

Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project

Draft Watershed Plan—Environmental Impact Statement

Deschutes County, Oregon

February 2026

United States Department of Agriculture, National Resources Conservation Service—Lead Federal Agency in cooperation with Deschutes Basin Board of Control and Central Oregon Irrigation District.

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Watershed Plan–Environmental Impact Statement for the Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project

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

Sponsoring Local Organization: Deschutes Basin Board of Control (lead sponsor) and Central Oregon Irrigation District (COID) (co-sponsor).

Authority: This Watershed Plan–Environmental Impact Statement (Plan-EIS) has been prepared under the Authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law Number [Pub. L. No.] 83-566). The Plan-EIS 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 (Fly Sheet): This document is intended to fulfill requirements of the NEPA and to be considered for authorization of Pub. L. No. 83-566 funding of the Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project (Project). The Project seeks to improve water conservation, water delivery reliability, and public safety for irrigation infrastructure in Oregon’s Deschutes Basin. The Project would include piping approximately 18.5 miles of COID’s Main Canal. Total estimated Project costs for the Preferred Alternative are \$356,591,000, of which \$86,376,000 would be paid by the sponsors and other non-federal funding sources. The estimated amount to be paid through NRCS Pub. L. No. 83-566 funds is \$270,215,000.

Comments: Comments must be submitted during the allotted Draft Public Review Period (within 45 days of the public release of the Draft Plan-EIS) and become part of the Administrative Record. Submit comments and inquiries: via mail to Central Oregon Irrigation District, Attention Watershed Plan-EIS, 1055 SW Lake CT, Redmond, OR 97756, via telephone at (541) 699-4415, via email at ciscomment@coid.org, or online at <https://coidpiping.com>.

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Office of Management and Budget (OMB) Fact Sheet

Summary Watershed Plan–Environmental Impact Statement Document

for

Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project

Upper Deschutes Basin Subwatersheds: North Unit Main Canal, Osborne Canyon-Crooked River,
Laidlaw Butte-Deschutes River, Cline Falls-Deschutes River, Lava Island Falls-Deschutes River,
Overturf Butte-Deschutes River, Deschutes Junction, and Odin Falls-Deschutes River

Deschutes County, Oregon

Oregon 5th Congressional District

Authorization

Public Law No. 83-566 Stat. 666 as amended (16 U.S.C. Section 1001 et seq.) 1954.

Sponsor

Central Oregon Irrigation District.

Proposed Action

The proposed action would pipe and pressurize a portion of the Central Oregon Irrigation District (COID) Pilot Butte Canal (PBC) from NE 17th Street in Redmond, Oregon, to the diversion point from the Deschutes River in Bend, Oregon.

Purpose and Need for Action

The purpose of the Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project (Project) is agricultural water management through irrigation water conservation in COID infrastructure, improvement of water delivery reliability to COID and North Unit Irrigation District (NUID) patrons, and reduction of long-term operation and maintenance (O&M) costs on approximately 18.5 miles of the COID-owned PBC. The Project is needed to address watershed problems and resource concerns including water loss in COID conveyance systems, water delivery and O&M inefficiencies, including risks to public safety. Implementation of the proposed action would address COID's objectives and goals to reduce seepage loss and provide better-managed water diversions for farm use, support agricultural land use, and increase public safety.

Description of the Preferred Alternative

Under the Preferred Alternative, COID would replace the existing open PBC within the Project Area¹ with a closed-conduit pipeline system. COID would pipe approximately 18.5 miles of its

¹ The Project Area consists of the existing District infrastructure to be modernized, areas where new infrastructure could be built as part of various alternative alignment options, and associated rights-of-way and/or easements where construction would take place.

currently unpipied system from NE 17th Street in Redmond, Oregon, to the diversion point from the Deschutes River in Bend, Oregon.

Project Measures

Under the Preferred Alternative, COID would install approximately 18.5 miles of pipe that is 10 to 11 feet in diameter and install supervisory control and data acquisition systems at two locations to improve operational efficiency. Additionally, 60 turnouts would be upgraded to pressurized delivery systems. Eleven of these turnouts deliver irrigation water to laterals off the PBC; the remainder provide irrigation water directly to COID patrons. Construction of the Preferred Alternative would occur over 3 years.

Resource Information

Subwatersheds	12-digit Hydrologic Unit Code	Latitude and Longitude	Subwatershed Size (acres)	Planning Area Within Subwatershed (acres)
North Unit Main Canal	170703051005	44.277078 -121.119381	11,451	1,225
Osborne Canyon-Crooked River	170703051101	44.391577 -121.17003	42,387	3,993
Overturf Butte-Deschutes River	170703010406	43.988146 -121.359392	31,374	1,021
Deschutes Junction	170703010801	44.070392 -121.26806	47,336	20,031
Laidlaw Butte-Deschutes River	170703010802	44.165512 -121.334446	42,749	4,722
Cline Falls-Deschutes River	170703010803	44.287424 -121.242082	11,864	880
Odin Falls-Deschutes River	170703010805	44.137419 -121.220784	66,353	8,582
Lava Island Falls-Deschutes River	170703010405	43.994549 -121.456711	12,518	0

Subwatershed Total Size

266,033 acres.

Watershed Planning Area Size

40,454 acres.

Climate and Topography

The Project Area is located in the rain shadow of the Cascade Mountain Range. Annual average precipitation for COID is 10 to 14 inches. The average high temperature for July is 82 degrees Fahrenheit and the average low temperature for December is 23 degrees Fahrenheit. The land within COID is slightly undulating with an average elevation of 3,504 feet above mean sea level.

Land Use (Planning Area)

Use	Acres
Irrigated Land	7,783
Nonirrigated Land	32,671

Land Ownership (Planning Area)

Owner	Percentage
Private	89.8%
State-Local	2.2%
Federal	8.0%

Population and Demographics

The Preferred Alternative would be located within Deschutes County with alignment sections within the city of Bend and the city of Redmond. The region is rapidly growing with the county expected to reach a forecast population of 275,905 by 2040; this is a 41.5 percent increase from the county's 2021 population.

Population and Demographics – Deschutes County and Oregon

	Deschutes County	Oregon
Population 2021	194,964	4,207,177
Unemployment Rate	5%	6%
Median Household Income	\$74,082	\$70,084

Relevant Resource and Community Concerns

Resource and community quality of life concerns identified through scoping included water conservation and quality, groundwater, aquatic and fish resources, soils, land use, visual resources, cultural and historic resources, socioeconomics, wetlands, terrestrial wildlife, public safety, construction impacts, vegetation resources, climate change impacts and resiliency, cumulative impacts, environmental justice and tribal consultation.

Alternatives Considered

Five alternatives were initially considered; three were eliminated from full analysis because they did not address the purpose and need for action, did not achieve the Federal Objective and Guiding Principles, or because they became unreasonable due to cost, logistics, existing technology, or social or environmental reasons. The No Action Alternative and a Modernization Alternative with six alternative alignment options were analyzed in full.

No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, COID would continue to operate and maintain the existing delivery system within the Project Area in its current condition. This alternative assumes that modernization of COID's infrastructure would not be reasonably certain to occur, as funding at the scale necessary to modernize COID infrastructure is not anticipated from other sources. The No Action Alternative would be a continuation of COID's current O&M.

Proposed Action (Modernization Alternative)

The Modernization Alternative would focus on a single-priority infrastructure modernization project: COID would replace the existing open PBC within the Project Area with a pressurized, 10- to 11-foot-diameter closed-conduit pipeline system. When completed, the total amount of pipe (proposed and existing) would extend over approximately 21 miles of the COID system from the diversion point from the Deschutes River in Bend, Oregon, to NE 17th Street in Redmond, Oregon.

Two project groups—Redmond and Rivers Edge—each contain a segment with three alternative alignment options to analyze impacts to the sections of the PBC that are listed in the National Register of Historic Places (NRHP).

City of Redmond Alternative Alignment Options

The Modernization Alternative has three options for piping within the NRHP-listed Downtown Redmond Segment Historic District section between NW Dogwood Avenue and NW Quince Avenue:

- Pilot Butte Canal Alignment (existing canal alignment).
- Piping to the East in the Watermaster's Access Road.
- Piping to the West within Northwest Canal Boulevard.

Deschutes County/North Bend Alternative Alignment Options

The Modernization Alternative has three options for piping the historic section of the canal between Yeoman Road and Cooley Road in Deschutes County and north Bend, in the Rivers Edge project group:

- Pilot Butte Canal Alignment (existing canal alignment).
- NE 18th Street Alignment.
- Old Deschutes Road Alignment.

Avoidance, Minimization, and Mitigation Measures

Temporary Access

Prior to construction, COID would contact adjacent landowners to discuss the Project. Landowners would be provided a construction schedule before construction begins. Where possible, work would be confined to existing and new easements. In addition, construction limits would be clearly flagged to preserve existing vegetation and prevent trespassing on private property. Access to residences and farms would be maintained during construction. Construction would generally occur during the daytime (7 a.m. to 7 p.m.) and primarily in the nonirrigation season (October through April) to minimize disturbance to landowners or other individuals in the construction area vicinity. Following project completion in an area, temporary construction access routes would be decommissioned, restored to original contours, and reseeded.

Staging, Storage, and Stockpiling

Mechanized equipment and vehicles would be selected, operated, and maintained in a manner that minimizes adverse effects on the environment. Construction staging areas would be selected and used to minimize effects on vegetation and avoid tree removal. The use of construction vehicles and equipment within 150 feet of streams would be minimized to the greatest extent practicable. Fueling and maintenance operations would be performed on flat surfaces, away from moving equipment, and at least 150 feet away from any water source.

Noise and Vibration

Mitigation of potential construction noise impacts will incorporate low-cost, easy-to-implement measures into project plans and specifications (for example, requiring equipment mufflers and prohibiting the use of air brakes).

Construction time constraints would be determined at the time of project construction. However, according to the local noise ordinances, construction work conducted between 10 p.m. and 7 a.m. would require special permits prior to conducting construction activities.

It is recommended that the Project provide a separate blasting plan for each cut that requires blasting, prepared by a qualified person. Blasting in the mass of rock to be excavated will be designed to control flyrock, minimize ground vibration and air blast, and result in loosened and fragmented in-place rock of a size that can be removed, transported, or crushed.

Blasting must comply with all applicable federal, state, and local regulations and be supervised by a licensed blaster. Activities should only be conducted when deemed necessary and under the direction of qualified personnel designated by the project engineer.

The blasting plan should include recommendations and methods to accomplish the following:

- Lay out production blast holes in a consistent pattern that does not affect the perimeter control blast holes.
- Use techniques that effectively limit and control flyrock.
- Clear the site of all boulders or other material prior to beginning blasting.
- Cover all blast areas that are within 200 feet of residences, facilities, or aboveground utilities using appropriate blast containment mats.
- Notify all owners and occupants of buildings, structures, and utilities that are within 1,250 feet of the blasting areas.
- Provide written notification at least 48 hours before blasting begins and again on the day the blasting operations occur.

Right-of-Way, Displacements, and Relocations

For properties that would experience permanent impacts, compensation and relocation assistance will mitigate the effects on affected property owners and tenants. Federal and state regulations require that property be purchased at fair market value.

Mitigation for temporary construction impacts may include best management practices (BMPs) to reduce noise and vibration, such as equipment mufflers, and limiting construction times to certain hours. Affected portions of public and private properties will be returned to their original condition following construction. Additional mitigation for construction easements could include payment to property owners in exchange for use of their property during construction. Access to impacted properties will be maximized to the extent possible, and specific provisions, including signage indicating businesses are open, will be made available.

Roads and Traffic Control

Impacts to traffic due to construction cannot be avoided due to the nature of the Project. Measures will be taken to appropriately detour traffic and coordinate with other nearby projects. Maintenance of traffic plans will be developed as part of final design. This will include wayfinding signs for alternative vehicle and pedestrian routes around the construction zones. Additionally, nearby landowners and residents will be notified of planned construction activities affecting their access.

Standard construction safety procedures and traffic control measures will be employed to reduce the risk of collisions between construction vehicles and other vehicles while construction is ongoing. Lane closures on roadways will be avoided during peak travel periods to the greatest extent possible to reduce potential traffic delays from construction vehicles.

Erosion Control

Silt fencing, straw wattles, geotextile filters, straw bales, or other erosion control measures will be used to minimize soil erosion and prevent eroded soil from entering waterbodies during construction. Erosion control measures will be free of weeds and weed seeds. Drainage measures will be incorporated into the engineering design to minimize effects of piping canals on local flooding. Construction will occur during the nonirrigation season so that there is no water within the canal.

Utilities

Construction-related impacts to the existing utilities within the alignments of the Project will not be avoidable. The following measures for water mains and service lines will be taken to minimize impacts to utility service during construction:

- If the connection to the existing system involves a temporary water system shutoff, provide written notices to the residents affected by the shutoff a minimum of 72 hours before the shutoff.
- Once work is started on a connection, proceed continuously without interruption and as rapidly as possible until completed.
- Schedule main shutoffs to ensure that mains do not remain shut off overnight, on Fridays, over weekends, or on holidays.
- Make service connections to water mains according to the recommendations of the pipe manufacturer and appropriate American Water Works Association standard for water service installation.
- Install water service connections as continuous without splices between the main and the meter unless otherwise approved by the agency with jurisdiction.
- Verify the locations of the existing service connections and meter assemblies in the field.
- Install water service assemblies to match finished lines and grades, and maintain proper clearances and cover for the entire service connection.
- Adjust the meter box to the finished grade after the surface has been acceptably restored. When meter boxes are to be installed in driveways or a vehicle-traveled way, use approved traffic-rated meter boxes.

The following measures to minimize impacts for sewer service interruptions will be taken:

- Bypass pump sanitary sewer and stormwater flows around the pipe section or manhole being repaired or replaced by plugging an existing upstream manhole and pumping the flow around the work area to a downstream manhole.
- Submit a bypass pumping plan at least 48 hours before beginning bypass pumping.
- Use a pump with adequate capacity to handle existing flows and additional flow due to rain.
- Pumps shall not exceed a noise level of 86 decibels at a distance of 50 feet.
- Do not operate bypass pumps at night except in an emergency.

- Do not discharge raw sewage onto private property, city streets, or into storm drain systems.

The following measures to minimize impacts for natural gas service interruptions will be taken:

- If the connection to the existing system involves a temporary natural gas system shutoff, provide written notices to the residents affected by the shutoff a minimum of 72 hours before the shutoff.
- Each disconnected service line must be tested in the same manner as a new service line before being reinstated.
- Each service line temporarily disconnected from the main must be tested from the point of disconnection to the service line valve in the same manner as a new service line before reconnecting.
- If provisions are made to maintain continuous service, such as by installation of a bypass, any part of the original service line used to maintain continuous service need not be tested.

The following measures to minimize impacts for electrical service interruptions will be taken:

- If the connection to the existing system involves temporary electrical shutoff, provide written notices to the residents affected by the shutoff a minimum of 72 hours before the shutoff.
- Planned electrical power outage notification will indicate the approximate duration of the power outage including dates and start and stop times.

Piping Resiliency

The pipe and associated trench will be designed to allow for long-term stability of the pipe and minimize potential loss of irrigation water to leakage. Mitigation measures include the following:

- Place the geomembrane securely to minimize the potential for shifting over time (a geotextile liner will be installed in the trench, followed by pipe bedding and the pipe).
- Compact fill material adequately to support the weight of planned vehicle and railroad traffic.
- Provide additional reinforcement as recommended by project engineers.

The engineer of record should coordinate with the project geologist to plan a targeted geologic investigation of subsurface variability, depth to bedrock, trench stability, erosion, seepage, and groundwater risks to support design-phase planning.

Revegetation and Visual Restoration

During excavation, topsoil will be saved and replaced as the top layer after trenches are backfilled. Areas disturbed for access purposes or during construction will be regraded to their original contours. When necessary, compacted areas such as access roads, stream crossings, staging, and stockpile areas will be loosened to facilitate revegetation and improve infiltration. Disturbed areas will be planted with a native seed mix appropriate to the habitat. Revegetation practices will follow the Natural Resources Conservation Service (NRCS) Oregon and Washington Guide for Conservation Seedings and Plantings (NRCS 2000). Costs of revegetation are included in project

installation cost estimates. Pruning and tree removal will occur entirely within the canal easement and will not exceed what is required for equipment clearance.

Mitigation for long-term visual and aesthetic impacts may incorporate measures to create visual interest in the alignment where the canal was visible before piping. This may include measures such as seeding with native plants or installation of landscaping, depending on the setting. Recreation uses such as linear parks or trails may be created along the alignment. The alignment may be used for the installation of public art or other aesthetic features that provide visual interest.

Hazardous Materials

A project-wide construction health and safety plan will minimize the potential for exposure of construction workers to hazardous materials and the risk to human health and the environment. Health and safety plans are required by federal Occupational Safety and Health Act regulations and state regulations.

A site-specific contaminated media management plan will ensure proper characterization, management, storage, disposal, and reporting of contaminated materials encountered during construction activities. The plan could outline the roles and responsibilities of personnel; health and safety requirements; methods and procedures for characterizing, managing, storing, and disposing of waste; and reporting requirements.

Spill Prevention, Control, and Countermeasures

Spill kits will be located at fuel storage areas, and construction crews will have adequate absorbent materials and containment booms on hand to enable rapid cleanup of spills. Immediately upon learning of any spills of fuel, oil, or hazardous material, or upon learning of conditions that could lead to an imminent spill, the person discovering the situation will initiate actions to contain the fluid or eliminate the source of the spill and notify the spill coordinator or crew lead immediately. If it is determined that a spill is beyond the scope of on-site equipment and personnel, an environmental emergency response contractor will be contacted immediately to contain or clean up the spill. Any spill into a waterbody or along the adjacent streambed will be reported immediately to the Oregon Emergency Response Service at 1-800-452-0311 and the National Response Center at 1-800-424-8802. The spill coordinator will complete a spill report form for each release of a regulated substance, regardless of volume.

Invasive Species Control

The following measures will be taken to avoid the introduction of invasive plants and noxious weeds into the Project Area.

- Inspect gear and equipment to be used in or near water for aquatic invasive species.
- Limit ground disturbance to those areas necessary to safely implement the Preferred Alternative.
- Begin activities in areas not characterized by invasive plants or noxious weeds before operating in infested areas.

- Use areas that are free of invasive plants or noxious weeds for staging, parking, and cleaning equipment. Avoid or minimize all types of travel through infested areas and restrict travel to those periods when the spread of seed or plant reproductive parts is least likely.
- Schedule soil work in infested roadsides or ditches during periods when seeds or propagules are least likely to be viable and spread.
- Monitor disturbed areas for at least three growing seasons following completion of activities. Provide follow-up treatments based on inspection results.
- Inspect material sources at their site of origin to ensure that they are free of invasive plant material before transport and use to the extent practicable. If possible, treat contaminated material before any use.

Wildlife

Construction will occur outside of the U.S. Fish and Wildlife Service (USFWS)-approved buffer distances for migratory birds and bald and golden eagle nests. If construction outside of the recommended buffer distance is not possible, it will be scheduled to take place outside of the nesting season.

Construction is anticipated to take place during February and March, outside of the primary nesting period for migratory birds of concern (April 15 through July 31). For occasions where project construction overlaps with the primary nesting period for raptors and eagles (February 15 through July 31), surveys will be conducted out to a radius of at least 2 miles of the construction site, per USFWS eagle nest survey protocol. Should an active nest be found, construction will not proceed prior to consultation with a local USFWS biologist to determine the next steps.

Blasting activities will adhere to management prescriptions in the USFWS National Bald Eagle Management Guidelines (USFWS 2007). These will include but may not be limited to avoiding blasting within a minimum of 0.5 miles of active nests, as well as avoiding blasting within 0.5 miles (or 1 mile in open areas) of communal roosts when eagles are congregating, without prior coordination with USFWS and the Oregon Department of Fish and Wildlife (ODFW). See Appendix F.9, Noise and Vibration Technical Report, for additional discussion of BMPs and mitigation measures for blasting noise.

In appropriate cases and under consultation with ODFW, ramps will be placed in open pipeline trenches during construction to avoid the potential for wildlife to become trapped overnight.

Cultural Resources

A cultural resource survey was conducted by a qualified archaeologist in all areas that may be affected by the proposed undertaking, including areas where ground disturbance will occur, consistent with NRCS and Bureau of Land Management cultural resource management policies. This survey included the identification and evaluation of cultural resources present within those areas to determine measures to avoid, minimize, or mitigate impacts to those resources.

If archaeological resources are inadvertently discovered during construction, an inadvertent discovery plan will be followed. Construction will stop in the vicinity of the discovery, the area will be secured and protected, a professional archaeologist will assess the discovery, consultation with

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the Oregon State Historic Preservation Office (SHPO), NRCS cultural resources staff, and Tribes will occur, as appropriate. Construction will resume in accordance with applicable guidance and law.

Draft Amendment 001 to Programmatic Agreement No. R19MA13745 for compliance with Section 106 of the National Historic Preservation Act for certain activities involving the Central Oregon Project System of canals, laterals, and associated irrigation features and facilities contains mitigation actions that are presented in detail in Appendix E.2 for the adverse effect to the Pilot Butte Canal Downtown Redmond Segment Historic District, listed in the NRHP in 2017 under the Carey and Reclamation Acts Irrigation projects in Oregon 1091-1978 Multiple Property Document.

The 2019 Programmatic Agreement, signed by NRCS in 2023, applies to and resolves adverse effects from the piping, repair, and maintenance of the COID canal system, while the Draft Amendment 001 to the Programmatic Agreement will resolve adverse effects by the undertaking to the Downtown Redmond Segment Historic District.

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	\$232,917,000	75%	\$77,640,000	25%	\$310,557,000	100%
Engineering	\$4,232,000	43%	\$1,411,000	57%	\$5,643,000	100%
Subtotal Costs	\$237,149,000	74%	\$79,051,000	26%	\$316,200,000	100%
Permitting	\$0	0%	\$843,000	100%	\$843,000	100%
Project Administration and Technical Assistance	\$33,066,000	94%	\$6,482,000	6%	\$39,548,000	100%
Annual O&M	N/A	N/A	N/A	N/A	N/A	N/A
Total Costs	\$270,215,000	75%	\$86,376,000	25%	\$356,591,000	100%

Project Benefits

Implementation of the Preferred Alternative would improve water delivery reliability for COID's patrons as a result of system pressurization and other modernization improvements that would increase the PBC system's operational efficiency. It would save an estimated 136 cubic feet per second (cfs) (43,544 acre-feet [AF]) of water from seepage and evaporation loss during the irrigation season. COID would pass a volume of water equivalent to the 136 cfs (43,544 AF) savings to NUID via a transfer of COID live-flow water rights in the Deschutes River. Accounting for seepage and

evaporation losses within the NUID system following delivery of saved water from COID, up to 32,161 AF (100 cfs) would be made available to NUID patrons (See Appendix D). As NUID continues to implement system modernization projects, its seepage and evaporation losses are expected to diminish over time; thus, the amount of saved water reaching NUID patrons would increase (NRCS 2023a; NUID 2022; NUID 2025). Regardless of continued seepage and evaporation losses within the NUID system following the transfer of live flow from COID, the project would enable NUID to retain a greater volume of its stored water in Wickiup Reservoir later into the year. This in turn would aid NUID in meeting its directives for winter releases from Wickiup Reservoir under the Deschutes Basin Habitat Conservation Plan (DBHCP) while more efficiently and reliably supplying its patrons with water during the irrigation season. Implementation of the Preferred Alternative would also reduce COID's O&M costs, reduce electricity costs from pumping, and improve public safety.

Number of Direct Beneficiaries

Approximately 2,500 patrons in both COID and NUID would benefit from this Project.

Other Beneficial Effects – Physical Terms

Implementation of the Preferred Alternative would have long-term beneficial effects on agricultural water availability, public safety, and water quality.

Damage Reduction Benefits	Preferred Alternative – Annual Benefits
Other – Reduced O&M	\$358,000
Other – Avoided Damage from Infrastructure Failure (Agricultural Yield Enhancement)	\$10,864,000
Other – Power Cost Savings	\$134,000
Other – Avoided Property Damage	\$4,173,000
Total Quantified Annual Benefits	\$15,529,000
Total Quantified Annual Cost	\$10,721,000
Benefit to Cost Ratio	1.4

Period of Analysis

Installation Period

3 years.

Project Life

100 years.

Funding Schedule

Year	Pub. L. No. 83-566	Other Funds	Total
1	\$93,319,000	\$29,939,000	\$123,258,000
2	\$99,834,000	\$31,869,000	\$131,703,000
3	\$77,062,000	\$24,568,000	\$101,630,000

Environmental Effects Major Conclusions

Implementation of the Preferred Alternative would improve water delivery reliability for COID's patrons, save an estimated 136 cfs (43,544 AF) of water from seepage loss during the irrigation season, pass an estimated 43,544 AF of water to NUID, reduce COID's O&M costs, reduce electricity costs from pumping, and improve public safety.

Areas of Controversy

During informal and formal scoping periods held in 2021 and 2022, the primary comments and concerns expressed by the public regarded historic preservation, property rights, and devaluation of properties from canal piping. Other comments related to the use of taxpayer funds; impacts to natural resources, surface water and groundwater resources, and wildfire; and impacts to future utilities.

Issues to be Resolved

NRCS and COID are consulting with SHPO and all interested consulting parties under Section 106 of the National Historic Preservation Act. Consultation will be completed prior to issuance of the Final Watershed Plan–Environmental Impact Statement.

NRCS and COID are consulting with USFWS under Section 7 of the Endangered Species Act regarding species under USFWS jurisdiction. This consultation will be completed prior to issuance of the Final Watershed Plan–Environmental Impact Statement.

Evidence of Unusual Congressional or Local Interest

None.

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

Aging infrastructure, growing populations, shifting rural economies, and changing climate conditions have increased pressure on water resources across the western United States. Within the Deschutes Basin, irrigated agriculture is the main out-of-stream water use. It primarily relies on 100-year-old infrastructure to divert, store, and deliver water to farms and ranches (Deschutes River Conservancy 2024). In recent years, the eight irrigation districts within the Deschutes Basin have focused on improving water resources management with the goal of addressing environmental needs for instream flows while still delivering enough water to district patrons.

The Deschutes Basin Habitat Conservation Plan (DBHCP; USFWS and NMFS 2020) is a collaborative strategy among the eight irrigation districts in the Deschutes Basin (Central Oregon Irrigation District [COID], North Unit Irrigation District [NUID], Arnold Irrigation District [AID], Lone Pine Irrigation District [LPID], Ochoco Irrigation District, Swalley Irrigation District, Three Sisters Irrigation District, and Tumalo Irrigation District), the City of Prineville, and the U.S. Fish and Wildlife Service (USFWS) to cover irrigation and related water management operations while enhancing fish and wildlife habitat. The districts and the City of Prineville all signed agreements with USFWS that carry a term of 30 years and protect the districts and City from Endangered Species Act (ESA) prosecution. In return, the districts and the City agreed to minimize and mitigate impacts to the ESA-listed species to the maximum extent practicable through the implementation of 21 different conservation measures established for the DBHCP. On December 31, 2020, USFWS announced its approval of the DBHCP and the issuance of USFWS incidental take permits specific to bull trout (*Salvelinus confluentus*) and Oregon spotted frog (*Rana pretiosa*); both are federally listed by USFWS as threatened. The National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) announced its approval of the DBHCP and the issuance of NMFS incidental take permits specific to steelhead (*Oncorhynchus mykiss*) on October 18, 2022.

In response to DBHCP approval, COID, NUID, LPID, and AID revised their previously existing 1938 Inter-District Agreement to modify reservoir storage and allocation to address the conservation measures and other provisions of the DBHCP (AID et al. 2020). The 2020 Revised Inter-District Agreement is separate from the DBHCP and is not required by the DBHCP. However, the agreement codifies requirements and parameters for coordination among COID, NUID, LPID, and AID for operations and water allocation in Crane Prairie and Wickiup Reservoirs for the full 30-year duration of the DBHCP, from 2020 until 2050 (AID et al. 2020).

The COID PBC Infrastructure Modernization Project (Project) is one of many ways that signatory irrigation districts are meeting guidelines in the DBHCP. The Project's water conservation efforts allow other signatory irrigation districts the flexibility to implement their water saving strategies. Thus, as a whole, the DBHCP guidelines are achieved. The Project benefits COID patrons, but also immediately benefits NUID because NUID is the most junior water rights holder in the Upper Deschutes Basin and is more heavily impacted by water scarcity in drought conditions when Deschutes River flows and reservoir storage volumes become unusually low. The primary benefactors of the Project are NUID's patrons.

COID is a senior water right holder in the Deschutes Basin. COID operates and maintains two separate canal systems—the PBC system and the Central Oregon Canal system—which together comprise approximately 400 miles of canals, laterals, and pipelines. The majority of this infrastructure is open, earthen, dug canals. The existing canals lose substantial amounts of water from a combination of (1) seepage related to the condition of the open canal distribution system and

the porous underlying soils and geology and (2) evaporation due to the open canal that is located in an arid climate in the Deschutes Basin. During the irrigation season, the unlined portion of the PBC that is currently proposed for modernization is estimated to lose up to 136 cubic feet per second (cfs), or approximately 43,544 acre-feet (AF) annually over a total distance of approximately 18.5 miles (FCA 2023). The COID System Improvement Plan (SIP) details water loss associated with specific canals and laterals (Crew 2016; Crew and FCA 2017).

COID is committed to implementing modernization and conservation measures to improve water delivery efficiency and reliability for its patrons. In addition to completing two SIPs in 2016 and 2017, which collectively considered piping the COID conveyance system,² COID has also pursued on-the-ground water conservation projects to provide permanent solutions to system-wide water losses (Crew 2016; Crew and FCA 2017). Although some improvements have been made, aging and outdated infrastructure continues to contribute to water delivery insecurity for out-of-stream users. The PBC and laterals in COID also present an increasing public safety hazard due to surrounding areas urbanizing which increases the risk of accidental drownings, as well as to potential flooding from canal wall failures. Additionally, aging infrastructure affects the financial stability of COID and its patrons as COID must find new approaches to fund growing maintenance needs.

In July 2020, COID completed the Smith Rock-King Way Watershed Plan–Environmental Assessment (NRCS 2020a) that studied modernization (piping) of approximately 7.9 miles of the COID water distribution system in the Smith Rock-King Way area of COID, to protect up to 29.4 cfs (approximately 9,392 AF) of water annually for instream use in the Deschutes River during the nonirrigation season. COID completed construction of the Smith Rock-King Way project in the spring of 2022.

Building upon the modernization efforts for the Smith Rock-King Way area, if COID pipes roughly an additional 18.5 miles of its PBC system from the southern terminus of the Smith Rock-King Way Modernization Project to the diversion point at the Deschutes River in Bend, up to 43,544 AF (136 cfs) of water would be saved annually. The volume of water saved would be passed to NUID via a transfer of a portion of COID’s live-flow water rights in the Deschutes River and, accounting for seepage and evaporation losses within NUID’s system, an estimated 32,161 AF (100 cfs) would be made available to NUID patrons (See Appendix D). As a result, NUID would be able to retain more of its stored water in Wickiup Reservoir later into the year. This would allow NUID to release water from Wickiup Reservoir to the Deschutes River during the nonirrigation season as directed by the DBHCP while also providing more reliable water to NUID patrons. During the irrigation season, COID patrons would continue receiving their water deliveries and NUID patrons would receive theirs more reliably, thereby supporting local agriculture and the local economy. Modernizing irrigation infrastructure offers an opportunity to save water, increase reliability of water delivery to farms, reduce risks to public safety from open irrigation canals, and reduce operation and maintenance (O&M) costs for COID.

² The scope of the proposed project only covers a portion of COID infrastructure. The engineering details and costs of the proposed project in this Plan-EIS are slightly different than those presented in the 2016 and 2017 SIPs. Therefore, the specific pipe diameters and costs from the SIPs are not referenced in this Plan-EIS.

1.1 Planning Area

COID is located in Bend, Redmond, and unincorporated areas of Deschutes County, Oregon. The planning area³ is defined as the area where canal seepage and conveyance inefficiencies are happening, and it is identified by the subwatersheds traversed by the proposed project (see Table 1-1 and Appendix B for details).

Table 1-1. Central Oregon Irrigation District Pilot Butte Canal Watershed Area.

Subwatersheds	12-digit Hydrologic Unit Code	Subwatershed Size (acres)
North Unit Main Canal	170703051005	11,451
Osborne Canyon-Crooked River	170703051101	42,387
Overturf Butte-Deschutes River	170703010406	31,374
Deschutes Junction	170703010801	47,336
Laidlaw Butte-Deschutes River	170703010802	42,749
Cline Falls-Deschutes River	170703010803	11,864
Odin Falls-Deschutes River	170703010805	66,353
Lava Island Falls-Deschutes River	170703010405	12,518

1.2 Project Area

The Project Area is the portion of the planning area where the Project would occur (Appendix C). The Project Area, making up only a portion of the COID total system, consists of the existing COID infrastructure to be modernized, areas where new infrastructure could be built as part of various alternative alignment options, and associated rights-of-ways (ROWs) and/or easements where construction would take place.

1.3 Current District Infrastructure and Operations

COID operates and maintains two separate canal systems. The Central Oregon Canal system runs east through Bend, Alfalfa, and Powell Butte and consists of over 222 miles of canals, laterals, and pipelines. The PBC system runs north through Bend, Redmond, and Terrebonne and consists of 178 miles of canals, laterals, and pipelines that convey water to approximately 17,149 acres of irrigated

³ The “planning area” referred to in this Plan-EIS is equivalent to the term “watershed area” as defined by the National Watershed Program Manual (NWPM) 506.60.TTT (NRCS 2015a). The term “planning area” is used in this Plan-EIS in an effort to reduce confusion between the NWPM 506.60.TTT watershed area definition and watershed areas as defined by hydrologic unit codes.

lands. This Draft Watershed Plan–Environmental Impact Statement (Plan-EIS) only provides detailed discussion of water and infrastructure associated with the PBC diversion and main canal.

COID diverts water to the PBC from the Deschutes River via the PBC diversion at North Canal Dam (river mile [RM] 164.8). The diversion has powered headgates and an agency-compliant fish screen to protect both upstream and downstream migrating fish within the river (Biota and R2 2013). During peak irrigation season, COID may divert up to 480 cfs through the PBC diversion (Talbot 2025). From the PBC diversion, water is transported through the PBC approximately 21.6 miles before reaching the northernmost point of the Project Area. Water is delivered to patrons directly from the PBC as well as through an extensive system of laterals that branch off the PBC. Patron turnouts from the PBC and laterals are gate-regulated and weir-measured by COID field staff. In addition to serving its own patrons, COID delivers water through the PBC to LPID's Lone Pine weir approximately 2,100 feet upstream of the northern end of the PBC. LPID is in the process of modernizing its system and adding a new turnout near the northern end of the currently piped Smith Rock section of the PBC, outside of the Project Area, to allow for a change in LPID's delivery location. As a result, the Lone Pine weir and spillway will be removed within 2 to 3 years and no longer used (Horrell 2024). COID also passes water to the NUID main canal via the NUID-PBC point of delivery at the northern end of the currently piped Smith Rock section of the PBC.

COID also owns 26,000 AF of stored water rights in Crane Prairie Reservoir, located in the uppermost reaches of the Deschutes River Watershed.⁴ The reservoir is federally authorized for irrigation and state-authorized for multiple purposes including instream flows for fish and wildlife. Crane Prairie Reservoir Dam is owned by the U.S. Bureau of Reclamation (Reclamation) and operated by COID. COID shares maintenance responsibilities with LPID and AID, which also have stored water rights in the reservoir. Water from Crane Prairie Reservoir was historically released throughout the irrigation season and conveyed through Wickiup Reservoir (a storage reservoir for NUID) and down the Deschutes River. However, on December 31, 2020, USFWS announced its approval of the DBHCP and the issuance of USFWS incidental take permits specific to bull trout (*Salvelinus confluentus*) and Oregon spotted frog (*Rana pretiosa*)—both federally listed as threatened. NMFS announced its approval of the DBHCP and the issuance of NMFS incidental take permits specific to steelhead (*Oncorhynchus mykiss*) and sockeye salmon (*Oncorhynchus nerka*) on October 18, 2022. In response to DBHCP approval, COID, NUID, LPID, and AID revised their 1938 Inter-District Agreement to modify reservoir storage and allocation to reflect the conservation measures and other provisions of the DBHCP (AID et al. 2020). The 2020 Revised Inter-District Agreement codifies requirements and parameters for coordination among COID, NUID, LPID, and AID for operations and water allocation in Crane Prairie and Wickiup Reservoirs for the full 30-year duration of the DBHCP until 2050 (AID et al. 2020).

Conservation measures in the DBHCP are designed to minimize and mitigate impacts caused by the incidental take of listed species that may result from the storage, release, diversion, and return of irrigation water by the districts. The conservation measures adjust the allowed timing, volume, and duration of reservoir releases, both during the irrigation and nonirrigation (winter) seasons, to better align with the life history needs of listed species while continuing to enable the districts to deliver water for irrigation (USFWS 2021). To achieve reservoir storage volumes and maintain flow levels in the Deschutes River that are identified in the DBHCP conservation measures, the 2020 Revised

⁴ This volume of storage is in reference to terms per the 1938 Inter-District Agreement. The implementation of the DBHCP and the related 2020 Revised Inter-District Agreement have reduced the amount of storage effectively available to COID to 5,000 AF through 2050, unless extended or modified by the written mutual agreement of the districts.

Inter-District Agreement limits the amount of stored water from Crane Prairie Reservoir that is available to the irrigation districts. COID has agreed to forgo the use of stored water in Crane Prairie Reservoir in exchange for up to 5,000 AF of stored water from Wickiup Reservoir. In exchange for the use of this volume of NUID’s stored water, COID provides NUID with an equal volume of Deschutes River water from COID’s live-flow rights. However, this is contingent on COID’s ability to provide the water without making a call on AID or LPID junior live-flow rights.

Per DBHCP conservation measure WR-1, NUID must progressively increase its winter releases from Wickiup Reservoir into the Deschutes River over the duration of the DBHCP. Minimum releases from years 1 to 7 of DBHCP implementation (2021 through 2027) are 100 cfs. Minimum releases increase to 300 cfs from years 8 to 13 of implementation (2028 through 2033), and again to between 400 cfs and 500 cfs for the remaining duration of the DBHCP (through 2050). For all Deschutes River live flow made available to NUID during the irrigation season via water savings from piping COID canals, an equivalent volume must be released below Wickiup Reservoir during the nonirrigation season. From years 1 to 7 of the DBHCP, this amount of water is released in addition to the DBHCP-mandated 100 cfs minimum. From years 8 to 13 and 14 to 50, this amount of water contributes to achieving the mandated minimum flows of 300 cfs and 400–500 cfs, respectively. At the present time, NUID may receive up to 36.4 cfs (11,628 AF) of water during the irrigation season that is saved from already-completed COID system modernization projects. This includes up to 29.4 cfs (9,392 AF) of water that is saved from COID’s Smith Rock-King Way Modernization Project; another approximately 5 cfs (1,597 AF) of water that is saved from the Siphon Power Property Canal Piping Project on the Central Oregon Canal; and approximately 2 cfs (639 AF) that is saved from the piping of COID’s J and L laterals (Talbot 2025). This water is either delivered to NUID at the point of delivery at the northern end of the currently piped Smith Rock section of the PBC, or NUID may divert the saved water at its point of diversion on the Deschutes River at North Canal Dam. In response, NUID legally protects the same volume of water for release into the Deschutes River downstream from Wickiup Reservoir, in addition to the DBHCP-mandated 100 cfs minimum, during the following nonirrigation season.

1.4 Decision Framework

This Plan-EIS has been prepared to assess and disclose the potential effects of the proposed action. Once the Natural Resources Conservation Service (NRCS) has approved federal funding through Public Law Number (Pub. L. No.) 83-566, a Plan-EIS 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.

This environmental document was initiated using the 40 CFR 1500-1508 (April 2022) and 7 CFR 650 regulations. These regulations have recently been rescinded and replaced with USDA regulations found under 7 CFR 1b. However, in a good-faith effort to fulfill NEPA’s requirements, including Congressional timeline and considerations of fiscal restraints, the agency decided to continue to use 40 CFR 1500-1508 (April 2022) and 7 CFR 650. This is permissible per the USDA policy guidance issued in the Interim Final Rule’s preamble. The Federal Register notice said: “To ensure an orderly transition without undue impact on the USDA mission, USDA subcomponents have discretion to continue using the versions of USDA and agency-specific NEPA regulations in place before publication of this interim final rule, as well as the 2020 version of the CEQ NEPA regulations,

where it makes sense for proposals that are at a certain stage in the applicable NEPA process (categorical exclusion, environmental assessment, or environmental impact statement).” 90 FR 29644 (July 3, 2025).

NRCS is the lead federal agency for this Plan-EIS 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 7 Code of Federal Regulations [CFR] Part 1b).

COID partnered with NRCS to implement the Project within the planning area under the watershed authority of the Pub. L. No. 83-566 program. 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-EIS and Project are prepared as necessary.

This Plan-EIS has been prepared in accordance with applicable USDA NEPA regulations (7 CFR Part 1b), NRCS Title 190 General Manual Part 410, and the NRCS National Environmental Compliance Handbook Title 190 Part 610. The Plan-EIS also meets the NRCS program policy of the 2024 NRCS National Watershed Program Manual (NWPM; NRCS 2024) and guidance of the 2014 NRCS National Watershed Program Handbook (NRCS 2014). This Plan-EIS 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-EIS following the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies (Principles, Requirements, and Guidelines; CEQ 2014). The USDA has issued guidance for analysis comprised of Departmental Manual 9500-13 and Departmental Regulation 9500-13, and NRCS uses this guidance as the framework for evaluating water resources investments (NRCS 2017).

