

Seventeen irrigation districts within the Klamath Basin are a part of the Klamath Project, collectively altering the natural hydrology of the Klamath River and its tributaries. These districts include Ady District Improvement Company, Enterprise Irrigation District, Horsefly Irrigation District, Klamath Irrigation District, Langell Valley Irrigation District, Malin Irrigation District, Midland District Improvement Company, P Canal Mutual Water Company, Pine Grove Irrigation District, Pioneer District Improvement Company, Plevna District Improvement Company, Poe Valley Improvement Company, Shasta View Irrigation District, Sunnyside Irrigation District, Tulelake Irrigation District, Van Brimmer Ditch Company, and Westside Improvement District.

### **6.10.2 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 occur on an ongoing basis. Reasonably foreseeable future actions generally include those actions formally proposed or planned or 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.

#### **6.10.2.1 Land Use Development**

Ongoing agricultural activities including crop production and pasturing in the project area are not expected to change from current conditions. Land use and development in the project area would continue to be managed according to the Klamath County Comprehensive Plan, Siskiyou County Comprehensive Plan, Klamath County Land Development Code, and Siskiyou County Zoning Ordinance. Public lands would continue to be maintained for their intended uses.

#### **6.10.2.2 Klamath Project Irrigation District Modernization Goals**

The two other major irrigation districts in the Klamath Project—Klamath Irrigation District and Tulelake Irrigation District—are currently working to initiate modernization of their infrastructure. Both irrigation districts are working on Plan-EAs to assess modernization alternatives; however, the scope of these projects has not yet been determined and each project is contingent on the availability of funding.

#### **6.10.2.3 Tule Smoke Hunt Club Wetlands Restoration Project**

Tule Smoke Hunt Club is a private duck hunting club located between the North Canal Diversion and the Ady Canal Diversion. Due to little fluctuation in water levels in the area, the marsh has filled with sediment and the water quality and value for fish and waterfowl has plummeted. Concerned parties in the area are currently working together to determine restoration activities that would increase wetland productivity and enhance water quality in the area; however, the scope of this project has not yet been determined.

### **6.10.3 Cumulative Effects by Resource**

Cumulative effects are considered for each resource using the intensity threshold matrix (Appendix E.1) in combination with past, present, and reasonably foreseeable future actions.

#### **6.10.3.1 Cultural Resources**

Past, ongoing, and future actions in the surrounding area that affect cultural resources include agricultural uses, land development, and water management activities, and visual impacts. The physical area affected by the proposed action is small compared to the area affected by other past, present, and reasonably foreseeable future actions in the area, and no cultural resources would be adversely affected by the proposed action; the proposed action would therefore have a negligible contribution to adverse cumulative effects on cultural resources.

#### **6.10.3.2 Land Use**

The planning area and project area have been substantially altered over the past century by a variety of human activities including agricultural development and development of irrigation infrastructure. The proposed action and future irrigation modernization actions would support existing land uses: predominantly agriculture and open space. Since these actions would collectively support existing land use, the proposed action would have negligible adverse cumulative effects.

#### **6.10.3.3 Socioeconomic Resources**

Past actions including agricultural and other land development, construction of irrigation and drainage infrastructure, and recently completed projects have established the socioeconomic setting of the Klamath Basin by supporting development, agriculture, and recreation. Current and reasonably foreseeable future actions would continue to support agriculture through improved infrastructure and economic development. Visitation to and recreation within LKNWR would be supported by current and reasonably foreseeable future actions. Since the proposed action would also support socioeconomics through construction expenditures and improved agricultural production, it would contribute to a cumulative benefit to socioeconomic resources in the area.

#### **6.10.3.4 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 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 adverse cumulative effects on soils.

#### **6.10.3.5 Vegetation**

Agriculture, irrigation canal construction, transportation infrastructure, and rural residential development have affected vegetation in the project area since the late 1800s. Agricultural activities have altered habitat in the region by removing native vegetation communities in some areas and replacing it with crop fields and pastures and through activities such as stream channelization and irrigation canal construction. These ongoing activities would continue to affect vegetation. Agricultural activities, livestock grazing, vegetation control along roads, and rural residential development are responsible for most of the past and ongoing effects on vegetation in the project area. In addition, vegetation control activities generally include mechanical cutting of vegetation and herbicide applications to control vegetation and noxious weeds. The amount of vegetation that would be affected by the proposed action is small compared to the area affected by past and

ongoing agricultural and forest management activities, livestock grazing, vegetation control along roads, and other utility corridors in the area. In addition, these past actions are not expected to change measurably from current conditions, resulting in minor adverse cumulative effects.

#### 6.10.3.6 Water Resources

The District entered into its first contract with the secretary of the interior on November 30, 1917. This contract authorized closing the gates at the Klamath Straits to drain the land, making it possible to farm. Since then, District infrastructure improvements have been ongoing and the District acquired additional water rights. In 1940, KDD signed a contract with USFWS to modify South Canal to increase deliveries by KDD to wildlife refuge lands lying in California.

Planned actions by other irrigation districts and water utilities may affect water supplies in the basin. Tule Lake Irrigation District and Klamath Irrigation District are also working to develop authorized Plan-EAs to provide water efficiencies through various infrastructure improvements. Voluntary cost-sharing, education, and technical assistance programs are ongoing in the basin to increase on-farm water use efficiency. These actions, accompanied by the proposed action, are expected to help increase the resiliency of irrigation water supplies through more efficient water management.

Further measures in KDD that are likely to occur following the proposed action include improvement of water use efficiency through the installation of more efficient irrigation systems and improved irrigation water management. These actions together with the proposed action would beneficially affect irrigation water supply in the District and available flows to LKNWR.

Water quality could be affected due to nonpoint source pollution such as erosion and runoff associated with ongoing and potential agricultural and land development activities, including the proposed action. The proposed action would be constructed when there is no water in the canal system, and construction BMPs would be used to avoid or minimize adverse water quality effects; construction practices for other potential construction and development projects are anticipated to be similar. The proposed action is anticipated to contribute to water quality improvements in the Klamath River by reducing the temperature of water discharged to the Klamath River through recirculation of water within the District prior to discharge.

The proposed action and other reasonably foreseeable future actions are anticipated to have a beneficial cumulative effect on water resources, as irrigation modernization projects would eliminate water loss and increase the amount of water that is conserved and recirculated and improve water quality during the irrigation season.