2 Purpose and Need for Action

2.1 Purpose and Need for Action, Federal Objective, and Authorized Project Purpose

2.1.1 Purpose and Need for Action

The proposed purpose of this Project falls under Pub. L. No. 83-566 Authorized Project Purpose (v), Agricultural Water Management, due to the proposed project's focus on irrigation water conservation and more reliable agricultural water supply delivery. The purpose of the Project is agricultural water management through irrigation water conservation in COID-owned infrastructure, improvement of water delivery reliability to COID and NUID patrons, and reduction in long-term O&M costs on approximately 18.5 miles of the COID-owned PBC. The Project is needed to address water loss in COID conveyance systems and water delivery, operation, and maintenance inefficiencies. Specifically, the Project would address COID's objectives and goals to reduce water loss due to seepage and evaporation by converting open canals to an underground closed-pipe system. It would also provide better-managed water diversions for farm use, contribute to the long-term sustainability of irrigated agricultural land use, and improve public safety by remedying potential drowning and flooding risks.

2.1.2 Federal Objective

Per the Federal Objective,⁵ water resources investments shall 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 2024). 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, and watershed approach (NRCS 2017).

2.2 Watershed Problems and Resource Concerns

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

2.2.1 Water Loss in District Conveyance Systems

The open, unlined PBC was constructed between 1904 and 1905. Because of the highly porous volcanic soils and the arid climate in the Upper Deschutes Basin, the existing canal loses substantial amounts of water through seepage and evaporation. The unlined and unpiped portions of the PBC currently proposed for modernization are estimated to lose up to 136 cfs, or approximately 43,544 AF, annually through seepage and evaporation over a total distance of approximately 18.5 miles (FCA 2023; COID 2016a). Existing seepage and evaporation losses from the PBC are discussed in further detail in Section 4.9.

⁵ A description of Federal Objective's Authorized Purposes can be found in 390-NWPM, Part 501, Subpart D, Section 501.40B5 (5th Edition, amended June 2024).

Open canal and lateral systems are inefficient because during the nonirrigation season they are not used and are dry. When the irrigation season starts, additional water and time are needed to fill the canals so that patrons can use the water. Conveying irrigation water in this way creates inefficiencies in delivery volume and timing that can compound the losses from seepage and evaporation over the length of the PBC system (FCA 2023). A closed pipe, as is proposed for COID, remedies these water loss inefficiencies.

2.2.2 Water Delivery and Operations Inefficiencies

The open, unlined PBC and laterals make it difficult for COID to deliver the correct amount of water to patrons at the correct time, particularly early and late in the irrigation season when water rights require COID to divert water from the Deschutes River at a reduced rate. At reduced flow rates, small changes in streamflow at the diversion can impact when water is available at each point of delivery, and patrons may receive inconsistent flows. For example, a point of delivery near the end of a lateral may receive no water in the morning and excess water in the evening. Even with highly skilled and trained staff, efficient deliveries to patrons are hindered as water loss in the system must be accounted for and changes to diversion rates can take multiple days before successfully meeting demand.

2.2.3 Risks to Public Safety

The existing open canal poses a risk to public safety during the irrigation season due to the potential for people and animals to fall into the open canal. The public can currently access the canal at many points along the system, including developed and informal recreation trails in Bend and Redmond. The open canal is adjacent to residential and commercial uses, and it is crossed by public and private roadways along its existing alignment. During the summer months when irrigation water flows at peak volume in the canal, water depths can reach 6 feet with water moving through the canal at up to over 500 cfs. These conditions can make it difficult for a child or an adult to climb out of the canal to safety and can result in injury or death. Along with multiple instances of injury, several drowning deaths have previously occurred in various central Oregon irrigation districts' canals, including in 1996, 1997, and 2004 (Flowers 2004).

The potential increasingly exists for periodic canal failure. This represents a risk of serious operational disruption and sudden loss of water for irrigators downstream and at times upstream of the failure location, as well as a risk to human life and property from flooding. Since 2005, there have been two incidents of canal failure that resulted in flood damage to homes and agricultural land. Potential for canal failure and flood damage is currently most pronounced in Redmond where burrowing activity by small mammals destabilizes the canal walls. However, the flooding and operational risks from canal failure are expected to increase over time throughout the entire length of the PBC due to continued degradation as the canal ages (Horrell 2023). The potential for safety impacts will likely grow as urban development continues in the project vicinity and more people and property are placed at risk.

2.2.4 Operations and Maintenance Inefficiencies

Maintaining the Pilot Butte Canal is costly to the District in terms of staff time, equipment, and materials. Sections of the Pilot Butte Canal run through the urban centers of Bend and Redmond, which increases the frequency of physical damage to the canal, which can lead to canal failures as described in Section 2.2.3. Past canal failures have caused flood damages ranging from over

\$500,000 to more than \$2.3 million. The District plans to increase operations and maintenance (O&M) expenditures in the future in an effort to reduce the likelihood of these incidents, but even with higher O&M effort and costs, canal failures are still expected.

2.3 Watershed and Resource Opportunities

The following resource opportunities would be realized through the implementation of the Project:

- Support and maintain existing irrigated agriculture through enhanced water supply reliability and improved water management.
- Minimize the potential for flooding, injury, and loss of life associated with the open COID PBC.
- Reduce COID's O&M costs in delivering irrigation water to its patrons.
- Improve streamflow, water quality, habitat, and habitat availability in the Deschutes River downstream from Wickiup Reservoir by enabling NUID to retain more water in Wickiup Reservoir during the irrigation season for release during the nonirrigation (winter) season.

3 Scope of the Plan-EIS

3.1 Agency, Tribal, and Public Outreach

A Notice of Intent to prepare an EIS for the Project was published in the Federal Register on June 17, 2022 (FR Volume 87, Issue 117). 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 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 0 for more details). Additionally, COID notified patrons of the scoping meeting and invited comments on the scope of the Draft Plan-EIS.

In accordance with 36 CFR 800, the National Historic Preservation Act of 1966 as amended (NHPA), and its subparts, NRCS has initiated consultation and coordination with the Oregon State Historic Preservation Office (SHPO; May 16, 2022;), federally recognized tribes (May 16, 2022;), and other Consulting Parties including Certified Local Governments on the Area of Potential Effects (APE; March 8, 2023) and prior to cultural resources survey (Table 7-1 and Appendix E.1). The general public was invited to comment on any topics of concern including Section 106 resources during the public scoping period. Input received from SHPO and BLM was incorporated into the cultural resource identification survey prior to implementation. No comments on the APE or cultural resource survey plans were received from other consulting parties or the public.

Per Executive Order 13007, Indian Sacred Sites, NRCS will coordinate with federally recognized tribes whose ancestral lands are known to have been in the counties of the undertaking prior to conducting cultural resources surveys. Tribes were contacted regarding survey work on April 29, 2024, and no input from Tribes was received regarding the cultural resource identification survey prior to implementation (see Appendix E.1).

After completion of the cultural resources identification survey and subsequent NRCS review, a copy of the completed survey report was furnished to SHPO and tribal governments with ancestral lands within the counties of the APE (see Appendix E.1). Further consultation occurred for the resolution of adverse effects to cultural resources through an amendment to a programmatic agreement which will be signed by Oregon NRCS and relevant parties and submitted to the Advisory Council of Historic Preservation. This consultation included outreach to the City of Bend, City of Redmond, and Deschutes County, and members of the public will be given the opportunity to comment on adverse effects during the Draft Plan-EIS public comment period.

NRCS conducted tribal consultation in accordance with the NHPA of 1966 and Executive Order (EO) 13175, Consultation and Coordination with Indian Tribal Governments, to maintain the NRCS government-to-government relationship between Native villages and tribes. Consultation letters regarding the cultural resources APE were sent to the Burns Paiute Tribe, Confederated Tribes of Warm Springs Reservation of Oregon, and the Confederated Tribes of the Grand Ronde on May 16, 2022, April 29, 2024, November 20, 2024, and April 17, 2025 (see Table 7-1 and Appendix E.1).

3.2 Scoping Meetings

An in-person formal public scoping meeting was held on Tuesday, July 19, 2022, from 6 to 7:30 p.m. at the Redmond Grange, 707 SW Kalama Avenue, Redmond, Oregon. The meeting presentation was also shared on the project website. Presenters included staff from COID (Craig Horrell), NRCS

(Gary Diridoni) and Parametrix (Shane Phelps). There were 42 members of the public in attendance at the meeting. Representatives of agencies and project partners including NRCS, Farmers Conservation Alliance, and the Deschutes County Soil and Water Conservation District also attended the meeting.

An informal public scoping meeting for agencies and stakeholders was held on October, 20, 2021, from 10 to 11 a.m. Pacific standard time via Zoom. The meeting consisted of a presentation of the Pub. L. No. 83-566 program, the project purpose and need, and an introduction to the NEPA process. Presenters included staff from COID (Craig Horrell), NRCS (Gary Diridoni) and Parametrix (Shane Phelps and Jeff Heilman). There were 25 total attendees, including 6 representing agencies and other stakeholders including USDA and Farmers Conservation Alliance.

3.3 Scoping Comments

The formal scoping comment period opened on June 17, 2022, and was originally scheduled to close on July 18, 2022. Closure of scoping was later extended to July 26, 2022, and a second time until August 2, 2022, to accommodate the July 19, 2022, formal public scoping meeting and to allow sufficient time for stakeholders to submit comments based on the July 19 meeting.

Comments were submitted via the following methods:

- At the public meeting on July 19, 2022.
- Federal eRulemaking Portal: Go to <http://www.regulations.gov> and search for docket ID NRCS-2022-0004.
- Mail, Craig Horrell, District Manager, Central Oregon Irrigation District, 1055 SW Lake Court, Redmond, Oregon 97756.

Table 3-1 presents comment topics received during the scoping period and where they are addressed in this Plan-EIS. Federal, state, tribal, and local agency consultation and other public participation activities are further described in Chapter 0 of this Plan-EIS.

Table 3-1. Public Scoping Comment Summary.

Comment Topic	Section Where Topic is Discussed
Historic preservation of the existing canal for those segments with official historic designation	Section 4.1 Cultural Resources Section 6.1 Cultural Resources
Consideration of the No Action Alternative for the North Bend historic segment	Section 5.2.4 Partial Modernization Section 5.3.1 No Action (Future without Federal Investment)
Property rights and the allowable activities under existing easements	Section 4.2.1 Land Ownership Section 4.12 Right-of-Way, Displacements, and Relocations Section 6.12 Right-of-Way, Displacements, and Relocations

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Comment Topic	Section Where Topic is Discussed
Devaluation of properties where the existing canal is a valuable water feature	Section 6.5.2 Socioeconomics Appendix D Investigation and Analysis Report
Use of taxpayer funds	Section 1.4 Decision Framework Appendix D Investigation and Analysis Report
Impacts to wildlife and habitat	Section 4.7.3 Wildlife Section 6.7.2 Modernization Alternative
Impacts to trees adjacent to the existing canal	Section 4.7.1 Vegetation Section 6.7.2 Modernization Alternative
Groundwater depletion and the impacts to wells and aquifers	Section 4.9.6 Groundwater Section 6.9 Water Resources
Impacts to adjacent residents and properties due to construction including: • Blasting • Noise and Dust • Traffic Delays and Detours on NE 18th Street • Utility Relocations	Section 4.10 Utilities Section 4.11 Noise and Vibration Section 4.13 Transportation Section 6.10 Utilities Section 6.11 Noise and Vibration Section 6.13 Transportation
Efficient use of water under existing conditions	Section 4.9 Water Resources Section 6.9 Water Resources
Prioritize piping of downstream laterals	Section 4.9 Water Resources Section 6.9 Water Resources
Wildfire risk	Section 4.4 Public Safety Section 6.4 Public Safety
Future utilities being precluded within the public ROW, such as sanitary sewer	Section 6.12 Right-of-Way, Displacements, and Relocations
Adequacy of public scoping format	Section 3.1 Agency, Tribal, and Public Outreach
Water resource impacts including permitting regulatory requirements under the Clean Water Act	Section 4.9 Water Resources Section 6.9 Water Resources
Financial assurance mechanisms to cover the costs of safety measures and project O&M, including specific adaptive management plans to contend with changing climatic conditions	Section 1.4 Decision Framework
Air quality impacts with respect to diesel and fugitive dust emissions during construction	Section 6.14 Air Quality

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Comment Topic	Section Where Topic is Discussed
Climate change impacts and resiliency and adaptative planning in the project design	Section 6.15 Climate Change, Resiliency, and Adaptation
Cumulative impacts	Section 6.17 Cumulative Effects
Environmental justice impacts evaluated at the block group level	No longer a requirement under NRCS policy for environmental evaluation
Documentation of tribal coordination	Section 3.1 Agency, Tribal, and Public Outreach Section 4.1 Cultural Resources Section 7.1 List of Persons and Agencies Consulted
Monitoring and adaptive management including invasive species monitoring and control	Section 4.7.1 Vegetation Section 6.7 Biological Resources Section 6.15 Climate Change, Resiliency, and Adaptation

3.4 Identification of Resource Concerns

Table 3-2 through Table 3-10 provide a summary of resource concerns and their relevance to the proposed action. Resource concerns determined not relevant were eliminated from detailed study; resource concerns determined relevant were carried forward for analysis.

Table 3-2. Concerns for the Project by Resource – Air.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Air Quality		X	Oregon Department of Environmental Quality air quality data indicates that the entire Project Area is in attainment for all criteria pollutants. Emissions from equipment associated with construction activities would occur; however, such emissions are considered negligible when compared to background levels and the application of BMPs.

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Table 3-3. Concerns for the Project by Resource – Soils.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Soils	X		Construction of the Project could affect soils.
Prime Farmlands	X		Prime farmlands occur in the Project Area and could be affected by the Project.

Table 3-4. Concerns for the Project by Resource – Human Environment.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Cultural Resources	X		Consultation with the SHPO and other Consulting Parties including affiliated tribes is required for compliance with Section 106 of the NHPA.
Land Use	X		Construction and operation of the Project could affect land use.
National Parks, Monuments, and Parklands		X	No relevant impact. No federal park facilities are within the Study Area.
Noise		X	No relevant impact to noise. With the implementation of BMPs, noise impacts during construction would be negligible and temporary.
Public Safety	X		Drowning risk in the open canal could be beneficially affected. Since 2005, there have been two incidents of canal failure that resulted in flood damage to homes and agricultural land.
Visual Resources	X		Visual resources in the Project Area could be affected where the open canal would be altered.

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Table 3-5. Concerns for the Project by Resource – Socioeconomics.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Local and Regional Economy	X		The proposed action involves an expenditure of public funds, which could affect the local and regional economy.
National Economic Development	X		A National Economic Development analysis has been completed as required by the Departmental Manual 9500-013, Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines.

Table 3-6. Concerns for the Project by Resource – Vegetation.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Invasive Species/Noxious Weeds		X	No relevant impact. With the implementation of BMPs, the spread of noxious weeds during construction would be avoided.
Mature Trees	X		Direct and indirect effects on mature trees could occur.
Special Status/Threatened or Endangered Species		X	None has been observed in the Project Area, and no designated critical habitat occurs in that area.

Table 3-7. Concerns for the Project by Resource – Water.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Coastal Zones		X	None present.
Groundwater Quantity, Aquifer Recharge	X		Construction and operation of the Project could affect aquifer recharge.

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Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Regional Water Resources Plans	X		The proposed action does not consider altering existing water resources plans or the management of any regional water resources. However, it has been designed with consideration to the DBHCP and the related 2020 Revised Inter-District Agreement among COID, AID, LPID, and NUID for management of Crane Prairie and Wickiup Reservoirs. The Project has specific applications for DBHCP Conservation Measure WR-1, which directs that for all saved water made available to NUID from COID piping projects, an equivalent volume should be applied to wintertime releases from Wickiup Dam into the Deschutes River.
Surface Water Quality	X		The proposed action could affect surface water quality by reducing the mobilization of pollutants into the open PBC via stormwater runoff.
Surface Water Quantity	X		For part of the first nonirrigation season following completion of the first project group (i.e., from October 20 to December 31, 2027), the streamflow in the Deschutes River within the study area would increase by up to 49.03 cfs (42 percent increase) beyond the minimum flow required under the DBHCP, resulting in beneficial impacts. After December 31, 2027, the proposed action would result in no net change in Deschutes River streamflow beyond that resulting from implementation of the DBHCP, and therefore would have no effect on surface water hydrology.
Wild and Scenic Rivers	X		The proposed action could indirectly affect the reaches of the Deschutes River that are designated under the Wild and Scenic Rivers Act.

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Table 3-8. Concerns for the Project by Resource – Wetlands and Riparian Areas.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Wetlands and Riparian Areas		X	Jurisdictional wetlands and riparian areas would not be affected by project construction activities because none are present within the Project Area.

Table 3-9. Concerns for the Project by Resource – Fish and Wildlife.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Coral Reefs		X	None present.
Endangered Species	X		Oregon spotted frog, bull trout, steelhead, or their habitats are known to occur in waterways associated with COID operations; i.e., the Deschutes River, Crane Prairie Reservoir, and Wickiup Reservoir. Project construction would only directly affect ditches and canals; i.e., the PBC and related COID infrastructure. These species and their habitats are not present within the PBC or the overall COID conveyance system, and would not be affected by construction. Water savings passed to NUID during Project operation would be retained in Wickiup Reservoir during the irrigation season and released during the nonirrigation season. For a portion of the first year of Project operation (i.e., from October 20 to December 31, 2027), the amount of water saved and released during the nonirrigation season would be added to the minimum of 100 cfs required by the DBHCP. Streamflow in the Deschutes River within the study area would thus increase by up to 49.03 cfs (42 percent increase) beyond the minimum flow required under the DBHCP. This would result in beneficial effects on Oregon spotted frog habitat in Wickiup Reservoir and in the Deschutes River below Wickiup Dam. There would be no effects on bull trout, steelhead, or their habitats, as they are not present above Big Falls (94 river miles downstream from Wickiup Reservoir). The baseline flow within the Deschutes River increases sufficiently over this distance due to tributary and spring contribution that increased flows below Wickiup Reservoir would not be biologically detectable by bull trout and steelhead. From 2028 on, water savings would become part of the DBHCP minimum 300 cfs winter release from Wickiup Reservoir, and the Modernization Alternative would not have any beneficial or adverse effects on Oregon spotted frog, other ESA listed or non-listed aquatic species, or their habitats.
Essential Fish Habitat		X	Since the Project would not adversely affect essential fish habitat, consultation under the Magnuson-Stevens Fishery Conservation and Management Act is not expected to be required.

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Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Fish and Fish Habitat	X		For part of the first nonirrigation season following completion of the first project group (i.e., from October 20 to December 31, 2027), the streamflow in the Deschutes River within the study area would increase by up to 49.03 cfs (42 percent increase) beyond the minimum flow required under the DBHCP. This would result in beneficial impacts to fish and fish habitat. After December 31, 2027, the proposed action would result in no net change in Deschutes River streamflow beyond that resulting from implementation of the DBHCP, and the proposed action would have no effect on fish or fish habitat. The proposed action would not affect fish habitat within the PBC system because no fish or fish habitat are known to occur within the PBC system.
General Wildlife and Wildlife Habitat	X		Construction and operation of project components could affect wildlife in and near the Project Area.

Table 3-10. Concerns for the Project by Resource – Ecosystem Services.

Resource	Yes, it is relevant to the proposed action	No, it is not relevant to the proposed action	Justification
Provisioning Services	X		Provisioning services supported by water quantity, quality, and availability could be impacted by the proposed action.
Regulating Services	X		Regulating services supported by water quantity, quality, and availability could be impacted by the proposed action.
Cultural Services	X		Cultural services supported by water quantity, quality, and availability could be impacted by the proposed action.

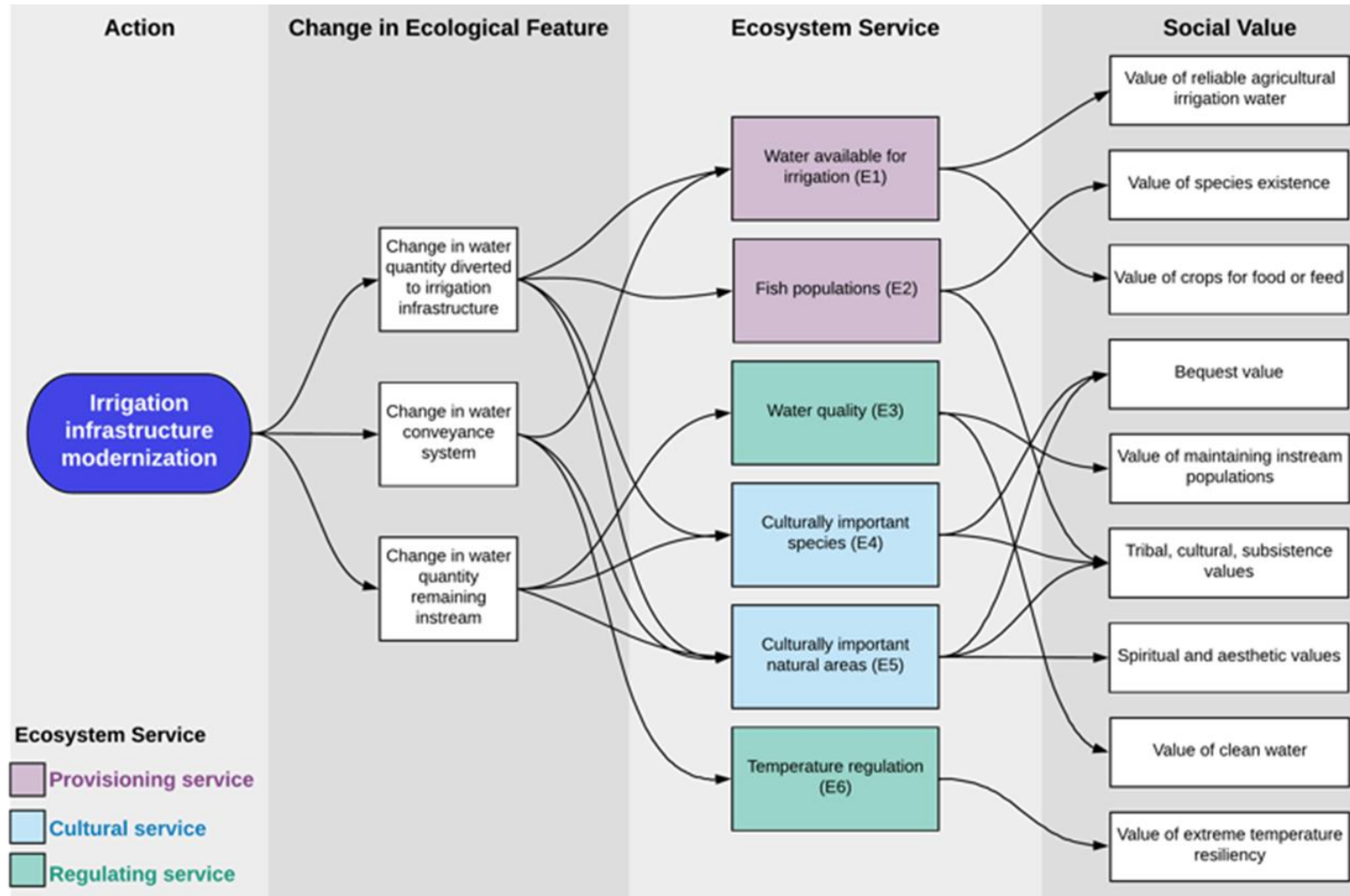
4 Affected Environment

The following sections describe the existing ecological, physical, biological, economic, and social resources of the Project Area and areas that could be affected by the operation of the COID system. The Project Area is defined in Section 1.2. Per requirements of the Principles, Requirements, and Guidelines, where applicable, this Plan-EIS describes the ecosystem services associated with each resource. Ecosystem services refer to the benefits that people and their communities derive from their natural environment in which they live. Availability of water for consumption, buffering against crop failure through pollination, and providing places in which people value living are all examples of benefits that flow from nature to people. Because these ecosystem services contribute to people’s “health, wealth, and well-being,” but often cannot be quantified in the same way as services sold in marketplaces, federal investment into projects that could impact ecosystems and natural resources require an ecosystem services assessment to illuminate how management decisions will enhance, sustain, or degrade the benefits that nature provides (NRCS 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-EIS assesses ecosystem services based on three of the four service categories (services 1-3 below) (NRCS 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, providing critical benefits that buffer against environmental catastrophe; examples include flood and disease control, water filtration, climate stabilization, and crop pollination.
3. Cultural services: services that make the world a place in which people want to live; examples include spiritual enrichment, 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 COID operations and provides a baseline for discussion in Section 6. The diagram links an action that would modernize COID infrastructure with potentially impacted ecosystem features and the provisioning, regulating, and cultural services that these ecosystems provide for people. Supporting services are not evaluated in this Plan-EIS because they give rise to and support the final ecosystem services (Provisioning, Regulating, and Cultural) (EEA 2019; NRCS 2017).



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

Figure 4-1. Ecosystem services concept diagram for the Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project.

4.1 Cultural Resources

4.1.1 Regulatory Context

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

4.1.2 Study Area

The Study Area for historic resources and archaeological resources is the APE. Formal definition of the APE has been made in consultation with SHPO and other consulting parties including federally recognized Indian tribes (see Appendix E.1 and Table 7-1). The APE encompasses the area where the Project may cause direct and indirect effects on historic properties, meaning where it could physically alter properties, as well as where there could be effects from noise and vibration and changes to the visual setting. The APE for the Project is shown on Figure 4-2.

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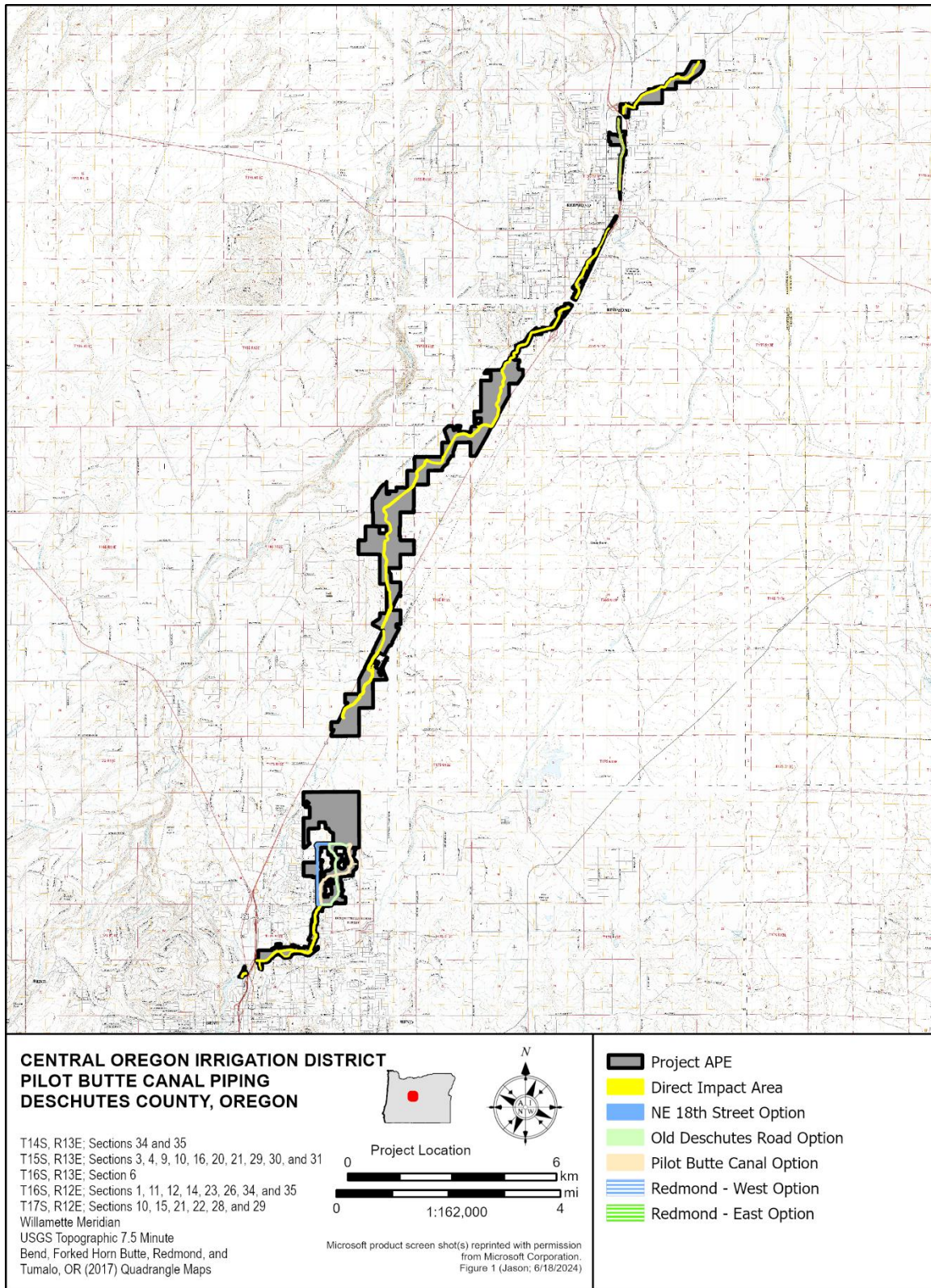


Figure 4-2. Historic and Cultural Resources Area of Potential Effects.

4.1.3 Existing Resources

4.1.3.1 Historic Built Resources

The APE from the time of the original development of the PBC in 1904–1905 remained sparsely developed for the first half of the twentieth century, consisting primarily of widely scattered farmsteads. The populations of Bend and Redmond increased significantly in the decades post 1960. Although the population reached 21,812 by 1950, Deschutes County remained relatively sparsely populated as late as 1960, at 23,100. Over the next 20 years the population grew rapidly, more than doubling by 1980 to 62,142, and today the county has a population of 213,000 according to current census data.⁶

The PBC, constructed in 1904–1905, remains the oldest known built resource within the APE. COID operates and maintains irrigation systems including the Pilot Butte and Central Oregon canals and associated canals, dams, laterals, sublaterals, ditches, and facilities, also known as the Central Oregon Project. The Central Oregon Project is defined in the Multiple Property Document, Carey and Reclamation Act Irrigation Projects in Oregon, 1901–1978 (MPD), accepted by the National Park Service on July 10, 2017 (NRIS# MC100001302). Reclamation determined, and SHPO concurred, that the Central Oregon Project is eligible for listing in the NRHP as a historic district, subsequently affirmed by the National Park Service through acceptance of the MPD. In addition, a 7,400-foot segment of the PBC between Yeoman and Cooley Roads in Deschutes County (NRIS # 15001052) and a 6,800-foot segment of the PBC in downtown Redmond (NRIS #MP100001303) are individually listed in the NRHP. The Yeoman to Cooley Road segment is nearly unaltered and is noted as the most challenging to construct because of the rolling, rocky terrain. It is the widest and deepest portion of the entire PBC and displays the most variability in dimensions, ranging in width from 20 to 81 feet and in depth from 3 to 10 feet. The downtown Redmond segment includes the full extent of the last intact, uninterrupted segment of the PBC that passes through downtown Redmond. Appendix E.1 provides the NRHP listings for the two individual segments.

Reclamation, SHPO, and COID executed a Memorandum of Agreement (MOA) #R14MA13733 in 2014 pursuant to 36 CFR 800.6. The 2014 MOA programmatically mitigates adverse effects to contributing features and structures in the Central Oregon Project which are not individually eligible for listing in the NRHP. Pursuant to MOA Stipulation 3.B.1 of the 2014 MOA, COID, Reclamation, and SHPO executed a Programmatic Agreement (PA-173; Agreement #R19MA13745) in 2019 to establish procedures to fulfill the consultation process described in 36 CFR Part 800 for the piping, repair, and maintenance of the COID canal system. NRCS was added as a signatory to the programmatic agreement in 2023. The programmatic agreement identified that COID will maintain the downtown Redmond reach “such that the historic integrity of and identification of the historic property as representative of an irrigation conveyance system will not be adversely affected.” At the time of Plan-EIS publication, NRCS and COID are actively consulting with SHPO and other interested consulting parties to revise the programmatic agreement regarding the downtown Redmond reach to accommodate piping. Mitigation measures to address impacts to historic resources per the programmatic agreement have been generated by NRCS and COID and have been initially agreed upon by SHPO. These mitigation measures are included in Appendix E.2.

The Oregon Trunk Railway (OTR)—completed in 1911 between Wishram, Washington, and Bend by James J. Hill’s Great Northern Railroad—played a pivotal role in the history of development

⁶ See www.worldpopulationreview.com, “Deschutes County, OR” visited 19-July-2023.

Central Oregon. “The OTR line expanded shipping capabilities for stock ranchers in the region while creating new opportunities for large-scale producers of wood products to operate in Bend during the early twentieth century” (Held 2011:2). While at one time carrying both passenger and freight rail traffic, the OTR line, owned and operated by BNSF Railway, today remains the primary freight carrier in Central Oregon.

The OTR-PBC crossings near NE Butler Market Road in Bend and NE King Way in Redmond, as original elements of the OTR line, although modified, are considered eligible as part of the linear OTR District as defined by SHPO in 2011 and reconfirmed in 2015. The crossings, carrying the railroad line over the PBC, remain on the original ROW and continue their original function (see Photograph 1 and Photograph 2).

In addition to the PBC and OTR, the APE was evaluated to identify the presence of additional historic built resources. Twenty-two resources within the APE were built in 1951 or earlier. Identified by date of construction, most of these structures lack obvious architectural significance, and as confirmed in the field, many are of common, unremarkable design, or have been subsequently modified and retain limited integrity to their assumed original design. Four built resources within the APE are considered to have potential historic significance that would support listing in the NRHP (see Table 4-1).



Photograph 1. OTR crossing the PBC at NE Butler Market Road.



Photograph 2. OTR crossing the PBC at NE King Way.

4.1.3.2 Archaeological Resources

Previous archaeological studies have identified pre-contact archaeological resources that show the presence of Native Americans throughout the region prior to Euroamerican contact. Pre-contact archaeological resources present include lithic scatters found on the surface and in subsurface deposits. Historic-period archaeological resources predominantly include can and debris scatters associated with early homesteading and settlement, travel through the region, and developments for agriculture.

Previous cultural resource surveys identified 19 pre-contact and historic-period archaeological resources intersecting and/or adjacent to the Direct Impact Area of the APE; these are summarized in Tables 1, 2, and 3 in the Archaeological Survey for the PBC (AINW 2024).

During pedestrian surveys in 2023, AINW identified seven new archaeological resources within the Direct Impact Area of the APE. NRCS determined six of these are not eligible for listing in the NRHP, and the eligibility of the remaining resource was not determined as it was not available for evaluation due to access constraints (see Appendix E.1). These resources include one historic-period site, two pre-contact isolates, and four historic-period debris scatters.

The Direct Impact Area of the APE also has the potential for pre-contact and historic-period archaeological resources on the surface and in subsurface deposits that could be encountered during construction.

Table 4-1. Potentially Eligible Built Resources.

Address	Tax Lot ID	Description	Photo(s)
64975 Deschutes Pleasant Ridge Road	16S-12E-26BO-800	Built c1920, this property includes multiple resources with a single-story wood-frame residence, stacked stone barn/outbuilding and at least three other outbuildings dated 1940–1950. The 16.15-acre parcel includes a second dwelling that appears related. While in only fair condition, this rural complex is considered potentially eligible under Criteria A (association) and C (design) for its architecture.	
6240 SW 43rd Street	15S-13E-31-500	Built c1930 (dated 1949 by the County), this resource appears to have been built earlier. Somewhat modified, this small one-story wood-frame dwelling retains sufficient integrity to relate its original design and is located within a rural area on a mature landscaped lot. The resource is considered potentially eligible under Criteria A (association) and C (design) for its architecture.	
2190 SW Canal Boulevard	15S-13E-04DA-200	Built c1929, this one and one-half story wood-frame farmhouse faces the PBC, with US 97 to the east. Multiple rural farm outbuildings, including some dated 1910 by the County, remain within a mature 1.40-acre setting. Although compromised by adjacent development and currently boarded up and vacant, the property is considered potentially eligible under Criteria A (association) and C (design) for its architecture.	
1000 NE King Way	15S-13E-3-500	Built c1920, this one-story wood-frame bungalow retains substantial integrity and is among the oldest standing structures within the Study Area. The property is considered potentially eligible under Criteria A (association) and C (design) for its architecture.	

4.2 Land Use

The land use analysis considered two study areas: the immediate Project Area and the larger region. The regional study area considers compatibility with state, county, and local land use plans within the boundaries of the city of Bend, city of Redmond, Deschutes County, and the COID service area. The Project Area includes the impacts to land uses on parcels immediately adjacent to the existing canal alignment and proposed alignment alternatives, including a 70-foot buffer on either side of the canal to account for construction impacts.

4.2.1 Land Ownership

The existing PBC covers a patchwork of public, private, and COID-owned properties. See Section 4.12, Right-of-Way, Displacements, and Relocations, for details on land ownership in the Project Area.

4.2.2 Regulatory Context

Land uses in the Study Area are regulated by a number of state, local, and regional laws, plans, policies, and regulations. These include ORS Chapter 545 – Irrigation Districts, Oregon Statewide Land Use Planning Goals, and the comprehensive plans and development codes of Deschutes County, the City of Bend, and the City of Redmond.

4.2.3 Zoning

4.2.3.1 Deschutes County Zoning

The applicable zones in Deschutes County are summarized in Table 4-2 through Table 4-4 and are described below.

Table 4-2. Study Area Parcels and Zoning for the Pilot Butte Canal Alternative Alignment Option – Unincorporated Deschutes County.

Zoning District	Parcels
Commercial Limited (CL) ^a	2
Exclusive Farm Use, Alfalfa Subzone (EFUAL)	3
Exclusive Farm Use, Tumalo/Redmond/Bend Subzone (EFUTRB)	52
General Industrial (IG) ^a	4
Light Industrial (IL) ^a	29
Rural Industrial (RI)	4
Multiple Use Agricultural (MUA10)	6

Zoning District	Parcels
Open Space and Conservation (OS&C)	1
Medium Density Residential (RM) ^a	18
Rural Residential (RR10)	19
Standard Residential (RS) ^a	84
Suburban Low Density Residential (SR 2-1/2)	43

^a These zoning designations are within the city of Bend. Analysis of parcel impacts in the PBC alignment does not uniformly follow jurisdictional boundaries.

Table 4-3. Study Area Parcels and Zoning for the NE 18th Street Alternative Alignment Option – Unincorporated Deschutes County.

Zoning District	Parcels
Light Industrial (IL) ^a	6
Public Facility (PF)	2
Medium Density Residential (RM) ^a	2
Standard Residential (RS) ^a	56
Suburban Low Density Residential (SR 2-1/2)	7

^a These zoning designations are within the City of Bend. Analysis of parcel impacts in the PBC alignment does not uniformly follow jurisdictional boundaries.

Table 4-4. Study Area Parcels and Zoning for the Old Deschutes Road Alternative Alignment Option – Unincorporated Deschutes County.

Zoning District	Parcels
Light Industrial (IL) ^a	5
Standard Residential (RS) ^a	13
Suburban Low Density Residential (SR 2-1/2)	36

^a These zoning designations are within the City of Bend. Analysis of parcel impacts in the PBC alignment does not uniformly follow jurisdictional boundaries.

4.2.3.1.1 Exclusive Farm Use, Alfalfa Subzone (EFUAL)

Exclusive Farm Use Zones are intended to preserve and maintain agricultural lands and to serve as a sanctuary for farm uses. Proposed irrigated land divisions in the Alfalfa Subzone must be at least 36 irrigated acres in size.

4.2.3.1.2 Exclusive Farm Use, Tumalo/Redmond/Bend Subzone (EFUTRB)

Exclusive Farm Use Zones are intended to preserve and maintain agricultural lands and to serve as a sanctuary for farm uses. Proposed irrigated land divisions in the Tumalo/Redmond/Bend Subzone must be at least 23 irrigated acres in size.

4.2.3.1.3 Open Space and Conservation (OS&C)

The Open Space and Conservation Zone is intended to protect designated areas of scenic and natural resources; to restrict development in areas with fragile, unusual, or unique qualities; and to protect and improve the quality of the air, water, and land resources; and to plan development that will conserve open space.

4.2.3.1.4 Rural Industrial (RI)

The Rural Industrial Zone is intended for industrial uses and their accessory uses such as agricultural, horticultural, and lumber processing; freight, distribution, warehousing, and storage; and contractors, welding, and building materials businesses.

4.2.3.1.5 Rural Residential (RR10)

The Rural Residential Zone is intended to provide rural residential living environments by providing standards for rural land use and development consistent with desired rural character and the capability of land and natural resources, as well as to manage the extension of public services.

4.2.3.1.6 Multiple Use Agricultural (MUA10)

The Multiple Use Agricultural Zone is intended to preserve the rural character of various areas of Deschutes County while permitting development consistent with that character and with the capacity of the natural resources of the area.

4.2.3.1.7 Suburban Low Density Residential (SR 2-1/2)

The Suburban Low Density Residential Zone is intended to encourage, accommodate, maintain, and protect large-lot suburban-type residential development in areas with Oregon Department of Environmental Quality (DEQ)-permitted sewer systems, individual sewer systems in appropriate locations, and other areas well suited for such development.

4.2.3.1.8 Landscape Management Combining Zone (LM)

This combining zone is intended to maintain scenic and natural resources of designated areas and to maintain and enhance scenic vistas and natural landscapes as seen from designated roads, rivers, or streams. Provisions of this zone apply to all areas within one-quarter mile of roads identified as landscape management corridors in the comprehensive plan and the County Zoning Map. This area includes US 97 between Bend's and Redmond's urban growth boundaries (UGBs).

4.2.3.2 City of Bend

The applicable zones in the city of Bend are summarized in Table 4-5 and described below.

Table 4-5. Study Area Parcels and Zoning for the Pilot Butte Canal Alternative Alignment Option – City of Bend.