#### 6.10.3.7 Fish and Aquatic Species

Past actions including agricultural development, railroad construction, road construction and maintenance, water diversion, and urban and rural residential development in combination with the proposed action would have minor adverse effects on fish. The potential effects from these past projects in the Klamath River basin, such as sediment entering waterbodies or aquatic habitat disturbance, would be temporary and likely complete before construction of the proposed action.

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 indirect temporary adverse 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, reasonably foreseeable future actions would either improve aquatic habitat conditions or have a neutral effect.

The proposed action when combined with other future actions is anticipated to have a minor beneficial cumulative effect on fish, aquatic species, and available habitat for native trout, shortnose and Lost River suckers, Pacific lamprey, and other species. Implementation of other irrigation modernization actions and water conservation-related projects in the basin could have an additive effect on the amount of water conserved.

#### 6.10.3.8 Wetland and Riparian Areas

Past actions that may have affected wetlands, riparian areas, and floodplains consist of the original construction of the irrigation canals as well as agricultural activities, livestock grazing, vegetation control, and residential development. Reasonably foreseeable future actions in the project area that could affect vegetation along irrigation canals include agricultural activities and vegetation control along roads and utility corridors. Changes to wetland vegetation in the project area caused by the proposed action would be minor compared to these activities. The cumulative adverse effect of the proposed action and other past, present, and reasonably foreseeable future projects on wetlands and opportunistic hydrophytic vegetation is expected to be minor.

#### 6.10.3.9 Wildlife

Past and ongoing land use activities including agriculture and rural residential development have affected wildlife and wildlife habitat in the region. Agricultural activities have substantially altered the habitat in the region by removing native vegetation communities in some areas and diverting waterflow. These ongoing activities would continue to affect wildlife and wildlife habitat in the project area.

Adverse effects to wildlife due to implementation of both the proposed action and past, current, and future irrigation modernization projects would be localized and temporary. These minor adverse effects would be limited to disturbance during construction affecting the wildlife that use open canals as a water source. Implementation of the proposed action would cause wildlife to find other water sources. Since the adverse effects on wildlife would happen over a period in which animals would be able to adapt, the cumulative effect on wildlife from implementation of the proposed action would be minor.

In addition, vegetation control activities including herbicide applications to control noxious weeds and 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 residential development in the area. In addition, the intensity of these ongoing actions is not expected to change measurably in the future, resulting in minor additional adverse cumulative effects.

#### 6.10.3.10 Ecosystem Services

All reasonably foreseeable actions regarding modernization of irrigation infrastructure in the Klamath Basin would work in concert to improve the efficiency and reliability of water delivery to irrigators and LKNWR. Past and ongoing actions described in the sections above have contributed to water availability for irrigators and LKNWR, instream water quality, fish populations, and culturally important species and natural areas. Past, ongoing, and reasonably foreseeable actions in the Klamath Basin could all affect ecosystem services in the watershed. When combined with other future actions, the proposed action is anticipated to have a beneficial cumulative effect on all ecosystem services assessed.

## 7 Consultation, Coordination, and Public Participation

In the development of the Draft Plan-EA, the District and its partners planned and conducted a public scoping meeting, issued press announcements, and had 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.

For work within waterways, permits from DSL and USACE must be completed. Oregon's Removal-Fill Law requires a permit from DSL prior to the removal or fill of organic or inorganic material in waters of the state, such as wetlands and reservoirs (ORS 196.800-990). The NWI identifies the area adjacent to the southern levee as a freshwater emergent wetland. The wetland is owned by Tule Smoke Hunting Club where the primary use of the wetlands is for duck hunting. A General Authorization permit is used for nine types of removal-fill activities including piling placement and waterway habitat restoration. A fish screen could be considered waterway habitat restoration to assist fish migration. USACE requires a nationwide or regional permit for construction in waters of the United States (33 C.F.R Part 1344). The type of permit required would be determined in coordination with USACE.

The project is in discussions with Tule Smoke Hunting Club. The club would need to grant temporary and permanent access for construction work on its property and for maintenance of the screens. The club would also need to grant permission to seal off the southern levee.

A Preliminary Investigative Feasibility Report was prepared to provide sponsors, local partners, agencies, and the public with information to evaluate the goals and objectives of the project. During the development of the Preliminary Investigative Feasibility Report, project sponsors conducted initial coordination with natural resource agencies and stakeholders in the Klamath Basin.

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

### Public Announcements

- NRCS public notice (January 12, 2022)  
<https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/oregon/public-notice-announcing-scoping-meeting-klamath>
- Klamath Falls Herald and News – three public notices (January 12, 19, and 26, 2022)
- Postcard to District patrons (January 15, 2022)

### Public Involvement Website

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

- Overview of the NRCS Pub. L. No. 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 Feasibility 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 virtual public scoping meeting was held on January 27, 2022. Presenters at the meeting included Gary Diridoni, NRCS; Raija Bushnell, FCA; and Amanda Schroeder, FCA. The presentations covered the financial assistance available through Pub. L. No. 83-566, the project purpose and need, the Plan-EA process, and ways in which the public could get involved. After the presentations, attendees had the opportunity to ask questions and they provided comments for the public record.

## 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 the project's inception.

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

Date	Contact, Agency	Communication
June 28, 2022	Steve Thomas, Fish Passage Engineer, NOAA	North Canal Fish Screen requirements.
June 2022	PacifiCorp	KDD discussed the upgrades to E and F pumping plants. At the time, PacifiCorp communicated that the upgrades were feasible.
November 8, 2022	Greg Austin, Project Leader for Klamath Basin Wildlife Refuge Complex, USFWS	KDD Infrastructure Modernization Project and potential effects to the LKNWR.
March 3, 2023	Alan Heck, Klamath Basin Area Manager, Bureau of Reclamation	NRCS requested Reclamation be a cooperating agency on the project given its history and nexus with the District.
May 12, 2023	Gary Diridoni, Damon Brosnan, Anne Timm, NRCS-OR	Discussed North Canal fish screen.
May 2023	South Suburban Sanitary District (SSSD)	KDD coordinated with SSSD on permitting projects with the railroad.
June 12, 2023	USFWS	Requested to be a cooperating agency on the project given its history and nexus with the District.
June 14, 2023	USFWS	USFWS accepts invitation from NRCS to be a cooperating agency on the project.