Zoning District	Parcels
Commercial Limited (CL)	2
General Industrial (IG)	4
Industrial Light (IL)	29
Residential Urban Medium Density (RM)	18
Residential Urban Standard Density (RS)	52

4.2.3.2.1 Commercial General (CG)

The Commercial General Zone is intended to provide a broad mix of commercial uses and for wholesale and heavier commercial uses in older, close-in sections of the community.

4.2.3.2.2 Commercial Limited (CL)

The Commercial Limited Zone is intended to establish locations for the development of commercial centers to provide for the shopping and service requirements for large sections of the community and to recognize existing uses both in centers and as parts of commercial strips.

4.2.3.2.3 Industrial Light (IL)

The Industrial Light Zone is intended to provide for those heavier commercial and light industrial uses located in existing built-up areas of the city.

4.2.3.2.4 Industrial General (IG)

The Industrial General Zone is intended to provide for the establishment of light and heavier industrial uses essential to the development of a balanced economic base in an industrial environment with a minimum of conflict between industrial and residential and light commercial uses.

4.2.3.2.5 Residential Urban Standard Density (RS)

The Urban Standard Density residential zone is intended to provide for the most common urban residential densities in places where community sewer services are or will be available, and to encourage, accommodate, maintain, and protect a suitable environment for family living.

4.2.3.2.6 Residential Urban Medium Density (RM)

The Urban Medium Density residential zone is intended to provide for the development of medium-density multiple family residential structures where such buildings are reasonably spaced on the lot to provide for light, air, privacy, safety, and insulation against transmission of sound in areas with sewer and water service.

4.2.3.2.7 Public Facility (PF)

The Public Facility Zone is intended to provide area for buildings and facilities that are owned and operated by federal, state, or local governments; public utilities; special districts; or nonprofit organizations and which are occupied to provide governmental or public services. This zone also allows school sites, public park and recreational facilities, natural areas, trails, wetlands, and similar types of open space owned and managed by a local government or special district.

4.2.3.2.8 Lava Ridge Refinement Plan Area

The Lava Ridge Refinement Plan is intended to ease the transition to urban density residential zoning in the northeast area of Bend. The plan promotes a network of well-connected streets, neighborhood parks, and neighborhood commercial areas at the edge of residential neighborhoods.

4.2.3.2.9 Juniper Ridge Overlay

The Juniper Ridge Overlay is a Special Planned District established to encourage employment-based commercial and industrial uses, along with compatible residential uses.

4.2.3.3 City of Redmond

The applicable zones in the city of Redmond are summarized in Table 4-6, Table 4-7, and Table 4-8 and are described below.

**Table 4-6. Study Area Parcels and Zoning – City of Redmond
Pilot Butte Canal Alternative Alignment Option.**

Zoning District	Parcels
Strip Service Commercial (C1)	46
Central Business District Commercial (C2)	2
Special Service Commercial (C3)	4
Park	4
General Residential (R4)	54
Urban Holding (UH10)	2

**Table 4-7. Study Area Parcels and Zoning – City of Redmond
Watermaster’s Access Road Alternative Alignment Option.**

Zoning District	Parcels
Strip Service Commercial (C1)	12
Central Business District Commercial (C2)	4

**Table 4-8. Study Area Parcels and Zoning – City of Redmond
North Canal Boulevard Alternative Alignment Option.**

Zoning District	Parcels
Strip Service Commercial (C1)	17
Special Service Commercial (C3)	15
High-Density Residential (R5)	16

4.2.3.3.1 General Residential (R4)

The General Residential Zone is intended to provide high-density residential neighborhoods with a mix of single-family residences, duplexes, and some conditionally permitted multifamily residential development. Limited commercial uses such as offices are also conditionally permitted where compatible with surrounding development.

4.2.3.3.2 High-Density Residential (R5)

The High-Density Residential Zone is intended to provide high-density residential neighborhoods with a mix of single-family residences, duplexes, and multifamily residential development. Limited commercial uses such as offices are also conditionally permitted where compatible with surrounding development.

4.2.3.3.3 Park

The Park Zone is intended to provide for public park uses such as playgrounds, ball fields, and open space.

4.2.3.3.4 Strip Service Commercial (C1)

The Strip Service Commercial Zone allows for the development of most commercial, retail, public facility, and office uses. Auto-oriented businesses such as auto repair shops and car washes are conditional uses. Multifamily and attached single-family residential is allowed in this zone, while single-family detached residential is a conditional use.

4.2.3.3.5 Central Business District Commercial (C2)

The Central Business District Commercial Zone allows for the development of most commercial, retail, public facilities, and office uses, including auto-oriented businesses such as auto repair shops and car washes. Single-family and multifamily residential are allowed in this zone.

4.2.3.3.6 Special Service Commercial (C3)

The Special Service Commercial Zone allows for the development of limited commercial and retail uses. Public facilities, including hospitals, and most office uses are allowed outright. Multifamily and attached single-family residential are allowed in this zone, while single-family detached residential is a conditional use.

4.2.3.3.7 Urban Holding (UH-10)

The City administers the UH-10 zone according to the provisions of Title 20 of the Deschutes County Code, Redmond Urban Area Zoning Ordinance. The ordinance is intended to protect the existing character of and values of land and buildings in the zone until it is ready to be developed for urban uses and is annexed into the city.

4.2.4 Land Use

The primary use of land within the existing PBC alignment is the O&M of the canal. The existing PBC alignment abuts a wide variety of land uses throughout the Study Area. Within the cities of Bend and Redmond, these uses are primarily industrial, single-family residential, and commercial. Portions of the canal run alongside parks, trails, open space, and a golf course. Within unincorporated Deschutes County, land uses are primarily agricultural and open space, along with some industrial and residential uses. The canal runs alongside transportation facilities for a portion of its length, including US 97 and local streets in Bend and Redmond. A 1.5-mile section of the existing PBC alignment in Bend, from Yeoman Road to approximately Old Deschutes Road, is listed in the NRHP.

Crops grown within COID are generally reflective of crop types grown in Deschutes and Jefferson Counties as a whole, consisting of hay and forage as well as wheat, vegetables, carrots, and field and grass seed crops. Table 4-9 summarizes the main crops grown in Deschutes County as of 2022 (NASS 2022).

Table 4-9. Top Crops Grown in Deschutes County.

Crops	Acreage in Deschutes County
Forage (hay/haylage)	20,768
Wheat for grain, all	1,383
Vegetables Harvested, all	532
Carrots	308
Field and grass seed crops, all	164
Total	23,155

Source: NASS 2022

4.2.4.1 Ecosystem Services

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

4.3 Parks and Recreation

This section identifies park and recreation resources within the Study Area.

4.3.1 Regulatory Context

Park and recreation facilities in the Project Area are supported and regulated by a number of state, local, and regional laws, plans, policies, and regulations. These include those funded by the Land and Water Conservation Fund (LWCF); Statewide Planning Goals 5 and 8; Deschutes County, City of Bend, and City of Redmond Comprehensive Plans and development codes; the Bend Park and Recreation District Comprehensive Plan; and the City of Redmond Citywide Park Master Plan.

4.3.2 Existing Resources

A number of parks, trails, and recreation facilities are traversed by or adjacent to the existing PBC alignment or proposed alternative alignment options (Figure 4-3). See Appendix F.1 of the Parks and Recreation Technical Report for additional details. Note that the park and recreation facilities shown on the figures also include those that fall outside of the Study Area. These are not discussed in this analysis.

A review of the Oregon Parks Land Ownership/LWCF Map Application indicated none of the recreation resources within the Study Area have received LWCF monies (OPRD 2023).

4.3.2.1 Riverview Park

Riverview Park is a half-acre park within the Bend Park and Recreation District. The park is located adjacent to the PBC point of diversion at the Deschutes River. Riverview Park features a river overlook with accessible river access and a handicap-accessible fishing area. Limited off-street parking is available, and a restroom on-site is open seasonally. The PBC point of diversion is visible from the park. There is no access to the point of diversion or the PBC within the park.

4.3.2.2 Canal Row Park

Canal Row Park is an approximately 3.75-acre park within the Bend Park and Recreation District. The park features grass fields, a playground, swing set, nature play area, paved and unpaved trails, an interactive water play feature, a picnic shelter, water fountains, and natural areas. Canal Row Park has seasonal public restroom facilities and is wheelchair accessible. The PBC is located within close proximity to the park, but the North Unit Canal and North Unit Canal access road are between the park and the PBC. There is no direct view of or access to the PBC from the park.

Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project
Draft Watershed Plan–Environmental Impact Statement

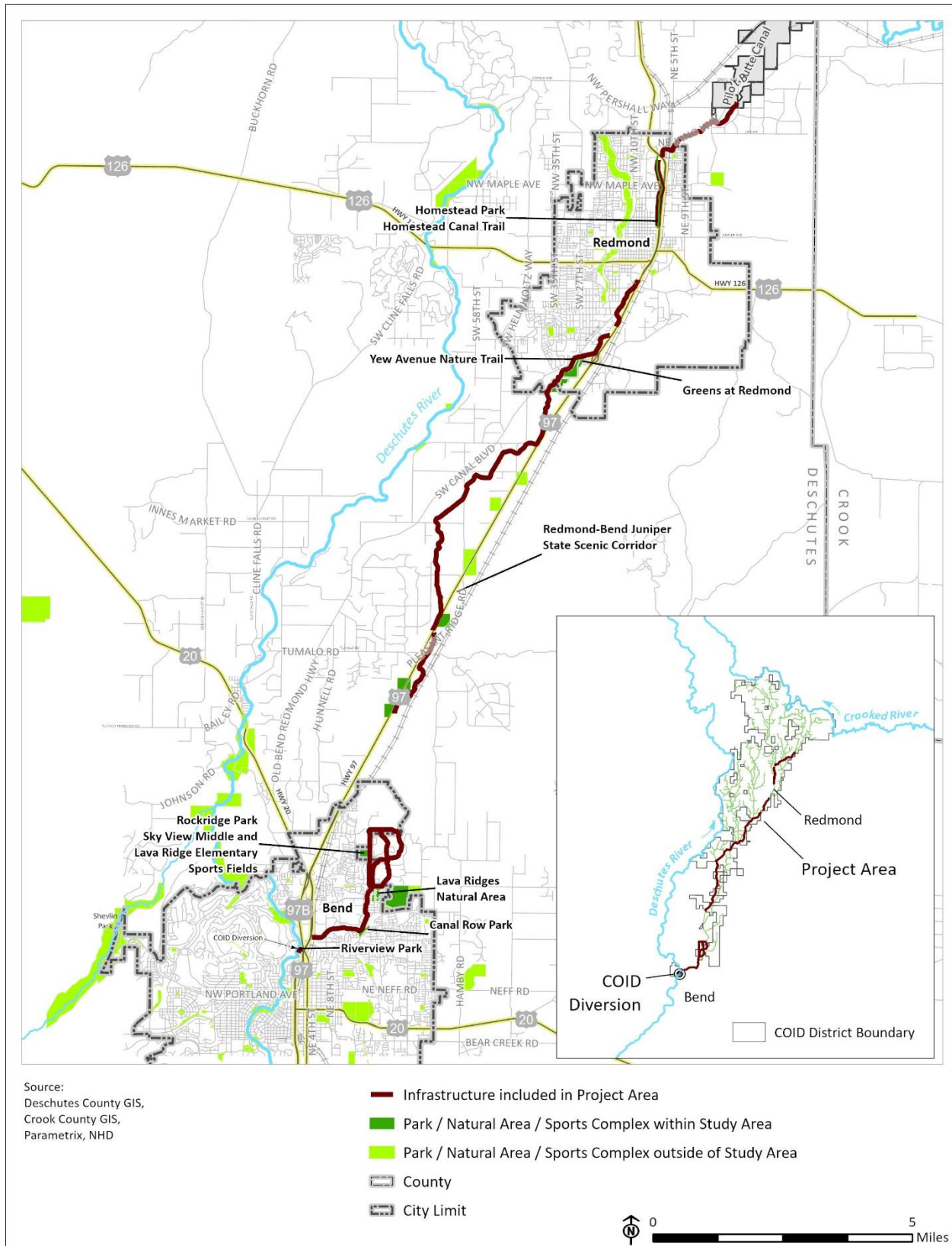


Figure 4-3. Existing parks, trails, and recreation facilities.

4.3.2.3 Lava Ridges Natural Area

Lava Ridges Natural Area is a series of open spaces owned by the Bend Park and Recreation District within the Lava Ridges subdivision. The COID O&M road is directly adjacent to the PBC for approximately 1 mile in this open space between Empire Avenue and Old Deschutes Road. The O&M road is used as an informal trail by community members; there is not currently a formal easement or use agreement in place for use of the road as a trail. Entrances to the access road are located on its intersections with Empire Avenue, Yeoman Road, and Old Deschutes Road.

4.3.2.4 Rock Ridge Park

Rock Ridge Park is a 36.6-acre park in the Bend Park and Recreation District; the park is located south of Lava Ridge Elementary School. Amenities include a bike skills course, nine-hole disc golf course, a fitness loop, natural areas, paved and unpaved paths, a picnic shelter, a playground, rental facilities, a skatepark, and a water play feature. The park has seasonal public restroom facilities and is wheelchair accessible. Only the NE 18th Street alternative alignment option would run adjacent to Rock Ridge Park. The area of the proposed NE 18th Street alignment is visible from the park. Access to the proposed PBC alignment is independent from the park.

4.3.2.5 Sky View Middle School and Lava Ridge Elementary School (Bend, 18th St Alternative)

Sports fields for Sky View Middle School and Lava Ridge Elementary School are located adjacent to the proposed NE 18th Street alternative alignment option. Both schools are within the Bend-La Pine School District. The area of the proposed NE 18th Street alternative alignment option is visible from the sports fields. Access to the proposed PBC alignment is independent from the fields.

4.3.2.6 Ponderosa Elementary School

Sports fields for Ponderosa Elementary School are located across Purcell Road from the Old Deschutes Road alternative alignment option. The school is located within the Bend-La Pine School District. The area of the proposed PBC alignment is visible from the sports fields. Access to the proposed PBC alignment is independent from the fields.

4.3.2.7 Redmond-Bend Juniper State Scenic Corridor

This scenic corridor along US 97 consists of 10 parcels managed by the Oregon Parks and Recreation Department. The existing PBC alignment between Bend and Redmond crosses two of these parcels. The parcels are undeveloped with no plans for trails or amenities. The area is intended to preserve the old growth western juniper found in the area.

4.3.2.8 Greens at Redmond

The Greens at Redmond is a public 18-hole golf course located in southern Redmond. The existing PBC alignment runs adjacent to the west side of the course and is advertised as a scenic amenity on the course. Access to the PBC in this portion of the alignment is independent of the golf course.

4.3.2.9 Yew Avenue Nature Trail (Redmond)

The Yew Avenue Nature Trail runs adjacent to the PBC alignment in Redmond for approximately 0.8 miles from approximately SW Ben Hogan Drive to SW Yew Avenue in The Greens at Redmond Subdivision. The trail is unpaved but well maintained. Access to the PBC in this portion of the alignment is available via the trail and by a maintenance road on the opposite bank of the canal.

4.3.2.10 Homestead Park (Redmond)

Homestead Park is a 2.86-acre park in the City of Redmond Parks Division. It is located between the existing PBC alignment and US 97. The park features a bike pump track, picnic tables, and an interpretive kiosk. A segment of the Homestead Canal Trail Runs through the park. The only vehicle access point to the park is the N Hemlock Avenue bridge that passes over the existing PBC alignment, though the park may be accessed by foot or bike via the Homestead Canal Trail from the north or south.

4.3.2.11 Homestead Canal Trail (Redmond)

The Homestead Canal Trail is a 5.3-mile-long trail built along the PBC alignment between NW Maple Avenue and SW ODEM Medo Way. The City of Redmond acquired easements from COID and the Oregon Department of Transportation (ODOT) for construction of the trail. The trail is paved, and it will ultimately include amenities such as trash cans, benches, interpretive signage, and drinking fountains. The trail provides important connections between neighborhoods, jobs, shopping, a regional transit hub, and medical facilities in Redmond. In addition, it passes through the historically significant homestead site of Frank and Josephine Redmond.

4.4 Public Safety

The Study Area for the public safety analysis is consistent with the Project Area. It includes the existing PBC alignment and COID easement, as well as potential piping alternative alignment options in Deschutes County/North Bend and Redmond.

The existing open canal poses a risk to public safety both when it carries water during the irrigation season and when it is dry. During the summer months when irrigation water is flowing at peak volume in the canal, water depths can reach to 6 feet with water moving through the canal at up to over 500 cfs. These conditions result in areas of deep, swift water that can make it difficult for a child or an adult to get to safety and can result in injury or death.

The public can currently access the canal at many points along the system, including developed and informal recreation trails in Bend and Redmond. The open canal is adjacent to residential and commercial uses, and it is crossed by public and private roadways along its existing alignment. The open canal presents both a fall and accident risk both when dry and carrying water.

Several deaths and injuries—including drownings, near drownings, and vehicle accidents—have occurred in COID and nearby irrigation district canals, with news reports citing incidents as early as 1996 and as recently as 2014 (The Bulletin 2014; KTVZ 2014; Chu 2004; Cliff 2008; Flowers 2004; Golden 2007; Minoura 2007). While these accidents have primarily occurred during irrigation season when the canal is filled with running water, at least one reported accident resulting in death has occurred from an all-terrain vehicle accident in the empty canal bed (Minoura 2007). The open canal, whether carrying water or dry, presents a risk for ongoing accidents, injury, or death from drowning, accidental falls into the canal, or vehicle accidents.

While drownings and other accidents have occurred within the PBC and nearby canals, additional public safety risks are present in the area surrounding the Project Area. Wildfire in Central Oregon and in the wildland urban interface and rural areas where the Project Area is located has become an increasing concern to the public in recent years. The U.S. Forest Service (USFS) Oregon Wildfire Risk Explorer defines wildfire risk as “both the likelihood of a wildfire and the expected impacts of a wildfire on highly valued resources and assets.” Data from the USFS Oregon Wildfire Risk Explorer show that 31 percent of the land in the Study Area is considered to have a very high wildfire risk, 12 percent is considered high, and 2 percent is considered to have moderate risk. There are no risk data in 56 percent of the Study Area (USFS and ODF 2023).

Since 2005, there have been two incidents of canal failure that resulted in flood damage to homes and agricultural land. Potential for canal failure and flood damage is most pronounced in the Redmond segment due to burrowing activity by small mammals, which destabilizes the canal walls. However, the flooding and operational risks from canal failure are expected to increase over time throughout the entire length of the PBC due to continued degradation as the canal ages (Horrell 2023).

The Study Area falls within the Bend Fire and Rescue District, Deschutes County Rural Fire District #2, and Redmond Fire and Rescue District. In urbanized areas, fire districts may use fire hydrants located on public roads as their primary source of water for fighting fires. Canals, cisterns, and ponds may also be used as water sources for fighting fires.

4.5 Neighborhoods and Socioeconomics

This section identifies neighborhoods and socioeconomic conditions within the Study Area.

4.5.1 Regulatory Context

Neighborhoods and socioeconomic conditions are supported and regulated by a number of regional and local laws, plans, policies, and regulations. These include the Deschutes County, City of Bend, and Redmond comprehensive plans.

4.5.2 Study Area

The Study Area for the neighborhood and socioeconomic analysis of long- and short-term environmental impacts is the area within 0.5 miles of the Project Area. The entirety of all census tracts and block groups intersecting the Study Area were selected to constitute the *Direct Study Area*, denoting the area where direct environmental impacts are likely to occur as a result of the Project. Therefore, *Study Area* and *Direct Study Area* are used interchangeably throughout this section, as environmental effects are considered for all intersecting census geographies even if partially located outside the strict Study Area (the area within 0.5 miles of the Project Area). Figures 5 through 8 in Appendix F.3 Neighborhoods and Socioeconomics Technical Report show the Direct Study Area boundary.

Regional socioeconomic analysis (employment, jobs, tax, and economic impacts) includes a larger Study Area encompassing both Deschutes and Jefferson Counties as the Project would impact agricultural production outside of the Direct Study Area. Specifically, the Project is expected to result in a greater volume of irrigation water being delivered to the NUID in Jefferson County; the greater volume is expected to enhance agricultural yields and have subsequent impacts on employment and income in Jefferson County.

In addition, this section uses the term *Primary Alignment*, which is the portion of the project alignment that is within the PBC that is not included in one of the alternative alignment options in the Deschutes County/North Bend or Redmond segments. This term is used only for population data. See also Table 2 in Appendix F.3, Neighborhoods and Socioeconomics Technical Report.

4.5.3 Existing Resources

4.5.3.1 Community Resources

This section discusses community resources including neighborhoods, community facilities, parks, social service providers, and libraries (see Figures 5 through 8 in Appendix F.3, Neighborhoods and Socioeconomics Technical Report for locations). Parks and school recreation areas are discussed in detail in Section 4.3, Parks and Recreation.

- **Neighborhoods** – The Study Area runs through several neighborhoods in Bend identified on the City’s neighborhood association map including River West, Awbrey Butte, Boyd Acres, Orchard District, and Mountain View. There are no identified neighborhood associations in the Study Area within unincorporated Deschutes County or within the city of Redmond. The Study Area is mainly residential and agricultural in Deschutes County and includes residential, commercial, business, and industrial use areas in Redmond.
- **Community Facilities** – Community facilities include nonprofit and private community gathering spaces within the Study Area. There are no community facilities located within the Bend portion of the Study Area. One church, the Saint Francis of Assisi Catholic Church, is located east of the Study Area. The Redmond Senior Center is the only community center located within the Study Area in Redmond. The Senior Center provides senior citizen services to improve the overall well-being of the elderly population.
- **Parks, Recreation, Trails** – Several parks in Bend are located in the Study Area including Riverview Park, Canal Row Park, Lava Ridges Natural Area, Rock Ridge Park, and Sky View Middle and Lava Ridge Elementary Sports Fields. The Redmond-Bend Juniper State Scenic Corridor is between Bend and Redmond. Within Redmond are The Greens at Redmond, Yew Avenue Nature Trail, Homestead Park, and the Homestead Canal Trail. See Section 4.3, Parks and Recreation, for additional information.
- **Social Service Providers** – There are no identified social service providers within the Study Area.
- **Libraries** – There are no libraries located within the Bend or Redmond portions of the Study Area. The Redmond Public Library is located to the west of the Study Area.

4.5.3.2 Socioeconomic Resources

4.5.3.2.1 Population

The region is rapidly growing with Deschutes County expected to reach a forecast population of 275,905⁷ by 2040; this is a 41.5 percent increase from the County's 2021 population. Table 4-10 provides race and ethnicity population data for the state, the county, the communities of Bend and Redmond, and the Study Area. The White (not Hispanic) population makes up the largest percentage of the Primary Alignment at 83 percent, and minorities make up 17 percent of the population. The Deschutes County/North Bend segment study area is 88 percent White and 12 percent minority, while the Redmond segment study area is 84 percent White and 16 percent minority. Hispanic or Latino populations make up the majority of the minority population with 7 percent in the Primary Alignment and the Deschutes County/North Bend segment study area and 9 percent in the Redmond segment study area.

Table 4-10. Minority Population Characteristics by State, County, and City.

Demographic	Oregon State %	Deschutes County %	Bend %	Redmond %	Primary Alignment %	Deschutes County/ N Bend Segment %	Redmond Segment %
Minority (Not White Alone)	26	14	16	19	17	12	16
Hispanic or Latino	14	8	9	14	7	7	9
White (Not Hispanic)	74	86	84	81	83	88	84
Black or African American	2	<1	1	<1	1	0	<1
Asian (Not Hispanic)	4	1	2	1	2	2	<1
American Indian and Alaskan Native	1	1	<1	1	<1	0	<1
Native Hawaiian and Other Pacific Islander	<1	<1	<1	<1	0	0	4

Source: American Community Survey 2017–2021 5-Year Data Release.

⁷ Coordinated Population Forecast for Deschutes County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2022 Through 2072. Portland State University, Population Research Center. <https://www.pdx.edu/population-research/sites/populationresearch.web.wdt.pdx.edu/files/2022-06/Deschutes.pdf>. June 30, 2022.

Farm operators and farm workers are key social groups associated with agricultural land and actions affecting agricultural operations. The Modernization Alternative would increase the availability of irrigation water to the NUID in Jefferson County (water savings from piping in COID is expected to be made available to NUID and benefit farms in NUID) and increase farm production value, thereby benefiting the farm economy in Jefferson County. Additionally, the Modernization Alternative is expected to decrease O&M costs to COID and its patrons, benefiting agricultural operators in Deschutes County. The income status of farm operators is not readily available because the Census of Agriculture reports only farm-related income and many farm operators have significant off-farm income.

4.5.3.2.2 Agricultural Production

Most farmland in Deschutes County is used for pastureland (95,995 acres) followed by cropland (32,209 acres). Deschutes County's top agricultural crop is forage (hay/haylage) at 20,768 acres and accounts for 65 percent of sales. Cattle comprises most livestock at 12,246 head of cattle, and livestock and poultry account for 35 percent of sales (NASS 2024). The vast majority of the water conserved from piping COID canals would be made available to NUID in Jefferson County.

As in Deschutes County in 2022, Jefferson County's pastureland comprised the largest portion of cropland acres (449,605 acres) followed by cropland with 66,351 acres. Cattle and calves make up the largest share of livestock at 18,862 head of cattle, and livestock and poultry account for 38 percent of sales. Crops make up 62 percent of sales with forage (hay) as the top crop in Jefferson County using 14,727 acres (NASS 2024).

Irrigation water supplies currently available to NUID are lower than historical levels due to recent changes in water management under the DBHCP (see Appendix F.7, Water Resources Technical Report for information specific to irrigation water).

4.5.3.2.3 Area Employment and Income

4.5.3.2.3.1 General Employment and Income

The existing alignment study area includes an unemployment rate of 5 percent, while the Deschutes County/North Bend segment study area has a 3 percent unemployment rate. The Redmond segment study area has the highest unemployment rate at 9 percent (U.S. Census Bureau 2021).

Deschutes County, the city of Bend, and the city of Redmond have an overall higher median household income compared to the state median with the Deschutes County/North Bend segment study area with the highest median household income at \$93,463 and the Redmond segment study area with the lowest at \$48,500 (U.S. Census Bureau 2021); however, 20 percent of the existing alignment study area population is considered low-income with 6 percent of families below the federal poverty line (see Table 4-11). The Redmond segment study area has the highest rate of renter-occupied households at 45 percent.

Table 4-11. Income and Household Owner/Renter Characteristics by State, County, City, and Study Area.

Demographic	Oregon State %	Deschutes County %	City of Bend %	City of Redmond %	Primary Alignment %	Deschutes County/ N Bend Segment %	Redmond Segment %
Low-Income Population	29	25	24	30	20	16	32
Families Below Federal Poverty Level	8	6	6	6	6	2	6
Renter-Occupied Households	37	30	39	35	39	20	45
Owner-Occupied Households	63	70	61	65	61	80	55

American Community Survey 2017–2021 5-Year Data Release.

N/A = not applicable

4.5.3.2.3.2 Agricultural Employment and Income

The U.S. Bureau of Economic Analysis economic data for farm workers and proprietors in Jefferson County in 2022 indicates that on average over the years 2018 to 2022 there were 345 farm workers, 458 proprietors, and approximately \$20 million in total farm earnings (to proprietors and farm workers).⁸ The 2017 Census of Agriculture reported that net cash farm income (net income to farm proprietors) in the County was roughly \$12.4 million (2017 dollars).⁹ The Bureau of Economic Analysis data indicate that agricultural employment accounts for approximately 8 percent of all jobs in Jefferson County and approximately 4 percent of income. See Appendix F.3, Neighborhoods and Socioeconomics Technical Report, for detailed income information.

4.5.3.2.4 Agricultural Property Values

Access to irrigation water supply increases the value of farmland when all other economic parameters are equal. Water supplies in the larger Study Area, particularly in Jefferson County, are increasingly constrained due to changes in hydrology and water management in the basin. By changing the availability or cost of irrigation water, the Project has the potential to increase farmland values. The agricultural income-generating value of access to irrigation water is reflected in the cropland cash rental values for irrigated lands versus nonirrigated lands. For example, for the state as a whole, irrigated cropland rented for an average of \$259 per acre in 2023, while dryland cropland

⁸ Only Jefferson County agricultural employment and income were examined since all the agricultural production impacts from the Project are expected to occur in Jefferson County.

⁹ Net proprietor income in the 2022 Census of Agriculture was \$1.5 million (2022 dollars) in Jefferson County. The drop from 2017 to 2022 is likely due to market disruptions following the COVID-19 pandemic. For this reason, 2017 likely represents a more typical year than the more recent 2022 data.

rented for \$107 per acre (this difference may reflect not just the value of water but also soils and topography). For Jefferson County in 2023, cash rent for irrigated cropland was \$162 per acre (data on nonirrigated cropland were not available).

4.5.3.2.5 *Residential Property Values*

Amenities such as nearby parks, recreation sites, or scenic views can increase property values of nearby residential homes if proximity to such amenities is valued by local homeowners. The PBC may serve as this type of scenic amenity to nearby residences. Some property owners may value the view of the canal from their property, and this value may be reflected in increased property values for properties proximate to the canal.

As described in the Visual Resources Technical Report (see Appendix F.6), approximately 182 residential parcels (out of a total of 589 parcels) have a direct view of the canal in the cities of Bend and Redmond and the unincorporated areas of Deschutes County. An additional 14 residential parcels (out of a total of 156 parcels) may have an indirect view of the canal (where the residence is located on a parcel that is not adjacent to the canal but may have a view of the canal across a road ROW or undeveloped parcel). Finally, an additional 760 residential parcels (out of a total of 994 parcels) may have a “territorial” view of the canal (residence is located on an elevated parcel and may have a distant view of the canal).

4.6 **Geology, Soils, and Hazardous Materials**

For the geology and soils discussion, the Study Area includes the Project Area but considers regional geologic and hydrogeologic conditions that may impact the Project Area. The Study Area for hazardous materials includes the Project Area (the existing PBC alignment and COID easements, as well as potential piping alternative alignment options) as well as properties within 0.25 miles either side of the Project Area. The 0.25-mile buffer accounts for the American Society for Testing and Materials standard distance for hazardous materials analyses. Potential impacts would likely be restricted to the immediate vicinity of the Project Area.

4.6.1 **Regulatory Context**

NRCS responsibilities for inventorying prime and unique farmlands are codified in 7 CFR Part 657. NRCS responsibilities for preserving and protecting farmlands under the Farmland Protection Policy Act of 1981 (Pub. L. No. 97–98, December 22, 1981) are codified in 7 CFR 658. Important farmlands—including lands identified with soils that are prime, unique, or statewide or locally important farmland—are subject to the provisions of the Farmland Protection Policy Act.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 1980 (42 U.S.C. 9601 et seq.) is a federal law designed to clean up sites contaminated with hazardous substances as well as broadly defined “pollutants or contaminants.” CERCLA's broad authority to clean up releases or threatened releases of hazardous substances that may endanger public health or welfare or the (natural) environment was given primarily to the U.S. Environmental Protection Agency (EPA).

State of Oregon rules and regulations regarding hazardous materials are contained within Oregon Administrative Rules (OAR) Chapter 340 and are implemented and enforced by DEQ.

4.6.2 Geology and Soils

4.6.2.1 Project Area Soils

The predominant soil unit in the southern half of the Project Area is the Gosney soil group, characterized by shallow, somewhat excessively drained soils on lava plains and formed in ash. Secondary to the Gosney group is the Deskamp series, consisting of moderately deep, somewhat excessively drained soils on lava plains. The predominant soil unit in the northern half of the Project Area is the Deschutes-Stukel series which consists of shallow, well-drained soils that formed in residual material weathered from tuff, diatomite, and other volcanic rocks. Stukel soils are on hills, lava plains, and rock benches and have slopes of 0 percent to 40 percent (NRCS 2023c). Soil types in the Project Area are discussed in greater detail in the Geology, Soils, and Hazardous Materials Technical Report (Appendix F.4).

4.6.2.1.1 Farmland Classification

NRCS has developed technical soil groups that are associated with a particular soil type and a soil's rating for agricultural commodity production (NRCS 2023b). NRCS soil groupings within the Project Area are 64 percent farmland of statewide importance, 14 percent prime farmland if irrigated, and 22 percent not prime farmland.

4.6.2.2 Project Area Topography

Elevation in the Project Area ranges from approximately 3,500 feet above sea level in the Bend area to approximately 2,900 feet above sea level in the Redmond area and northeast of Redmond. The existing canal is generally flat with a gradual slope downward to the north, following the general topography and hydraulic gradient as the Deschutes River.

4.6.2.3 Project Area Geologic Mapping

The Project Area lies within the Deschutes Basin, which is situated between the Ochoco Mountains to the east and the Cascade Mountains to the west. The geology of the Deschutes Basin is influenced by the episodic volcanic activity of the past several million years. The region is characterized by the Newberry Volcano Formation and Deschutes Formation. These formations are characterized by basalt rock and basaltic andesite lava flows and vent deposits (DOGAMI n.d.). In addition to volcanic lava flows of basalt, the regional geology also consists of tuff and pumice deposits and interbedded sedimentary layers of clay, silt, sand, and gravel.

The surface geologic map unit within the Project Area is Newberry Basalt (Qbn), which is described as Pleistocene-era, open-textured vesicular lava flows (Sherrod et al. 2004). These flows erupted from vents on the north flank of the Newberry Volcano and flowed north across a broad plain extending to Redmond. Beyond Redmond, the basalt flowed into the Deschutes and Crooked River canyons and reached Lake Billy Chinook via the Deschutes Canyon.

The Newberry basalt rock fabric is predominantly gray and slightly weathered to fresh with a hardness of R3 to R4 and a Geological Strength Index range of 20 to 90 (ODOT 2021). The basalt varies from some vesicles (5 to 25 percent) to highly vesicular (15 to 50 percent) to locally scoriaceous (greater than or equal to 50 percent). Basaltic rock with a lower Geological Strength Index is typified by a disintegrated or brecciated texture associated with very close discontinuity spacing and smooth and/or infilled joints and fractures. Rock with a greater Geological Strength

Index is characteristically dense and competent with a massive texture, moderately close to wide discontinuity spacing, rough to slightly smooth joint and fracture surfaces, and trace to no infill.

The Sisters fault zone is located in the vicinity of Bend. The majority of faulting occurred in the late Quaternary (DOGAMI n.d.). Additional faulting activity is not anticipated in the Project Area.

4.6.3 Hazardous Materials

4.6.3.1 Regulatory Database Review

The affected environment within the Study Area was assessed by reviewing state and federal regulatory database records. A complete list of the databases reviewed and associated search distances is included in Appendix A of the Geology, Soils, and Hazardous Materials Technical Report (Appendix F.4). The identified sites were assigned a risk category of high, medium, or low based on proximity to the Project Area, the type and number of databases in which the site was found, known releases of hazardous materials or petroleum products, and status of remediation or cleanup efforts.

State databases indicate a confirmed release of hazardous material or petroleum hydrocarbons on approximately 50 sites located within 0.25 miles of the Project Area.

Based on location, regulatory or cleanup status, and/or the minor nature and extent of the release, the majority of the sites are low risk. Four sites were determined to be in the medium-risk category. These sites are discussed in Section 5.3 of Appendix F.4 Hazardous Materials Technical Report, and their locations are identified in Figures 5 through 8 of that report.

4.7 Biological Resources

The Project Area for biological resources includes all land adjacent to or intersected by the existing PBC alignment and alternative alignment options, including a 200-foot buffer on either side of the alignments to account for potential construction impacts. The Study Area for biological resources includes the Project Area and all waters associated with District operations: Crane Prairie Reservoir, Wickiup Reservoir, and the Deschutes River. Vegetated habitats, terrestrial wildlife, aquatic species, and wetlands and waters that are present or potentially occur within the Study Area are described below.

4.7.1 Regulatory Context

Sensitive biological resources—including vegetation, wildlife, aquatic species, wetlands and waters, and associated habitats in the Study Area—are regulated by a number of state, local, and regional laws, plans, policies, and regulations including the ESA of 1973, the DBHCP, the Migratory Bird Treaty Act (MBTA) of 1918, and the Bald and Golden Eagle Protection Act (BGEPA) of 1940. Additional regulatory context is presented in the Biological Resources Technical Report located in Appendix F.5.

4.7.2 Vegetation

Much of the Study Area is highly developed; however, existing vegetation still plays a role in providing important ecological functions. These include habitat and food sources for wildlife, improved air quality, instream shade, stormwater filtration, and flood control (Oregon Watershed Plans 2020).

4.7.2.1 Common Vegetation

Upland vegetation found within the Study Area includes western juniper, big sagebrush, and low sagebrush, rabbit brush, wild rye, bunch grasses, and other plant species commonly found in the dry Central Oregon steppe environment (Oregon Watershed Plans 2020). Agricultural crop grasses and forbs have established along sections of the PBC that are adjacent to agricultural activities. Table 2 in the Biological Resources Technical Report provides a list of common plant species in the area.

Hydrophytic plants such as sedges (*Carex* spp.), rushes (*Juncus* spp.), reed canarygrass (*Phalaris arundinacea*), irises (*Iris* spp.), bulrush (*Scirpus* spp.), and willow (*Salix* spp.) occur sporadically along the top of the canal bank. During the warmer months of July and August, submerged aquatic plants (species of pond weed and algae) thrive in the slower-flowing segments of the canal system. COID mechanically removes these plants on a periodic basis (Oregon Watershed Plans 2020).

COID mows annually along the PBC and main laterals where canal roads and conditions allow wheeled tractor access. Vegetation management also includes weed trimming, tree removal, and delimbing as necessary. Canals are cleared of encroaching vegetation (grasses, reeds, shrubs) on a 2- to 3-year basis.

4.7.2.2 Special Status Species

A query of the USFWS IPaC database (USFWS n.d.a) identified no ESA-listed endangered, threatened, or candidate plant species or their designated critical habitats within the Study Area. Similarly, Oregon Biodiversity Information Center (ORBIC) observation data do not identify any Oregon special status plant species within the Study Area (ORBIC 2023).

4.7.2.3 Common and Noxious Weeds

The Deschutes Basin Board of County Commissioners determines a weed to be noxious if it is “injurious to public health, agriculture, recreation, wildlife, or any public or private property,” and “impacts and displaces desirable vegetation.” Certain noxious weeds are so pervasive that they have been classified by ORS 569.350 as a menace to public welfare (Oregon Department of Agriculture [ODA] 2022). Noxious weeds frequently found within the Study Area include spotted knapweed (*Centaurea stoebe*), Dalmatian toadflax (*Linaria dalmatica*), and Canada thistle (*Cirsium arvense*) (ODA n.d.). Table 3 in the Biological Resources Technical Report lists common and noxious weeds found in the Study Area, along with the management priority rating for each noxious weed species.

In spring and fall of each year, COID applies herbicide along the PBC where canal roads are accessible and spot-sprays noxious weeds on the opposite side of the canal. COID routinely contracts with Deschutes County Vegetation Management (and occasionally other qualified contractors) for weed treatment.

4.7.3 Wildlife

4.7.3.1 General Wildlife

Wildlife present within the Study Area largely consist of habitat generalists or edge species that are disturbance-tolerant and able to adapt to or exploit the agricultural environment. These include deer, coyote, skunk, gray squirrel, raccoon, and red-tailed hawk (Oregon Watershed Plans 2020).

Wildlife within the Study Area may use the canal as a water source and dispersal corridor. Where not cleared, vegetation along the PBC can provide food, cover, and breeding sites for wildlife throughout the year. In portions of the Study Area located within more highly urbanized settings, such as Bend and downtown Redmond, habitat connectivity has been modified by construction of buildings, streets, and other facilities. Potential habitat used by urban-adapted species in developed areas may include bioswales, street trees, green roofs, and yards. Table 4 in the Biological Resources Technical Report lists wildlife species that are likely to occur in the Study Area.

4.7.3.2 MBTA/BGEPA Species

Multiple migratory birds protected under the MBTA or BGEPA may be present in the Study Area. Habitat is limited within the Project Area and the COID ROW due to maintenance activities that remove vegetation on an annual basis. Migratory birds of particular conservation concern are identified in Table 5 of the Biological Resources Technical Report.

Deschutes County maintains a database of known bald and golden eagle nesting sites. The area along the Deschutes River between SW Coyote Avenue and SW McVey Avenue contains the only known eagle nesting site within approximately 1 mile of the Study Area (Deschutes County Community Development 2023). No other known bald or golden eagle territories are within a one-half mile of the Study Area, although it is also possible that a nest could be identified nearby prior to project construction.

4.7.3.3 Federally Listed Species

An official species list obtained from the USFWS Oregon Fish and Wildlife Office (USFWS 2025) identified two federally listed terrestrial wildlife species whose potential ranges include the Project Area, including one endangered mammal species, gray wolf (*Canis lupus*) and one threatened bird species, yellow-billed cuckoo (*Coccyzus americanus*), as well as one proposed threatened invertebrate species, monarch butterfly (*Danaus plexippus*) and one proposed endangered invertebrate species, Suckley's cuckoo bumble bee (*Bombus suckleyi*) (see Table 6 in the Biological Resources Technical Report). No designated critical habitats occur within the Study Area. An ORBIC data search identified no records of ESA-listed threatened or endangered terrestrial wildlife species in the Project Area (ORBIC 2023). No federally listed terrestrial wildlife species are expected to be present in the Study Area due to lack of suitable habitat.

Suckley's cuckoo bumble bee has been found in various habitat types including prairies, grasslands, meadows, woodlands, and agricultural and urban areas. Although the species is rare, its historical range includes Deschutes County; therefore, it could potentially be present. Monarch butterfly migrates through Central Oregon but does not overwinter in the vicinity of the Project Area. Monarch butterfly relies on its host plant, milkweed (*Asclepias* spp.), for breeding and on other nectar plants for feeding. It breeds in Central Oregon from approximately June 1 to September 30 (Xerces Society 2018). Formal surveys for milkweed were not conducted, but it is assumed that this species may be present within the Project Area vicinity. If Suckley's cuckoo bumble bee or monarch butterfly is listed before the Project begins, NRCS would undertake ESA Section 7 consultation with USFWS for potential impacts to the species as part of the preparation and submittal of a forthcoming biological assessment to USFWS (See Section 4.7.4.2 below)

4.7.3.4 State-Listed Species

ODFW maintains a list of native wildlife species in Oregon that are designated as threatened or endangered according to criteria set forth by rule (OAR 635-100-0105; ODFW 2021). According to ORBIC data, no state-listed threatened or endangered species are present in the Project Area, but two state-listed sensitive mammal species—one state-listed sensitive critical mammal species and one state-listed sensitive critical bird species—were identified whose ranges include the Project Area (see Table 7 in the Biological Resources Technical Report). The Project Area does not include suitable habitat for these species.

4.7.4 Aquatic Species

4.7.4.1 General Fish and Aquatic Species

The PBC does not support game fish, salmonids, or threatened or endangered fish species. Fish screens compliant with ODFW standards were installed on the COID diversion from the Deschutes River at North Canal Dam (RM 164.8) in 2004 (ODFW n.d.a). The screens prevent fish from entering the PBC conveyance system. However, amphibians may be present in the open irrigation canal and on adjacent banks where there is suitable vegetation.

Waterbodies associated with the Study Area, including Crane Prairie and Wickiup Reservoirs and the Deschutes River, provide habitat for 22 documented native and non-native fish species. These include resident native species such as bull trout, spring and fall Chinook salmon (*Oncorhynchus tshawytscha*), mountain whitefish (*Prosopium williamsoni*), summer steelhead, rainbow trout (*Oncorhynchus mykiss*), redband trout (*Oncorhynchus mykiss* ssp.), and sockeye/kokanee (*Oncorhynchus nerka*). Non-native nuisance fish include smallmouth bass (*Micropterus dolomieu*; ODFW 2023).

Other aquatic species found within or along waterbodies associated with COID operations, including potentially the PBC, include amphibians such as western toad (*Anaxyrus boreas*), Pacific treefrog (*Pseudacris regilla*), and long-toed salamander (*Ambystoma macrodactylum*). These amphibian species are native to Oregon and may be present in open irrigation canals and adjacent banks where there is suitable vegetation (Oregon Watershed Plans 2020). All of them are identified as species of least concern by the International Union for Conservation of Nature (IUCN 2023). Non-native nuisance aquatic species present include bullfrog (*Lithobates catesbeianus*; Oregon Watershed Plans 2020). Table 8 in the Biological Resources Technical Report lists aquatic species found in the Study Area.

4.7.4.2 Federally Listed Fish and Aquatic Species

The ESA protects threatened and endangered species by way of Section 7 consultation to ensure that proposed project-related actions are not likely to jeopardize the existence of any species (or a species' designated critical habitat) on the list. The ESA consultation process is under the jurisdiction of USFWS and NMFS. An endangered species is defined by the ESA as “any species which is in danger of extinction throughout all or a significant portion of its range” (NMFS 2023). A threatened species is defined by the ESA as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (NMFS 2023).

Federally listed fish and aquatic species under USFWS jurisdiction that are known to occur in the waterbodies associated with COID operations or within the vicinity of the Project Area include

Oregon spotted frog (USFWS n.d.b), northwestern pond turtle (*Actinemys marmorata*; ODFW n.d.b), and bull trout (USFWS n.d.c). Designated critical habitat for Oregon spotted frog occurs in the Deschutes River upstream of Bend (RM 173), including in Wickiup and Crane Prairie Reservoirs (Oregon Watershed Plans 2020). Designated critical habitat for bull trout does not occur within the Study Area. No critical habitat has been designated for northwestern pond turtle.

Federally listed fish under NMFS jurisdiction that occur in waterbodies associated with COID operations or within the vicinity of the Project Area include steelhead (*Oncorhynchus mykiss*, Middle Columbia River Distinct Population Segment). The reintroduced population of Middle Columbia River steelhead in the Deschutes River above the Pelton Round Butte Project was designated as a non-essential experimental population under Section 10(j) of the ESA on January 15, 2013 (78 FR 2893). Critical habitat is not designated (Oregon Watershed Plans 2020). On January 15, 2025, the non-essential experimental population designation was removed, and Middle Columbia River steelhead is now listed as threatened under ESA (89 FR 15168).

Federally listed fish and aquatic species in the Study Area, along with their critical habitats and respective Primary Constituent Elements as applicable, are discussed in Section 5.3.3.3 of the Biological Resources Technical Report. These species and their habitat will also be addressed in a forthcoming Biological Assessment as part of ESA Section 7 consultation.

4.7.4.3 State-Listed Species

There are no state-listed threatened, endangered, or candidate fish or aquatic species known to occur within the Project Area or within waterbodies associated with COID operations (ODFW 2021; ORBIC 2023). Bull trout is designated as a state species of concern in Oregon; northwestern pond turtle is designated as a state sensitive critical species; and western toad is designated as a state sensitive species. Bull trout and northwestern pond turtle are not known to occur within the PBC within the Project Area. According to the ODFW Compass database, western toad occurs throughout the length of the existing PBC (ODFW n.d.c). See Section 5.3.3.4 of the Biological Resources Technical Report for additional discussion of the western toad and its habitat requirements.

4.7.5 Wetlands

Wetlands in the area associated with the proposed action may be subject to federal or state regulations depending on their characteristics. Within the state of Oregon, wetlands are managed under two regulations: the Clean Water Act (CWA) and Oregon Removal-Fill Law.

Analysis of the USFWS Nationwide Wetlands Inventory mapper and aerial imagery identified seven wetland features within the Study Area. An informal wetland inventory conducted on-site in October 2021 determined that five of these features are likely to be wetlands, but that they were artificially created and thus non-jurisdictional under federal or state regulation. Because the Project Area is limited to the existing PBC alignment and the alternative alignment options, jurisdictional waters are not assumed to be present in the Project Area. Wetland features present within the Project Area are summarized in Table 10 of the Biological Resources Technical Report.

4.7.6 Ecosystem Services

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

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

Cultural service, Culturally important species (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., believing protecting a species and its habitat is the right thing to do), altruism (i.e., believing a resource should be protected so that others can use it or benefit from it), and/or a desire to bequest the resource (i.e., believing a resource should be protected for future generations). To many residents of Central Oregon, the conservation of fish and aquatic life has come to represent the restoration of the Deschutes River ecosystem. In addition, members of the Confederated Tribes of Warm Springs have fishing rights and rely on the Deschutes River fisheries for subsistence. Culturally important fish and aquatic species in the Deschutes River ecosystem include species such as salmon, bull trout, and steelhead for both subsistence and cultural values, and Oregon spotted frog for cultural values.

4.8 Visual Resources

This section identifies visual resources within the Study Area.

4.8.1 Regulatory Context

Visual resources in the Project Area are supported and regulated by a number of state, local, and regional laws, plans, policies, and regulations. These include the Bureau of Land Management (BLM) Visual Contrast Rating formal process for visual impact assessment; Statewide Planning Goal 5 which protects scenic resources; the Deschutes County, City of Bend, and City of Redmond Comprehensive Plans which contain goals and policies for scenic areas; and the Deschutes County development code Landscape Management Combining Zone and Open Space and Conservation Zone.

4.8.2 Study Area

The Study Area for visual resources includes any areas from which the existing or future PBC alignments may be visible. Typically, this includes land immediately adjacent to or close to the canal, but this may vary widely along the canal's alignment due to views being obstructed or enhanced by existing development and structures, vegetation, or topography. The Study Area also includes elevated areas that may have a view of the canal from afar.

For the purposes of this analysis, the following categories of visual proximity have been identified:

1. Direct View: Parcel is directly adjacent to an unpiped section of the PBC.
2. Indirect View: Parcel is separated from an unpiped section of the PBC by a road ROW or undeveloped parcel.
3. Territorial View: Parcel is elevated and has a territorial view of an unpiped section of the PBC.

4.8.3 Existing Resources

The PBC exists within the larger visual setting of Deschutes County. Visual features of the canal vary along its alignment. In some areas it is immediately adjacent to existing homes, trails, and parks.

In other areas, the canal is difficult to see because of surrounding vegetation or topography. The canal passes through a range of visual settings along its length, including urban development, residential neighborhoods, agriculture, and open space.

Views of the PBC change seasonally. The canal is filled with up to 6 feet of water during the irrigation season, which typically runs from May to October. Outside of the irrigation season, the canal does not carry irrigation water, and it often runs dry. The canal is carved directly into basalt rock, and its rocky, uneven bed is visible when the canal is dry. An unpaved O&M access road runs adjacent to the PBC through much of the Study Area. Vegetation removal maintenance is performed annually in the PBC and surrounding area within the COID easement.

Although the canal is not a naturally formed waterway, many property owners who live adjacent to the canal consider it an aesthetic amenity, and they derive enjoyment from the view of the canal and the wildlife that occurs in the Project Area.

The PBC alignment and proposed alternatives can be divided into three distinct segments that share common visual features: the city of Bend, unincorporated Deschutes County, and the city of Redmond. In Appendix F.6, Visual Resources Technical Report, Figure 7 shows an overview of the full Study Area and the parcels in each visual proximity category and Figure 8 through Figure 14 provides a parcel-level view of the categories. For a summary of parcels by visual of proximity and by zoning designation, please see Table 2 and Table 3 in Appendix F.6.

4.8.3.1 City of Bend

The PBC is not currently piped at any point of its alignment through the city of Bend. Scenery around the PBC in the city limits includes urban areas, industrial areas, residential areas, parks, and open spaces. The canal runs adjacent to many residential properties, and it may be considered a water feature to these properties during irrigation season. In some areas along the alignment, COID access roads are used as recreational trails, and the PBC is visible from park and recreation areas (see Section 4.3, Parks and Recreation).

In the city of Bend, 214 parcels may have a direct view of the PBC, while 48 parcels may have an indirect view, and 979 parcels may have a territorial view. Most of the parcels with a direct view are within residential zoning designations.

A portion of the existing alignment in northeast Bend, from approximately Yeoman Road to Cooley Road, is listed in the NRHP (Photograph 3). Visual features that contribute to its historic significance include the surrounding undisturbed natural setting, the size and shape of the canal, and markings indicative of the tools and methods used during the construction of the canal (Oregon Historic Sites Database 2022). For more information on the NRHP listing, see Appendix E.1.

The visual setting along the NE 18th Street alternative alignment option includes residential areas, parks, schools, and open space. The area proposed for the new alignment is currently the NE 18th Street (ROW): a paved, two-lane roadway with bike lanes and sidewalks.

The Old Deschutes Road alternative alignment option is within the existing road ROW: a paved roadway with gravel shoulders which runs through agricultural, rural residential, and open space areas. The northernmost portion of the ROW in this alignment is currently unimproved open space with no roadway infrastructure.



Photograph 3. PBC Alignment in Bend

4.8.3.2 Deschutes County

The existing PBC alignment between Bend and Redmond is largely within a rural setting, surrounded by open space and agricultural uses (Photograph 4). Open space in this area is high desert in nature, characterized by juniper trees and sagebrush. The canal runs alongside US 97 for much of its alignment between Bend and Redmond. The surrounding area is highly scenic, with views of the Cascade Mountains to the west.

A portion of the canal runs through the unincorporated community of Deschutes, where it is surrounded by light industrial and rural residential structures and uses. The Redmond-Bend Juniper State Scenic Corridor consists of 10 parcels owned by the Oregon Parks and Recreation Department in this area. The parcels are intended for the preservation of old growth juniper trees. The PBC runs through or adjacent to several of these parcels.

The PBC alignment north of Redmond to the end of the Study Area is primarily surrounded by agricultural uses and rural residential development. Some segments of the PBC have previously been piped in this area. These segments are outside of the Study Area for this Project.

In unincorporated Deschutes County, 154 parcels may have a direct view of the PBC, 39 parcels may have an indirect view, and 15 parcels may have a territorial view. Most of the parcels with a direct view are within agricultural and residential zoning designations.



Photograph 4. PBC Alignment in Unincorporated Deschutes County

4.8.3.3 City of Redmond

The PBC alignment in the city of Redmond crosses through a variety of urban and suburban settings including residential neighborhoods, industrial and commercial areas, and parks and open space. The canal runs adjacent to The Greens at Redmond golf course, Homestead Park, the Homestead Canal Trail, and the Yew Avenue Nature Trail. Portions of the alignment run alongside existing roadways including US 97 and Canal Boulevard (Photograph 5). Some segments of the PBC have been piped within Redmond city limits; these segments are not included in the Study Area.

In the city of Redmond, 221 parcels may have a direct view of the unpiped portion of the PBC, and 69 parcels may have an indirect view. There are no parcels with a territorial view within the city. Most of the parcels with a direct view are within residential zoning designations.



Photograph 5. PBC Alignment in Redmond

4.9 Water Resources

This section identifies water resources within the Study Area.

4.9.1 Regulatory Context

Water resources in the Study Area are regulated by an extensive framework of federal, state, and local laws, plans, and policies. Regulations that are likely to apply to the Project include those identified below. The body of regulations governing water resources in the Project Area is discussed in detail in Appendix F.7, Water Resources Technical Report.

- Federal CWA of 1977, as amended (33 U.S.C. 1251-1376), which requires states to set water quality standards for all surface water contaminants and makes it unlawful to discharge a pollutant from a point source into navigable waters without a permit. Permitting processes under the purview of the CWA include:
 - Section 402 National Pollutant Discharge Elimination System Permits
 - Section 303(d) Impaired Waters and Total Maximum Daily Loads
 - Section 404 for Permitting Discharges of Dredge or Fill Material
 - Section 401 Water Quality Certification

- Federal Safe Drinking Water Act of 1974, as amended (42 U.S.C. 300f), which requires many actions to protect drinking water and its sources including rivers, lakes, reservoirs, springs, and groundwater wells.
- ORS 468B, Water Quality, which sets effluent limitations and describes the State of Oregon’s implementation of the CWA.
- ORS 196.795-990, Oregon Removal-Fill Law, which requires a permit for removal or placement of fill material in wetlands or waterways of the state.
- ORS 545, Oregon Irrigation District Law, which provides the foundations for formation, development, operation, and governance of irrigation districts in Oregon.
- Oregon’s Statewide Planning Goals and Guidelines, OAR 660-015-0000. Goal 6 instructs local governments to consider protection of air, water, and land resources from pollutants when developing comprehensive plans.
- 1200-C Construction Stormwater Permit. Oregon DEQ requires this permit for construction activities covering 1 or more acres that could potentially generate stormwater runoff into surface waters or conveyance systems leading to surface waters of the state.

4.9.2 Study Area

The Project Area for the water resources analysis includes the existing PBC alignment, COID easements, and the area needed to construct all permanent infrastructure. This area includes temporary construction staging, storage, and access sites, as well as parcels adjacent to the PBC alignment where modifications would be required for associated work such as utility realignments or upgrades.

The Study Area for water rights and surface water resources includes the Project Area and all waterbodies affected by COID infrastructure and operations: Crane Prairie Reservoir, Wickiup Reservoir, and the Upper Deschutes River upstream of the PBC diversion at North Canal Dam (see Figure 5 in Appendix F.7 Water Resources Technical Report). The Study Area for groundwater includes approximately 40,435 acres located in the center of the Upper Deschutes Basin, consisting of areas within approximately 1.4 miles of the Project Area (see Figure 6 in Appendix F.7, Water Resources Technical Report). This is the distance within which the Project would be most likely to influence groundwater levels, based on analysis of groundwater wells within the project vicinity and review of regional groundwater studies (Gannett et al. 2001; Gannett et al. 2003; Gannett and Lite 2013).

4.9.3 District Water Rights and Operations

4.9.3.1 District Water Rights

The PBC conveys water to 17,149 irrigated acres in the Upper Deschutes Basin. COID is a senior water right holder on the Deschutes River. COID meets the majority of its water needs via live flow from its diversions on the Deschutes River under Certificate 94956, which carries 1900 and 1907 priority dates (see Table 2 in Appendix F.7). Supplemental stored water may be needed during portions of the irrigation season.

COID holds supplemental storage rights on Crane Prairie Reservoir, located in the upper reaches of the Deschutes River Watershed. The use and amount of stored water in Crane Prairie and Wickiup Reservoirs is governed by Oregon Statutes and an Inter-District Agreement among Reclamation, COID, NUID, LPID, and AID, which was revised in 2020. COID holds 26,000 AF out of 50,000 total AF of stored water rights in Crane Prairie Reservoir. AID holds rights to 13,500 AF, and the remainder (10,500 AF) is held by LPID. Stored water rights in Wickiup Reservoir are held entirely by NUID.

On December 31, 2020, USFWS announced the approval of the DBHCP and issuance of incidental take permits for bull trout and Oregon spotted frog, both federally listed as threatened. On October 18, 2022, NMFS approved the DBHCP and issued incidental take permits for federally listed threatened steelhead and sockeye salmon. Conservation measures in the DBHCP are designed to minimize and mitigate impacts to listed species that may result from irrigation water management for 30 years (2021–2050). The 2020 Revised Inter-District Agreement codifies long-term requirements and parameters for coordination among the districts for Crane Prairie Reservoir and Wickiup Reservoir operations and the requirements and parameters will last the full duration of the DBHCP (AID et al. 2020). Appendix F.7, Water Resources Technical Report, provides detailed discussion of the DBHCP conservation measures, their requirements for reservoir operations, and seasonal flow levels in the Upper Deschutes River. Appendix F.7 also details the 2020 Revised Inter-District Agreement’s parameters for allocating stored and live-flow water among the four participating districts.

4.9.3.2 District Operations

4.9.3.2.1 *Central Oregon Irrigation District*

On average, 95 percent of COID’s water comes from live flow in the Deschutes River. COID holds 1,370 cfs of live-flow water rights in the river, which is primarily diverted at the Central Oregon Canal diversion (RM 171) and the PBC diversion at North Canal Dam (RM 164.8). Water diverted to the PBC is transported north approximately 21.6 miles from the diversion before reaching the northern limits of the Project Area. Water is delivered to COID patrons directly from the PBC and through a system of laterals branching off the PBC. Patron turnouts and laterals are operated and maintained by COID field staff.

In the past, about 5 percent of COID’s water has come from storage in Crane Prairie Reservoir. The reservoir is owned by Reclamation, but COID finances and oversees day-to-day O&M. The reservoir is federally authorized for irrigation and state-authorized for multiple purposes including instream flows for fish and wildlife. Crane Prairie Reservoir Dam is also owned by Reclamation and operated by COID. Maintenance responsibility is shared with LPID and AID.

Water from Crane Prairie Reservoir is released during the irrigation and nonirrigation seasons, at levels prescribed by the DBHCP, to maintain reservoir levels and year-round flows in the Deschutes River that better align with the life history needs of listed aquatic species. COID is responsible for operating Crane Prairie Dam and Reservoir in a manner consistent with the DBHCP conservation measures and with the 2020 Revised Inter-District Agreement. See Appendix F.7 for detailed discussion of COID operations.

4.9.3.2.2 *North Unit Irrigation District*

COID is responsible for delivering water to NUID, which is passed to the NUID main canal at the north end of the currently piped Smith Rock section of the PBC. Given that NUID is a junior water right holder in the Deschutes Basin, it can only divert live flow when live flow in the Deschutes River exceeds 1,250 cfs. Historically, 70 percent of the water diverted by NUID was from storage in Wickiup Reservoir (NRCS 2023a). With the approval of the DBHCP and the 2020 Revised Inter-District Agreement, NUID has access to additional Deschutes River water from COID live-flow rights in exchange for 5,000 AF of stored water from Wickiup Reservoir. During the irrigation season, NUID may also receive up to 29.4 cfs (9,392 AF) of water saved by piping the Smith Rock section of the PBC. Appendix F.7 discusses the accounting arrangement between COID and NUID for allocation of stored and live-flow water.

4.9.3.2.3 *Lone Pine Irrigation District*

COID delivers water to LPID at the Lone Pine weir near the northern end of the PBC, outside of the Project Area. LPID holds a live-flow water right for up to 29.1 cfs with a priority date of 1900. LPID supplements its live-flow right with stored water from Crane Prairie and Wickiup Reservoirs according to the 2020 Revised Inter-District Agreement.

4.9.3.2.4 *Arnold Irrigation District*

AID diverts live flow and stored water from the Deschutes River at the Arnold Canal Diversion (RM 174.5) near Bend. COID does not deliver water directly to AID. However, COID's live-flow water rights in the Deschutes River are senior to AID's and, if needed, it can make a call on AID's junior water rights to serve COID patrons. The two districts are also required by the 2020 Revised Inter-District Agreement to coordinate with one another along with NUID and LPID regarding Crane Prairie Reservoir and Wickiup Reservoir operations.

4.9.4 **Surface Water Hydrology**

Waterbodies associated with COID operations are identified in Table 4 and Figure 5 in Appendix F.7, Water Resources Technical Report. Detailed discussion of existing surface water hydrology conditions in the Study Area is included in Section 5.3.2 of Appendix F.7.

Historically, the spring-fed Deschutes River had relatively consistent streamflow seasonally and annually (Deschutes River Conservancy 2012). Hydrologic conditions have changed with construction and operation of reservoirs, dams, and diversions on the river and its tributaries. Water management for irrigation has resulted in lower flows downstream from reservoirs during the storage season (i.e., late fall, winter, and early spring), higher flows downstream from reservoirs during the irrigation season (April to October), and lower flows farther downstream due to irrigation diversions during the irrigation season (USFWS and NMFS 2020).

Crane Prairie Reservoir relies on snowmelt, tributary inflows, and precipitation for inflow. Crane Prairie Dam and Reservoir are operated in coordination with Wickiup Dam and Reservoir, as directed by the 2020 Revised Inter-District Agreement. Water levels in Crane Prairie Reservoir are based primarily upon DBHCP requirements to maintain reservoir levels within a constant surface elevation range and storage volume, and to maintain a consistent outflow to Wickiup Reservoir of approximately 75 cfs throughout the year.

Wickiup Reservoir relies on snowmelt, tributaries, releases from Crane Prairie Reservoir, and precipitation for inflow. During the irrigation season, water is released by NUID and conveyed through the Deschutes River to the appropriate COID, AID, or NUID diversion point. During the nonirrigation season, water is released from the reservoir to meet the districts' commitments per the DBHCP and the 2020 Revised Inter-District Agreement.

The Upper Deschutes Basin has experienced a drying trend for several decades (Gannett and Lite 2013) and is susceptible to future changes in precipitation and the amount and timing of spring runoff (Shelton and Fridirici 2001). The State of Oregon has issued drought declarations for Deschutes and Jefferson Counties each year from 2020 through 2023 (Oregon Water Resources Department [OWRD] 2023) that have led to curtailments in deliveries to District patrons during late summer (COID 2023). Models suggest that increased rain and a decrease in snowpack combined with an accelerated rate of spring snowmelt will have a progressively greater influence on the future water supply in the area; these changes will make managing the water supply more difficult (Shelton and Fridirici 2001; Reclamation 2016). This trend has potential for a decrease in annual mean streamflow and decreases in groundwater discharge to spring-fed streams (Gannett and Lite 2013).

4.9.5 Surface Water Quality

All waterbodies associated with COID operations are included on the DEQ Section 303(d) impaired list (DEQ 2022). Water management in the Deschutes Basin has altered seasonal streamflow patterns, increasing streamflow above historical levels in some reaches and decreasing streamflow below historical levels in other reaches. Low streamflow affects water quality in the Deschutes River by exacerbating temperature and dissolved oxygen problems. In addition, water quality often influences the spread and extent of invasive aquatic species, and these problems interact synergistically to degrade wildlife habitat within and around the Deschutes River.

Crane Prairie Reservoir, Wickiup Reservoir, and the Deschutes River are all identified as exceeding impairment parameters for temperature and dissolved oxygen (DEQ 2022). In addition, Crane Prairie Reservoir exceeds impairment parameters for pH and harmful algal blooms, Wickiup Reservoir exceeds impairment parameters for harmful algal blooms, and the Deschutes River exceeds impairment parameters for sedimentation, turbidity, flow modification, habitat modification, and pH. Appendix F.7 provides additional details on water quality conditions in waterbodies associated with COID operations, and Table 6 lists the water quality impairment parameters that each waterbody exceeds.

4.9.6 Groundwater

4.9.6.1 Hydrogeology

Groundwater generally flows east and then north through the Upper Deschutes Basin. Due to the area's porous geology, groundwater levels and stream discharge are associated with movement of water between surface water and groundwater systems. Rivers, streams, and irrigation canals in the Upper Deschutes Basin all show seepage losses, indicative of the area's permeable geology (Gannett et al. 2001).

The water table in the Study Area is generally hundreds of feet below the land surface with a slight downward gradient from south to north (Gannett et al. 2001). The water table is closer to the land surface in the Redmond area than near Bend. See Appendix F.7 for additional details on the hydrogeology of the Study Area.

4.9.6.2 Groundwater Level Change

Aquifers in the Upper Deschutes Basin have experienced a drying trend since the 1950s and are susceptible to future changes in precipitation and the amount and timing of spring runoff (Gannett and Lite 2013; Shelton and Fridirici 2001). This has been shown to be largely driven by climate oscillations (Gannett et al. 2001; Gannett et al. 2003).

Irrigation canal seepage has contributed to elevated groundwater levels in the central part of the Upper Deschutes Basin over the past century. Previous studies (Sceva 1968; Gannett et al. 2001) have shown that canal seepage is a substantial component of the groundwater budget. Canal seepage rates have been found to vary greatly within the basin depending on the geology of the canal bottom, the degree to which cracks and voids have been filled by sediment, and the wetted perimeter of the canal. Groundwater measurements from the early 1900s, prior to construction of the canal network, are largely nonexistent; therefore, it is impossible to determine how much groundwater level rise is directly attributable to canal seepage.

Up to approximately 43,544 AF per year may be lost from the PBC via canal seepage (FCA 2023; COID 2016a). Due to variations in geology and hydraulic conductivity, seepage losses are not uniform throughout the Project Area. In general, the highest rates of canal seepage occur in reaches farther south and are especially high in the vicinity of Bend.

Gannett and Lite (2013) found that canal lining and piping within the Upper Deschutes Basin between 1994 and 2008 have likely contributed to decreased recharge and declining groundwater levels, particularly near affected canals; however, impacts from climate variations have the largest influence on groundwater levels.

4.9.6.3 Groundwater Pumping

Groundwater pumping in the Study Area is overwhelmingly for domestic use and municipal drinking water supplies. A query of the OWRD Well Report Database (2025) identified only 11 agricultural irrigation wells in the Study Area. Figure 7 in Appendix F.7 shows the relative concentrations of domestic water wells, agricultural wells, and groundwater observation wells in the Study Area.

4.9.7 Ecosystem Services

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

Provisioning service, Water available for irrigation (Figure 4-1 [E1]): As described in Sections 1.3 and 4.9, water from the headwaters of the Deschutes Basin is stored, conveyed, and diverted, affecting the upper and middle reaches of the Deschutes River. This water provides irrigation for food and feed and maintenance of agricultural lands.

Regulating service, Water quality (Figure 4-1 [E3]): The amount of water instream affects water quality including temperature, turbidity, sediment, and pollutants. In general, low streamflow challenges a waterbody's ability to resist warming because less water heats faster than more water. Because of this property, greater instream flow can help to keep water cool—an important factor for temperature-sensitive aquatic species living in these stream habitats (Section 4.7.4). In cold winter months, however, the banks of waterbodies with low streamflow are susceptible to freeze-thaw cycles that can increase bank erosion and increase sediment in the water. Therefore, greater

streamflow also helps to dilute pollutants. Section 4.9.4 describes surface water quality in the waterbodies associated with COID operations.

Water flowing through the COID PBC provides the following ecosystem services.

Cultural service, Culturally important areas (Figure 4-1, [E5]): The PBC runs through a variety of different areas with various land uses (Section 4.2 and Section 4.8). Several sections of the canal run through residential areas. To some adjacent residents, the canal brings a sense of tranquility and enjoyment. As identified during the public scoping comment period of this Plan-EIS, residents indicated that they receive aesthetic enjoyment from the canal. Residents enjoy seeing and hearing the water in the canal and the wildlife that the canal attracts during the irrigation season. Some residents also identified that their value of the canal was linked to its designation as a historic site.

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

4.10 Utilities

The Study Area for utilities includes the Project Area and potential detour routes that may be created during construction. The Project Area includes a 70-foot construction footprint alongside either side of the PBC alignment and alternative alignment options to account for the anticipated area of disturbance during the construction process.

There is a wide range of public services and utilities in the Study Area that are provided by several public and private entities. Rural areas in unincorporated Deschutes County are generally served by fewer utilities and public services than the urban areas of Bend and Redmond. Table 4-12 lists utility providers that serve customers within the Study Area.

Table 4-12. Utility Providers in the Study Area.

Utility	Provider
Electric	Pacific Power Central Electric Cooperative
Natural Gas	Cascade Natural Gas
Sewer/Wastewater	City of Bend Public Works Utility Department City of Redmond Public Works Utility Department

Utility	Provider
Water	Avion Water City of Bend Public Works Utility Department City of Redmond Public Works Utility Department
Irrigation	Central Oregon Irrigation District
Cable/Telecom	TDS Fatbeam Lumen Level(3) Zayo
Solid Waste and Recycling	Bend, Cascade Disposal and Republic Services Redmond, Republic Services

Utility systems are located within the Study Area in several areas through the existing PBC alignment and proposed alternative alignment options, and the systems could potentially be impacted by the Project. The Utilities Technical Report (Appendix F.8) identifies all the utility crossings that are known within the prospective alignments. In general, there are more utility conflicts in the urbanized areas of Bend and Redmond, especially along route options within existing streets, than in the existing canal alignment and in unincorporated Deschutes County.

Vertical conflicts between the existing canal alignment and existing utilities are utility crossings that are either underground or overhead and are mounted on bridge crossings or utility poles. Horizontal conflicts between the PBC alignment and existing utilities are parallel or longitudinal utility alignments where proposed piping would be in the same space and orientation as the utility.

4.11 Noise and Vibration

Zoning within the Project Area is administered by Deschutes County, the City of Bend, and the City of Redmond. Zones describe what uses are allowed, limited, or prohibited on the property, provide guidance on use intensity, and set development standards. Zoning in an area is generally indicative of existing land uses and intended future land uses. A complete summary description of all zoning designations crossed by the proposed action are presented in Appendix F.1, Land Use Technical Report.

The existing PBC alignment crosses a wide variety of land uses within the Study Area. Land uses can identify noise- and vibration-sensitive receptors such as residences—both single-family and multifamily—parks, schools, hospitals, and places of worship. Within the cities of Bend and Redmond, these uses are primarily industrial, single-family residential, and commercial. Portions of the canal run alongside parks, trails, open space, and a golf course. Within unincorporated Deschutes County, land uses are primarily agricultural and open space, along with some industrial and residential uses. The canal runs alongside transportation facilities for a portion of its length,

including US 97 and local streets in Bend and Redmond. A 1.5-mile section of the existing PBC alignment in Bend, from Yeoman Road to approximately Old Deschutes Road, is listed in the NRHP.

Schools in Bend near the existing PBC alignment include Realms High School and Ponderosa Elementary School. Parks in Bend near this alignment include Canal Row Park. No schools or parks were identified along the existing PBC alignment in Deschutes County. In south Redmond, schools near this alignment include Ridgeview High School. In central Redmond, schools adjacent to the alignment include Boulden Rogen Early Childhood Academy. A 1.3-mile section of the existing PBC alignment in central Redmond, from NW Dogwood Avenue to NW Quince Avenue, is listed in the NRHP. Central Redmond also contains the Downtown Redmond Segment Historic District to the west of the existing PBC alignment. In Deschutes County north of Redmond, Diamond Bar Ranch Park is near the alignment.

The Downtown Redmond Segment Historic District is located approximately 1.5 miles southwest of the existing canal alignment in central Redmond; this segment is proposed for piping and is not anticipated to be affected by the Project.

No existing ambient noise studies were conducted for the Noise and Vibration Technical Report (see Appendix F.9). The most recent study within the Study Area was performed as part of the US 97 Bend North Corridor Project Final Environmental Impact Statement (FHWA and ODOT 2014). Noise measurements were collected primarily along the east side of US 97 and east of the BNSF Railway tracks in north Bend at noise-sensitive land uses. Six of these monitoring locations are within the south portion of the COID Study Area.

The levels measured in 2014 correspond to noise levels associated with lands where serenity and quiet are of extraordinary importance, and preserving these qualities is essential to continue their intended purpose. These land uses are not commonly found, but if they are, they have an hourly sound level criterion that approaches but does not exceed 57 decibels (dB), exterior, on an A-weighted decibel scale (dBA).

The Redmond Municipal Airport – Roberts Field is located southeast of the Project Area within the Redmond city limits and east of US 97. According to the Airport Layout Plan, the 65 dBA existing airport noise contours do not encroach into the Project Area.

4.12 Right-of-Way, Displacements, and Relocations

The Study Area includes parcels immediately adjacent to the existing canal alignment and proposed alternative alignment options, including a 70-foot buffer on either side of the canal to account for construction impacts.

In unincorporated Deschutes County, there are 365 parcels within the Study Area. Existing zoning designations and corresponding land uses within this portion of the Study Area are characterized by low-density, large-lot residential use; agriculture; rural industrial development; and open space and conservation.

In the city of Bend, there are 105 parcels within the Study Area. Existing zoning designations and corresponding land uses within this portion of the Study Area are characterized by single-family residential, business commercial, and industrial uses. The NE 18th Street alternative alignment option also includes institutional (elementary and middle school) uses.

In the city of Redmond, there are 178 parcels within the Study Area. Existing zoning designations and corresponding land uses within this portion of the Study Area are characterized by residential, commercial, and park and open space use.

The existing PBC covers a patchwork of public, private, and COID-owned properties. Ownership of the land under the canal varies by location as described below:

- NE King Way to downtown Redmond. The existing canal is primarily within public ROW with portions crossing private property west of NE 17th Street.
- City of Redmond. The existing canal is primarily within public ROW with portions crossing private property and publicly owned parcels. COID owns three parcels within the city of Redmond that overlap the existing canal.
- Unincorporated Deschutes County (city of Redmond to city of Bend). From the city of Redmond's southern border to the crossing of US 97 near Tumalo Road, the canal is within private property. East and south of the US 97 crossing, the canal is within private land and federally owned public land.
- City of Bend. Within the city of Bend, the canal is primarily within private property with limited locations where it crosses COID and public properties.

In total, COID owns 15 properties covering 67.5 acres that are under or adjacent to the existing canal. In addition to the land owned by COID, COID has 123 existing easements that extend outward from both sides of the canal for nearly the entire length of the canal that is not within COID-owned property or public ROW. These easements extend outward 20 to 164 feet from the centerline of the canal and total 325 acres. The average width of these easements is 78 feet, and the mode (most commonly observed value in a set of data) is 100 feet. See Appendix F.10 Right-of-Way, Displacements, and Relocations Technical Report for additional information.

4.13 Transportation

Table 2 in Appendix F.11, Transportation Technical Report, catalogs the crossings of transportation facilities intersecting the existing PBC alignment. Forty-four crossings of the existing PBC were identified and include a variety of transportation facilities such as railroads, private roads, local city and county roads, and state highways. These crossings are on bridges or culverts that have the potential to be affected as a result of the proposed piping of the PBC.

4.14 Air Quality

4.14.1 Regulatory Context

General conformity ensures that the actions taken by federal agencies do not interfere with a state's plans to attain and maintain national standards for air quality. General conformity applies to all federal actions (e.g., funding, licensing, permitting, or approving) that do not include federal transportation projects as defined in 40 CFR 93.101 and that take place in nonattainment or maintenance areas for all criteria pollutants: ozone (O₃), particulate matter (PM₁₀, PM_{2.5}), nitrogen dioxide (NO₂), carbon monoxide (CO), lead, and sulfur dioxide (SO₂).

Under the Clean Air Act, EPA sets air quality standards and periodically updates the standards to ensure that they are continuously protective of public health. Based on new health information, the

EPA has proposed to tighten the fine particulate matter standard and is beginning a review of the ozone standard. State and local agencies are required to monitor air quality within their jurisdictions and to use their monitoring data as the basis to classify areas as “attainment” (meeting the standards), “nonattainment” (not meeting the standards), or “unclassifiable” (not enough information to classify). DEQ operates a statewide monitoring network to address this requirement.

The Bend Metropolitan Planning Organization planning area is classified as an attainment area, as it continues to meet air quality standards. As a result, there is no requirement for a general conformity analysis for the federal action (funding) being considered for the Project.

4.14.2 Existing Conditions

The PBC is an irrigation water canal that is not a source of air quality criteria pollutants.

4.15 Climate Change, Resiliency, and Adaptation

Currently, the PBC is an open canal for approximately 18.5 miles from its diversion point at the Deschutes River, except for short, piped segments north of Bend and downtown Redmond. The PBC loses up to approximately 43,544 AF per year of the water diverted from the Deschutes River through a combination of seepage due to the porous underlying geology, evaporation due to the arid climate, and other operational losses from system inefficiencies. Seepage and evaporation potentially account for up to two-thirds of the total loss. This means that to meet patrons’ irrigation needs, COID must divert excess water from the river to account for the water lost. With a changing climate, increasingly reduced snowpack, earlier snowmelt, and a longer dry season, lower stream flows and lower groundwater recharge would be expected.

Models suggest that increased rain and a decrease in snowpack combined with an accelerated rate of spring snowmelt will have a progressively greater influence on the future water supply in the area; these changes will make managing the water supply more difficult. This trend has potential for a decrease in annual mean streamflow and decreases in groundwater discharge to spring-fed streams.

Adaptive management is an iterative approach to resource management that involves measuring and monitoring management outcomes and making decisions and adjustments in response to new information. Adaptive management allows for feedback between observation and corrective action to ensure that the decision-making framework includes monitoring of metrics for the proposed action. This facilitates the tracking and evaluation of progress toward environmental, social, and economic benefits expected from the Project. It also assists district managers in accounting for unanticipated changes, inaccurate predictions, or emerging information. Monitoring and adaptive management frameworks allow for increased or modified efforts when issues are identified, or metrics are not met and decreased efforts when metrics are on track or achieved. Long-term monitoring must be flexible and adapt to the issues and opportunities that arise.

4.16 Wild and Scenic Rivers

4.16.1 Regulatory Context

The Wild and Scenic Rivers Act (16 U.S.C. 1271) was passed by Congress in 1968 to preserve certain selected rivers of the Nation that possess natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. Rivers may be designated by Congress or, in some cases, the Secretary of the Interior. Each river is administered by

either a federal or state agency. Designations may not necessarily include the entire river and may include tributaries. The Wild and Scenic Rivers Act designation also encompasses a corridor of land adjacent to each side of the river, which is designed to protect river-related values. For federally administered rivers in the lower 48 states, a river's designated corridor generally averages one-quarter mile from either bank. Designated rivers are classified as Wild, Scenic, or Recreational. These classifications depend on the level of development along the river at the time of its designation. Different sections of a river might have different classifications (Rivers.gov 2024).

- Wild – Rivers or sections thereof that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines that are essentially primitive and waters that are unpolluted.
- Scenic – Rivers or sections that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- Recreational – Rivers or sections that are readily accessible by road or railroad, may have some development along their shorelines, and may have undergone some previous impoundment or diversion.

The Oregon Scenic Waterway Act was established by ballot initiative in 1970 and is administered under the authority of the Oregon State Parks and Recreation Commission (ORS 390.805 to 390.925). The goals of the scenic waterway program are as follows:

- To protect the free-flowing character of designated rivers for fish, wildlife, and recreation.
- To protect and enhance scenic, aesthetic, natural, recreation, scientific, and fish and wildlife values.
- To protect private property rights.
- To promote expansion of the scenic waterway system.
- To encourage other local, state, and federal agencies to act consistently with the goals of the program.

4.16.2 Existing Conditions

The Deschutes River was designated as a Federal Wild and Scenic River in 1988 in three separate segments. The State of Oregon also designates all three segments as a State Scenic Waterways.

4.16.2.1 Upper Deschutes Wild and Scenic River Segment

The Upper Deschutes Wild and Scenic River begins just downstream of Wickiup Dam at the Wickiup gauging station (approximately RM 224.5) and continues downstream to the Bend UGB. The Upper Deschutes Wild and Scenic River corridor includes the river and an area of adjacent land totaling approximately 17,000 acres and is administered by the USFS. Within this segment, the river is classified as Scenic and Recreational under the Wild and Scenic Rivers Act (USFS 1996).

The hydrology of the Upper Deschutes Wild and Scenic River is influenced by releases from Wickiup Reservoir. Therefore, it is among the waterbodies influenced by COID operations and by NUID, LPID and AID operations. However, the downstream limit of the Upper Deschutes Wild and Scenic River Corridor is located approximately 5.3 miles from the COID diversion at North Canal Dam and the head of the PBC. The entirety of the Project Area is located outside of the

designated Wild and Scenic portion of the Deschutes River as well as outside of the upland portion of the Wild and Scenic River Corridor.

4.16.2.2 Middle and Lower Deschutes Wild and Scenic River Segments

The Middle Deschutes Wild and Scenic River extends 20 miles from Odin Falls to the upper end of Lake Billy Chinook. Within this segment, the river is classified as Scenic (BLM 1992). The Middle Deschutes Wild and Scenic River is located approximately 4.3 miles from the Project Area (King Way segment) at its closest point. The 100-mile section of the river from the Pelton Reregulating Dam (roughly 27 miles from the Project Area) to the confluence with the Columbia River is designated as the Lower Deschutes Wild and Scenic River (BLM 1993). The Middle and Lower Deschutes Wild and Scenic River segments and their respective designated corridors are located outside of the Study Area and are not discussed further in this Plan-EIS.