Date	Contact, Agency	Communication
August 2, 2023	Reclamation	Submission of ARPA permit application for cultural surveys on Reclamation owned lands.
September 8, 2023	Ben Ramirez, Oregon Department of Fish and Wildlife	KDD North Canal fish screen benefits.
September 12, 2023	Gary Diridoni and Anne Timm, NRCS-OR	Discussed NRCS review of Preliminary Draft Plan.
September 20, 2023	OR State Historic Preservation Office	Consultation on proposed project and APE.
September 21, 2023	Les Anderson, Klamath Tribes Culture and Heritage Dept	Consultation on proposed project and APE.
October 24, 2023	Anne Timm, NRCS-OR	Discussing project timeline and other restoration projects in the area.
October 27, 2023	Louis Landre, State Agricultural Economist, NRCS-OR	Value of supporting LKNWR wetlands and fish screen qualitative benefits.
November 28, 2023	Christina Rubidoux, Klamath Tribes Culture and Heritage Dept.	Phone call following up on consultation request of September 21, 2023.
December 1, 2023	Anastasia Lee, Reclamation	Reclamation designates NRCS as lead federal agency.
December 4, 2023	Gina McGaughey, Modoc Nation Les Anderson and Christina Rubidoux, Klamath Tribes	Letter sent to consult the Modoc Nation and Klamath Tribes regarding cultural survey actions on Reclamation land within the project area (ARPA Permit).
December 4, 2023	Alan Heck, Klamath Basin Area Manager, Bureau of Reclamation	Reclamation accepted the NRCS invitation to be a cooperating agency.
January 19, 2024	Ken Sandusky, Modoc Nation Kathryn Kaiser, Reclamation	Discussed cultural resources and project on-site. Rachel Gebauer met with representatives of Reclamation and the Modoc Nation (ARPA permit).
February 12, 2024	Greg Austin, USFWS	USFWS acknowledged that it had begun coordination with KDD on the North Canal Extension Project.

Date	Contact, Agency	Communication
April 19, 2024	Karl Stock and Kathryn Kaiser, Reclamation	ARPA permit approved.

## 7.2 Review of Draft Plan-EA

*[To be completed after public review of the Draft Plan-EA.]*



## 8 Preferred Alternative

### 8.1 Selection and Rationale for the Preferred Alternative

NRCS and the District agree that Alternative 2 – Proposed Action-Modernization Alternative is the Preferred Alternative. NRCS has selected the Modernization Alternative<sup>14</sup> based on its ability to meet the purpose and need for the project, best address the Federal Objective and Guiding Principles, and provide the most beneficial effects on environmental, social, and economic resources.

Section 6 of this Plan-EA describes effects to resources in detail. In summary, the Modernization Alternative would have minor temporary adverse effects on soils (Section 6.4.2); minor effects ranging in duration from temporary to long-term on vegetation resources (Section 6.5.2); and negligible to minor long-term adverse effects to land use (Section 6.2.2). Adverse effects on wildlife (Section 6.9.2), fish and aquatic species (Section 6.7.2), and wetland and riparian resources (Section 6.8.2) would be minor and range in duration from temporary to long-term. All adverse effects would be mitigated through BMPs and other compliance measures.

In the long-term, the Modernization Alternative would benefit several of the resources assessed. As analyzed in the NED (see Appendix D.1), this alternative would yield positive economic benefits including creating a delivery point to LKNWR from Upper Klamath Lake and the Klamath River, thus increasing delivery capacity, reducing O&M costs, and reducing carbon emissions. Construction of a fish screen would prevent fish from entering the KDD conveyance system. SCADA would improve operation efficiency through remote monitoring and reduce operational spills. Also, when considering trade-offs of the effects to ecosystem services, the Modernization Alternative would have more beneficial effects (see Table 5-1 for more information). When compared to the No Action Alternative in the face of current conditions and future environmental changes, the Modernization Alternative would support the agricultural resiliency of District patrons and the health and resiliency of the Klamath Basin.

### 8.2 Measures to be Installed

The District would install a fish screen at the North Canal Diversion on the Klamath River. The District would extend North Canal 0.47 miles from Fugate Road to CSH 161—connecting North Canal to the P-1 Lateral and adding a point of delivery to LKNWR—and modify five road crossings along North Canal to accommodate an additional flow of 100 cfs through North Canal. The District would upgrade the Reclamation-owned E and F pumping plants along KSD to a more common voltage, install associated VFDs, and install a recirculation pipeline going from the outlet of the westernmost pump in the E Pumping Plant to Center Canal. Fourteen SCADA sites and four automated gates would be installed throughout the District (Table 8-1), which would allow for greater control of water conveyance.

The modernization actions would be constructed in six project groups with construction occurring over 3 years. Table 8-2 summarizes the measures to be installed. Sections 8.6 and 8.7 provide more

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<sup>14</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).

information about construction and O&M of the Preferred Alternative. Appendix D.3 includes a detailed breakdown of project costs.

**Table 8-1. Proposed SCADA Installation Sites.**

Site Name	Equipment to be Installed	Construction Disturbance (square feet)
Township Pump Station and Ady Canal – connected pair	Two water level measurement devices, two VFDs, flow meters, solar panel, radio antenna <sup>1</sup>	1,634
North Canal	Water level measurement in canal, flow meter, solar panel, radio antenna <sup>1</sup>	313
Tail of extended North Canal	Automated gate <sup>2</sup> , flow meter, solar panel, radio antenna <sup>1</sup>	313
Andrieu Lateral	Flow meter, solar panel, radio antenna <sup>1</sup>	313
Eastside Pump and North Canal – connected pair	Automated gate, flow meter, water level measurement, radio antenna <sup>1</sup>	3,118
Ady Canal	Six automated gates, flow meter, water level measurement, radio antenna <sup>1</sup>	400
West Canal	Two automated gates, flow meter, water level measurement, radio antenna <sup>1</sup>	313
Center Canal	Automated gate, flow meter, radio antenna <sup>1</sup>	313
Center Canal Flume	Water level measurement, radio antenna <sup>1</sup>	313
Tail of Center Canal	Flow meter, radio antenna	313
E Pumping Plant	Water level measurements devices above and below pumps, flow meter, radio antenna	313
F Pumping Plant	Water level measurements devices above and below pumps, flow meter, radio antenna	313

Notes:

<sup>1</sup>May be cellular.

<sup>2</sup>May include two gates depending on final design.