4.16.3 Ecosystem Services

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

5 Alternatives

5.1 Formulation Process

Four action alternatives and one No Action Alternative were initially considered during the scoping process. The formulation of alternatives followed the USDA regulations for implementing NEPA (7 CFR Part 1b) and numerous USDA-NRCS watershed planning policies. Scoping comments were also incorporated into the formulation process of alternatives. The four action alternatives are:

- Canal Lining
- Dryland Farming
- Market-Based Approaches
- Infrastructure Modernization with Federal Investment

At project scoping, alternative alignment options for the Modernization Alternative for the Deschutes County/North Bend segment of the PBC that is listed in the NRHP were presented to the public for comment. Based on initial consultation with SHPO in 2022 and 2023, additional alternative alignment options for the Modernization Alternative were added for analysis related to the Redmond segment of the PBC that is listed in the NRHP. The additional options for the two NRHP-listed sections included analysis of no modernization (no piping); these are identified as the Partial Modernization Alternative discussed in Section 5.2.

When formulating an alternative, it was first determined whether the alternative met the project purpose. The alternative was then further analyzed for four criteria: completeness, effectiveness, efficiency, and acceptability (NRCS 2017; Appendix D). Some of the initial alternatives considered did not meet the formulation criteria and were eliminated from further analysis (Appendix D).

The risks and uncertainty are primarily associated with the No Action Alternative. For example, to meet patrons' irrigation needs, COID currently must divert excess water from the Deschutes River to account for water loss due to the porous underlying geology, evaporation due to the arid climate, and other existing operational losses from system inefficiencies. With variable weather conditions in future years that may be accompanied by a corresponding reduced snowpack, earlier snowmelt, and potentially longer dry season, lower streamflows and lower groundwater recharge would be expected but cannot be predicted. The availability of consistent water in the Deschutes River to satisfy irrigation demands cannot be predicted.

As described in Section 2.2.3, the potential for periodic canal failure all along the canal is increasing, which under the No Action Alternative could potentially cause harm to built historic resources along the canal from flooding. It is not possible to accurately predict whether a canal failure will cause flood damage to any specific property.

Adaptive management strategies presented in Table 6-2 may reduce some of this uncertainty.

5.2 Alternatives Eliminated from Detailed Study

Four potential alternatives were evaluated based on the formulation criteria, but after further consideration they were not analyzed in detail as a viable alternative. Alternatives were removed from consideration if they did not address the purpose and need for action, did not achieve the Federal Objective and Guiding Principles, or became unreasonable because of cost, logistics,

existing technology, or environmental reasons (NWPM 501.37; NRCS 2024). Alternatives eliminated from detailed study and the rationales for dismissing these alternatives are discussed in further detail in Appendix D.

5.2.1 Canal Lining

Canal lining would involve covering the bottom and sides of the currently open COID PBC with a geotextile liner and shotcrete to prevent water from seeping into the underlying soils and rock. Canal lining would require subgrade preparation, geotextile liner installation, and application of a layer of shotcrete to protect the geotextile liner across approximately 18.5 miles of open canal.

Lining would increase the water velocity in the canal because the shotcrete cover is a smoother surface than the existing underlying soils and rocks. The smoother surface would make the sides of the canal slippery and make it more difficult for people, livestock, and wildlife that might accidentally fall in the water to be able to climb out, especially considering the flow volumes of the COID PBC.

Canal lining would only partially meet the project purpose of conserving water. While lining would reduce water loss from seepage, it would not reduce water loss from evaporation. The lining materials would have an expected lifespan of approximately 33 years before needing to be replaced. Before replacement, as the system aged, it would likely require maintenance with progressively increasing frequency. This would be necessary to address wear and cracks in the lining, which would otherwise result in increased water loss through seepage over time. Additionally, this alternative would still require energy use and other pumping costs for farmers similar to their current operations.

The initial capital costs of canal lining were estimated based upon the size of the existing open canal, earthwork to reshape the canal, materials, and installation of the liner and shotcrete. The estimated capital cost for lining the PBC is \$471,799,000.

The present value of the estimated capital costs, replacement costs, and annual O&M costs are \$864,728,000 (2023 dollars) over 100 years. This is \$537,747,000 greater than the cost of piping the PBC, as included in the Modernization Alternative, over 100 years. Based on this cost, canal lining was eliminated from further study.

Furthermore, canal lining would not fully meet the project purpose to improve water delivery reliability. An anticipated increase in operational costs would not meet the Project's purpose to improve operational efficiencies. Losses from evaporation and seepage (as the lining aged and cracked) would result in less water conservation as compared to the Modernization Alternative, making canal lining a less-effective approach. Canal lining would increase public safety risks as any accidental entry (fall) into the canal would make self-rescue more difficult due to the smoother canal wall surfaces. As a result, the canal lining alternative was dismissed from further consideration, because it would not meet the project purpose and need, would be inefficient, would decrease public safety, and would not achieve the Federal Objective and Guiding Principles.

5.2.2 Dryland Farming

Dryland farming is a non-structural alternative. This method of farming uses no irrigation and incorporates drought-resistant crops and practices to conserve moisture. The Dryland Farming Alternative would include voluntary conversion by COID patrons to dryland farming. Crop rotations would likely change from an annual production to a winter crop-summer fallow rotation,

where only one crop is produced in 2 years. If sufficient annual precipitation exists (12 to 18 inches annually), rotations may change to a 3-year winter crop-based rotation, where crops are grown in 2 out of every 3 years. New equipment purchases or changes to the specific types of crops grown could potentially be required in order to implement different water conservation tillage practices. Economic losses would be incurred as a result of keeping prime farmland in a fallow state for extended time periods.

Dryland farming was eliminated for further study for multiple reasons. Project sponsors must have the legal authority and resources to carry out, operate, and maintain works of improvement (Pub. L. No. 83-566, Section 2, 1954).¹⁰ Since COID lacks the statutory authority or responsibility to carry out, operate, and maintain dryland farming by COID patrons, conversion to dryland farming is not within the scope of actions that COID can entertain as project sponsor.

While dryland farming would meet the sponsors' objective to improve water conservation by using less irrigation water, it would not comport with Pub. L. No. 83-566 requirements, would not meet the objectives to improve water delivery reliability and public safety for COID canals and lateral infrastructure, and would allow canal leakage and evaporation to continue.

Furthermore, it would not meet the Project's purpose and need, its effectiveness would be uncertain since conversion to dryland farming would be voluntary, and it would not achieve the sustainable economic development component of the Federal Objective and Guiding Principles.

5.2.3 Market-Based Approaches Including Voluntary Reduction

Market-Based Approaches refers to patrons voluntarily accepting less than their full water delivery rate from COID, or to patrons temporarily or permanently moving water or water rights from their lands to streams. A reduction in duty by a patron could mean that COID diverts less water, which would leave more water instream.

Because COID is obligated to provide a certain amount of water to patrons to meet associated rights, this alternative would be voluntary and at the discretion of individual patrons. For this reason, there would be no assurance that water would be conserved. Additionally, because the system has open canals, subject to certain operating inefficiencies, COID would still need to divert enough water, accounting for seepage and evaporation, to ensure those deliveries.

After due deliberation and consultation with COID, market-based incentives were eliminated from further evaluation as an alternative as this approach would not meet the project purpose and need.

5.2.4 Partial Modernization

The Partial Modernization Alternative was considered to wholly avoid construction within the individually listed historic sections of the PBC in Deschutes County/North Bend and in Redmond. This alternative would include some of the project groups of piping considered under the Modernization Alternative and its alternative alignment options but would not pipe either of the historic sections leaving them open and functioning in their current configuration.

In Deschutes County/North Bend, this alternative would keep the 7,800-foot NRHP-listed stretch of the PBC between Yeoman and Cooley Roads in its current configuration and functionality as an

¹⁰ Pub. L. No. 83-566 Section 2. Local organization"—any State, political subdivision thereof, soil or water conservation district, flood prevention or control district, or combinations thereof, or any other agency having authority under State law to carry out, maintain and operate the works of improvement."

open canal. It would require a pressure-reducing station south of Yeoman Road to slow the flow velocity as it exits the pressurized pipe so that the existing open canal can function as currently designed. Similarly, within the Redmond section, this alternative would keep the 6,800-foot NRHP-listed stretch of the PBC in Redmond in its current configuration and functionality as an open canal. It would require installing a pressure-reducing station near the intersection of SW Veteran's Way and US 97 to slow the flow velocity as it exits the pressurized pipe so that the existing open canal can function as currently designed.

Water savings under this alternative would be less than completely piping the PBC, because water loss through seepage and evaporation would continue to occur over 14,600 linear feet of the Project Area. Total water savings under this alignment option would be reduced to approximately 37,124 AF (approximately 15% less than the full piping alternative), and the total amount made available to NUID patrons after seepage and evaporation losses in the NUID system would be about 27,419 AF (See Appendix D). Seepage and evaporation losses within the NUID system would be expected to increasingly diminish over time as NUID implements ongoing and future system modernization projects (NRCS 2023a; NUID 2022; NUID 2025)

The Partial Modernization Alternative would not address the project purpose and need. Water would continue to be lost to seepage and evaporation in these segments. Water delivery reliability for farmers, streamflow and habitat conditions for fish and aquatic species, public safety, and sediment levels in irrigation water would not be efficiently improved. Because less water would be conserved or permanently allocated instream, the Partial Modernization Alternative would not fully achieve the Federal Objective to protect the environment, the healthy and resilient ecosystem guiding principle, or the sustainable economic development guiding principle. The Partial Modernization Alternative would not allow COID to fully meet its commitments for the PBC under the DBHCP.

5.3 Alternatives Description

5.3.1 No Action (Future without Federal Investment)

Under the No Action Alternative, COID would continue to operate and maintain the existing delivery system within the Project Area in its current condition. This alternative assumes that modernization of COID's infrastructure would not be reasonably certain to occur, as funding at the scale necessary to modernize COID infrastructure is not anticipated from other sources. The No Action Alternative would be a continuation of COID's current O&M.

The No Action Alternative would not meet the project purpose and need. Water would continue to be lost to seepage and evaporation in COID infrastructure. Water delivery reliability for farmers, streamflow and habitat conditions for fish and aquatic species, public safety, and sediment levels in irrigation water would not improve. Because no water would be conserved or permanently allocated instream, the No Action Alternative would not achieve the Federal Objective to protect the environment, the healthy and resilient ecosystem guiding principle, or the sustainable economic development guiding principle.

5.3.2 Modernization Alternative (Future with Federal Investment)

The Modernization Alternative would focus on a single-priority infrastructure modernization project: COID would replace the existing open PBC within the Project Area with a pressurized, 10-foot-outer-diameter to 11-foot-outer-diameter, closed-conduit pipeline system (see Figure 5-1).

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When completed, the pipe would extend over approximately 21 miles of the COID system from the diversion point from the Deschutes River in Bend, Oregon, to NE 17th Street in Redmond, Oregon. Approximately 18.5 miles of new pipe would be installed through this Modernization Alternative, and approximately 2.5 miles is already piped as part of previous actions. Pipeline construction would begin in the northern portion of the Project Area at the piped section of the PBC that was approved under the 2020 Smith Rock-King Way Infrastructure Modernization Project Final Watershed Plan–Environmental Assessment (NRCS 2020), and progress south to the North Canal Dam. Construction of the Modernization Alternative would occur over the course of 3 years; two project groups would be constructed each construction season. The six project groups are described in Table 5-1.

Table 5-1. Pilot Butte Canal Project Groups Comprising the Project Area and Construction Sequence.

Project Group	Length of Project Improvements (ft)	Construction Year	Construction Start	Construction End
1 – King Way	11,000	1	October 2026	April 2027
2 – Redmond ^a				
Pilot Butte Canal Alternative Alignment Option	13,500	2	October 2027	April 2028
Watermaster Road Alternative Alignment Option	13,500	2	October 2027	April 2028
NW Canal Boulevard Alternative Alignment Option	13,500	2	October 2027	April 2028
3 – Veterans Way	16,700	3	October 2028	April 2029
4 – Canal	13,900	3	October 2028	April 2029
5 – Deschutes Market	22,000	2	October 2027	April 2028

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Project Group	Length of Project Improvements (ft)	Construction Year	Construction Start	Construction End
6 – Rivers Edge	18,100 to 19,800			
Pilot Butte Canal Alternative Alignment Option	18,100	1	October 2026	April 2027
18th Street Alternative Alignment Option	19,300	1	October 2026	April 2027
Old Deschutes Road Alternative Alignment Option	19,800	1	October 2026	April 2027

- a Included in this project group are 1,100 feet of existing pipe that would be replaced with new pipe of a larger diameter.
- b Approximately 18.5 miles of new pipe would be installed through this Modernization Alternative, and approximately 2.5 miles are already piped or installed in culverts as part of previous actions.

Construction would occur during the nonirrigation season (October to April), with Project Group 1 (King Way) and Project Group 6 (Rivers Edge) construction beginning as early as the 2026–2027 nonirrigation season. The construction sequencing may be changed to provide flexibility for the construction contractor. Construction of each project group is anticipated to require one nonirrigation season to complete, and all six project groups would be completed over the course of three construction seasons. Two project groups—Redmond and Rivers Edge—each contain a segment with multiple alignment alternative options. The alternative alignment options are discussed below. Under the Modernization Alternative, federal funding through Pub. L. No. 83-566 would be available and would be expected to cover approximately 75 percent of the total construction costs. COID would cover the remaining 25 percent of total costs.

A section of the PBC in Deschutes County just south of the Juniper Ridge hydroelectric facility, in the Rivers Edge project group, and another section in the downtown area of Redmond, in the Redmond project group, include historic features listed in the NRHP. In 2019, a Section 106 programmatic agreement was signed by COID, SHPO, and Reclamation. NRCS was added as a signatory in 2023. The programmatic agreement identified that COID will maintain the downtown Redmond reach “such that the historic integrity of and identification of the historic property as representative of an irrigation conveyance system will not be adversely affected.” At time of Plan-EIS publication, NRCS and COID are actively consulting with SHPO to revise the programmatic agreement regarding the downtown Redmond reach to accommodate piping. Mitigation measures to address impacts to historic resources per the programmatic agreement have been generated by NRCS and COID and have been initially agreed upon by SHPO. These mitigation measures are included in Appendix E.2. The alternative alignment options for the Deschutes County/North Bend (in the Rivers Edge project group) and the city of Redmond (in the Redmond project group) NRHP-listed historic sections of the Project Area are described in Section 4.1.3.

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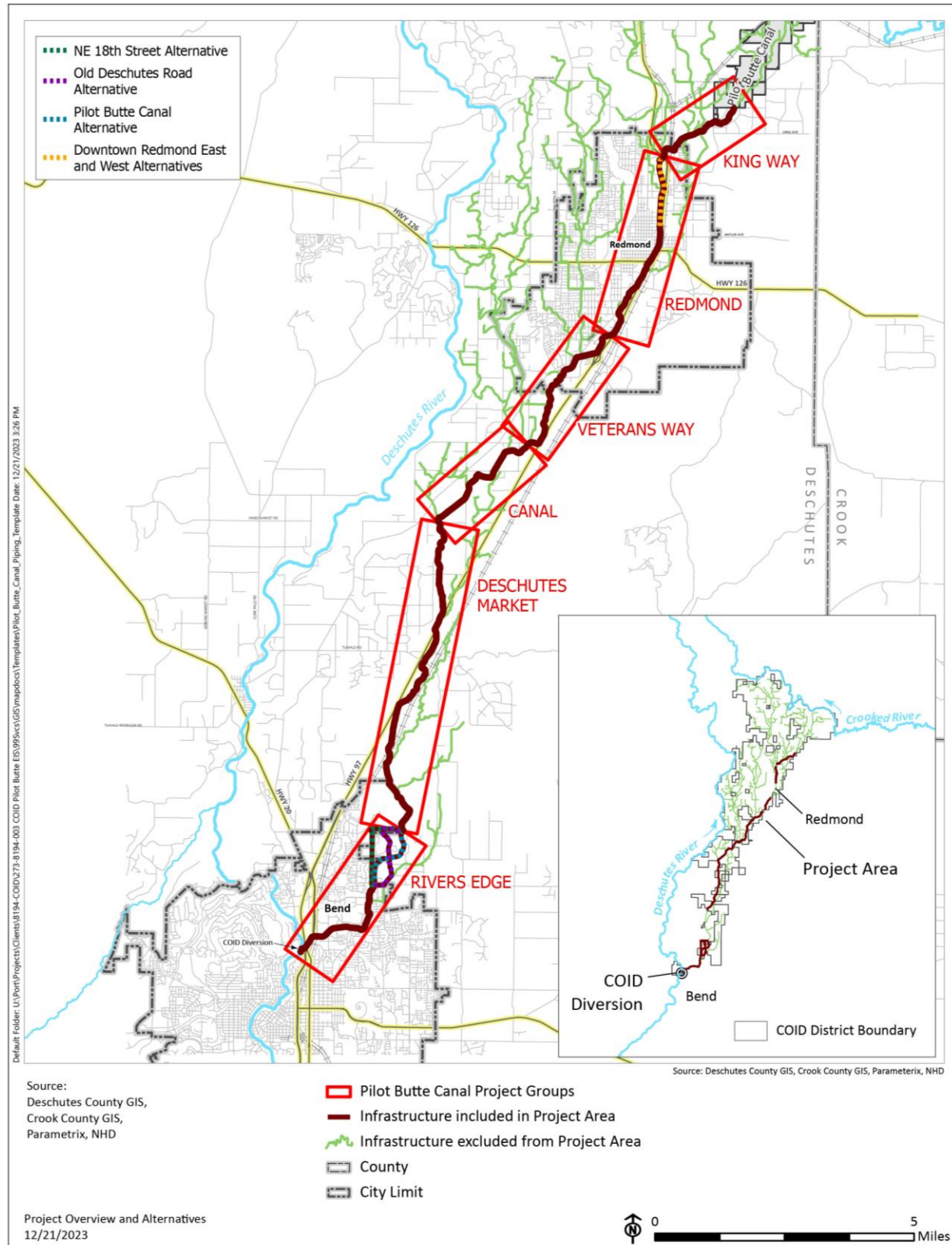


Figure 5-1. Project groups.

5.3.3 Deschutes County/North Bend Alternative Alignment Options

The Modernization Alternative has three options for piping the historic section of the canal between Yeoman Road and Cooley Road in Deschutes County and north Bend in the Rivers Edge project group (see Figure 5-2).

- Pilot Butte Canal Alignment (existing canal alignment).
- NE 18th Street Alignment.
- Old Deschutes Road Alignment.

5.3.3.1 Pilot Butte Canal Alternative Alignment Option (Existing Canal Route)

This alignment option would replace the open canal with pipe directly within the existing open canal alignment. This alignment option would be built wholly within the section of canal that is listed in the NRHP. This option would not pipe the open canal section immediately south of the Juniper Ridge hydroelectric facility (approximately 170 feet), and it would require installing a pressure-reducing station prior to where flow enters the hydroelectric facility.

5.3.3.2 NE 18th Street Alternative Alignment Option

This option would pipe the PBC within a new alignment beginning at the intersection of the existing alignment and Yeoman Road. It would travel west and then north to follow NE 18th Street to its intersection with Cooley Road. At Cooley Road, the alignment option would make an approximately 90-degree turn to follow an alignment extending from near the eastern terminus of Cooley Road to the existing PBC. This option would avoid impacts to the section of the PBC that is listed in the NRHP. The historic section of the canal would be left in place, but it would no longer receive irrigation water from the COID system and would not be maintained by COID. Additionally, the historic canal section would be fenced to prevent trespassing and to mitigate public safety concerns associated with the abandoned canal.

5.3.3.3 Old Deschutes Road Alternative Alignment Option

The Old Deschutes Road alignment option would place pipe in a new alignment beginning at Yeoman Road. It would travel east along Yeoman Road and then northeast to follow Old Deschutes Road. The alignment would travel generally north, cross the existing PBC, then continue north to Cooley Road. The alignment would make an approximately 90-degree turn to follow Cooley Road to the existing PBC. The historic section of the canal would be left in place, but it would no longer receive irrigation water from the COID system and would not be maintained by COID. Additionally, the historic canal section would be fenced to prevent trespassing and to mitigate public safety concerns associated with the abandoned canal.

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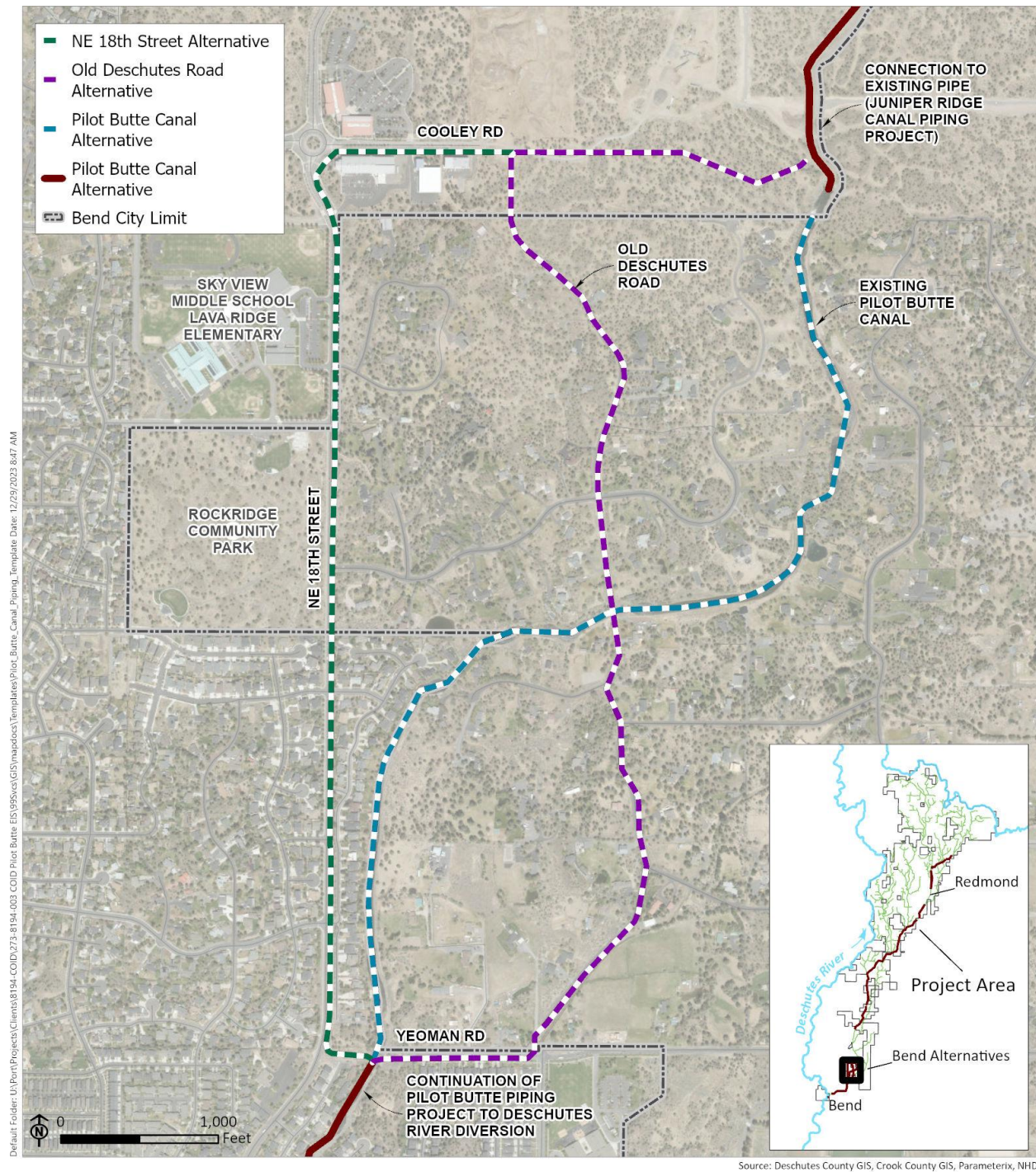


Figure 5-2. Deschutes County/North Bend alternative alignment options.

5.3.4 City of Redmond Alternative Alignment Options

The Modernization Alternative has three options for piping within the NRHP-listed historic downtown Redmond section between NW Dogwood Avenue and NW Quince Avenue (see Figure 5-3).

- Pilot Butte Canal Alignment (existing canal alignment)
- Piping to the East in the Watermaster's Access Road
- Piping to the West within Northwest Canal Boulevard

5.3.4.1 Pilot Butte Canal Alternative Alignment Option (Existing Canal Route)

This alignment option would replace the open canal with pipe directly within the existing open canal alignment. This alignment option would be built wholly within the section of canal that is listed in the NRHP.

5.3.4.2 Piping to the East in the Watermaster's Access Road Alternative Alignment Option

This alignment option would install pipe to the east of the existing PBC and avoid impacts to the section of canal that is listed in the NRHP. The historic section of the canal would be left in place, but it would no longer receive irrigation water from the COID system and would not be maintained by COID. Additionally, the historic canal section would be fenced to prevent trespassing and to mitigate public safety concerns associated with the abandoned canal.

5.3.4.3 Piping to the West Within Northwest Canal Boulevard Alternative Alignment Option

This alignment option would pipe to the west of the existing PBC, primarily within NW Canal Boulevard, and avoid impacts to the section of canal that is listed in the NRHP. The historic section of the canal would be left in place, but it would no longer receive irrigation water from the COID system and would not be maintained by COID. Additionally, the historic canal section would be fenced to prevent trespassing and to mitigate public safety concerns associated with the abandoned canal.

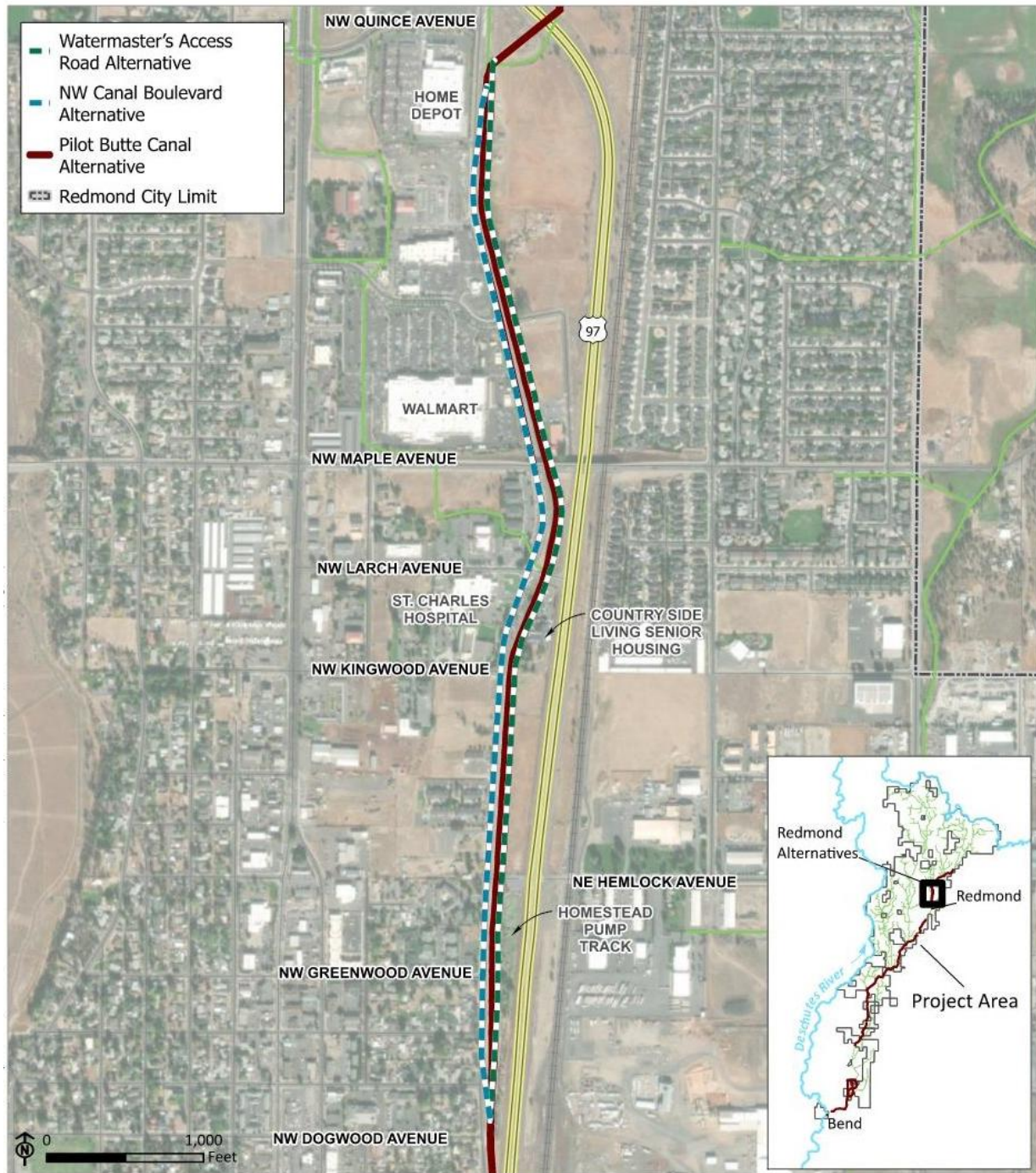


Figure 5-3. Redmond alternative alignment options.

5.3.5 Construction Means and Methods – Piping

In general, the existing canal would be trenched for subgrade preparation prior to pipe installation using excavators, with excavated material being side-cast adjacent to the canal. Blasting would likely be required in areas of shallow bedrock, primarily in the southern portions of the Project Area. A geotextile liner would be installed in the trench, followed by pipe bedding and the pipe. The

side-cast excavated material would then be returned to the trench as pipe cover. Trench design would follow NRCS Conservation Practice Standard for Irrigation Pipeline (Code 430-CPS-1). Pipeline installation within new alignments, such as the Old Deschutes Road, would incorporate similar approaches. Excess material that could not be reused as backfill following construction of the new pipeline alignments would be disposed of in an approved upland location. Specific details regarding construction materials, means, and methods would be determined during final design.

Construction of the Modernization Alternative would include mobilizing and staging construction equipment; delivering pipe to construction areas; excavating trenches; fusing pipelines; placing pipe in trenches, which in some cases are below the grade of the canal; compacting backfill; and restoring and reseeded disturbed areas. In some locations, construction access would need to be created before delivering pipe or equipment into construction areas and could include vegetation removal within the construction area. Appropriately sized construction equipment would be used to minimize disturbance in the construction area.

Pipe installation would require staging and storage areas for pipe, other construction materials, and construction equipment. If excavated materials cannot be reprocessed for backfill primarily due to engineering requirements, fill material would be obtained from Deschutes County-area commercial quarries. Staging areas have not yet been identified and would be determined prior to construction. Any relevant environmental clearances related to these staging areas would be obtained by COID or its contractor prior to construction. Areas that have been previously disturbed, are existing commercially used spaces, and are accessible via existing access routes would be prioritized for use as staging, storage, and borrow/fill areas (as applicable).

Vegetation clearing before construction, vegetation and weed management during construction, and reseeded after construction would be completed according to COID current vegetation management practices and NRCS Oregon and Washington Guide for Conservation Seedings and Plantings (NRCS 2000). During construction, vegetation clearing would be minimized to the extent practicable, and locations for vehicle and equipment access, staging, and storage would be selected to avoid trees and other slow-growing vegetation. Trees would only be removed if there was no other alternative to access the construction site or if they posed a safety threat to construction crews working in the canal trench.

Canal segments identified for piping would be accessed from existing COID maintenance roads when possible. Existing maintenance roads and overland access routes commonly used for O&M may require some improvements for use during construction.

In some cases, temporary overland travel routes within existing COID easements may be necessary to access certain canal segments associated with the proposed action that do not have established maintenance roads. To facilitate restoration, temporary travel routes would be left in their natural condition with only minimal alterations when necessary to allow for travel during construction. The most direct route possible would be used to access the construction area. Any work needed to create equipment access would occur prior to, or concurrently with, piping.

During the irrigation season from April to October, O&M work would be performed on an as-needed basis. Outside the irrigation season, COID would perform system component maintenance or repairs to its meters, valves, and air and vacuum infrastructure.

5.3.6 Conclusion

The Modernization Alternative would contribute to the sponsors' objectives and the Federal Objective and Guiding Principles as follows:

- Improve water conservation – This alternative would reduce water loss from seepage and evaporation in the PBC through piping. These actions would result in an estimated annual water savings of up to 43,544.1 AF.
- Increase water delivery reliability to patrons and farms – Modernizing the PBC would improve operational irrigation water delivery for all patrons served by this canal. This alternative would also improve water availability and drought resilience for patrons throughout COID.
- Reduce O&M costs – Modernizing the PBC would eliminate the need to inspect, repair, and remove obstructions in the Project Area. It would also eliminate up to 44 bridge crossings of the canal that would no longer need to be inspected and maintained.

The estimated project cost for the Modernization Alternative, including NRCS Technical Assistance and Program Administration as well as permitting, would be \$356,591,000 to \$385,228,000 (2025 dollars) depending upon the route options selected for modernization. Additional information regarding the costing and the net present value of the Modernization Alternative can be found in Appendix D.

5.4 Summary and Comparison of Alternatives

Table 5-2 through Table 5-13 compare the No Action/Future without Federal Investment (No Action Alternative) and the Full Modernization Alternative, including the alternative alignment options in Deschutes County and north Bend and the Downtown Redmond Segment Historic District. The tables summarize measures addressed as well as environmental, social, cultural, and economic effects.

Table 5-2. Summary and Comparison of Alternative Plans and Alternative Alignment Options.^a

Item or Concern	No Action Alternative	Full Modernization - Entire Pilot Butte Canal Alignment (Preferred Alternative)	Full Modernization - Old Deschutes Road Alignment <i>Deschutes County/ North Bend Options</i>	Full Modernization - NE 18th Street Alignment <i>Deschutes County/ North Bend Options</i>	Full Modernization - Watermaster Road Alignment <i>Redmond Historic Segment Options</i>	Full Modernization - NW Canal Boulevard Alignment <i>Redmond Historic Segment Options</i>
Locally Preferred		✓				
National Economic Development (NED)		✓	✓	✓	✓	✓
Socially Preferred ^a	✓					
Environmentally Preferred		✓				

^a Based on scoping comments desiring to keep canal unpipied.

Table 5-3. Guiding Principles.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Healthy and Resilient Ecosystems		✓	✓	✓	✓	✓
Sustainable Economic Development		✓	✓	✓	✓	✓
Floodplains	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Public Safety		✓	✓	✓	✓	✓
Watershed Approach		✓	✓	✓	✓	✓
Provisioning Services – Irrigation Water		✓	✓	✓	✓	✓
Provisioning Services – Instream Fish Species	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Regulating Services – Water Quality		✓	✓	✓	✓	✓
Cultural Services – Culturally Important Species	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Note: Checkmarks indicate that the Guiding Principles have been met.

5.4.1 National Economic Development Analysis

Table 5-4. National Economic Development Analysis – Installation Costs.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Federal Pub. L. No. 83-566	\$0	\$270,215,000	\$282,777,000	\$284,968,000	\$273,432,000	\$277,325,000
Local only or Matching Pub. L. No. 83-566	\$0	\$86,376,000	\$90,167,000	\$91,001,000	\$87,480,000	\$88,525,000
Total	\$0	\$356,591,000	\$372,944,000	\$375,969,000	\$360,912,000	\$365,850,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping, and groundwater pumping.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-5. National Economic Development Analysis – Project Group 1 King Way.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Average Annual Cost – Installation ¹	\$0	\$1,052,000	\$1,052,000	\$1,052,000	\$1,052,000	\$1,052,000
Average Annual Cost – Other ²	\$0	\$7,000	\$7,000	\$7,000	\$7,000	\$7,000
Average Annual Cost – Total	\$0	\$1,059,000	\$1,059,000	\$1,059,000	\$1,059,000	\$1,059,000
Annual Benefits	\$0	\$1,101,000	\$1,101,000	\$1,101,000	\$1,101,000	\$1,101,000
Annual Costs	\$0	\$1,059,000	\$1,059,000	\$1,059,000	\$1,059,000	\$1,059,000
Annual Net Benefits ³	\$0	\$42,000	\$42,000	\$42,000	\$42,000	\$42,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping and groundwater pumping.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-6. National Economic Development Analysis – Project Group 2 Redmond.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Average Annual Cost – Installation ¹	\$0	\$1,724,000	\$1,724,000	\$1,724,000	\$1,853,000	\$2,000,000
Average Annual Cost – Other ²	\$0	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000
Average Annual Cost – Total	\$0	\$1,732,000	\$1,732,000	\$1,732,000	\$1,861,000	\$2,008,000
Annual Benefits	\$0	\$4,560,000	\$4,560,000	\$4,560,000	\$4,560,000	\$4,560,000
Annual Costs	\$0	\$1,732,000	\$1,732,000	\$1,732,000	\$1,861,000	\$2,008,000
Annual Net Benefits ³	\$0	\$2,828,000	\$2,828,000	\$2,828,000	\$2,699,000	\$2,552,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping, groundwater pumping, and carbon emissions.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-7. National Economic Development Analysis – Project Group 3 Veterans Way.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Average Annual Cost – Installation ¹	\$0	\$1,627,000	\$1,627,000	\$1,627,000	\$1,627,000	\$1,627,000
Average Annual Cost – Other ²	\$0	\$11,000	\$11,000	\$11,000	\$11,000	\$11,000
Average Annual Cost – Total	\$0	\$1,638,000	\$1,638,000	\$1,638,000	\$1,638,000	\$1,638,000
Annual Benefits	\$0	\$2,210,000	\$2,210,000	\$2,210,000	\$2,210,000	\$2,210,000
Annual Costs	\$0	\$1,638,000	\$1,638,000	\$1,638,000	\$1,638,000	\$1,638,000
Annual Net Benefits ³	\$0	\$572,000	\$572,000	\$572,000	\$572,000	\$572,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping and groundwater pumping.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-8. National Economic Development Analysis – Project Group 4 Canal.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Average Annual Cost – Installation ¹	\$0	\$1,316,000	\$1,316,000	\$1,316,000	\$1,316,000	\$1,316,000
Average Annual Cost – Other ²	\$0	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000
Average Annual Cost – Total	\$0	\$1,325,000	\$1,325,000	\$1,325,000	\$1,325,000	\$1,325,000
Annual Benefits	\$0	\$2,238,000	\$2,238,000	\$2,238,000	\$2,238,000	\$2,238,000
Annual Costs	\$0	\$1,325,000	\$1,325,000	\$1,325,000	\$1,325,000	\$1,325,000
Annual Net Benefits ³	\$0	\$913,000	\$913,000	\$913,000	\$913,000	\$913,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping and groundwater pumping.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-9. National Economic Development Analysis – Project Group 5 Deschutes Market.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Average Annual Cost – Installation ¹	\$0	\$2,205,000	\$2,205,000	\$2,205,000	\$2,205,000	\$2,205,000
Average Annual Cost – Other ²	\$0	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Average Annual Cost – Total	\$0	\$2,220,000	\$2,220,000	\$2,220,000	\$2,220,000	\$2,220,000
Annual Benefits	\$0	\$2,258,000	\$2,258,000	\$2,258,000	\$2,258,000	\$2,258,000
Annual Costs	\$0	\$2,220,000	\$2,220,000	\$2,220,000	\$2,220,000	\$2,220,000
Annual Net Benefits ³	\$0	\$38,000	\$38,000	\$38,000	\$38,000	\$38,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping and groundwater pumping.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-10. National Economic Development Analysis – Project Group 6 Rivers Edge.

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Average Annual Cost – Installation ¹	\$0	\$2,735,000	\$3,237,000	\$3,330,000	\$2,735,000	\$2,735,000
Average Annual Cost – Other ²	\$0	\$12,000	\$14,000	\$13,000	\$12,000	\$12,000
Average Annual Cost – Total	\$0	\$2,747,000	\$3,251,000	\$3,343,000	\$2,747,000	\$2,747,000
Annual Benefits	\$0	\$3,162,000	\$3,162,000	\$3,162,000	\$3,162,000	\$3,162,000
Annual Costs	\$0	\$2,747,000	\$3,251,000	\$3,343,000	\$2,747,000	\$2,747,000
Annual Net Benefits ³	\$0	\$415,000	-\$89,000	-\$181,000	\$415,000	\$415,000

1 The Modernization Alternative Average Annual Cost is the additional average annual installation costs above the No Action Alternative Average Annual Cost.
2 Average Annual Cost “Other” includes COID pumping and groundwater pumping.
3 Annual Net Benefits shown for the Modernization Alternative are the additional net benefits compared to the No Action Alternative.

Table 5-11. Regional Economic Development Analysis – Regional Economic Impacts (Employment).

Item or Concern	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Annual Local Jobs during Construction (including direct/indirect/induced) ¹	0	1,020	1,010	960	1,030	1,050
Annual Jobs from Recreation	0	0	0	0	0	0
Annual Jobs from Agriculture (including direct/indirect/induced)	0	150	150	150	150	150

Prepared September 2025

1/This assumes that Project-related construction income is similar to the local income generated from typical construction spending in the region as estimated by IMPLAN regional economic modeling software. It may overstate impacts as it assumes that the project administration and technical assistance provided by NRCS is generally provided by local staff and not state office staff located outside the region.

Table 5-12. Regional Economic Development Analysis – Beneficial Effects Annualized (Income Millions, 2025 dollars).