**Table 8-2. Proposed Features for the Preferred Alternative within Klamath Drainage District, 2023\$.<sup>1</sup>**

Type	Project Group	Quantity	Construction Subtotal <sup>2,3</sup>
Earthwork, outlet headwall structures, water flow meter weirs	PG1 North Canal Improvements	Five improvements	\$726,000
Flow meters, sensors, power, radios, solar panels	PG2 SCADA System	14 sites	\$381,000
Cone screens, slide gates, intake, controls, concrete foundation	PG3 Screen North Canal Diversion	One fish screen	\$9,010,000
Pumps, utility line extensions, pads, fencing, vaults, VFDs, utility disconnects, electrical feeders, SCADA controls	PG4 E and F Pumping Plants	Two plant upgrades	\$3,175,000
Steel pipe, manhole, sluice gate, catwalk, energy dissipation structure	PG5 E Pump Recirculation	One new pipeline	\$464,000
Monitoring equipment	PG 6 Upgraded Turnouts	76 turnouts	\$22,000
Type	Project Group	Quantity	Construction Subtotal <sup>2,3</sup>
Subtotal	Construction	N/A	\$13,778,000
Subtotal	Engineering	N/A	\$835,000
Subtotal	Project Admin	N/A	\$2,020,000
Subtotal	Permitting	N/A	\$168,000
Subtotal	Real Property Rights	N/A	\$77,000
<b>Total</b>	<b>All Projects and Costs</b>	<b>\$0</b>	<b>\$16,878,000</b>

Notes:

<sup>1</sup> Price Base: 2023 dollars.<sup>2</sup> Construction subtotal includes cost of materials; construction contingency and management; contractor markup; and survey costs. See Appendix D for individual material costs.<sup>3</sup> All values rounded to the nearest \$1,000.

Construction<sup>15</sup> of the Preferred Alternative would include mobilization and staging of construction equipment, delivery of supplies to construction areas, excavation of canals and trenches, installation of a coffer dam and 10 cone fish screens, removal of earthen material, placement of culverts, compaction of backfill, grading and modification of an access road to the fish screens, installation of pipe, and restoration and reseeding of the disturbed areas. At the site of the fish screens, electrical connectivity would be installed and construction access would need to be created prior to bringing screens or equipment into the construction area. This could include removal of vegetation within the

<sup>15</sup> The costs of construction activities are included in the project installation costs.

construction area. Appropriately sized construction equipment would be used to minimize disturbance in the construction area. Borrow material may be needed to backfill the trench surrounding the pipelines if insufficient native material is available from excavation projects and prior dredging activities.

Construction would begin as early as the 2025 nonirrigation season and is anticipated to take 3 years to complete. Construction of the fish screen would begin between July 1 and January 31, based on Oregon guidelines for timing of in-water work, and take approximately 18 months. The North Canal improvements would be implemented starting between January and April and take approximately 12 months to complete. Upgrades to the E and F pumping plants would occur between February and May and August and December and would be completed within one calendar year. Installation of the recirculation pipeline at the E Pumping Plant would begin after on-farm flooding activities between January 1 and April 1; it would take approximately 6 months to complete. Installation of SCADA and automated gates and upgrades to patron turnouts would occur during any time of the year; upgrades to turnouts would take place from January to April. Patron deliveries would be minimally affected during construction, and the District would work with patrons to minimize effects.

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

Project design features and BMPs that would be applied during construction of the Preferred Alternative to avoid and minimize effects on environmental and social resources are described in Appendix E.11.

### **8.4 Permits and Compliance**

The following permits and compliance would be required for implementation of the Modernization Alternative.

#### **8.4.1 Local and County**

**Klamath County Floodplain Administrator.** All work, except for construction of the fish screen, would be outside of the 100-year floodplain. Consultation with the County floodplain administrator would determine appropriate permitting requirements for the expanded attenuation bay or sediment basin.

#### **8.4.2 State**

**Oregon 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, and materials and equipment staging and stockpiling that would disturb 1 or more acres of land and have the potential to discharge into a public waterbody. The proposed project would meet these conditions; therefore, prior to project construction, as appropriate, a permit would be applied for.

**Oregon Department of State Lands and California State Lands Commission.** Prior to project implementation, consultation with DSL and the California State Lands Commission would occur to perform wetland determinations for sites throughout the project area and determine exemption applicability to water conveyance infrastructure in the project area.

**Oregon Fish Passage Law.** Laws regarding fish passage are found in ORS 509.580 through ORS 509.910 and in OAR 635, Division 412. No additional consultation or permitting would be required because the Modernization Alternative would not artificially obstruct fish passage.

**Oregon Department of Transportation.** For construction activities that require the use of the state highway for other than a normal transportation activity, a utility encroachment permit is required.

**North Coast Regional Water Quality Control Board.** Any person discharging waste or proposing to discharge waste that could affect the quality of the waters of the state, other than into a community sewer system, and any person operating or proposing to construct an injection well is required to file a Report of Waste Discharge with the Regional Water Board.

**California Department of Transportation.** An encroachment permit must be obtained for all proposed activities related to the placement of encroachments within, under, or over the state highway ROW.

### **8.4.3 Federal**

**National Historic Preservation Act Section 106.** Pursuant to 36 C.F.R. Part 800 of the NHPA (1966, as amended in 2000) and the regulations of the Advisory Council on Historic Preservation implementing Section 106 of the NHPA (54 U.S.C. 306108), 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 National Register of Historic Places. Consultation with SHPO to fulfill Section 106 obligations would be completed for the 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 C.F.R. 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 U.S., 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. 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, in 33 C.F.R. 323.4(a)(6) and 40 C.F.R. 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. Prior to construction activities, coordination and consultation with USACE would occur and measures would be taken as required to identify and mitigate effects to potential jurisdictional wetlands and Waters of the United States.

**Clean Water Act Section 401.** Section 401 of the CWA authorizes the state department of environmental quality to review proposed activities or facilities that require a federal permit and that may discharge into the waters of the state.

Actual delineations and permitting under Sections 401 and 404 of the CWA have been deferred until the project phase and associated designs more directly inform impacts and permitting requirements. 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.

**Farmland Protection Policy Act.** The Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*) directs federal agencies to identify and quantify adverse impacts of federal programs on 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 nonagricultural uses. The project would support agricultural production 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, called "Interagency Cooperation," is the mechanism by which federal agencies ensure 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 or NMFS when any action the agency carries out, funds, or authorizes (such as through a permit) *may affect* a listed endangered or threatened species.

The Modernization Alternative will have long-term benefits to Lost River and shortnose sucker due to preventing entrainment of the species into the North Canal and by water quality improvements in the Klamath River. However, elements of the Modernization Alternative, such as in-water work associated with the construction of the North Canal fish screen and loss of habitat as a result of the footprint of the fish screen would have adverse impacts on Lost River and shortnose suckers and their critical habitat. The Modernization Alternative may also impact northwestern pond turtle but is not anticipated to adversely affect the species. Coordination with USFWS regarding ESA-listed species is ongoing, and formal Section 7 consultation under the ESA would be initiated for Lost River and shortnose suckers following the public review period. Informal Section 7 conferencing or consultation under the ESA would also be initiated northwestern pond turtle following the public review period.

The Modernization Alternative will have long-term minor adverse effects to SONCC coho salmon due to stormwater runoff from proposed road improvements. Coordination with NMFS regarding ESA-listed fish species is ongoing, and formal Section 7 consultation under the ESA as amended would be initiated for SONCC coho salmon following the public review period.

**Magnuson Stevens Act.** The Magnuson-Stevens Act established requirements for including Essential Fish Habitat (EFH) descriptions in federal fishery management plans, and it requires federal agencies to consult with NMFS on activities that may adversely affect EFH (Pub. L. No. 104-297). Stormwater runoff from proposed road improvements may adversely affect EFH downstream of the planning area for groundfish and Pacific salmon. Consultation with NMFS under the Magnuson Stevens act would be initiated for groundfish and salmon EFH following the public review period.

**Safe Drinking Water Act.** Since the project 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 (16 U.S.C. 703–712). Under the Act, taking, killing, or possessing

migratory birds, or taking, destroying, or possessing their eggs or nests, is unlawful. The Act classifies most species of birds as migratory, except for upland and nonnative birds such as pheasant, chukar, gray partridge, house sparrow, European starling, and rock dove.

**Bald and Golden Eagle Protection Act.** The BGEPA prohibits the taking or possessing of and commerce in bald and golden eagles, with limited exceptions (16 U.S.C. 668–668d). The Act only covers intentional acts or acts in “wanton disregard” of the safety of bald or golden eagles. The project is adjacent to known nesting sites; therefore, seasonal restriction on the use of high noise equipment is in effect for construction in the northern part of the planning area. Additionally, pre-clearance surveys would occur prior to construction to verify the presence or absence of golden eagles in the area. These surveys would be consistent with USFWS survey guidelines. Should nesting sites be discovered, the requirements of the BGEPA would be implemented appropriately.

## 8.5 Costs

Table 8-3 presents the total project cost of \$16,878,000 for the Preferred Alternative.

Pub. L. No. 83-566 funds would support \$12,729,000 of the total project cost, and \$4,149,000 would be contributed by other nonfederal 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 installation of the Preferred Alternative. These costs were estimated based on costs for similar installations at other irrigation districts in Oregon. The planning construction costs are estimated using the best available information about the project without having detailed design information.

Engineering costs were estimated as a percentage of the cost of construction.

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 project. Final construction costs would only reflect the time and materials to perform the work.

## 8.6 Installation and Financing

The following sub-sections present the installation and financing of the Preferred Alternative. Included in this section is a framework for implementing the Preferred Alternative, the sequence of installation, responsibilities, contracting, real property and relocations, other agencies, cultural resources, financing, and conditions for providing assistance.

### 8.6.1 Framework for Carrying out the Plan

The Preferred Alternative would be implemented in a planned sequence as discussed in Section 8.6.2. The responsibilities of NRCS and the sponsors for the project are outlined in Section 8.6.3. No cost-shared on-farm measures are involved with this project; therefore, the responsibilities of individual participants do not need to be discussed. No preconditions are anticipated for installing the project.

### 8.6.2 Planned Sequence of Installation

The District would obtain all approvals and permits for the project prior to the start of construction. The entire project would be completed over a 5-year period. The District developed an appropriate construction phasing schedule that addresses District priorities while working within engineering and funding constraints to meet District, patron, and community development needs.

**Table 8-3. Construction Timeline and Installation Costs by Funding Source for the Modernization Alternative, Klamath Basin Subwatersheds, Oregon, 2023\$.<sup>1</sup>**

	Construction Years	Pub. L. No. 83-566 Funds	Other, Nonfederal Funds	Total Construction Costs
PG 1 North Canal Improvements	0	\$677,000	\$250,000	\$927,000
PG 2 SCADA System	0	\$351,000	\$110,000	\$461,000
PG 3 Fish Screen	1-2	\$8,269,000	\$2,693,000	\$10,962,000
PG 4 E and F Pumping Plants	2	\$2,915,000	\$914,000	\$3,829,000
PG 5 E Pump Recirculation	2	\$495,000	\$176,000	\$671,000
PG 6 Upgraded Turnouts	1	\$22,000	\$6,000	\$28,000
<b>Total Project</b>	<b>N/A</b>	<b>\$12,729,000</b>	<b>\$4,149,000</b>	<b>\$16,878,000</b>

Notes:

<sup>1</sup> Price Base: 2023 dollars.

### 8.6.3 Responsibilities

NRCS is responsible for leading the planning efforts, providing engineering design and construction oversight assistance, and certifying completion of the project. The District would be responsible for engineering design, project administration, environmental permitting, contracting, and construction implementation. The District 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 the EA.

As cooperating agencies, Reclamation and USFWS are responsible for assisting in the planning effort; reviewing engineering designs to ensure construction methods meet Reclamation standards; participating in Section 106 of NHPA as the owner of the infrastructure; providing language for this Plan-EA; and providing subject matter experts to answer questions regarding topics such as the history of the Klamath Project, O&M plans, past ESA consultations, and other topics as needed.

NRCS, Reclamation, and USFWS would each prepare its own Finding of No Significant Impact statement if warranted. Further site-specific environmental compliance may be required for specific implementation activities. Each agency would be responsible for preparing categorical exclusions or other such instruments for implementation.

### 8.6.4 Contracting

Irrigation modernization projects would be completed using NRCS funding mechanisms. The District would be primarily responsible for overseeing and administering the construction of the project in coordination with NRCS. Reclamation and USFWS would be consulted as needed.



### **8.6.5 Real Property and Relocations**

Any real property acquisition needed (as described in Section 6.2.2.) would be completed in conjunction with private land owners, Reclamation, and USFWS prior to authorization. All construction would be completed under either existing KDD-operated and -maintained easements or the newly obtained easement agreements as described in Section 6.2.2. Seventy-seven thousand dollars has been included in project costs for acquisition of easements. Reclamation and USFWS realty staff would provide feedback and review internal documentation of existing ROW descriptions and stipulations.

### **8.6.6 Financing**

NRCS would provide 75 percent of the total project cost for the Preferred Alternative through Pub. L. No. 83-566.<sup>16</sup> The District is responsible for securing funding for the remaining 25 percent of the costs, including funds that are not eligible under the National Watershed Program (i.e., project administration and technical assistance). Table 8-4 and Table 8-5 present annual installation costs of the project and the proportion of funding through Pub. L. No. 83-566 funding and other funding sources.