Item or Concern	Type of Benefit	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Region	Construction (Direct, indirect, induced labor income from installation expenditures) ¹	\$0	\$6.18	\$6.14	\$5.87	\$6.26	\$6.34
	Ag Damage Reduction (NED benefits plus direct, indirect, induced labor income)	\$0	\$20.31	\$20.31	\$20.31	\$20.31	\$20.31
	District OMR Savings	\$0	\$0.36	\$0.36	\$0.36	\$0.36	\$0.36
	Patron Energy Savings	\$0	\$0.13	\$0.13	\$0.13	\$0.13	\$0.13
	Avoided Property Damage (Canal Failure)	\$0	\$4.17	\$4.17	\$4.17	\$4.17	\$4.17
	Total	\$0	\$31.15	\$31.10	\$30.83	\$31.22	\$31.30
Rest of Nation	Labor Income from Project Construction and Increased Agricultural Production	\$0	Some ripple effects on jobs and income, not quantified	Some ripple effects on jobs and income, not quantified	Some ripple effects on jobs and income, not quantified	Some ripple effects on jobs and income, not quantified	Some ripple effects on jobs and income, not quantified

Prepared September 2025

1/This assumes that Project-related construction income is similar to the local income generated from typical construction spending in the region as estimated by IMPLAN regional economic modeling software. It may overstate impacts as it assumes that the project administration and technical assistance provided by NRCS is generally provided by local staff and not state office staff located outside the region.

Table 5-13. Regional Economic Development Analysis – Adverse Effects Annualized (Millions, 2025 dollars).

Item or Concern	Type of Adverse Effect	No Action Alternative	Full Modernization of Entire Pilot Butte Canal Alignment	Old Deschutes Road <i>Deschutes County/ North Bend Options</i>	NE 18th Street <i>Deschutes County/ North Bend Options</i>	Watermaster Road <i>Redmond Historic Segment Options</i>	NW Canal Boulevard <i>Redmond Historic Segment Options</i>
Region	Installation Costs ¹	\$0	\$0	\$0	\$0	\$0	\$0
	O&M Costs	\$0	\$0.06	\$0.06	\$0.06	\$0.06	\$0.06
Rest of Nation	Installation Costs	\$0	\$10.72	\$11.23	\$11.32	\$10.72	\$10.87
	O&M Costs	\$0	\$0	\$0	\$0	\$0	\$0

2025 Dollars Using a 3.0 percent discount rate.

Prepared September 2025

^{1/} Grants are expected to cover the regional share of installation costs; most of these costs are expected to be from sources outside the region, so no regional installation costs are included and all installation costs are allocated to the Rest of the Nation.

6 Environmental Consequences

6.1 Cultural Resources

6.1.1 No Action Alternative (Future without Federal Investment)

6.1.1.1 Historic Built Resources

The No Action Alternative would leave PBC and other built resources as they currently exist, without any change or modification. As such, this alternative would not result in impact to any resource of historic significance. As described in Section 2.2.3, the potential for periodic canal failure all along the canal is increasing, which under the No Action Alternative could potentially cause harm to built historic resources along the canal from flooding. It is not possible to accurately predict whether a canal failure will cause flood damage to any specific property.

6.1.1.2 Archaeological Resources

Under the No Action Alternative, no ground disturbance would occur other than continuation of COID's current O&M, so no impacts to identified archaeological resources are anticipated. As described in Section 2.2.3, the potential for periodic canal failure all along the canal is increasing, which under the No Action Alternative could potentially cause harm to archaeological resources along the canal from flooding. It is not possible to accurately predict whether a canal failure will cause flood damage to any specific property.

6.1.2 Modernization Alternative

6.1.2.1 Historic Built Resources

Modifications to the PBC are subject to the requirements of Programmatic Agreement PA-173, originally signed by NRCS in 2023 with SHPO and Reclamation. In accordance with 36 CFR 800.4 NRCS has determined that eligible and listed historic properties lie within the APE. In accordance with 36 CFR 800.5, NRCS has made a Finding of Adverse Effects to the PBC segments listed in the NRHP. Pursuant to 36 CFR 800.6 and in consultation with the signatory parties, an amendment to PA-173 is in process that provides mitigation and a resolution of adverse effects to historic properties. Other Consulting Parties have been invited to review the proposed mitigation measures, and ultimately the Amendment will be signed by the signatories to PA-173, in addition to the City of Redmond, and submitted to the Advisory Council on Historic Preservation. Mitigation measures included in the Programmatic Agreement are presented in Appendix E.2.

After a Preferred Alternative is finalized, COID will prepare Determination of Eligibility documentation for the non-canal-related built resources identified as potentially eligible (Table 4-1), and the Project will follow the requirements of Section 106 of the NHPA, including individual evaluation and Determinations of Significance. For resources determined eligible by SHPO, individual Findings of Effect will be prepared and submitted for concurrence. If the Modernization Alternative would result in an adverse impact to non-canal historically significant resources, an MOA and mitigation would be developed for approval and implementation in coordination with NRCS and SHPO.

6.1.2.1.1 *Long-Term Impacts*

The Modernization Alternative as proposed would have an adverse effect on sections of the canal previously determined eligible for or listed in the NRHP, impacting historic character and eliminating the open canal design. Proposed piping of the PBC would result in a loss of historic character and integrity to the Pilot Butte Canal Historic District (Cooley Road-Yeoman Road Segment) in Bend. Impacts to this segment are covered by the 2019 Programmatic Agreement. NRCS, in coordination with COID, determined that the proposed piping of the Pilot Butte Canal: Downtown Redmond Segment Historic District would result in a loss of historic character and integrity to that property. NRCS submitted a Finding of Effect on April 14, 2025, to SHPO, and SHPO concurred with the Finding of Adverse Effect on May 13, 2025 (see Appendix E.1.A, Cultural Resources Correspondence). Consultation is ongoing to resolve adverse effects to the Downtown Redmond Segment Historic District. The 2019 Programmatic Agreement, signed by NRCS in 2023, applies to and resolves adverse effects from the piping, repair, and maintenance of the COID canal system, while the Draft Amendment 001 to the Programmatic Agreement will resolve adverse effects by the undertaking to the Downtown Redmond Segment Historic District. At the time of Plan-EIS publication, NRCS and COID are actively consulting with SHPO and other interested consulting parties to revise the programmatic agreement regarding the downtown Redmond reach to accommodate piping. Mitigation measures to address impacts to historic resources per the programmatic agreement have been generated by NRCS and COID and have been initially agreed upon by SHPO. These mitigation measures are included in Appendix E.2.

The proposed piping of the PBC would have an effect on the OTR through the removal of the existing bridges that carry the rail line over the canal. The existing concrete footings and abutments would remain, with the new 11-foot-diameter pipe set within the canal and covered with fill to the existing railroad grade. The crossing would essentially be converted to an at-grade OTR crossing of the piped PBC.

The Modernization Alternative would have a physical and visual effect on the OTR, transforming these two short sections within the historic ROW from crossings to, visually, a simple continuation of the rail corridor.

An analysis of effect finds that while the Project as proposed would have an effect on a historic resource, the OTR, resulting in visual and physical modifications to these two 15-foot-long portions of the ROW, it would not impact any character-defining feature of the resources and would not, in any significant manner, impact the Criterion A significance of the linear district as defined. As a result, the modification of the OTR-PBC crossings would have an effect on the Oregon Trunk Railway Linear District, a resource determined eligible for listing in the NRHP, but that effect would not be adverse (see Appendix E.1). SHPO concurred (Case No. 24-1725; October 2, 2024) that the OTR-PBC crossings at NE Butler Market Road and at NE King Way are contributing structures to the NRHP-eligible Oregon Trunk Railway District. SHPO also concurred that the removal of these structures as part of piping the PBC would not adversely affect the district due to the overall scale of the district.

6.1.2.1.2 *Temporary Construction Impacts*

The Modernization Alternative would replace the existing open PBC within the Project Area with a pressurized, 10- to 11-foot-outer-diameter, closed-conduit pipeline system. Details on the construction methods and means within the open PBC are presented in Section 5.3.5. Construction

impacts to the railroad bridge components to be removed are presented in Section 6.13, Transportation.

6.1.2.2 Archaeological Resources

6.1.2.2.1 Long-Term Impacts

The Modernization Alternative is not anticipated to impact archaeological resources, with the exception that if the Old Deschutes Road Option is selected, additional shovel testing and evaluation for listing for one site would be necessary. If that resource was determined eligible for listing in the NRHP, and the Project could not avoid impacts to the site, Section 106 compliance would be required. All other modernization options would have no impact to archaeological resources.

6.1.2.2.2 Temporary Construction Impacts

If pre-contact or historic-period archaeological resources are encountered during construction, all ground-disturbing activity near the find(s) should be halted and SHPO promptly notified. If human remains are encountered in any of the excavations, all ground-disturbing activity in the vicinity of the find(s) should be halted immediately and the State Police, SHPO, the appropriate Indian tribes, and the Commission on Indian Services should be promptly notified pursuant to ORS 97.745(4). The area of the find(s) will be secured and protected from further disturbances until the State provides notice to proceed. All construction or laydown areas will be sited to avoid potentially or designated significant resources in Table 4-1.

6.2 Land Use

6.2.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, piping of the PBC would not occur and there would be no changes to land use within the Study Area.

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

Provisioning service, Water available for irrigation (Figure 4-1 [E1]): Under the No Action Alternative, there would be no effect on irrigation water because the amount of irrigation water diverted from the Deschutes River by COID would largely remain the same and no additional water would be passed to NUID.

6.2.2 Modernization Alternative

6.2.2.1 Long-Term Impacts

Under the Modernization Alternative, all piping would be within the existing canal bed. There would be no acquisitions or permanent changes to land use.

The existing canal would be relocated underground, and the canal would no longer be a visible, aboveground irrigation use. There would be a minor, long-term indirect effect on residences, businesses, and recreation resources that would no longer have a view of the existing canal. See Appendix F.6, Visual Resources Technical Report, for additional details.

*6.2.2.1.1 Deschutes County/North Bend Alternative Alignment Options**6.2.2.1.1.1 Pilot Butte Canal Alignment (Existing Canal Route)*

Under this piping option, all permanent impacts would be within the existing canal bed. There would be no acquisitions or permanent changes to land use outside of the existing canal bed.

The existing canal would be relocated underground, and the canal would no longer be a visible, aboveground irrigation use. A view of the existing canal is an amenity of many existing residences, businesses, and recreation areas; there would be a minor long-term effect on these land uses that would no longer have a view of the existing canal. See Appendix F.6, Visual Resources Technical Report, for additional details.

This piping option would install an underground pipe and remove the existing PBC in this segment, a historic resource listed on the NRHP and identified in the Deschutes County Comprehensive Plan Goal 5 Inventory. While the NRHP-listed portion of the canal would be removed, it would remain as open space once construction is completed. This would create a long-term moderate adverse effect on land use within the Study Area in this portion of the alignment.

6.2.2.1.1.2 NE 18th Street Option and Old Deschutes Road Alternative Alignment Option

Both options share one permanent property impact. A permanent, partial property acquisition of 0.4 acres would occur on a parcel owned by the City of Bend (Deschutes County Map Tax Lot Number 1712100000100, (Appendix F.10, Figures A-7 and A-8). The impacted parcel is currently vacant land, but it is within the Juniper Ridge Overlay Special Planned District.

There is no existing irrigation infrastructure in these areas, and all modernization improvements would be located underground at the conclusion of construction. There would be no permanent impact created by changes to visual or aesthetic features on land uses in these areas; however, permanent use restrictions would be in place within easements surrounding the pipeline.

Under both piping options, the existing PBC would remain in place but would be permanently dewatered. While the canal is currently dry outside of the irrigation season, this alternative would create a minor indirect long-term impact by removing water from the canal on a permanent basis. Removal of water in the canal would alter the land use of the existing alignment, as it would no longer be used for the conveyance of irrigation water and would alter the setting of residences in this portion of the alignment during irrigation season.

*6.2.2.1.2 City of Redmond Alternative Alignment Options**6.2.2.1.2.1 Pilot Butte Canal Alignment (Existing Canal Route)*

Under this piping option, all permanent impacts would be within the existing canal bed. There would be no acquisitions or permanent changes to land use outside of the existing canal bed.

The existing canal would be relocated underground, and the canal would no longer be a visible, aboveground irrigation use. There would be a minor long-term indirect effect on residences, businesses, and recreation resources that would no longer have a view of the existing canal. See Appendix F.6, Visual Resources Technical Report, for additional information.

This piping option would remove the existing PBC in this segment, a historic resource listed on the NRHP. While the NRHP-listed portion of the canal would be removed, it would remain as open

space once construction is completed. This would create a long-term moderate adverse effect on land use in the Study Area within this portion of the alignment.

6.2.2.1.2.2 Piping to the East in the Watermaster's Access Road

Under this piping option, there would be permanent impacts to 14 parcels, including both City of Redmond land and privately owned properties. These impacts would extend outside of existing COID easements and total 0.7 acres. Land uses on impacted parcels include medical office, senior living, commercial, and residential uses. There would not be any displacements of residents, businesses, parking, or access, and no impacts to structures are anticipated.

Under this piping option, the existing PBC would remain in place but would be permanently dewatered. While the canal is currently dry outside of the irrigation season, this alternative would create a minor long-term indirect impact by removing water from the canal on a permanent basis, altering the visual character of residences, businesses, and recreation resources in this portion of the alignment during irrigation season.

6.2.2.1.2.3 Piping to the West within Northwest Canal Boulevard

Under this piping option, there would be no permanent impacts and there would not be any displacements of residents or businesses.

Under this piping option, the existing PBC would remain in place but would be permanently dewatered. While the canal is currently dry outside of the irrigation season, this alternative would create a minor long-term indirect impact by removing water from the canal on a permanent basis, altering the visual character of residences, businesses, and recreation resources in this portion of the alignment during irrigation season.

6.2.2.2 Temporary Construction Impacts

For all alternatives and options, excluding the No Action Alternative, construction activities and equipment would create short-term visual, noise, and vibration impacts to land uses surrounding the PBC alignment. For more information, see Appendix F.6, Visual Resources Technical Report, and Appendix F.9, Noise and Vibration Technical Report. Road closures and traffic detours would occur where construction activities take place in areas where the PBC crosses road ROW or where piping would be installed in road ROW. For more information, see Appendix F.11, Transportation Technical Report.

6.2.2.2.1 *Modernization Alternative (Full Piping)*

Under the Modernization Alternative, there would be temporary construction easements (TCEs) required for 284 properties, totaling 163 acres. This includes impacts to 253 private properties, 7 City of Bend properties, 11 City of Redmond properties, 5 Deschutes County properties, 2 NUID properties, 1 ODOT property, 1 Oregon Parks and Recreation Department property, and 4 federal properties. Impacted land uses include commercial, industrial, residential, agriculture, recreation, and open space. Access to and use of these portions of these properties may be limited during construction activities. No impacts to structures are anticipated.

Noise, vibration, and dust generated during construction activities, especially blasting, may impact sensitive land uses such as residential developments and health care facilities. See Appendix F.9, Noise and Vibration Technical Report, for additional information. The exact locations of the blasting activities would be determined with additional geotechnical investigations.

Preliminary geotechnical investigations in the northern portion of the alignment (King Way Project Group) have been evaluated during design. In order to reach approximately 15 feet of depth below existing grade for the pipe trench, the bottom 2 to 10 feet of the pipe trench would require blasting. The variation is due to different geologic conditions as the alignment progresses from south to north in the King Way Project Group. Although detailed geological investigations have not been completed along the entire alignment, it is anticipated that similar ground conditions would be encountered through the entirety of the alignment.

6.2.2.2.2 *Deschutes County/North Bend Option*

6.2.2.2.2.1 Pilot Butte Canal Option

Under this piping option, TCEs would be required for 75 properties, totaling 19.3 acres. All impacted properties are privately owned. Impacted land uses are primarily single-family residential.

6.2.2.2.2.2 NE 18th Street Option

Under this piping option, TCEs would be required for 75 properties, totaling 19.3 acres. Impacted properties include 72 private properties, 1 Bend School District Property, and 2 City of Bend properties. Impacted land uses are single-family residential, parks and recreation, school, and commercial.

6.2.2.2.2.3 Old Deschutes Road Option

Under this piping option, TCEs would be required for 54 properties, totaling 17.8 acres. Impacted properties include 50 private properties and 4 City of Bend properties. Impacted land uses are primarily single-family residential.

6.2.2.2.3 *City of Redmond Option*

6.2.2.2.3.1 Pilot Butte Canal Alignment (Existing Canal Route)

Under this piping option, TCEs would be required for 16 properties, totaling 4.5 acres. Impacted properties include 12 private properties, 1 State of Oregon property, and 3 City of Redmond properties. Land uses on impacted parcels include medical office, senior living, commercial, recreation, and residential uses.

6.2.2.2.3.2 Piping to the East in the Watermaster's Access Road

Under this piping option, TCEs would be required for 16 properties, totaling 10.5 acres. Impacted properties include 12 private properties, 1 State of Oregon property, and 3 City of Redmond properties. Land uses on impacted parcels include medical office, senior living, commercial, recreation, and residential uses.

6.2.2.2.3.3 Piping to the West within Northwest Canal Boulevard

Under this piping option, TCEs would be required for 47 properties, totaling 7.9 acres. Impacted properties include 41 private properties, 1 State of Oregon property, 2 Central Oregon Electrical Co-Op properties, and 3 City of Redmond properties. Land uses on impacted parcels include hospital and medical offices, senior living, commercial, recreation, and residential uses.

6.2.3 Ecosystem Services

Provisioning service, Water available for irrigation (Figure 4-1, [E1]): Ecosystem services of water for irrigation would be supported through the improvement of delivery infrastructure. The amount of additional water available to be passed to North Unit depends on the alternative alignment option. See the NED in Appendix D for further information.

6.3 Parks and Recreation

6.3.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, there would be no conversion of park and recreation facilities to another use, and there would be no changes in access to park and recreation facilities.

6.3.2 Modernization Alternative

6.3.2.1 Long-Term Impacts

6.3.2.1.1 Modernization Alternative (Full Piping)

Piping under the Modernization Alternative would remove the existing open canal that runs through or adjacent to several parks and recreation facilities in the Study Area.

Long-term negligible impacts to views of the canal from within parks would occur at River Park, Canal Row Park, and the Redmond-Bend Juniper State Scenic Corridor. In these parks or recreation facilities, the canal is either not a prominent feature of existing views or there is little public access to the views from the facility.

A long-term minor impact to the view of the canal from the golf course at The Greens at Redmond would occur under the Modernization Alternative, as the canal is currently advertised as a scenic amenity of the golf course and removal of the canal as a visual resource and seasonal water feature would alter the appearance of the scenic amenity. The golf course features other vegetation, landscaping, and water features that add visual interest to the course that does not rely on the existing canal.

A long-term moderate impact to the Yew Avenue Nature Trail is anticipated because piping of the canal would alter the setting of the trail by removing the canal as a visual resource and seasonal water feature and a primary feature of the trail is its location immediately adjacent to the canal. There is little vegetation, and there are no other prominent visual features along the trail's alignment.

6.3.2.1.2 Deschutes County/North Bend Alternative Alignment Options

6.3.2.1.2.1 Pilot Butte Canal Alignment (Existing Canal Route)

A long-term moderate impact to the visual and aesthetic features of the Lava Ridges Natural Area would occur because piping would remove and fill in the open canal running adjacent to the natural area and the entirety of the 1-mile informal trail along this portion of the alignment. The primary feature of the trail is its location immediately adjacent to the canal.

6.3.2.1.2.2 NE 18th Street Alternative Alignment Option

A long-term minor impact on the Lava Ridges Natural Area would occur by removing water from the canal on a permanent basis, altering the setting of the trail and natural area. Under the NE 18th Street alternative alignment option, the historic section of the existing PBC would remain in its current state in this portion of its alignment, but it would no longer receive irrigation water from COID facilities.

No long-term impacts are anticipated for Rock Ridge Park, Sky View Middle School, and Lava Ridge Elementary School. The NE 18th Street alternative alignment option would realign this section of the PBC, with irrigation water being carried through a buried pipeline within NE 18th Street, adjacent to these facilities. As the pipe would be located underground, it would not have long-term noise, visual, access, or other impacts to these park and recreation resources.

6.3.2.1.2.3 Old Deschutes Road Alternative Alignment Option

A long-term minor impact to the Lava Ridges Natural Area would occur by removing water from the canal on a permanent basis, altering the setting of the trail and natural area. Under the Old Deschutes Road alternative alignment option, the existing PBC would remain in its current state in this portion of its alignment, but it would no longer receive irrigation water from COID facilities.

No long-term impacts are anticipated for Ponderosa Elementary School. The Old Deschutes Road alternative alignment option would realign this section of the PBC through a buried pipeline across Purcell Street from Ponderosa Elementary School. As the pipe would be located underground, it would not have long-term noise, visual, access, or other impacts to the school's recreation resources.

6.3.2.1.3 City of Redmond Alternative Alignment Options

6.3.2.1.3.1 Pilot Butte Canal Alignment (Existing Canal Route)

A long-term minor impact to Homestead Park is anticipated from piping within the existing PBC alignment. Piping would remove a visual and aesthetic feature of the park. However, the main feature of the park, the bicycle pump track, would remain as is.

A long-term moderate impact to Homestead Canal Trail is anticipated from piping within the existing PBC alignment. Piping would remove the primary visual and aesthetic feature of the trail, as there is little vegetation or landscaping to provide visual or aesthetic interest along the alignment.

6.3.2.1.3.2 Piping to the East in the Watermaster's Access Road or Piping to the West within Northwest Canal Boulevard

A long-term minor impact to Homestead Park and to Homestead Canal Trail is anticipated from either piping to the east in Watermaster's Access Road or piping to the west within NW Canal Boulevard. While the canal structure would remain as is, piping the PBC would permanently dewater the canal, removing a visual and aesthetic feature of the facilities.

6.3.2.2 Temporary Construction Impacts

6.3.2.2.1 Modernization Alternative (Full Piping)

For the Modernization Alternative and all piping options, construction activities would include vegetation clearing, trenching, equipment mobilizing and staging, and backfill of trenches after pipe installation. Blasting may be required in areas of shallow bedrock. Vegetation clearing would be

minimized to the extent practicable, and reseeded would be completed after construction. Tree removal would be avoided as much as possible and would only occur in instances when there is no other alternative to access the construction site or if the tree poses a safety threat to construction crews or property.

No physical impacts to Riverview Park and Canal Row Park are anticipated; however, construction activities would cause visual and noise impacts to these facilities.

Physical impacts from construction are anticipated to occur within portions of the Redmond-Bend Juniper State Scenic Corridor; however, no usage impacts are anticipated. Other construction impacts in the area would include visual and noise impacts from construction activities and equipment; however, there are currently no developed trails or other recreation facilities within the parcels that make up the corridor.

Physical impacts from construction and potential usage closures are anticipated to occur within portions of The Greens at Redmond golf course and the Yew Avenue Nature Trail. Portions of the landscaping at Hole 1 and Hole 11 could be directly impacted, and portions of the course could need to be closed during construction. The Yew Avenue Trail alignment is within the 50-foot PBC easement, and the trail would be disturbed and would be closed during construction. The trail surface and access would be restored after completion of construction. Other construction impacts to the natural area would include visual and noise impacts from construction activities and equipment.

6.3.2.2.2 Deschutes County/North Bend Alternative Alignment Options

6.3.2.2.2.1 Pilot Butte Canal Alignment (Existing Canal Route)

Physical impacts from construction and potential usage closures are anticipated to occur within portions of the Lava Ridges Natural Area and trail. The trail alignment is within the 50-foot PBC easement, and the trail would be disturbed and would be closed during construction. The trail surface and access would be restored after the completion of construction. Other construction impacts to the natural area would include visual and noise impacts from construction activities and equipment.

6.3.2.2.2.2 NE 18th Street Alternative Alignment Option

Physical impacts from construction and potential usage disruptions are anticipated to occur to Rock Ridge Park, Sky View Middle School, and Lava Ridge Elementary School. Portions of the eastern edge of the park and school sports fields, including several trees, are located within the 50-foot construction buffer and may be impacted during construction. Other construction impacts would include visual and noise impacts from construction activities and equipment.

Access to the park and school from NE 18th Street would be closed during construction. One parking lot at the school along NE 18th Street would be completely inaccessible during construction activities. This closure would primarily impact access to the baseball field at the northeast corner of the property. Due to the need to complete construction during the nonirrigation season, construction activities would likely occur during the school year. COID could coordinate with the school district to determine how to minimize impacts to students and school staff.

6.3.2.2.2.3 Old Deschutes Road Alternative Alignment Option

No physical impacts to Ponderosa Elementary School are anticipated; however, visual and noise impacts from construction activities and equipment are anticipated. Access to the park and school from Yeoman Road to the west would be removed during construction. Access from Yeoman Road to the east and from Purcell Boulevard would not be impacted during construction.

6.3.2.2.3 *City of Redmond Alternative Alignment Options*

6.3.2.2.3.1 Pilot Butte Canal Alignment (Existing Canal Route)

No physical impacts to Homestead Park are anticipated, but access to the park from NW Canal Boulevard would be closed during construction of this segment of the Project. There are no other vehicle access points to the park, and the park may need to be closed for the duration of construction, especially if the Homestead Canal Trail is closed as well. Other construction impacts to the park would include visual and noise impacts from construction activities and equipment.

Physical impacts from construction and usage closures of Homestead Canal Trail are anticipated. Portions of the trail alignment are within the 50-foot PBC easement and would be directly impacted, requiring closure during construction activities. The trail surface and access would be restored after the completion of construction. Other construction impacts to the trail would include visual and noise impacts from construction activities and equipment.

6.3.2.2.3.2 Piping to the East in the Watermaster's Access Road

No physical impacts to Homestead Park are anticipated, but access to the park from NW Canal Boulevard would be closed during construction. There are no other vehicle access points to the park, and it could be necessary to close the park for the duration of construction, especially if the Homestead Canal Trail is closed as well. Other construction impacts to the park would include visual and noise impacts from construction activities and equipment.

Physical impacts from construction and usage closures of Homestead Canal Trail are anticipated. The trail surface and access would be restored after the completion of construction. Other construction impacts to the trail would include visual and noise impacts from construction activities and equipment.

6.3.2.2.3.3 Piping to the West within Northwest Canal Boulevard

No physical impacts to Homestead Park or Homestead Canal Trail are anticipated, but access to the park and trail from NW Canal Boulevard would be closed during construction of this segment of the Project. There are no other vehicle access points to the park, and it could be necessary to close the park for the duration of construction. Visual and noise impacts from the close proximity of construction activities and equipment would occur.

6.4 Public Safety

6.4.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, the PBC would remain open and there would be no effect on public safety; risks for drowning and open canal-related accidents would remain. Wildfire risk would remain the same. Flooding risk is expected to increase as the canal infrastructure continues to age.

6.4.2 Modernization Alternative**6.4.2.1 Long-Term Impacts**

Once fully completed, the Modernization Alternative would eliminate the risks for drowning and open canal-related accidents in segments of the Project Area where the currently open PBC would be converted to buried pipe. The Modernization Alternative would, therefore, result in long-term beneficial effects on public safety because drowning and other open canal-related accidents would no longer be possible in the Project Area. The risk of flooding would be substantially diminished.

The effects of the Project as it relates to wildfire are expected to be similar to the other piping projects that have been completed in the area. The Deschutes County Rural Fire District #2 has previously indicated that removal of the canal would not create an additional burden on its ability to fight fire and would not increase wildfire risk (NRCS 2021b). After piping the canal, it would no longer be available as a source of water for fighting fires, but fire hydrants, cisterns, ponds, and other open canals in the area would remain available as water sources. Because this Project would have no effect on the ability to fight fires, the proposed Project would have no effect on public safety as it relates to wildfire.

*6.4.2.1.1 Deschutes County/North Bend Alternative Alignment Options***6.4.2.1.1.1 Pilot Butte Canal Alignment (Existing Canal Route)**

This option would eliminate the risks for drowning and open canal-related accidents from the open PBC in this segment of the alignment because it would be converted to buried pipe. It would result in long-term beneficial effects on public safety because drowning and other open canal-related accidents would no longer be possible in this segment of the alignment. Wildfire risk would remain the same.

6.4.2.1.1.2 NE 18th Street Alternative Alignment Option and Old Deschutes Road Alternative Alignment Option

These options would eliminate the drowning risk from the open PBC in this segment of the alignment because it would be permanently dewatered. The canal would remain open and may still create a public safety risk of falling into the dry canal bed or of motor vehicle accidents. It would result in long-term beneficial effects on public safety because drowning would no longer be possible in this segment of the alignment. Wildfire risk would remain the same.

*6.4.2.1.2 City of Redmond Alternative Alignment Options***6.4.2.1.2.1 Pilot Butte Canal Alignment (Existing Canal Route)**

This option would eliminate the risks for drowning and open canal-related accidents from the open PBC in this segment of the alignment because it would be converted to buried pipe. It would result in long-term beneficial effects on public safety because drowning and other open canal-related accidents would no longer be possible in this segment of the alignment. Wildfire risk would remain the same. The risk of flooding would be substantially diminished.

6.4.2.1.2.2 Piping to the East in the Watermaster’s Access Road and Piping to the West within Northwest Canal Boulevard

These options would eliminate the drowning risk from the open PBC in this segment of the alignment because it would be permanently dewatered. The canal would remain open and could still create a risk for falling or motor vehicle accidents. It would result in long-term beneficial effects on public safety because drowning would no longer be possible in this segment of the alignment. Wildfire risk would remain the same. The risk of flooding would be substantially diminished.

6.4.2.2 Temporary Construction Impacts

During construction associated with the Piping Alternative and all Deschutes County/North Bend and City of Redmond Alternative Alignment Options, public safety would be affected by vehicle and heavy equipment traffic entering and leaving the Project Area. Construction traffic could interact with motor vehicles, pedestrians, and bicyclists traveling through urban, suburban, and rural areas along county and community roads that intersect the Project Area. Blasting activities pose a risk to public safety, as there is the potential for flying debris to cause injury and/or damage structures or utilities.

Construction would take place during the nonirrigation season when wildfire risk is low. Additionally, burn bans or other restrictions based on wildfire hazard potential would be followed as appropriate.

Standard safety protocols and best management practices (BMPs) would be followed during construction to minimize risk to public safety; therefore, a short-term minor effect on public safety is anticipated during construction because effects on public safety would be minimized by BMPs and would be limited to within the Project Area.

6.5 Neighborhoods and Socioeconomic Resources

The neighborhoods analysis addressed how the Project would directly or indirectly affect neighborhoods, community gathering spaces, social interactions, and community cohesion, while the socioeconomics analysis addressed local and regional demographics and economic trends.

6.5.1 Community Resources

6.5.1.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, there would be no conversion of community resources to another use. There would be no changes in access to neighborhoods, community facilities, parks, social service providers, and libraries.

6.5.1.2 Modernization Alternative (Full Piping)

6.5.1.2.1 Long-Term Impacts

Negligible to minor long-term impacts for the Boyd Acres, Orchard District, and Mountain View neighborhoods are anticipated from piping the canal under the Modernization Alternative. Although piping the canal would remove the seasonal open water for some abutting properties and adjacent parks (see Section 6.3, Parks and Recreation), overall neighborhood characteristics and cohesion

would not be impacted. Other community resources would also not be affected by the Modernization Alternative.

Piping the canal could provide an increase in neighborhood safety by removing the canal and seasonal fast-flowing open water. See Section 6.4, Public Safety, for additional information.

The Modernization Alternative would not have a long-term effect on vehicle, pedestrian, or cyclist access to neighborhoods or other community resources. See Section 6.13, Transportation, for additional information.

6.5.1.2.1.1 Deschutes County/North Bend Alternative Alignment Options

Pilot Butte Canal Alignment (Existing Canal Route)

A long-term negligible to minor impact by altering the views from adjacent properties and parks is anticipated from piping the existing alignment and removing the canal as a visual feature. See Section 6.8, Visual Resources, for additional information. The remaining community resources would not experience long-term impacts from piping the PBC alignment.

NE 18th Street Alternative Alignment Option

A long-term negligible impact on the adjacent neighborhoods and parks abutting the canal is anticipated by altering the irrigation-season view and aesthetic qualities of the canal. The new pipe would be placed underground within the existing NE 18th Street road prism, and the road would be reconstructed. Water would be removed from the canal, and it would be permanently dry, mimicking the nonirrigation season conditions year-round. Other community resources would not experience long-term impacts from this option.

Old Deschutes Road Alternative Alignment Option

A long-term negligible impact on the adjacent neighborhoods and parks abutting the canal is anticipated by altering the irrigation-season view and aesthetic qualities of the canal. Similar to the NE 18th Street Option, this option would abandon the existing canal in place, and the canal would no longer receive irrigation water from the COID system. The new pipe would be placed underground and backfilled.

6.5.1.2.1.2 City of Redmond Alternative Alignment Options

Pilot Butte Canal Alignment (Existing Canal Route)

A long-term negligible to minor impact by altering the views from adjacent properties and Homestead Park Pump Track is anticipated from piping the existing alignment and removing the canal as a visual feature. There would be no long-term impacts on accessing neighborhoods or other community resources.

Piping to the East in the Watermaster's Access Road

Long-term negligible to minor impacts on the adjacent properties and the park are anticipated by altering the irrigation-season view and aesthetic qualities of the canal. The seasonal water would be permanently removed and diverted to the new pipe located to the east. There would be no long-term impacts on accessing neighborhoods or other community resources.

Piping to the West within Northwest Canal Boulevard

Long-term negligible to minor impacts on the adjacent properties and the park are anticipated by altering the irrigation-season view and aesthetic qualities of the canal. The seasonal water would be permanently removed and diverted to the new pipe located to the west. There would be no long-term impacts on accessing neighborhoods or other community resources.

*6.5.1.2.2 Temporary Construction Impacts**6.5.1.2.2.1 Modernization Alternative (Full Piping)*

The Modernization Alternative would require blasting, excavating materials, mobilizing and staging construction equipment, removing vegetation before construction, backfilling, and restoring and reseeding disturbed areas. Trees would only be removed if there were no other way to access the construction site or if there would be a safety threat to construction crews.

Adjacent neighborhoods would experience moderate temporary impacts from construction activities. The impacts could include visual, noise, vibration, and dust. Impacts from construction could temporarily affect access to neighborhoods and adjacent community resources. Construction impacts could temporarily disrupt pedestrian and cycling routes along roadways and bridges. See Section 6.13, Transportation, for more information on temporary impacts.

*6.5.1.2.2.2 Deschutes County/North Bend Alternative Alignment Options**Pilot Butte Canal Alignment*

Temporary impacts from this option would be similar to the construction impacts from the Modernization Alternative. There would be fewer impacts to nearby schools and parks, compared to the NE 18th Street Alternative Alignment Option. This option would also require installing a pressure-reducing station prior to where flow enters the existing hydroelectric facility.

NE 18th Street Alternative Alignment Option

This option would have the highest temporary impacts to sensitive neighborhood and community resources for the route options in the North Bend area. Noise and vibration impacts could affect two schools (Lava Ridge Elementary and Sky View Middle) and Rockridge Community Park as this option would require the complete reconstruction of NE 18th Street. Roadway and traffic impacts would temporarily affect neighborhood access and pedestrian and bicyclist routes. See Section 6.13, Transportation, for a complete discussion of temporary construction impacts for this option.

Old Deschutes Road Alternative Alignment Option

This option would have fewer impacts to community resources compared to the NE 18th Street Option; however, there would be roadway reconstruction that would impact neighborhood access and pedestrian and bicyclist routes. See Section 6.13, Transportation, for a complete discussion of temporary construction impacts for this option.

*6.5.1.2.2.3 City of Redmond Alternative Alignment Options**Pilot Butte Canal Alignment (Existing Canal Route)*

Piping construction in the existing canal route would require closing the existing bridge during construction, impacting pedestrian and bicyclist access to properties east of the canal and the highway. Access to Homestead Park, the Homestead Canal Trail, the Redmond Athletic Club

(located just east of Walmart), and the Country Side Living memory care facility would also be disrupted during construction.

Piping to the East in the Watermaster's Access Road

This option would affect multiple bridge crossings, creating access closures due to construction. Access to the Redmond Athletic Club and the Country Side Living memory care facility would be temporarily disrupted. There would be construction-related noise, visual, dust, and vibration impacts to adjacent neighborhoods, parks, and trails.

Piping to the West within Northwest Canal Boulevard

This option would require the complete reconstruction of NW Canal Boulevard creating construction-related noise, visual, dust, and vibration impacts to adjacent neighborhoods, parks, and trails. This would have the highest impact to sensitive neighborhood and community resources for the route options considered for the City of Redmond and would create the greatest temporary traffic disruptions to NW Canal Boulevard. See Section 6.13, Transportation, for a complete discussion of temporary construction impacts for this option.

6.5.2 Socioeconomics

6.5.2.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, COID-allocated agricultural water would not be conserved which would affect stored water levels in Wickiup Reservoir as presented in Section 6.9.1.

6.5.2.1.1 Population and Agriculture-Dependent Economic Communities

No physical environmental impacts are expected from the No Action Alternative; therefore, no physical environmental impacts on populations would occur. However, community effects may result from changes in economic opportunity or local government fiscal stability.

Under the No Action Alternative, farm employment and income are projected to decrease which would adversely affect low-income farm workers appreciably more than the general population.

Further, under the No Action Alternative, agricultural land value and associated agricultural property taxes and government fiscal stability may decline in Jefferson County. The No Action Alternative thus is expected to have an adverse impact on Jefferson County government services and the agriculture-dependent communities that they serve.

6.5.2.1.2 Agricultural Production

Under the No Action Alternative, reduced water supplies in NUID are expected to result in reduced agricultural production and fallowing in all but wet years. Reduced agricultural production is expected to result in reduced agricultural income and employment, which would have ripple effects in other economic sectors in Jefferson and Deschutes Counties. The analysis of agricultural economic impacts is described in detail in Appendix D, National Economic Development Analysis.

6.5.2.1.3 Area Employment and Income

To the extent that decreased farm employment leads to farm workers or proprietors relocating outside of the Study Area or not finding long-term alternative employment, the contraction in the local economy affecting employment and income would have a long-term impact.

6.5.2.1.4 Agricultural Property Values

Irrigated farmland has more value than dryland farmland, so under the No Action Alternative farmland values would likely fall in proportion to the decrease in income-generating potential from producing crops with irrigation water, barring conversion of the land for other uses.

6.5.2.1.5 Residential Property Values

No effects on residential property values are expected related to aesthetic features or neighborhoods, as these features would not change under the No Action Alternative. However, there may be adverse effects on property values related to continued and increased flood risk under No Action Alternative.

6.5.2.1.6 Government Fiscal Stability

Under the No Action Alternative relative to baseline or historical conditions, agricultural production value is expected to decrease in Jefferson County leading to a potential decrease in annual property taxes.

*6.5.2.2 Modernization Alternative (Full Piping)**6.5.2.2.1 Long-Term Impacts**6.5.2.2.1.1 Population and Agriculture-Dependent Economic Communities*

No physical environmental impacts would result from the Modernization Alternative; therefore, no physical environmental impacts on agriculture-dependent economic communities would occur. However, effects could result from changes in economic opportunity or local government fiscal stability.

Relative to the No Action Alternative, under the Modernization Alternative farm employment and income could increase which would beneficially affect agriculture-dependent economic communities appreciably more than the general population.

Further, the Modernization Alternative would support agricultural land value and associated agricultural property taxes and government fiscal stability. The Modernization Alternative would have a beneficial effect on government services, which could benefit agriculture-dependent economic communities along with other communities.

6.5.2.2.1.2 Agricultural Production

The Modernization Alternative would help sustain the historical level of agricultural production in NUID and Jefferson County and avoid the adverse agricultural and economic impacts described for the No Action Alternative. The estimated employment and income effect (direct, indirect, and induced) of the proposed action compared to the No Action Alternative would mean that the Jefferson County economy would maintain approximately 150 jobs (up to approximately 1.5 percent of county employment) and \$20.31 million in labor income due to avoiding a long-term reduction in the availability of irrigation water and the associated reduction in farm production (see Appendix D).

6.5.2.2.1.3 Area Employment and Income

All NUID farm proprietors and farm workers would be more likely to benefit from more reliable irrigation water supplies and associated greater income and employment opportunities compared to

the No Action Alternative. Greater income enhances the long-term viability of farms, as farm operators are better able to meet loan repayment obligations on farm equipment, land and other capital, and operating expenses. Increased farm employment opportunities and farm incomes would beneficially impact farm workers, who often have low incomes; this increase would support an economically vulnerable population.

6.5.2.2.1.4 Agricultural Property Values

By providing conserved irrigation water for agricultural production in NUID, the Modernization Alternative would support higher long-term agricultural property values in NUID than under the No Action Alternative. Potential reductions in property values under the No Action Alternative would be less likely to occur under the Modernization Alternative. Under the Modernization Alternative, future agricultural property values in NUID are expected to be consistent with historical trends in NUID agricultural land value. For agricultural lands in COID, property values could slightly increase due to O&M cost savings and provision of pressurized water due to piping (see the National Economic Development Analysis in Appendix D); this impact is expected to be minor.

6.5.2.2.1.5 Residential Property Values

There are approximately 182 residential parcels located adjacent to the PBC with a direct view of the canal in Bend, unincorporated areas of Deschutes County, and Redmond. There are an additional 14 parcels located near the canal but not adjacent to it (with indirect views of the canal) and 760 parcels located on elevated sites with possible territorial views of the canal. Under all route options, piping the canal would change the aesthetics and the view from these properties and it could affect property values.

Residential homes proximate to water features often have higher property values, reflecting the desirability and value held by homeowners for views of water or access to water. For example, one review of 25 economic studies that researched the impact of rivers, streams, and canals on nearby property values found that these water features increase property values in most cases (Nicholls and Crompton 2017). None of the studies in the review analyzed the property value effects of irrigation canals. Three studies that were part of the review focused on canals in the United States. However, these three studies were of boatable canals in urban settings in Texas and Florida. These canals are very different from seasonal irrigation canals such as the PBC. The three studies found that nearby canals increase residential property values by 10 to 30 percent (Nicholls and Crompton 2017).