Most of the required match funding would be provided through grants. If necessary, a portion of the project cost would be financed through loans. O&M costs after project completion would be provided through KDD revenues.

### **8.6.7 Conditions for Providing Assistance**

Conditions for the District to receive program funds for 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 agriculture to ensure the project meets 16 U.S.C. 1005.

## **8.7 Operations and Maintenance**

The District would be responsible for the O&M of the project for the 100 years of its design life. Prior to construction, a separate O&M agreement, based on the NRCS National Operation and Maintenance Manual, would be made between NRCS and the District. The agreement would continue through the design life of the project and could be modified with NRCS approval.

The District and NRCS would make annual inspections of project measures to assure the quality of ongoing O&M. The District would be in charge of scheduling O&M inspections and responsible for any necessary work. The District's O&M would consist of an inspection program that would systematically inspect all modernization actions of the project over a period of several years.

The proposed system would continue its current operation schedule, and work would be performed on an as-needed basis. SCADA and telemetry system maintenance would occur on a regular schedule and on an as needed basis throughout the year. Throughout the year, the District would perform major system maintenance including maintaining pipelines, fish screens, and miscellaneous maintenance and repair work. The District would be willing to take on the O&M of the pumps

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<sup>16</sup> NRCS reserves the authority and right to discontinue or reduce program benefits based on changes in agency priorities, funding availability, or the failure of KDD to fulfill the provisions of their agreement.

under an agreement. All procedures would be followed as specified in the O&M agreement between the project sponsor and NRCS.

## **8.8 Economic and Structural Table**

**Table 8-4. Economic Table 1 – Estimated Installation Cost of the Modernization Alternative,  
Water Resource Project Measures, Klamath River Watershed, Oregon, 2023\$.<sup>1</sup>**

<b>Works of Improvement</b>	<b>Unit</b>	<b>Federal Land – Number</b>	<b>Nonfederal Land – Number</b>	<b>Total – Number</b>	<b>Pub. L. No. 83-566 Federal land NRCS<sup>2</sup></b>	<b>Pub. L. No. 83-566 Nonfederal land NRCS<sup>2</sup></b>	<b>Pub. L. No. 83-566 Estimated Total</b>	<b>Other Funds Federal land</b>	<b>Other Funds Nonfederal land</b>	<b>Other Funds Estimated Total</b>	<b>Estimated Cost – Total</b>
PG1 North Canal Improvements	acres	0.0	250.6	250.6	\$0	\$677,000	\$677,000	\$0	\$250,000	\$250,000	\$927,000
PG2 SCADA System	square feet	4,055.9	3,822.0	7,877.9	\$181,000	\$170,000	\$351,000	\$57,000	\$53,000	\$110,000	\$461,000
PG3 Fish Screen	acres	0.0	16.6	16.6	\$0	\$8,269,000	\$8,269,000	\$0	\$2,693,000	\$2,693,000	\$10,962,000
PG4 E and F Pumping Plants	acres	0.1	0.0	0.1	\$2,915,000	\$0	\$2,915,000	\$914,000	\$0	\$914,000	\$3,829,000
PG5 E Pump Recirculation	square feet	3,933.0	0.0	3,933.0	\$495,000	\$0	\$495,000	\$176,000	\$0	\$176,000	\$671,000
PG6 Upgraded Turnouts	square feet	0.0	1,900.0	1,900.0	\$0	\$22,000	\$22,000	\$0	\$6,000	\$6,000	\$28,000
<b>Total project</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>\$3,591,000</b>	<b>\$9,138,000</b>	<b>\$12,729,000</b>	<b>\$1,147,000</b>	<b>\$3,002,000</b>	<b>\$4,149,000</b>	<b>\$16,878,000</b>

Notes: Totals may not sum due to rounding.

Prepared: July 2024

<sup>1</sup> Price base: 2023 dollars.<sup>2</sup> Federal agency responsible for assisting in installation of works of improvement.

**Table 8-5. Estimated Cost Distribution – Water Resource Project Measures, Klamath River Watershed, Oregon, 2023 dollars.<sup>1</sup>**

<b>Works of Improvement</b>	<b>Pub. L. No.83-566 Construction</b>	<b>Pub. L. No.83-566 Engineering</b>	<b>Pub. L. No. 83-566 Project Admin Subtotal <sup>2</sup></b>	<b>Total Pub. L. No. 83-566</b>	<b>Other Funds - Construction</b>	<b>Other Funds - Engineering</b>	<b>Other Funds - Real Property Rights</b>	<b>Other Funds - Permitting</b>	<b>Total Other</b>	<b>Total – Installation costs</b>
PG1 North Canal Improvements	\$545,000	\$22,000	\$110,000	\$677,000	\$181,000	\$7,000	\$32,000	\$30,000	\$250,000	\$927,000
PG2 SCADA System	\$286,000	\$10,000	\$55,000	\$351,000	\$95,000	\$12,000	\$0	\$3,000	\$110,000	\$461,000
PG3 Fish Screen	\$6,758,000	\$227,000	\$1,284,000	\$8,269,000	\$2,252,000	\$296,000	\$45,000	\$100,000	\$2,693,000	\$10,962,000
PG4 E and F Pumping Plants	\$2,382,000	\$80,000	\$453,000	\$2,915,000	\$793,000	\$101,000	\$0	\$20,000	\$914,000	\$3,829,000
PG5 E Pump Recirculation	\$348,000	\$33,000	\$114,000	\$495,000	\$116,000	\$45,000	\$0	\$15,000	\$176,000	\$671,000
PG6 Upgraded Turnouts	\$17,000	\$1,000	\$4,000	\$22,000	\$5,000	\$1,000	\$0	\$0	\$6,000	\$28,000
<b>Total project</b>	<b>\$10,336,000</b>	<b>\$373,000</b>	<b>\$2,020,000</b>	<b>\$12,729,000</b>	<b>\$3,442,000</b>	<b>\$462,000</b>	<b>\$77,000</b>	<b>\$168,000</b>	<b>\$4,149,000</b>	<b>\$16,878,000</b>

Notes: Totals may not sum due to rounding.

Prepared: July 2024

<sup>1</sup> Price base: 2023 dollars.<sup>2</sup> Federal agency responsible for assisting in installation of works of improvement. This includes technical assistance.