More pertinent to this analysis, in 2022 NRCS conducted a study of residential properties close to the Arnold Main Canal and properties in other Central Oregon irrigational districts where an adjacent canal had been piped (NRCS 2022a). The study found that the properties adjacent to an open canal had a sales value 5 to 20 percent higher than properties not adjacent to an open canal (depending on the year and location of sale). The NRCS study also analyzed how property values in other Central Oregon irrigation districts changed after piping and concluded that the property value premium remained. This retention in value may be because once piping was completed, the land over the canal was converted to green space that may provide a similar value as the canal (see Appendix F.3 Neighborhoods and Socioeconomic Resources Technical Report for additional information). In other words, it is possible that any additional value in canal-adjacent properties reflects the value of open space or green space, with value similar regardless of whether the open space has a canal or other types of landscape. Properties adjacent to Central Oregon canals have a backyard next to open space, potentially providing increased privacy and a general sense of being in a less-developed area. Properties not adjacent to the canal often have roads or other properties

abutting their backyards, which may be less desirable. It may be that adjacency to open space, rather than to an irrigation canal, is the driver of price premium on properties adjacent to Central Oregon canals such as the PBC.

In sum, it is not clear if residential property values would be affected by piping the PBC. The value of some properties, particularly those immediately adjacent to the canal with direct views of the canal, could potentially decline. For these properties in particular, the canal could act as an aesthetic amenity with a positive economic value that increases property value. However, several factors could offset potential declines in value associated with the Project. First, the canal would be replaced by revegetated green space, which could provide an aesthetic amenity and value. Second, some property owners or potential property buyers may not desire a canal adjacent to their property (and would potentially value such a property less) because of the safety hazard posed by an open canal. Third, as noted above there is a risk of canal failure and potential flooding to nearby properties (see the National Economic Development Analysis in Appendix D). The risk of flooding may depress property values of parcels that are adjacent to the canal, particularly as the canal ages and the risk of such failures increases. In sum, while some individual homeowners and property values may be adversely impacted due to the change in aesthetic amenities, overall, across the Study Area no significant impact on property values from the Modernization Alternative would be expected.

6.5.2.2.1.6 Government Fiscal Stability

Property taxes that support local government revenues are based on assessed value of property; if property values change, there is the potential for local government revenues to change. As described above, there would be little to no change in residential property values (and hence, taxes) at the city and county level under the Modernization Alternative. However, long-term agricultural property value and associated taxes in NUID under the Modernization Alternative would be higher than (but consistent with what would be expected under historical trends) under the No Action Alternative.

The Modernization Alternative would maintain irrigation water access on already irrigated lands, and it would offset reductions in irrigation water availability that would otherwise occur in the No Action Alternative due to changes in water management with the DBHCP. As such, under the Modernization Alternative all else equal, agricultural property taxes would be maintained at or near historical levels, and Jefferson County would avoid the potential decrease in property taxes estimated under the No Action Alternative. This is a beneficial effect on local government fiscal stability relative to the No Action Alternative.

6.5.3 Temporary Construction Impacts

6.5.3.1.1.1 Modernization Alternative (Full Piping)

In addition to the effects on noise, aesthetics, and transportation noted in Section 6.5.1.2.2, the primary socioeconomic effect during the construction period would be to increase employment and income opportunities in construction and related sectors. The Project is expected to be constructed in six project groups that would be constructed in pairs with each pair taking 1 year to complete, such that the six groups constructed across a total of 3 years (see Table 5-1). Construction-related impacts on socioeconomics would be limited to short-term effects on economic opportunity due to the boost in spending in the construction sector and the ripple effects on employment and income across the Study Area economy due to the influx of federal funds. As construction in each segment is expected to last one year, effects on individual neighborhoods would be limited to this time period and there would be no long-term effects on property values or associated property

taxes/government revenues. To the extent that construction workers are from agriculture-dependent economic communities, there may be beneficial effects on the economic opportunity to these communities during the 3-year construction time period.

Over the course of the 3-year construction period, the Project is expected to support an average of approximately 960 to 1,150 jobs and provide \$5.87 million to \$6.34 million in annualized labor income (see Appendix F.3, Neighborhoods and Socioeconomic Resources Technical Report).

6.6 Geology, Soils, and Hazardous Materials

6.6.1 No Action Alternative (Future without Federal Investment)

6.6.1.1 Geology and Soils

Under the No Action Alternative, no disturbance of geologic materials underlying the Project Area would occur. Erosion would continue to occur within open canals, and sedimentation would continue, resulting in long-term minor effects on soils. Continued operation of COID's existing system would not be expected to measurably affect soils associated with prime farmlands.

6.6.1.2 Hazardous Materials

Under the No Action Alternative, no disturbance or remediation of known contaminated sites would occur as part of this Project. Any potential hazardous material releases occurring adjacent to or near the open canal could contaminate the soil of the canal as well as the water within the canal, and contaminants could migrate downstream.

6.6.2 Modernization Alternative

6.6.2.1 Long-Term Impacts

6.6.2.1.1 *Geology and Soils*

For the Modernization Alternative, the current canal would be removed and replaced with an underground pipe for the alternative alignment option that uses the existing canal. For alternative alignment options that use a new alignment, the current canal would be left in place in its current condition but with no water flowing. The pipe would be placed underground, within native bedrock material, and would be covered with engineered fill and completed with soil. The impacts would be the same regardless of the selected alternative alignment option.

Overall, the Modernization Alternative would have minor to minimal long-term effects on soils and geological resources. The impacts would be the same regardless of the selected alternative alignment option.

Trenching to install the underground piping would permanently remove areas of existing basaltic bedrock along the pipe alignment, resulting in long-term minor effects on geological resources. Long-term effects on soil would include reduced erosion and sedimentation where buried pipelines would replace open canals. Additionally, water saved through reduced evaporation and seepage would support irrigated agriculture on soils classified as prime farmland if irrigated and farmland of statewide importance.

6.6.2.1.2 *Hazardous Materials*

Under the Modernization Alternative and all alternative alignment options, there is potential for disturbance of up to four known medium-risk contaminated sites. These sites are described in Section 5.3.1 of the Geology, Soils and Hazardous Materials Technical Report (Appendix F.4). None of the sites would require ongoing cleanup or remediation in the long term. Because there would be no difference among the alternative alignment options in the number of sites potentially affected, the potential long-term impacts would be the same regardless of alternative alignment option.

6.6.2.2 *Temporary Construction Impacts*

6.6.2.2.1 *Geology and Soils*

Actions proposed under the Modernization Alternative would result in temporary impacts to soils, including soils classified as farmland of statewide importance and prime farmland if irrigated. During construction, soil would be disturbed, vegetation would be cleared, and excavation, backfilling, and grading would occur in the Project Area. Clearing, compaction, and other activities would increase the potential for soil erosion and sedimentation. Soils adjacent to canals, within temporary staging and storage areas, and along construction access roads would be affected.

To minimize effects to soils from temporary construction access, existing maintenance roads and access routes commonly used for O&M would be used when possible. BMPs would be implemented to minimize erosion and contain runoff on-site. These could include measures such as silt fencing, straw wattles, geotextile filters, and applying water to disturbed soils to prevent wind erosion.

Along most of the Project Area, short-term effects on soil resources would be minor because construction-phase BMPs would be implemented during excavation for the new pipe. After construction, the new pipe would be buried, and all disturbed areas would be recontoured and planted with a seed mix of native grasses and forbs in consultation with NRCS.

For the Modernization Alternative and all alternative alignment options, trenching would likely require removing bedrock through a combination of excavation (e.g., backhoe, rock hammers, or equivalent) and blasting. Blasting could potentially occur at any point along the pipe alignment. Once trenching is complete, a liner would be installed and gravel fill would be placed within the trench. Trucking would be required to remove excavated bedrock and to import gravel fill. Overall, temporary construction impacts to soils and geology would not be expected to differ among the alternative alignment options.

6.6.2.2.2 *Hazardous Materials*

Two of the four known contaminated sites referenced above pose a moderate risk for mobilization of contaminants or contaminant exposure during construction. These include the Redmond Chevron site at 2005 S Hwy 97 and the former Unocal Bulk Plant site at 260 NE Canal Boulevard. The Unocal Bulk Plant site received a No Further Action (NFA) determination from DEQ. If an NFA is received by the Redmond Chevron site from DEQ prior to construction, this site would be reevaluated and most likely considered a low-risk site. Because of the distance of the other known contaminated sites from the Project Area, project construction is not likely to encounter contaminated soil or groundwater from these sites. To avoid inadvertent mobilization of contaminants in the event that contaminated soil or groundwater is encountered during

construction, contaminated media management plans would be prepared for work occurring near areas of potential contamination. Contractors would be made aware of any institutional and engineering controls in place at any of the sites, and they would be instructed to avoid any project disturbances to these controls that could violate restrictions that are in place.

Construction could potentially disturb previously unknown contamination along the Project Area (undocumented storage tanks, asbestos-containing materials, lead-based paint) during excavation, earthwork, grading, and utility work. Adverse effects can result from mobilization of hazardous materials during construction if not correctly mitigated. Exposure is typically greatest during excavation work, demolition, or application of materials that contain hazardous substances. Effects from hazardous materials may cause a risk to worker safety, public health, and the environment; raise liability issues; increase project costs; and/or cause schedule delays. Additionally, construction activities, vehicles, materials, and equipment have the potential to release fuels, fluids, petroleum products or other contaminants into the environment during construction activities if these hazardous materials spilled or were handled improperly.

No high-risk hazardous materials sites have been identified in the Study Area based on the hazardous materials database reviews conducted as part of this analysis. Construction is therefore not likely to encounter large amounts of hazardous materials in soil or groundwater. To minimize the potential for inadvertent spills or releases of hazardous materials, contractors would implement construction-phase spill control plans and adhere to applicable regulations regarding hazardous material handling and spill response. Overall, short-term hazardous materials impacts are expected to be minimal.

6.7 Biological Resources

6.7.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, existing conditions would remain unchanged. If construction did not take place, there would be no additional impacts to vegetation, wildlife, aquatic species, or wetlands and waters beyond those resulting from existing water management under current conditions.

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

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

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

6.7.2 Modernization Alternative

6.7.2.1 Long-Term Impacts

Under the Modernization Alternative, piping the PBC would remove the influence of the existing open canal on vegetation, wildlife, aquatic species, and wetlands within the Study Area. The long-term impacts on biological resources from fully piping the PBC would be largely the same under all alternative alignment options. The long-term impacts of not modernizing the Deschutes County/North Bend and Redmond NRHP-listed segments would likewise not be appreciably different from those resulting from fully piping the PBC. The Biological Resources Technical Report (Appendix F.5) contains detailed discussion of the potential impacts of the individual alternative alignment options.

6.7.2.1.1 Vegetation

The Modernization Alternative would remove a source of hydrology for existing hydrophytic vegetation along portions of the canal. The Project Area would transition from an open canal with adjacent wetland plant species to a dry upland habitat characterized by upland plant species, similar to the vegetated habitats that existed prior to construction of the canal. While wetland vegetation currently present along the canal would be permanently lost, natural wetland habitat exists elsewhere in the Deschutes River system, and piping the PBC would not be expected to affect the population-level viability of native wetland plant species overall.

The Modernization Alternative would eliminate the potential for the open canal to provide a vector for noxious weeds in the Project Area to disperse to other areas of COID and NUID. After construction, disturbed areas adjacent to the canal would be restored to near-previous contours, and the area over the pipe would be graded to blend with the surrounding landscape. Disturbed areas, including those areas above the newly piped canal, would be recontoured with topsoil and vegetated with an NRCS-approved seed mix of grasses and forbs. Tree removal, where unavoidable, would be mitigated through on-site and in-kind replacement to the greatest extent feasible. Where permanent tree removal would be necessary due to potential pipe damage from tree roots, alternative mitigation approaches would be implemented in accordance with the respective Bend, Redmond, or Deschutes County tree protection code through coordination with the appropriate local jurisdiction. Revegetation of the corridor could require future monitoring and management. Overall, implementation of the Modernization Alternative would have a long-term minor effect on vegetation, because disturbance would occur over about 1 percent of COID and measures would be implemented to minimize effects on vegetation.

6.7.2.1.2 Wildlife

Over time, the Modernization Alternative could lead to long-term minor effects on wildlife. The removal of a seasonal water source could result in changes in the distribution patterns of wildlife on the landscape as they seek water sources elsewhere. The Modernization Alternative would potentially reduce human presence throughout the Project Area, as fewer trips to maintain the PBC and headgates would be necessary. This would result in lower potential for human-wildlife interactions and improve seclusion for wildlife. Piping the PBC would remove a barrier to movement of ungulates and other terrestrial wildlife and eliminate the potential risk of wildlife becoming trapped in the canal and drowning. Habitat fragmentation would be reduced, and small

animals would have greater habitat connectivity. Reseeding with an NRCS-approved seed mix of grasses and forbs would also create habitat benefits for some terrestrial wildlife species.

6.7.2.1.3 *Aquatic Species*

The COID irrigation diversions are screened, and COID's existing irrigation infrastructure does not provide passage or adequate habitat for fish (ODFW n.d.a). Therefore, implementation of the Modernization Alternative would have no effect on fish.

Implementation of the Modernization Alternative would result in a long-term, minor impact to some common aquatic and riparian species in the PBC such as western toad, Pacific treefrog, and long-toed salamander. These species would lose wetland habitat currently provided by the PBC. However, the existing habitat is low quality, available only when the canals carry water, and it is not considered critical to the long-term survival of these species.

Following completion of the Modernization Alternative, the water saved would be used to fulfill COID's and NUID's water rights during the irrigation season. This would not alter streamflow within the Deschutes River during the irrigation season. However, it would improve water delivery reliability for irrigators as the DBHCP is fully phased in and the requirements for compliance with its conservation measures constrain the overall availability of Deschutes River water for irrigation. During the first part of the first nonirrigation season following initiation of Project construction (i.e., October 20 – December 31, 2027), the Modernization Alternative would result in flows in the Deschutes River below Wickiup Reservoir that are higher than the minimum prescribed by the DBHCP. The first project group would complete construction in 2027 (year 7 of DBHCP implementation). The saved water from the Modernization Alternative would therefore be managed by NUID according to the DBHCP conservation measures' prescriptions for years 1 through 7. The volume of water saved under the Modernization Alternative and passed to NUID would be retained in Wickiup reservoir during the irrigation season and used to increase the amount of water released from Wickiup Reservoir during the nonirrigation season above the DBHCP year 1 through 7 minimum of 100 cfs. As of 2028 (year 8 of DBHCP implementation), the minimum amount of water allocated to winter release from Wickiup Reservoir will increase to 300 cfs, and the Modernization Alternative would not alter streamflow within the Deschutes River or otherwise affect water volume or flow within waterbodies affected by COID operations during any time of the year. The Modernization Alternative, by retaining saved water within Wickiup Reservoir later into the year and increasing winter flows above the minimum required release from Wickiup Reservoir for the first nonirrigation season following construction, would have a short-term beneficial effect on habitat for ESA-listed Oregon spotted frog habitat in Wickiup Reservoir and in the Deschutes River between Wickiup Reservoir and Bend. This beneficial effect would last from completion of the first project group in 2027 until the DBHCP year 8 increase in minimum flows in 2028. The beneficial effects would decrease as the flow within the Deschutes River continues to increase downstream due to tributary and spring contributions. Any increase in minimum flows below Wickiup Reservoir would be below the level of biological detection by ESA-listed bull trout and steelhead, because these species are not present above Big Falls, which is 32 river miles downstream from the COID diversion and 94 river miles downstream from Wickiup Reservoir. From 2028 on, the Modernization Alternative is not expected to have any beneficial or adverse effects on Oregon spotted frog or other ESA listed and non-listed aquatic species or their habitats.

6.7.2.1.4 Wetlands

While the canal is currently dry outside of the irrigation season, the implementation of the Modernization Alternative would permanently remove a seasonal source of water that serves the adjacent artificial fringe wetlands present along the canal. After completion of pipe installation, seepage losses would be eliminated, limiting the water available for hydrophytic vegetation that depends upon canal seepage for hydrology.

Because the wetlands along the canal receive hydrology directly from irrigation flows and seepage and are likely less than 1 acre, they are likely not jurisdictional. Additionally, these wetlands provide relatively low-quality wetland habitat, and the surrounding area is highly developed, disturbed, and fragmented by urbanization. Higher-quality, natural wetland habitats exist elsewhere in the Deschutes River system, and the elimination of existing fringe wetlands along the canal would not represent a significant loss of wetland habitat on a basinwide scale.

Implementation of the Modernization Alternative would remove the current source of hydrology for artificial wetlands and hydrophytic vegetation in the Project Area. However, it would not be expected to have effects on jurisdictional wetland resources and would have long-term minor effects on wetlands overall.

6.7.2.2 Temporary Construction Impacts

Under the Modernization Alternative and all alternative alignment options, construction activities would include vegetation clearing, trenching, equipment mobilization and staging, and backfilling of trenches after pipe installation. Blasting could potentially be required anywhere along the pipe alignment to allow for construction in areas of shallow bedrock.

Vegetation clearing would be minimized to the extent practicable, and reseedling would be completed after construction with an NRCS-approved seed mix of grasses and forbs. Tree removal would be avoided as much as possible and would only occur where no feasible alternative is available due to construction requirements, worker safety, or potential risk of damage to the pipeline.

Temporal habitat loss, disturbance from the presence of construction workers and equipment operations, and noise from blasting would affect wildlife in the short term. Blasting could result in minor to moderate adverse effects to raptors and eagles, as construction activities may overlap with their primary nesting season. Shockwaves and vibrations from blasting activities could cause physical damage to nearby nests, potentially dislodging them from trees or structures. Additionally, the disturbance caused by blasting could lead to abandonment of nests, leaving eggs or chicks vulnerable to predation or exposure. Blasting impacts would be minimized through the use of BMPs that are summarized in the Biological Resources Technical Report (Appendix F.5) and discussed in detail in the Noise and Vibration Technical Report (Appendix F.9).

No construction impacts to fish would be expected, as ODFW-compliant fish screens are in place at the Deschutes River point of diversion and prevent fish from entering the PBC system.

Construction impacts to aquatic species within the PBC would include loss of habitat, noise impacts from construction activities and equipment, and potential death or injury from construction activities. However, the current habitat is low quality, available only when the canal carries water, and is not considered critical to the long-term survival of these species.

Construction impacts to wetlands could include sedimentation from stormwater runoff and accidental fuel spills. Implementation of BMPs such as silt fencing would be used to minimize effects.

6.7.3 Ecosystem Services

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

Provisioning service, Fish populations (Figure 4-1, [E2]): Harvest of resident and anadromous fish would not be affected under the Modernization Alternative. There would be no biologically detectable change in streamflow during the first year of Project implementation and no change in streamflow beginning in the second year of Project implementation.

Cultural service, Culturally important species (Figure 4-1, [E4]): Implementation of the Modernization Alternative would not affect Confederated Tribes of Warm Springs goals including enhanced fishing, community, health, cultural identity, subsistence, and religious tribal values. The Modernization Alternative would support the goals of the DBHCP Biological Opinion for Oregon spotted frog.

6.8 Visual Resources

6.8.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, piping of the PBC would not occur, and there would be no changes in the visual appearance of the Study Area.

6.8.2 Modernization Alternative

6.8.2.1 Long-Term Impacts

The Modernization Alternative (full piping) would have a long-term moderate effect on visual resources. The visual change would most affect properties adjacent to the Project Area with direct or indirect views of the PBC. The Modernization Alternative would have lesser effects on those properties with a territorial view of the PBC from afar, as the PBC is only a small component of the total view from these properties. Piping of the PBC throughout the Project Area would result in visual impacts to 589 parcels with a direct view of the canal, 156 parcels with an indirect view of the canal, and 994 parcels with a territorial view of the canal.

Piping of the PBC would remove the open canal as a visual resource along its alignment in the Study Area. After construction, the pipe would be buried and it would not be visible. Areas adjacent to the canal would be restored to near-prior contours, and the area over the pipe would be graded to blend with the surrounding landscape. Disturbed areas, including those areas above the newly buried pipes, would be planted with a seed mix of native grasses and forbs in consultation with NRCS. The view of the Project Area would change from an open canal (with or without water depending on the season) to a corridor of native upland vegetation in areas where construction would take place. The maintenance road within the COID ROW would remain in place for COID access.

Mature trees would only be removed if they presented a safety risk to crews during construction, if access to the construction site was infeasible without tree removal, or if a tree's close proximity to the pipe posed a risk of damage to the pipe from ongoing root growth. Tree protection would be

installed during construction to assist construction crews in avoiding impacts to existing mature trees to the greatest extent feasible. Tree removal, where unavoidable, would be mitigated through on-site and in-kind replacement to the greatest extent feasible. Where permanent tree removal would be necessary due to potential pipe damage from tree roots, alternative mitigation approaches would be implemented in accordance with the respective Bend, Redmond, or Deschutes County tree protection code through coordination with the appropriate city or County jurisdiction.

6.8.2.1.1 Deschutes County/North Bend Alternative Alignment Options

6.8.2.1.1.1 Pilot Butte Canal Alignment (Existing Canal Route)

A long-term moderate impact to the visual and aesthetic features visible from properties with a direct or indirect view is anticipated with this option. The canal would be piped in its existing alignment removing and filling in the open canal running adjacent to the natural areas and residences along this portion of the alignment. There are 81 parcels with a direct view of the canal, and 1 parcel with an indirect view of the canal within this option area (Figure 6-1).

6.8.2.1.1.2 NE 18th Street Alternative Alignment Option

A long-term minor impact to the visual and aesthetic features visible from properties with a direct or indirect view of the PBC is anticipated with this option during the irrigation season. Under the NE 18th Street Option, the existing PBC would remain in its current physical state, but it would no longer receive irrigation water from COID facilities, altering the visual character of this portion of the canal during the irrigation season (Figure 6-1).

No long-term impacts are anticipated from locating an underground pipe beneath the existing NE 18th Street and Cooley Road roadways and the undeveloped area between the terminus of Cooley Road and the existing PBC, as the buried irrigation pipe would not be visible post construction.

6.8.2.1.1.3 Old Deschutes Road Alternative Alignment Option

A long-term minor impact to the visual and aesthetic features visible from properties with a direct or indirect view of the PBC is anticipated with this option during the irrigation season. Under the Old Deschutes Road Alternative Alignment Option, the existing PBC would remain in its current physical state, but it would no longer receive irrigation water from COID facilities, altering the visual character of this portion of the canal during irrigation season (Figure 6-1).

No long-term impacts are anticipated from locating an underground pipe beneath the existing Yeoman Road and Old Deschutes Road roadways, the unimproved portion of the Old Deschutes Road ROW, and the undeveloped area between Cooley Road and the existing PBC, as the buried irrigation pipe would not be visible post construction.

Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project
Draft Watershed Plan–Environmental Impact Statement

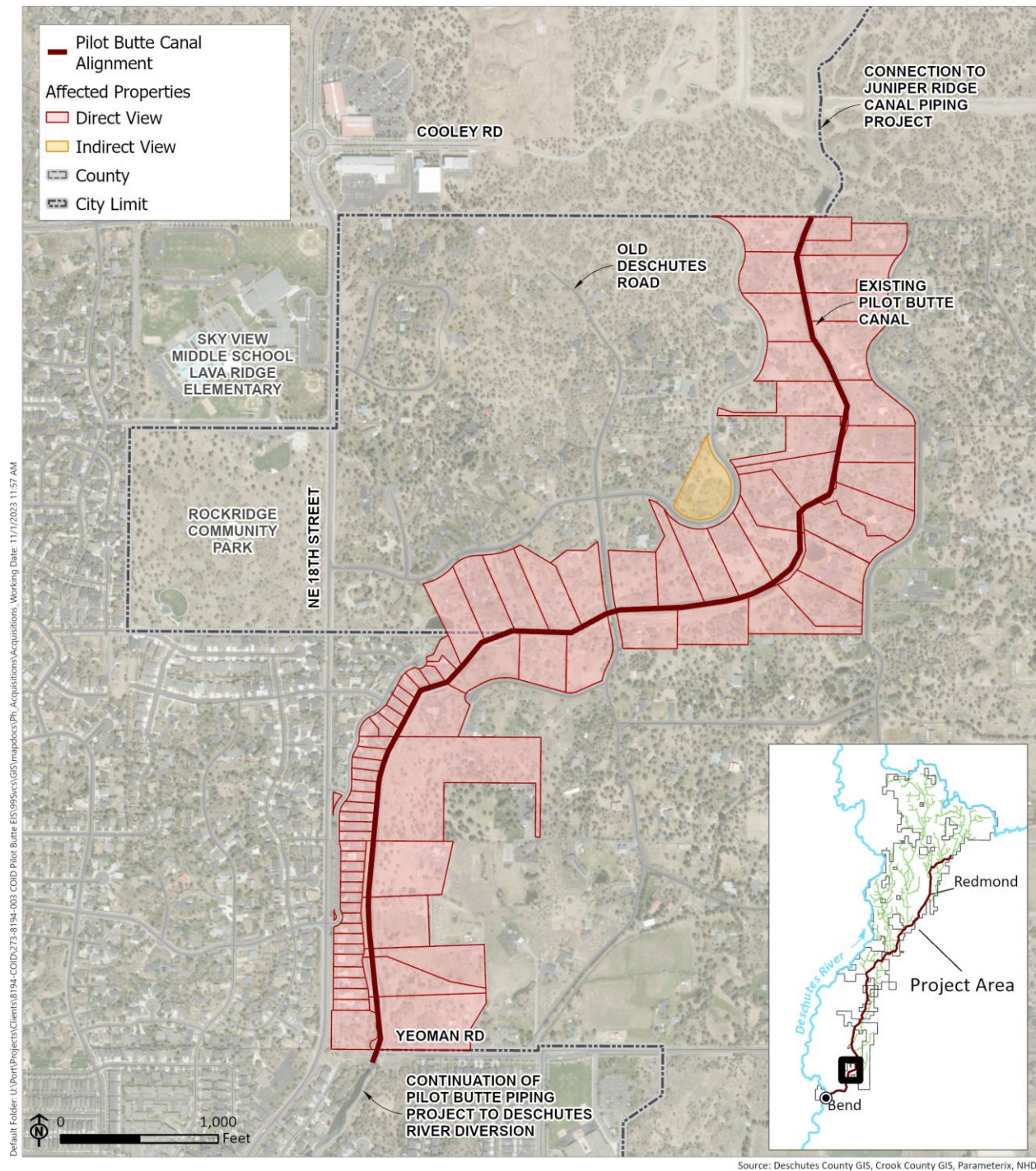


Figure 6-1. Parcels with visual proximity to the PBC in the North Bend Pilot Butte Canal Alternative Alignment Option.

6.8.2.1.2 *City of Redmond Alternative Alignment Option*

6.8.2.1.2.1 Pilot Butte Canal Alignment (Existing Canal Route)

A long-term moderate impact to the visual and aesthetic features visible from properties and ROW with a direct or indirect view is anticipated with this option. The canal would be piped in its existing alignment removing and filling in the open canal running adjacent to the natural areas and residences along this portion of the alignment. There are 22 parcels with a direct view of the canal and 34 parcels with an indirect view of the canal within this piping option (see Figure 6-2).

6.8.2.1.2.2 Piping to the East in the Watermaster's Access Road

A long-term minor impact to the visual and aesthetic features visible from properties with a direct or indirect view of the PBC is anticipated with this option during the irrigation season. Under the Watermaster's Access Road option, the existing PBC would remain in its current physical state, but it would no longer receive irrigation water from COID facilities, altering the visual character of this portion of the canal during irrigation season (Figure 6-2).

No long-term impacts are anticipated from locating an underground pipe beneath the existing Watermaster's Access Road, as the buried irrigation pipe would not be visible post construction.

6.8.2.1.2.3 Piping to the West within North Canal Boulevard

A long-term minor impact to the visual and aesthetic features visible from properties with a direct or indirect view of the PBC is anticipated with this option during the irrigation season. Under the North Canal Boulevard option, the existing PBC would remain in its current physical state, but it would no longer receive irrigation water from COID facilities, altering the visual character of this portion of the canal during irrigation season (Figure 6-2).

No long-term impacts are anticipated from locating an underground pipe beneath the existing Canal Boulevard roadway, as the buried irrigation pipe would not be visible post construction.

Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project
 Draft Watershed Plan–Environmental Impact Statement

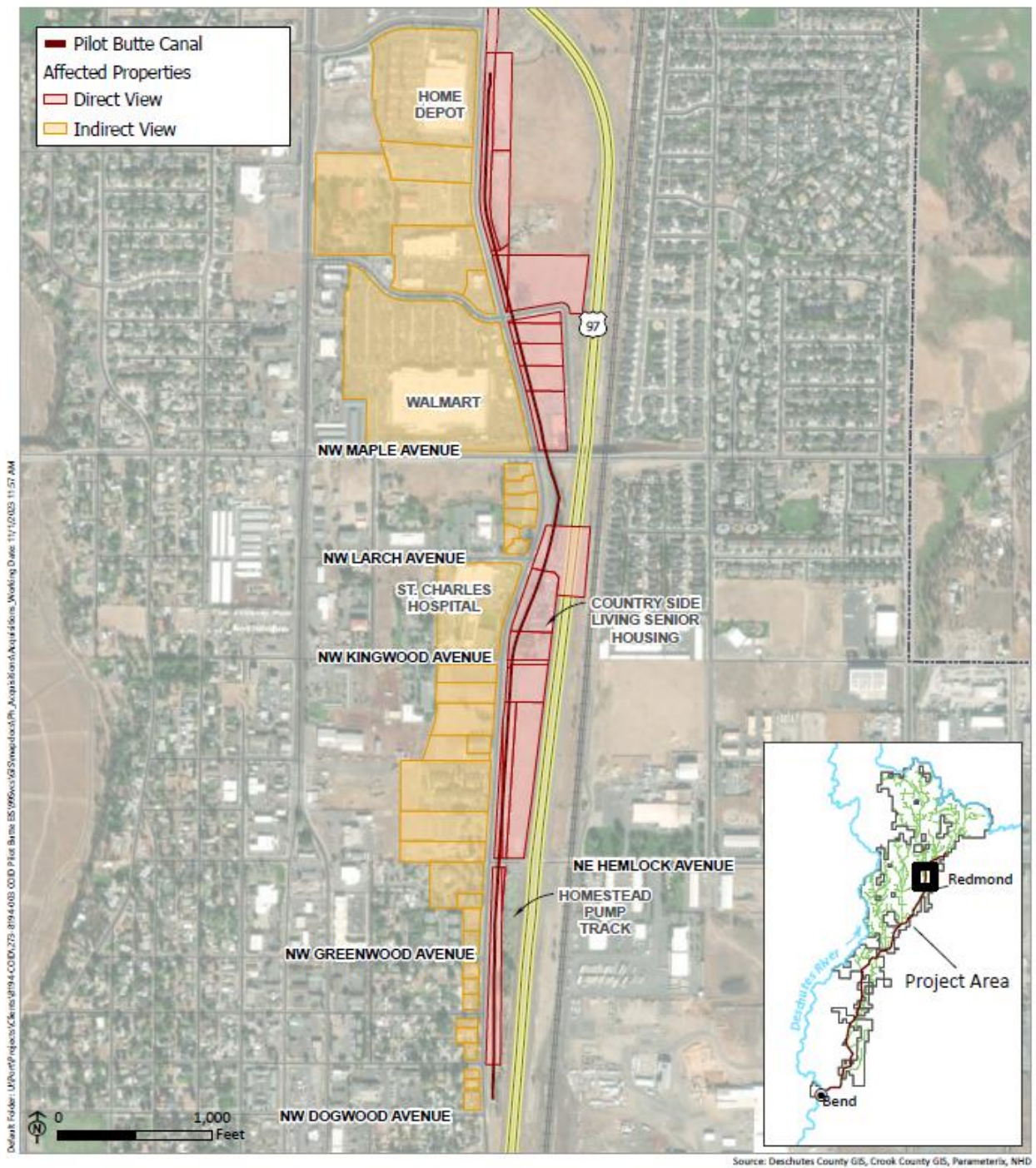


Figure 6-2. Parcels with visual proximity to the PBC in the Redmont Pilot Butte Canal Alternative Alignment Option.

6.8.2.2 Temporary Construction Impacts

6.8.2.2.1 *Modernization Alternative (Full Piping)*

Construction activities would take place during the nonirrigation season and would occur in phases; therefore, visual disruptions associated with construction would be limited to the phase or part of the phase under construction. Construction activities would include vegetation clearing, trenching, equipment mobilizing and staging, and backfill of trenches after pipe installation. Vegetation clearing would be minimized to the extent practicable, and reseeded would be completed after construction.

Tree removal would be avoided as much as possible, and where unavoidable, would be mitigated through on-site and in-kind replacement to the greatest extent feasible. Where permanent tree removal would be necessary due to potential pipe damage from tree roots, alternative mitigation approaches would be implemented in accordance with the respective Bend, Redmond, or Deschutes County tree protection code through coordination with the appropriate city or County jurisdiction.

Construction activities, such as the use of heavy equipment or pipe laying, would be visible to residents and motorists within the Study Area; however, visual disruption from COID machinery and trucks is an uncommon feature in the landscape.

In residential areas where the open canal is adjacent to the backyards of houses, construction activities would be temporarily pronounced. However, effects would be minimized through BMPs such as limiting construction to daytime hours. Construction activities would be less pronounced in the segments of the Project Area that pass through agricultural land because there would be fewer residences with a direct view of the canal in those areas.

6.8.2.2.2 *Deschutes County/North Bend Alternative Alignment Options*

6.8.2.2.2.1 Pilot Butte Canal Alignment (Existing Canal Route), NE 18th Street Alternative Alignment Option, and Old Deschutes Road Alternative Alignment Option

All three Deschutes County/North Bend alignment options—the Pilot Butte Canal Alternative Alignment Option, the NE 18th Street Alternative Alignment Option, and the Old Deschutes Road Alternative Alignment Option—would result in temporary construction impacts to visual resources in the Study Area, including the visibility of construction equipment and activities and temporary vegetation removal.

6.8.2.2.3 *City of Redmond Alternative Alignment Option*

6.8.2.2.3.1 Pilot Butte Canal Alignment (Existing Canal Route), Piping to the East in Watermaster's Access Road, and Piping to the West in North Canal Boulevard

All three city of Redmond Piping alternative alignment options—the Pilot Butte Canal alignment, piping to the east in Watermaster's Access Road, and piping to the west within Northwest Canal Boulevard—would result in temporary construction impacts on visual resources in the Study Area, including the visibility of construction equipment and activities and temporary vegetation removal.

6.9 Water Resources

Table 7 in the Water Resources Technical Report (Appendix F.7) provides a summary of the potential long-term effects of the project alternative alignment options on water resources. See

Sections 7.2.1 and 7.2.2 of Appendix F.7 for detailed discussion of the potential long-term impacts of the No Action and Modernization Alternatives.

6.9.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, the existing open portions of the PBC would remain unpiped and COID's delivery system within the Project Area would remain in its current condition.

Modernization of COID's infrastructure along the PBC would not be reasonably certain to occur.

No water would be saved. Losses associated with seepage and evaporation would continue at current levels. Water delivery reliability for COID patrons would not improve, and current concerns regarding water availability for agricultural use would not be addressed.

6.9.1.1 Water Rights

Under the No Action Alternative, there would be no change to COID's water rights or the water rights of other irrigation districts in the Upper Deschutes Basin. Curtailments in irrigation water delivery for patrons of COID and other districts relying on Deschutes River water, as has happened during recent drought years (COID 2023), could continue. Without additional saved water, the future ability of COID to deliver water to NUID and LPID could be constrained. This would be exacerbated when the full instream flow requirements of the DBHCP are implemented, beginning at year 13 in 2033 (USFWS and NMFS 2020).

6.9.1.2 Surface Water Hydrology

The No Action Alternative would have no effect on existing surface water hydrology in waterbodies associated with COID operations. The implementation of the DBHCP would result in lower summer flows and higher winter flows in the Deschutes River between Wickiup Reservoir and North Canal Dam. COID would continue to divert water into the PBC in volumes that account for water loss due to seepage and evaporation. No additional water would be saved for pass-through as live flow to NUID.

6.9.1.3 Surface Water Quality

The No Action Alternative would have no effect on existing surface water quality. The open canal would continue to collect stormwater runoff from urban areas and agricultural crops and livestock operations, subsequently delivering contaminants such as herbicides, pesticides, fecal coliform bacteria (i.e., *E. coli*), and other pollutants to patrons downgradient in the system. This could create concerns for some patrons within COID as it could affect the safety of the local food system. There would be no change in potential turbidity from the erosion of canal banks or from sediment transported via stormwater inflow. There would be no effect on the Deschutes River's inclusion on Oregon's Section 303(d) list or change in its exceedance of water quality impairment parameters.

6.9.1.4 Groundwater

The No Action Alternative would have no effect on existing groundwater conditions in the Project Area or the Upper Deschutes Basin. Approximately 43,544 AF of water would continue to seep from the PBC into the upper portion of the Deschutes Basin aquifer each year. Groundwater levels are anticipated to continue to decline due to climate change (Appendix A; Shelton and Fridirici 2001; Gannett and Lite 2013; Reclamation 2016; OWRD 2021; Frankson et al. 2022).

6.9.1.5 Ecosystem Services

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

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

Regulating service, Water quality (Figure 4-1, [E3]): Under the No Action Alternative, the quality of water remaining instream during the irrigation season downstream of COID's diversion would not be affected.

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

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

6.9.2 Modernization Alternative

6.9.2.1 Long-Term Impacts

6.9.2.1.1 Impacts Common to all Full Piping Alternative Alignment Options

The Modernization Alternative would have identical long-term impacts on water resources under all the full piping alignment options, because under all options, the PBC's entire flow through the Project Area would be conveyed through a pipe. This would result in identical canal seepage reduction and water savings and identical effects on water rights, surface water hydrology, water quality, and groundwater. For all full piping options, canal seepage reduction under the Modernization Alternative would save approximately 43,544 AF per year (136 cfs). The saved water would be passed through to NUID. Accounting for seepage and evaporation losses within NUID's system, up to 32,161 AF (100 cfs) would be made available to NUID patrons initially (see Appendix D); however, seepage and evaporation losses within the NUID system would be expected to increasingly diminish over time as NUID implements ongoing and future system modernization projects (NRCS 2023a; NUID 2022; NUID 2025). Water savings would accrue over the course of the Modernization Alternative 3-year construction period. Table 8 in the Water Resources Technical Report (Appendix F.7) summarizes the anticipated water savings by project group for each full piping option under the Modernization Alternative.

6.9.2.1.1.1 Water Rights

Under the Modernization Alternative, COID would diminish its water right certificate(s) by an amount equivalent to the full volume that is saved from piping. Saved water would be passed through as live flow to NUID. Because LPID and AID water rights are senior in priority to NUID water rights, these districts have signed a baseline forbearance agreement allowing NUID to use water saved from COID piping projects ahead of LPID and AID. This agreement could be modified as the proposed action and future COID piping projects are implemented. COID would

coordinate with the other districts to ensure that storage allocation and system operations at Wickiup Reservoir align with the conservation measures in the DBHCP and the 2020 Revised Inter-District Agreement. See Appendix F.7 for a detailed discussion of anticipated changes in water rights and allocation arrangements among the districts. Compared to the No Action Alternative, the likelihood that NUID would be able to satisfy its patrons' irrigation demands on a consistent basis as the DBHCP approaches full phase-in would be higher.

6.9.2.1.1.2 Surface Water Hydrology

The Modernization Alternative would have no effect on Crane Prairie Reservoir because it would not influence Crane Prairie Reservoir operations. It would have a short-term effect on surface water hydrology in Wickiup Reservoir because the water saved during the 2027 irrigation season, following completion of the first project group, would result in allocation of more water to storage than otherwise needed to achieve the DBHCP-required minimum winter release of 100 cfs from Wickiup Reservoir. In the long term, after December 31, 2027, the required amount of water to be allocated to winter release from Wickiup Reservoir will increase to 300 cfs and the Modernization Alternative would have no effect on surface water hydrology in Wickiup Reservoir. Similarly, the Modernization Alternative would have a short-term effect on surface water hydrology in the Deschutes River from Wickiup Reservoir to the PBC diversion because it would result in the release of more than the DBHCP-required minimum 100 cfs from Wickiup Reservoir during a portion of the first nonirrigation season following construction of the first project group. In the long term, after December 31, 2027, there would be no effect on surface water hydrology in the Deschutes River. The changes in NUID water rights associated with the pass-through of saved COID water to NUID would support the DBHCP-required minimum flow augmentation in the Deschutes River below Wickiup Reservoir during the nonirrigation season. This would help to facilitate compliance with the requirements of the DBHCP conservation measures while bolstering both COID's and NUID's abilities to efficiently and reliably deliver live flow to their patrons for irrigation.

6.9.2.1.1.3 Surface Water Quality

The Modernization Alternative would have no effect on water quality in waterbodies associated with COID operations (i.e., Crane Prairie Reservoir, Wickiup Reservoir, and the Deschutes River), because no actions associated with the Modernization Alternative would take place within or adjacent to these waterbodies. All potential surface water quality effects would result from actions taken within the PBC alignment and alternative alignment options. The Modernization Alternative would prevent contaminants from entering the irrigation water supply where the currently open canal is converted to pipe. By preventing contaminants from entering the PBC in stormwater runoff, thus reducing nonpoint source contamination carried on-farm through irrigation water delivery, the Modernization Alternative would result in beneficial effects on irrigation water quality.

6.9.2.1.1.4 Groundwater

The Modernization Alternative would reduce canal seepage by up to approximately 43,544 AF annually and reduce groundwater recharge by a roughly corresponding amount. The groundwater impacts analysis in the Water Resources Technical Report (Appendix F.7) indicates that localized effects on groundwater levels would differ depending on location along the PBC based on geology, water table depths, and hydraulic conductivity. Up to -68 to -50 feet of groundwater level decline may occur in the Study Area within the upper 100 feet of the saturated zone. These declines would decrease to a -10-foot decline extending up to 5 miles from the canal and would range from -2 feet to less than -5 feet at depths below 200 feet.