**Table 8-6. Estimated Average Annual NED Costs, Klamath River Watershed, Oregon, 2023 dollars.<sup>1</sup>**

<b>Project Group</b>	<b>Project Outlays (Amortization of Installation Cost)</b>	<b>Other Direct Costs of the Modernization Alternative over the No Action Alternative</b>	<b>Total Average Annual Costs</b>
PG1 North Canal Improvements	\$25,000	\$135,000	\$160,000
PG2 SCADA System	\$13,000	\$12,000	\$25,000
PG3 Fish Screen	\$289,000	\$19,000	\$308,000
PG4 E and F Pumping Plants	\$100,000	-\$85,000	\$15,000
PG5 E Pump Recirculation	\$17,000	\$26,000	\$43,000
PG6 Upgraded Turnouts	\$1,000	\$0	\$1,000
<b>Total</b>	<b>\$445,000</b>	<b>\$107,000</b>	<b>\$552,000</b>

Note: Totals may not sum due to rounding.

Prepared July 2024

<sup>1</sup> Price Base: 2023 dollars amortized over 100 years at a discount rate of 2.5 percent.**Table 8-7. Estimated Average Annual Damage Reduction Benefits, Klamath River Watershed, Oregon, 2023 dollars.<sup>1</sup>**

<b>PG1 North Canal Improvements On-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Reduced OMR	\$10,000	\$0
<b>On-site Subtotal</b>	<b>\$10,000</b>	<b>\$0</b>
<b>PG1 North Canal Improvements Off-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Avoided Carbon Emissions <sup>2</sup>	\$0	\$0
Habitat Value	\$0	\$150,000
<b>Off-site Quantified Subtotal</b>	<b>\$0</b>	<b>\$150,000</b>
<b>Total Quantified Benefits</b>	<b>\$0</b>	<b>\$160,000</b>
<b>PG2 SCADA System On-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>

Reduced OMR	\$40,000	\$0
<b>On-site Subtotal</b>	<b>\$40,000</b>	<b>\$0</b>
<b>PG2 SCADA System Off-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Avoided Carbon Emissions <sup>2</sup>	\$0	\$0
Habitat Value	\$0	\$0
<b>Off-site Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total Quantified Benefits</b>	<b>\$0</b>	<b>\$40,000</b>
<b>PG3 Fish Screen On-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Reduced OMR	\$0	\$0
<b>On-site Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>PG3 Fish Screen Off-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Avoided Carbon Emissions <sup>2</sup>	\$0	\$0
Habitat Value	\$0	\$0
Fish Value	\$0	Positive, Unquantified Benefits
<b>Off-site Quantified Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total Quantified Benefits</b>	<b>\$0</b>	<b>\$0</b>
<b>PG4 E and F Pumping Plants On-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Reduced OMR	\$29,000	\$0
<b>On-site Subtotal</b>	<b>\$29,000</b>	<b>\$0</b>
<b>PG4 E and F Pumping Plants Off-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Avoided Carbon Emissions <sup>2</sup>	\$0	\$0
Habitat Value	\$0	\$0
<b>Off-site Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total Quantified Benefits</b>	<b>\$0</b>	<b>\$29,000</b>
<b>PG5 E Pump Recirculation On-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>

Reduced OMR	\$77,000	\$0
<b>On-site Subtotal</b>	<b>\$77,000</b>	<b>\$0</b>
<b>PG5 E Pump Recirculation Off-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Avoided Carbon Emissions <sup>2</sup>	\$0	\$1,000
Habitat Value	\$0	\$0
<b>Off-site Subtotal</b>	<b>\$0</b>	<b>\$1,000</b>
<b>Total Quantified Benefits</b>	<b>\$0</b>	<b>\$78,000</b>
<b>PG6 Upgraded Turnouts On-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Reduced OMR	\$0	\$0
Water Use Transparency	Positive, Unquantified Benefits	\$0
<b>On-site Quantified Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>PG6 Upgraded Turnouts Off-Site Damage Reduction Benefits</b>	<b>Agricultural- related</b>	<b>Non- Agricultural- related</b>
Avoided Carbon Emissions <sup>2</sup>	\$0	\$0
Habitat Value	\$0	\$0
<b>Off-site Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total Quantified Benefits</b>	<b>\$0</b>	<b>\$0</b>

Note: Totals may not sum due to rounding.

Prepared July 2024

<sup>1</sup> Price Base: 2023 dollars amortized over 100 years at a discount rate of 2.5 percent.

<sup>2</sup> This value represents the benefit of avoided carbon emissions as measured by the social cost of carbon. These benefits would also accrue to local residents, but the majority of the value would be experienced outside the proposed project area.

**Table 8-8. Comparison of NED Costs and Benefits of the Modernization Alternative, Klamath River Watershed, Oregon, 2023 dollars.<sup>1</sup>**

<b>Works of Improvement</b>	<b>Agriculture-related Reduced OMR</b>	<b>Non-agricultural Carbon Value</b>	<b>Non-agricultural Habitat Value</b>	<b>Average Annual Benefits</b>	<b>Average Annual Cost <sup>2</sup></b>	<b>Benefit-Cost Ratio</b>
PG1 North Canal Improvements	\$10,000	\$0	\$150,000	\$160,000	\$160,000	1.0
PG2 SCADA System	\$40,000	\$0	\$0	\$40,000	\$25,000	1.6
PG3 Fish Screen	\$0	\$0	\$0	\$0	\$308,000	0.0
PG4 E and F Pumping Plants	\$29,000	\$0	\$0	\$29,000	\$15,000	1.9
PG5 E Pump Recirculation	\$77,000	\$1,000	\$0	\$78,000	\$43,000	1.8
PG6 Upgraded Turnouts	\$0	\$0	\$0	\$0	\$1,000	0.0
<b>Total</b>	<b>\$156,000</b>	<b>\$1,000</b>	<b>\$150,000</b>	<b>\$307,000</b>	<b>\$552,000</b>	<b>0.6</b>

<sup>1</sup> Price Base: 2023 dollars amortized over 100 years at a discount rate of 2.5 percent.

Prepared July 2024

<sup>2</sup> From Table D-10.



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## 10 List of Preparers

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

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

Name	Organization	Title	Education	Professional Experience	Area Responsible For
Gary Diridoni	NRCS - Oregon	Assistant State Conservationist – Watershed Resources	Fisheries Management Graduate Certificate B.S. Wildlife Management B.S. Interdisciplinary Studies, Ecosystem Conservation	21 years	General
Antonio Bentivoglio	Watershed Planner	M.Sc. UCLA Fish Systematics	25 years	General	Antonio Bentivoglio
Anne Timm	NRCS - Oregon	Watershed Planner	Ph.D. Fisheries and Wildlife M.S. Environmental Science B.A. Biology	22 years	General
Louis Landre	NRCS - Oregon	Agricultural Economist	M.S. Applied Economics B.S. Biology	25 years	Economic and Socioeconomic Analysis, Alternative Analysis, Overall Watershed Planning
Michael Petrozza	NRCS - Oregon	State Archeologist	Ph.D. Anthropology M.A. Anthropology B.A. Cultural Anthropology	8 years	Section 106 Consultation



Name	Organization	Title	Education	Professional Experience	Area Responsible For
Rachel Gebauer	NRCS - Oregon	State Archeologist	M.A. Anthropology	26 years	Section 106 Consultation
Cassandra Dobson	Parametrix (under contract with FCA)	Planner III	M.U.R.P. Land Use Planning B.A. Political Science	6 years	Ecosystem Services, Land Use, Soils, Socioeconomics Affected Environment, Cumulative Effects
Jennifer Hughes	Parametrix (under contract with FCA)	Senior Planner	M.U.R.P. Environmental Planning B.S. Physical Geography	21 years	Document Review Affected Environment and Environmental Consequences
Irina Lapina	Parametrix (under contract with FCA)	Scientist III	M.S. Biology	20 years	Vegetation, Wildlife, and Fish and Aquatic Resources
Taya MacLean	Parametrix (under contract with FCA)	Senior Scientist	M.S. Biology B.S. Forestry and Natural Resources Management	24 years	Water Resources
Tait Elder	Parametrix (under contract with FCA)	Archeologist	M.A. Anthropology B.A. Anthropology	X	Section 106
Raija Bushnell	FCA	Watershed Planning Program Manager	M.P.A. Natural Resource Policy M.S.E.S Natural Resource Management B.A. Political Science	9 years	General
Amanda Schroeder	FCA	Program Specialist	B.S. Natural Resources Management	8 years	General, Introduction, Purpose and Need for Action, Scope of the Plan-EA
David Mueller	FCA	Project Specialist	M.P.P Public Policy	4 years	General, Introduction,

Name	Organization	Title	Education	Professional Experience	Area Responsible For
			B.A. Biology		Purpose and Need for Action, Scope of the Plan-EA
Megan Christian	FCA	Project Specialist	M.S. Environmental Sciences and Engineering B.S.P.H. Environmental Health Sciences	3 years	General, Introduction, Purpose and Need for Action, Scope of the Plan-EA
Barbara Wyse	Highland Economics (under contract with FCA)	Senior Economist	M.S. Environmental and Natural Resource Economics B.A. Environmental Sciences and Policy	14 years	Economic Analysis
Winston Oakley	Highland Economics (under contract with FCA)	Economist	M.S. Applied Economics B.S. Environmental Sciences, Policy, and Management	5 years	Economic Analysis

## 11 Distribution List

City of Klamath Falls, OR  
Klamath County, OR  
Klamath County Flood Control & Water Conservation District  
Klamath County Soil and Water Conservation District  
Tulelake Irrigation District  
Klamath Irrigation District  
Malin Irrigation District  
Shasta Butte Irrigation District  
Horsefly Irrigation District  
Langell Valley Irrigation District  
Oregon Department of Agriculture (ODA)  
Oregon Department of Environmental Quality (DEQ)  
Oregon Department of Fish and Wildlife (ODFW)  
Oregon Department of State Lands (DSL)  
Oregon Department of Transportation (ODOT)  
Oregon Water Resources Department (OWRD)  
Oregon Watershed Enhancement Board (OWEB)  
Oregon State Historic and Preservation Office (SHPO)  
Oregon Regional Solutions Office  
U.S. Army Corps of Engineers (USACE)  
U.S. Bureau of Land Management (BLM)  
U.S. Bureau of Reclamation, Klamath Basin Area Office  
U.S. Environmental Protection Agency Region 9  
U.S. Fish and Wildlife Service (USFWS) Lower Klamath National Wildlife Refuges  
National Oceanic and Atmospheric Administration (NOAA) Fisheries  
USDA NRCS-OR Offices  
Klamath Tribes  
Yurok Tribe  
Karuk Tribe  
Modoc Nation  
Klamath Water Users Association  
Klamath Watershed Partnership  
Intermountain West Joint Venture  
Trout Unlimited  
Lost River Ranch  
Ducks Unlimited  
American Rivers  
California Trout  
California Special Districts Association  
Oregon Water Resources Congress  
Family Farm Alliance  
Cal-Ore Wetlands  
PacifiCorp  
Oregon State Senator Dennis Linthicum (District 28)  
Oregon State Representative Werner Reschke (District 56)  
Oregon Representative Cliff Bentz (2nd District)

Oregon Senator Ron Wyden

Oregon Senator Jeff Merkley

## 12 Acronyms, Abbreviations, and Short-forms

APE	Area of Potential Effects
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
CalIPC	California Invasive Plant Council
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CWA	Clean Water Act
CWRCB	California Water Resources Control Board
DEQ	Oregon Department of Environmental Quality
DSL	Department of State Lands
EA	Environmental Assessment
EFH	Essential Fish Habitat
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FCA	Farmers Conservation Alliance
FOD	Final Order of Determination
GIS	Geographic Information Systems
HA	Hydrologic Area
HU	Hydrologic Unit
IPaC	Information for Planning and Consultation
KBA	Klamath Basin Adjudication
KDD	Klamath Drainage District
KHDIC	Klamath Hills District Improvement Company
KPWU	Klamath Project Water Users
KSD	Klamath Straits Drain
LKNWR	Lower Klamath National Wildlife Refuge
MBTA	Migratory Bird Treaty Act
MDIC	Midland District Improvement Company
MOA	Memorandum of Agreement
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
ODFW	Oregon Department of Fish and Wildlife
O&M	Operations and Maintenance
OM&R	Operation, maintenance, and replacement
OMB	Office of Management and Budget
ORBIC	Oregon Biodiversity Information Center
OS&C	Open Space and Conservation
OWRD	Oregon Water Resources Department
Pub. L. No.	Public Law
PR&G	Principles, Requirements, and Guidelines for Water and Land Related Resources

	Implementation Studies
ROW	Right-of-way
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Office
TLNWR	Tule Lake National Wildlife Refuge
TMDL	Total Maximum Daily Loads
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VFD	Variable frequency drive
WRIS	Oregon Water Rights Information System

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## **14 Appendix**

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