The Modernization Alternative could contribute to adverse impacts on nearby domestic and irrigation wells by decreasing seepage to groundwater. The effects on groundwater availability at wells would diminish with distance from the PBC and depth to groundwater at the well location. Additionally, groundwater levels are expected to decline throughout the Upper Deschutes Basin due to climate change. Therefore, it is difficult to predict the specific potential impacts of the Modernization Alternative on local domestic and irrigation wells.

6.9.2.2 Temporary Construction Impacts

6.9.2.2.1 No Action Alternative

Under the No Action Alternative, COID would continue to operate and maintain the existing delivery system within the Project Area in its current condition. No construction activities would take place; therefore, no temporary construction impacts would result from the No Action Alternative.

6.9.2.2.2 Modernization Alternative

Temporary impacts of the Modernization Alternative would be attributable to construction activities and would be expected to abate following completion of construction. Short-term impacts would be expected to be similar in character for all of the Modernization Alternative alignment options.

No short-term impacts to water rights are anticipated because construction of piping within the six project groups is expected to last three total nonirrigation seasons. Construction would take place outside of the period when irrigation water is being delivered to COID patrons and would not be expected to disrupt patrons' use of water under COID's water rights. Other districts' water rights would likewise not be disrupted.

No short-term impacts to surface water hydrology are anticipated because no work is proposed within waterbodies affected by COID operations and no structures are proposed for placement within the Deschutes River. All construction work would take place within the existing PBC or, in the case of the alternative alignment options, in upland areas where new pipe alignments would be excavated. Work within the existing PBC would take place during the nonirrigation season when no water flows through the canal.

Construction activities can potentially affect surface water quality by facilitating erosion and mobilization of sediment in stormwater. Accidental discharge of fuels, fluids, and construction materials can impact surface water quality via stormwater runoff and groundwater quality via infiltration. No work is proposed within or adjacent to the Deschutes River itself; therefore, discharge of sediment and contaminants directly to surface waterbodies is not anticipated. The anticipated excavation depth to install the pipeline would be insufficient to result in direct contact with or introduction of contaminants into groundwater.

Construction-phase erosion, sediment, and pollution control and spill prevention BMPs would be implemented to prevent stormwater runoff from mobilizing sediment and pollutants into surface waters and introducing contaminants into groundwater. Following construction, new pipelines would be buried and disturbed areas would be recontoured and planted with a seed mix of native grasses and forbs in consultation with NRCS. This would minimize the potential for soil erosion and mobilization of sediments in stormwater following construction. The potential for soil erosion along the banks of the PBC would be eliminated where the open canal is replaced with a buried pipe.

Pollution control and spill prevention BMPs would be implemented to avoid and minimize impacts from accidental spills of fuels, fluids, solvents, oils, and other hazardous materials typically associated with construction vehicles and equipment. A construction-phase spill prevention control and countermeasures plan would include protocols for storing and handling hazardous substances, as well as cleanup response protocols to be used in the event of inadvertent releases. Potential construction-phase BMPs to reduce or control environmental health hazards are listed in Section 7.3.2 of Appendix F.7.

6.9.2.3 Potential Off-Site Construction Staging Areas

The construction contractor may use one or more off-site staging areas to store or assemble materials that would then be transported by truck to the construction site. Off-site staging could occur with any of the alternative alignment options. Whether, where, and how to use such sites would be the contractor's decision. Therefore, the actual site or sites cannot be known at this time and detailed analysis of impacts is not possible. It is assumed that because of regulatory and time constraints on the contractor, they would seek to use a developed site with road access. It is also assumed that the contractor would be responsible for any required permitting or mitigation for use of a site.

Mobilization of soils, sediments, and contaminants in stormwater runoff from the site could occur from off-site staging. This would depend on the site selected, as use of a developed site would generally not trigger water-related permitting requirements. Use of an undeveloped site could trigger the requirement for National Pollutant Discharge Elimination System compliance, which would come in the form of a 1200-C construction stormwater permit from DEQ.

6.9.3 Ecosystem Services

The Modernization Alternative would have both adverse and beneficial effects on water-related ecosystems services

Provisioning service, Water available for irrigation (Figure 4-1, [E1]): Implementation of the Modernization Alternative would have a beneficial effect on irrigation water deliveries. Water conveyance through closed pipes would improve efficiency by eliminating water loss due to seepage and evaporation, which in turn would allow COID to pass saved water to NUID. By passing COID's saved water to NUID during the irrigation season, NUID would have access to more irrigation water to help fulfill its patrons' irrigation needs. See the NED in Appendix D for additional information. Modernizing COID irrigation infrastructure would enable COID to be more resilient to environmental changes and maximize the efficiency of water conveyance.

Regulating service, Water quality (Figure 4-1, [E3]): Following implementation of the Modernization Alternative, COID would pass the volume of water saved during the irrigation season to NUID by transferring a portion of its live-flow water rights in the Deschutes River to NUID for irrigation use. During the nonirrigation season, NUID would release an equivalent volume of water from Wickiup Reservoir to the amount that had been saved and passed to NUID during the previous irrigation season. Slightly less water would be saved under the alternative alignment options; however, NUID would still be required to release the same amount of water as a result of the DBHCP. There would be no expected changes to water quality during the irrigation season due to the volume of instream water remaining the same during that time.

Cultural service, Culturally important areas (Figure 4-1, [E5]): Because implementation of most of the alignments of the Modernization Alternative would be replace the open canal with a covered pipe, residents would no longer see or hear water running through the open canal during the irrigation season. This action may have an adverse effect on the aesthetic services that the open canal brings to some residents. Under the alternative alignment options that were left open, this aesthetic service would remain the same.

Regulating service, temperature regulation (Figure 4-1, [E6]): Implementation of the Modernization Alternative would eliminate the potentially small cooling or warming effect that the canal may have on the local environment. No local data were available to evaluate the effect of piping the canal on temperature regulation; therefore, it is unknown if the elimination of this service is beneficial or adverse. Based on data about irrigation and temperature regulation in general (Section 4.9.7), the effect is expected to be negligible.

6.10 Utilities

6.10.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, there would be no changes or impacts to the existing utility facilities or the environment surrounding the facilities.

6.10.2 Modernization Alternative

6.10.2.1 Long-Term Impacts

Long-term impacts to utilities from the Modernization Alternative are anticipated to be limited. Existing utility lines could require adjustment or relocation to avoid conflicts with the proposed canal piping. Utility lines that could require adjustment include water mains, gravity and pressure sewer mains, storm mains, gas mains, underground power lines, and communication lines. Long term, costs for utility maintenance are not anticipated to increase after construction is complete.

6.10.2.2 Temporary Construction Impacts

The construction of the PBC pipe would be largely impactful to the existing utilities that run parallel to or cross the proposed canal piping alignment. Construction at any given location would be completed during a single nonirrigation season during the winter months. For the construction of the canal piping, existing utilities would require adjustment or relocation to avoid conflicts. Detours would need to be set for traffic and pedestrian movement during construction. Refer to the Transportation Technical Report (Appendix F.11) for detour alternatives for areas where existing utilities are parallel to the proposed alignment.

Creating bypasses for water, sewer, or gas utilities could be required to minimize service downtime. Franchise utility agreements would be reviewed to confirm relocation of conflicting franchise utilities. Most, if not all, of the work necessary to remedy the conflicts would be performed within the existing ROW or within the canal easement.

The NE 18th Street alignment would have significant impacts to the existing utilities both vertically and in parallel. The NE 18th Street alignment would have the highest utility disruption impacts of the Deschutes County/North Bend route alternative alignment options. The water, gas, and

communications lines running along NE 18th Street and power lines running down Cooley Road would require relocation to accommodate canal piping. Blasting the existing rock to facilitate excavation would not be advisable due to the proximity of the existing utilities. Other crossing utilities including water, sewer, and gas would require relocation or vertical adjustment when crossing the canal piping. No long-term environmental impacts to utility facilities are anticipated from this option.

The NW Canal Boulevard alignment would have significant impacts to the existing utilities both vertically and in parallel. The NW Canal Boulevard alignment would have the highest amount of utility disruption impacts of the City of Redmond route alternative alignment options. Existing water and sewer lines running along NW Canal Boulevard could require relocation to avoid conflicts with the proposed canal piping. Blasting the existing rock to facilitate excavation would not be advisable due to the proximity of the existing utilities. Other crossing utilities including water, sewer, gas, and underground power would likely require vertical adjustment when crossing the canal piping. Utility location services would verify utility locations and conflicts. No long-term environmental impacts to utility facilities are anticipated from this option.

Staging areas are not anticipated to have utility conflicts unless overhead vertical clearance is required for specialized construction equipment.

6.11 Noise and Vibration

6.11.1 No Action Alternative (Future without Federal Investment)

The No Action Alternative would avoid construction-related noise impacts. The operation of the irrigation canal is not a significant noise generator and cannot be readily distinguished from the existing transportation-related ambient noise sources including US 97, surface road networks in Bend and Redmond, the Redmond Municipal Airport – Roberts Field, and the BNSF Railway tracks.

6.11.2 Modernization Alternative

6.11.2.1 Long-Term Impacts

No long-term impacts are expected from the Modernization Alternative. The pipe would be underground and would not be a major source of noise.

6.11.2.2 Temporary Construction Impacts

Construction noise would cause a direct impact to noise levels along all project groups of the canal and potential alignments where construction would occur. The most prevalent noise sources would likely be equipment powered by internal combustion engines (usually diesel) and blasting associated with trench excavation. Noise from equipment likely to be used on this project (tractors, trucks, graders, rock drills, cranes, etc.) would range from 55 dBA for a pickup truck to 98 dBA for blasting when measured from a distance of 50 feet.

Vibrations transmitted through the ground during construction operations may act as a nuisance to those sensing it and detrimentally affect structures and sensitive devices. Construction vibrations affect structures in two primary ways: vibrations may produce direct damage to structures and may cause damage due to vibration-induced settlement.

Excavation of the pipe trench is anticipated to encounter shallow bedrock along the entire alignment. The bedrock consists primarily of basalt and basaltic andesite lava flows and vent deposits. Additional information regarding geological and soil conditions is presented in Appendix F.4, Geology, Soils and Hazardous Materials Technical Report. Preliminary geotechnical investigations in the northern portion of the alignment (King Way Project Group) have been evaluated during design. To reach approximately 15 feet below existing grade for the pipe trench, the bottom 2 to 10 feet of the pipe trench would require blasting. The variation is due to different geologic conditions as the alignment progresses from south to north in the King Way Project Group. Although detailed geological investigations have not been completed along the entire alignment, it is anticipated that similar ground conditions would be encountered through the entirety of the alignment. Mechanical impact excavation in these geologic units is anticipated to generate substantial noise and vibration impacts. However, the construction noise and vibration effects are anticipated to be intermittent and dependent on the type, operation, location and function of the equipment and the equipment usage cycle. If blasting is used, which is likely, additional vibration and air blast waves would also be expected to occur above and beyond what would be experienced by mechanical impact excavation.

Although construction of the Modernization Alternative would take place outside of the irrigation season and therefore outside of the nesting season for migratory birds of concern, construction could overlap with the primary nesting season for eagles and raptors. This could result in minor to moderate adverse effects as shockwaves and vibrations from construction activities, specifically blasting, could cause physical damage to nearby nests as well as prompt nest abandonment.

Blasting and other activities associated with trench excavation can cause noise, dust, and vibration. The environmental effects of noise and dust vary depending not only on the size and location of the blast but also on atmospheric conditions such as wind and humidity.

Changes in air pressure, as well as flying dust and debris from a blast, can physically damage buildings, trees, and other natural and human-made objects within the blast zone. Ongoing blasting noises can diminish the quality of life for people, livestock, and wildlife near the blast zone.

6.12 Right-of-Way, Displacements, and Relocations

6.12.1 No Action Alternative (Future without Federal Investment)

The No Action Alternative would result in the canal remaining as an open canal in its current alignment and would result in no additional property or ROW impacts.

6.12.2 Modernization Alternative

6.12.2.1 Long-Term Impacts

The Modernization Alternative (full piping) would result in 18.3 acres of permanent impact to pipe the existing canal within the existing canal alignment. The proposed pipe size and associated permanent impact area would be narrower than the existing canal bed and therefore likely result in no permanent impacts to property or ROW.

See Appendix F.10 Right-of-Way, Displacements and Relocations Technical Report for ROW and property impact mapping and figures.

6.12.2.2 Deschutes County/North Bend Alternative Alignment Options

6.12.2.2.1 Pilot Butte Canal Alternative Alignment Option (Existing Canal Route)

The PBC alignment would use the existing canal bed and likely result in no permanent impacts to property or ROW. A pressure-reducing station would need to be installed upstream of the existing forebay, within COID ROW. Following the existing canal bed would result in the lowest permanent footprint of the Deschutes County/North Bend alignment options. Existing COID easements on adjacent tax lots along this alignment would extend beyond the limits of the proposed permanent impacts from piping. No additional ROW would be required permanently to accommodate this alignment option.

6.12.2.2.2 NE 18th Street Alternative Alignment Option

The NE 18th Street alignment would result in 2.3 acres of permanent impacts that would affect one public property and three ROWs. From the Juniper Ridge Hydro Facility, the NE 18th Street alignment would travel west resulting in 0.41 acres of permanent impact to a parcel owned by the City of Bend; the parcel includes both the Juniper Ridge hydroelectric plant and the associated Juniper Ridge segment of the piped PBC. The location and level of potential impact associated with the NE 18th Street Alignment would be identical to that of the Old Deschutes Road alignment for this property.

Entering Cooley Road from its current eastern terminus, the NE 18th Street alignment would result in a permanent impact to Cooley Road to accommodate the pipe and existing utility relocations. At the intersection with NE 18th Street, this alignment would travel nearly a mile south along NE 18th Street to Yeoman Road, resulting in permanent impacts to road ROW but avoiding permanent impacts to public and private property along either side. In total, the NE 18th Street alignment would result in 1.9 acres of permanent impacts to public ROWs, which would be more than the other two Deschutes County/North Bend alignment options.

6.12.2.2.3 Old Deschutes Road Alternative Alignment Option

The Old Deschutes Road alignment would result in 2.1 acres of permanent impacts that would affect one public property and two public ROWs. From the Juniper Ridge hydroelectric plant, the Old Deschutes Road alignment would follow the same alignment west to Cooley Road as the NE 18th Street Alignment, resulting in the same 0.41 acres of permanent impact to City of Bend property. No other permanent property impacts are expected for this alignment option.

The Old Deschutes Road alignment follows the currently unbuilt ROW for Cooley Road from its eastern terminus to the unbuilt ROW for Old Deschutes Road; the alignment turns south and follows the Old Deschutes Road ROW south to the intersection with Yeoman Road. Permanent impacts associated with this alignment option would stay within the Old Deschutes Road ROW, avoiding permanent impacts to adjacent properties. At the intersection with Yeoman Road, the Old Deschutes Road alignment would follow the Yeoman Road ROW west until connecting with the existing canal west of Desert Sage Street. The permanent impacts to ROW for this alignment option would be 1.7 acres, slightly less than the permanent ROW impacts associated with the NE 18th Street alignment and more than public ROW impacts associated with the PBC alignment.

6.12.2.3 City of Redmond Alternative Alignment Options

6.12.2.3.1 Pilot Butte Canal Alternative Alignment Option (Existing Canal Route)

The PBC alignment would use the existing canal bed and result in no permanent impacts to property or ROW outside of the existing canal bed. Existing COID easement on adjacent tax lots along this alignment would extend beyond the limits of the proposed permanent impacts from piping. Using the existing canal bed, this alignment option would not impact or require new ROW crossings from NW Canal Boulevard east.

6.12.2.3.2 Piping to the East in the Watermaster's Access Road Alternative Alignment Option

Piping to the east of the existing canal along the Watermaster's Access Road (Watermaster's Access Road Alignment) would result in 1.8 acres of permanent impacts, more than the other Redmond alignment options. Permanent impacts would occur on 14 properties including 3 owned by the City of Redmond, 1 ODOT property used for accessing US 97, and 10 private properties east of the existing canal. From the southern terminus, the Watermaster's Access Road Alignment would avoid impacting the Homestead Pump Track and one private property before impacting the western portion of two vacant City of Redmond properties, two private properties, and then the ODOT property providing a southbound exit from and southbound access to US 97 at NW Larch Avenue. Continuing north, this option would permanently impact four private properties and a City of Redmond property between NW Maple Avenue and NE 2nd Street. North of NE 2nd Street, four additional private properties would be permanently affected before the alignment reaches the north terminus. While this alignment option would impact residential and commercial properties, no displacements are anticipated and existing parking would be maintained. Permanent impacts would extend east beyond COID's current easements.

Piping to the east of the existing canal along the Watermaster's Access Road would result in permanent impacts to several ROWs connecting to NW Canal Boulevard. As this alternative alignment option is shifted east of the existing canal, and therefore east of the existing canal crossings, eight ROWs would require new crossings but could remain in their current transportation use following construction. Starting from the southern terminus, the City of Redmond crossing at NE Hemlock would be impacted, followed to the north by a private crossing at NW Kingwood Avenue. Continuing north, a private crossing south of NW Larch Avenue would be affected, and the US 97 access at NW Larch Avenue would be impacted. North of NW Larch Avenue, the alignment would impact the abutment of the NW Maple Avenue/NE Negus Way overpass of US 97 before affecting the crossing at NW 2nd Street and two private ROWs crossing the existing canal. No other City of Redmond alternative alignment option would permanently impact these crossings, as they would follow the existing canal or NW Canal Boulevard.

6.12.2.3.3 Piping to the West within Northwest Canal Boulevard Alternative Alignment Option

Piping to the west of the existing canal within the NW Canal Boulevard ROW (NW Canal Boulevard Alignment) would result in no permanent property impacts, as the alignment is entirely within the NW Canal Boulevard ROW. It is tied with the PBC alignment for the least impactful to private property of the City of Redmond alternative alignment options.

Piping to the west of the existing canal within the NW Canal Boulevard would result in 1.6 acres of permanent public ROW impacts, more than any other City of Redmond alternative alignment option. From the southern terminus, this option would enter the NW Canal Boulevard ROW north

of NW Elm Avenue and extend 1.15 miles north until rejoining the existing canal bed south of NE Quince Avenue. This alignment would stay primarily within the center of the NW Canal Boulevard ROW, avoiding impacts to cross streets to the west and the existing canal crossings to the east. Existing utility relocations would be required for the entire 1.15 miles within NW Canal Boulevard.

6.12.2.4 Temporary Construction Impacts

6.12.2.4.1 Modernization Alternative (Full Piping)

The Modernization Alternative (full piping) would result in 212 acres of temporary impacts to property and ROWs during construction. Table 6-1 lists temporary project impacts of the Modernization Alternative within the context of using existing COID easements and proposed construction access roads. In total, 163 acres of temporary construction impacts would affect properties, and 49 acres of temporary construction impacts would occur within the existing canal, on COID property, and to public ROWs. Temporary impacts to public and private properties are not expected to impact structures but may limit access to portions of a property during the construction.

Table 6-1. Properties Temporarily Affected

Ownership	Number of Properties
Private	254
City of Bend	7
City of Redmond	11
Deschutes County	5
North Unit Irrigation District	2
Oregon Department of Transportation	1
Oregon Parks and Recreation Department	1
Federal	4
Total	284

From the southern terminus at US 97 in Bend to Yeoman Road, construction impacts would occur to properties on both sides of the existing canal. The impacted properties would include commercial, industrial, vacant, and residential properties, but no impacts to structures or parking are anticipated. Farther north, several large public and private parcels would be impacted as the proposed alignment option parallels US 97 up to Tumalo Road.

After crossing US 97 north of Tumalo Road, the Modernization Alternative follows the existing canal to the city of Redmond southern boundary; during construction there would be temporary impacts to private residential and agricultural properties along this alignment. The alignment would

avoid construction impacts to residential properties along the west side of the canal up to SW Ben Hogan Drive where temporary impacts would continue on both sides of the existing canal and would affect private residential properties as well as City of Redmond property.

North of SW Airport Way, construction impacts would affect commercial and light industrial properties intermittently with portions of construction being entirely within the existing canal bed. The pattern of scattered construction impacts would continue north to the connection with the City of Redmond Alternative Alignment Options north of NW Dogwood Road. No structure or parking impacts are anticipated for any of the affected properties.

North and east of US 97, the alignment would temporarily impact residential and ranch properties on both sides of the canal but would not impact structures, parking, or driveways. North and east of NE 17th Street, construction would be contained within the existing canal, and no property impacts are anticipated.

The Modernization Alternative (full piping) would result in 49 acres of temporary impacts to public ROWs; approximately 18 acres of these construction impacts would occur at 20 locations where the existing canal crosses public ROW. From the southern terminus, the alignment would impact the BNSF Railway crossing east of US 97 in Bend, followed by City of Bend road crossings at Boyd Acres Road, NE Brinson Road, and finally NE Empire Avenue before meeting the Deschutes County/North Bend alternative alignment options at Yeoman Road. Each of these crossings already accommodates the canal, so no long-term impacts are anticipated.

North of the Juniper Ridge piped section, the alignment would temporarily impact two crossings at Tumalo Road before using the existing piped crossing under US 97. Between US 97 and the city of Redmond southern limits, the alignment would temporarily impact five Deschutes County road crossings and approximately 2.3 acres of ODOT ROW at the US 97 crossing. The portion of ODOT property that would be impacted already includes the canal; no impacts to traffic are anticipated.

Within the city of Redmond, the alignment would temporarily impact four City-owned road crossings before meeting the Redmond alternative alignment options. North and east of US 97, the alignment would temporarily affect the BNSF Railway crossing along with three Deschutes County road crossings. A portion of King Way between NE 5th Street and NE 17th Street could be impacted temporarily as well.

6.13 Transportation

6.13.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, there would be no changes or impacts to transportation facilities.

6.13.2 Modernization Alternative

6.13.2.1 Long-Term Impacts

Long-term impacts from the Modernization Alternative are not expected. Transportation infrastructure would be replaced to match existing conditions or would be improved to meet current design standards. With the removal of the open canal, several bridge crossings would no longer be needed and could be removed, including the two BNSF Railroad bridges over the open canal. This would have a positive impact by reducing long-term maintenance costs for the owner.

6.13.2.2 Temporary Construction Impacts

Construction for piping the PBC would have a high impact to the existing roadway and BNSF Railway crossings of the canal.

6.13.2.2.1 Railroad Crossings

There are two existing active railroad crossings of the PBC. Construction would be challenging around these crossings, and will require coordination with BNSF Railway during the final design phase to further understand the constraints.

BNSF Railway crossing near US 97 and Butler Market Road. Preliminary plans identify the bridge slab as being removed and replaced with existing footings and abutments protected in place. Removing the rail bridge slab would require a diversion or “shoo-fly” of train tracks to maintain active train traffic. A shoo-fly is constrained by an at-grade roadway crossing at Butler Market Road, approximately 700 feet to the south. There is also an existing rail overcrossing at Empire Avenue located approximately 4,000 feet to the north. Additionally, space is constrained by US 97 and electrical power transmission lines to the west and industrial businesses to the east. Such a diversion would be a significant cost and schedule impact to the Project.

BNSF Railway crossing near NE King Way. Preliminary plans identify the bridge as being removed and the trench backfilled. Removing the rail bridge would require a diversion or “shoo-fly” of train tracks to maintain active train traffic. A shoo-fly is constrained by an existing at-grade roadway crossing at King Way, 180 feet to the north. Additionally to the south, space is constrained by US 97 to the west and housing to the east. Such a diversion would be a significant cost and schedule impact to the Project.

6.13.2.2.2 State Highway Crossings

Of the existing roadway crossings, US 97 crosses the PBC three times. US 97 in Oregon is a state highway owned by ODOT. US 97 is a critical north-south highway in Central Oregon and supports 24,000 to 50,000 vehicles a day. Installation of the pipe would need to be staged to avoid full closures, as there is no alternate route of this classification. Typically, traffic would be detoured on the same or higher classification of roadway to maintain operations. Night work would also be considered to limit impacts to traffic.

6.13.2.2.3 Arterial, Collector, and Local Roadway Crossings

There are 28 public roadway crossings of the existing canal. These public roadways range in classification from local to arterial. Typically, traffic would be detoured on the same or higher classification of roadway to maintain operations. For arterials and collectors, this may require lengthy out-of-direction travel to route to the nearest alternative route. Local roads often have more options for alternative routes and may have shorter, less impactful detours. Potential detour routes are identified in detail in the Transportation Technical Report (Appendix F.11).

Improvements would need to be coordinated with the City of Bend, City of Redmond, or Deschutes County to identify opportunities to combine projects or avoid overlapping projects. Several of the crossing locations coincide with future projects identified by local transportation system plans. The City of Bend does not allow pavement cuts (openings in the pavement) in pavement sections that are 5 years old or less, and the City of Redmond does not allow pavement cuts in pavement sections that are 2 years old or less.

6.13.2.2.4 Private Road Crossings

Eleven of the existing canal crossings are on privately owned roads. These present challenges as the property may not be accessible by another route. Construction staging would need to be developed to maintain access to these properties, and work may include constructing a temporary bridge or temporary access overtop already installed pipe sections.

6.14 Air Quality

6.14.1 No Action Alternative (Future without Federal Investment)

No long-term or temporary construction impacts to air quality would occur in the No Action Alternative.

6.14.2 Modernization Alternative

6.14.2.1 Long-Term Impacts

No long-term air quality impacts are anticipated as a result of the Modernization Alternative. The irrigation system would be piped underground or left open in discrete segments and is not a source of criteria air pollutants. Therefore, no mitigation would be required.

6.14.2.2 Temporary Construction Impacts

Direct impacts of construction activities would result in the temporary emission of several air pollutants. PM₁₀ emissions are associated with dust created from land clearing, excavation, cut-and-fill operations, and blasting. All other pollutants (including PM_{2.5}, CO, SO₂, and NO₂) are generated from heavy-duty diesel engines used in construction equipment and vehicles.

Construction of the Project would occur in project groups and would be spread out through the Project Area over a 3-year period. Construction emissions in the Study Area would vary from day to day depending on work being done, equipment used, and weather conditions. Soil moisture, silt content of soil, wind speed, and the amount of equipment operating in an area can impact the amount of fugitive dust (i.e., PM₁₀) generated from the site. The amount of PM₁₀ emitted from the site would be minimized by using BMPs.

Fugitive dust generated during construction would be minimized by taking reasonable precautions as required by the construction specifications. Control measures typically would include BMPs for dust suppression, such as the following:

- Using water or dust suppressants on unpaved roads.
- Covering trucks that are likely to give rise to airborne dust.
- Minimizing disturbed areas.
- Using blasting mats to control fly rock and airborne soil particles generated by blasting operations in areas of residential or commercial land uses.
- Using street sweepers to remove entrained dust from paved roads.
- Using soil-stabilization BMPs such as tackifier, mulch, and temporary seeding, as required by permit.

6.15 Climate Change, Resiliency, and Adaptation

6.15.1 No Action Alternative (Future without Federal Investment)

To meet patrons' irrigation needs, COID must divert excess water from the Deschutes River to account for water loss due to the porous underlying geology, evaporation due to the arid climate, and other operational losses from system inefficiencies. With a changing climate, increasingly reduced snowpack, earlier snowmelt, and a longer dry season, lower streamflows and lower groundwater recharge would be expected. The availability of water in the Deschutes River to satisfy irrigation demands would diminish, and water shortages for COID patrons would likely result. Additionally, sufficient streamflow to provide for fish and aquatic species habitat needs would not be available.

6.15.2 Modernization Alternative

6.15.2.1 Long-Term Impacts

The Modernization Alternative is expected to help mitigate the impacts of climate change on COID and NUID patrons and the COID system by replacing the open canal with a closed-conduit pressurized pipeline. To protect the pipeline system itself from climate-driven hazards such as more frequent wildfires, the Modernization Alternative includes heat-resistant steel or high-density polyethylene piping that would be buried a minimum of 3 feet below the ground surface. Thus, the piped system has been designed to take into consideration future climate scenarios.

Piping the PBC would contribute to the long-term sustainability of irrigated agriculture by minimizing water loss, ensuring efficient water use, and ensuring more reliable access to irrigation water for COID and NUID patrons. Summer flows between Wickiup Reservoir and North Canal Dam in Bend would decrease, while winter flows would increase. Relatively more water would be available as live flow to satisfy NUID patrons' irrigation demands due to water savings from piping the PBC. By improving the overall efficiency of water delivery to agricultural producers, the Project aims to ensure that the infrastructure investments made today support robust climate resilience and continue to provide benefits for irrigated agriculture and instream habitat as climate conditions change.

Pressurization under the Modernization Alternative would reduce the power required to pump water onto farm fields. This benefit would save COID patrons between 228,238 and 881,438 kilowatt-hour (kWh) annually in the project group service areas. In addition to power savings in the project group service areas, piping of the King Way and Redmond Project Groups and associated pressurization would benefit irrigators in the Smith Rock service area within COID as well as irrigators in LPID, reducing their power needs by an additional 231,279 to 2,121,592 kWh annually.

Changes in energy use are expected to result in changes in carbon dioxide emissions from power generation. Every MWh of reduced energy use is estimated to translate into an estimated reduction of 0.7525 metric tons of carbon emissions. The Modernization Alternative would decrease carbon emissions by eliminating some pumping energy use by COID patrons.

The purpose of the proposed project is to improve water conservation in COID infrastructure, improve water delivery reliability to COID patrons, and reduce long-term O&M costs on up to approximately 18.5 miles of the COID-owned PBC. Additional project goals include improving public safety; conserving streamflow for fish, aquatic, and riparian habitat; and limiting the spread of

invasive species. Short-term goals include limiting and mitigating construction-related disturbance. See Table 6-2 for adaptive management strategies.

Table 6-2. Adaptive Management Strategies.

Project Objectives	Approach	Key Monitoring Elements
Conserve water	Reduce loss due to seepage, evaporation, and operational inefficiencies, and conserve water to benefit irrigated agriculture and fish and wildlife habitat in the Deschutes River Basin.	Withdrawal of water from the Deschutes River. Stream gauging. Systems leak detection. Future water loss studies.
Improve water delivery reliability	Summer flows between Wickiup Reservoir and North Canal Dam in Bend would decrease, while winter flows would increase. Relatively more water would be available as live flow to satisfy NUID patrons' irrigation demands due to water savings from piping the PBC.	Water withdrawn from the Deschutes River. Water delivered to patrons.
Reduce O&M costs	Reduce the need for clearing encroaching or aquatic vegetation from canals. Reduce the need for repairing side slope collapses, breaches in canal walls, and bank damage from livestock, rodents, etc. Reduce the need for maintenance of in-canal infrastructure (weirs, headgates, etc.).	Annual cost of O&M for COID. Annual utility costs for COID patrons.
Improve public safety	Close the system to eliminate access points to the canal where humans and wildlife can fall into the canal and drown. Closing the system would reduce flooding risks in the urban environments of Bend and Redmond due to canal sidewall failure.	Injury and fatality reporting. Property damage and loss reporting.
Conserve streamflow for fish, aquatic, and riparian habitat	The saved water would be passed through to NUID. NUID would then release an equal volume from Wickiup Reservoir during the nonirrigation season. COID and other irrigation districts in the Upper Deschutes River Basin would cooperate to achieve conservation goals of the Deschutes Basin Habitat Conservation Plan.	Coordination among COID, NUID, AID, LPID and USFWS. Monitoring for target seasonal streamflow goals at gauges throughout the Upper Deschutes River system. Monitoring of target water surface elevations at Crane Prairie Reservoir.

Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project

Draft Watershed Plan–Environmental Impact Statement

Project Objectives	Approach	Key Monitoring Elements
Limit spread of invasive species	Revegetate areas disturbed during construction with native seed mix to prevent invasive weeds from establishing. Close the system to limit the potential for irrigation water to act as a vector for the spread of invasive weed seeds.	Invasive species observation, reporting, and removal. Percentage native plant cover.
Limit construction-related disturbance	Plan construction to occur during the daytime in the nonirrigation months and follow BMPs and mitigation measures to minimize effects on environmental and social resources.	Temporary access roads. Staging area storage and stockpile. Erosion control. Spill prevention, control, and countermeasure. In-water construction. Wetland and riparian areas. Invasive species control. Revegetation. Wildlife mitigation. Fish passage preservation. Cultural resource protections through avoidance. Land rights and easements.

AID = Arnold Irrigation District; COID = Central Oregon Irrigation District; LPID = Lone Pine Irrigation District; NUID = North Unit Irrigation District; USFWS = U.S. Fish and Wildlife Service; BMPs = Best Management Practices

COID would compile baseline monitoring conditions using techniques such as survey, photos, aerial photography, and annual monitoring reports to set the initial conditions for monitoring and adaptive management. Data gathering would continue during the construction phase of the Project and for up to 5 years after project completion (or until objectives have been met, whichever is sooner). As data are evaluated, COID would follow the appropriate adaptive action based on progress toward meeting the objectives. See Table 6-3 for proposed adaptive actions.

Table 6-3. Proposed Adaptive Actions.

Monitored Objective Status	Adaptive Action
Meeting objectives	Reduce or eliminate metrics or geographic areas where success is achieved and maintained.
Trending toward meeting objectives	Continue, reduce, or eliminate metrics based on trends.
Not meeting or trending away from objectives	Evaluate why objectives are not being met. Assess monitoring program. Evaluate if metrics are appropriate for objective. Develop plan to address issues. Implement plan and monitor results.

6.15.2.2 Temporary Construction Impacts

Limiting construction-related disturbances as presented in Table 6-3 would meet climate change, resiliency, and adaptation goals.

6.16 Wild and Scenic Rivers

6.16.1 No Action Alternative (Future without Federal Investment)

Under the No Action Alternative, no modernization improvements would be constructed. Existing water management practices and existing hydrological and hydrographic trends would continue. The No Action Alternative would have no effect on wild and scenic rivers.

6.16.1.1 Ecosystem Services

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

Cultural service, Culturally important natural areas (Figure 4-1, [E5]): There would be no effect on the Outstandingly Remarkable Values that led to the designations of the Upper, Middle, and Lower Wild and Scenic Deschutes River segments. There would likewise be no associated effect on Central Oregon community member values.

6.16.2 Modernization Alternative

6.16.2.1 Long-Term Impacts

Under the Modernization Alternative, all modernization improvements would be located a minimum of approximately 4 miles outside of wild and scenic rivers and their designated corridors. While changes in seasonal flow regimes in the Upper Deschutes Wild and Scenic River would result

from implementation of the DBHCP, these changes would take place independently of the Project. The Modernization Alternative would have no long-term impacts on wild and scenic rivers.

6.16.2.2 Temporary Construction Impacts

All construction activities would take place a minimum of approximately 4 miles from a Wild and Scenic River or designated corridor. Therefore, construction equipment, activities, dust, and other elements that could create temporary adverse impacts to Wild and Scenic River values would not be perceptible from a Wild and Scenic River or designated corridor. The Modernization Alternative would have no temporary impacts on wild and scenic rivers.

6.16.2.3 Ecosystem Services

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

Cultural service, Culturally important natural areas (Figure 4-1, [E5]): Implementation of the Modernization Alternative would not affect any of the Deschutes River Outstandingly Remarkable Values including fisheries and hydrology or Central Oregon community member values (Appendix E.2).

6.17 Cumulative Effects

Cumulative effects result from the total effect of the proposed Project when added to other past, present, and reasonably foreseeable future projects or actions. Cumulative effects may be partly caused by the Project, but they may also be caused by other projects. Cumulative effects are studied so the public, decision-makers, and project proponents take time to consider the big-picture effects a project would have on the community and environment.

Past actions over the last 120 years that have affected resources in the Deschutes River Watershed are generally land development activities that include irrigated agriculture (consisting of canal system construction, previous piping projects, and diversions), urban and suburban development, industrial land and water uses, commercial development, water diversions for non-agricultural uses, and transportation infrastructure.

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

6.17.1 Past Actions

6.17.1.1 Water Resources Perspective

U.S. Bureau of Reclamation Deschutes Project (past and ongoing project)

Congress approved the Deschutes Project in 1937. The Civilian Conservation Corps quickly rehabilitated the Crane Prairie Dam in 1940. Wickiup Dam and the 65-mile-long North Unit Main

Canal were completed in the late 1940s. The Deschutes Project lands are in the vicinity of Madras, Oregon. Principal features include Wickiup Dam and Reservoir, Crane Prairie Dam and Reservoir, Haystack Dam and Reservoir, North Unit Main Canal and lateral system, and the Crooked River Pumping Plant. The Project furnishes a full supply of irrigation water for about 50,000 acres of land within the NUID and a supplemental supply for more than 48,000 acres in COID and Crook County Improvement District No. 1.

COID Smith Rock-King Way Piping Project (past project)

The purpose of the Smith Rock-King Way piping project is to improve water conservation and safety in 7.9 miles of COID-owned canal and laterals and to improve water delivery reliability to COID patrons within the Project Area.

By converting open canals into underground closed-pipe systems, the project reduced water loss from seepage by an estimated 29.4 cfs or 9,392 AF annually. Water saved from the project is passed to NUID during the irrigation season for agricultural use. In return, NUID releases an equal volume of water into the Deschutes River from Wickiup Reservoir; this protects the water through instream leases in perpetuity during the winter for instream flows when it is needed most for fish and aquatic species.

6.17.2 Current and Reasonably Foreseeable Future Actions

6.17.2.1 Water Resources Perspective

AID Modernization Project (ongoing and reasonably foreseeable; final watershed plan–environmental assessment [plan-EA] dated August 2022)

The AID Modernization Project has begun piping 11.9 miles of the AID’s main canal in four phases, the first phase of piping having been completed in the 2023–2024 nonirrigation season. The project will improve water conservation in AID-owned infrastructure; improve water supply management and delivery reliability to AID patrons; increase drought resiliency; improve public safety on up to 11.9 miles of the main canal; and enhance streamflow in the Deschutes River.

By converting the open irrigation canal into a buried, closed-pipe system, the project will reduce water loss from seepage, saving an estimated 32.5 cfs of water or 11,083 AF annually. Water saved from the project will pass to NUID during the irrigation season for agricultural use. In return, NUID will release an equal volume of water into the Deschutes River from Wickiup Reservoir during the nonirrigation season.

NUID Modernization Project (ongoing and reasonably foreseeable; final plan-EA dated January 2023)

The NUID Modernization Project is located in Jefferson County, Oregon. The project will convert 27.5 miles of laterals to gravity-pressurized, buried pipe; upgrade 153 turnouts; and construct four 1,000-cubic-yard retention ponds, each approximately 0.5 acres in size. When fully complete, the NUID Modernization Project is expected to make approximately 6.4 cfs (about 2,728 AF) of water available to NUID as live flow for irrigation due to reduced seepage and evaporation in NUID laterals. Up to 2.1 cfs will be protected and stored in Wickiup Reservoir for release as winter flow. The project will improve water conservation in the NUID system; improve water delivery reliability and drought resilience for NUID irrigators; reduce NUID’s O&M costs; reduce operational spills into natural waterbodies; and improve streamflow, water quality, habitat, and habitat availability in

the Deschutes River. As of early 2025, one 1.5-mile segment of the project had been completed and a second segment was under construction (Clark 2024; NUID 2025).

Ochoco Irrigation District Modernization Project (ongoing and reasonably foreseeable; final plan-EA dated December 2020)

The Ochoco Irrigation District Modernization Project is located in Crook County, Oregon. The project will install a total of 16.8 miles of buried pipeline which will replace the open, unlined canals and laterals of Grimes Flat and the Iron Horse section of the Crooked River Distribution Canal. The project will also install a new pipeline and improve existing canal capacity to deliver irrigation water to the upper McKay Creek lands associated with the McKay Creek Water Rights Switch. Related improvements include replacing aging pump stations and raising canal banks to deepen canals. The project will improve irrigation water management and delivery, reduce district O&M costs, improve public safety along piped sections, and increase streamflow in McKay Creek and the Crooked River. The first phase of the project—a new pumping station at the corner of Combs Flat and Laughlin Roads—was constructed during the 2023–2024 nonirrigation season.

Installing a new pipeline to serve irrigators in the upper reaches of McKay Creek will improve water supply reliability for farmers and ranchers in that area while restoring seasonal flow of up to 11.2 cfs of streamflow in a portion of the creek. Converting open irrigation canals into underground, closed-pipe systems will reduce water loss from seepage by up to an estimated 5.9 cfs, of which an estimated 4.82 cfs will be allocated instream in the Crooked River; remaining water savings will improve water supplies for existing irrigated lands in the district.

LPID Modernization Project (ongoing and reasonably foreseeable; final plan-EA dated August 2021)

The LPID Modernization Project is located in Deschutes County, Oregon. The project will realign the district's conveyance system to achieve optimal efficiency of water delivery and reduce costs. It will also construct a new river crossing at the Crooked River and enter the district from the southern boundary, install 10.9 miles of pressurized buried pipe, and decommission 9.7 miles of open canal.

The project will improve irrigation water management and delivery, reduce district O&M costs, and enhance streamflow in the Deschutes River. By converting open irrigation canals into underground, closed-pipe systems, the project will eliminate water losses from seepage and end spills, thus saving an estimated 2,103 AF of water annually when fully complete.

Swalley Irrigation District Modernization Project (ongoing and reasonably foreseeable; final plan-EA dated December 2018)

The Swalley Irrigation District currently serves 668 patrons, which include Bend Parks & Recreation District, Bend-LaPine Schools, the City of Bend, Avion Water, the USFS, and many others. The district was awarded \$11.2 million in federal funds through the NRCS Watershed Protection and Flood Prevention Program. The irrigation district is using the funds to modernize and pipe 16.6 miles of its remaining open canals to improve water conservation, water delivery reliability, and public safety, as well as contribute to increases in streamflow in the Middle Deschutes River. The project will be conducted in phases over 7 years.

The first project phase—the Rogers Lateral piping project—was completed in early 2020. The first phase installed 16,045 feet of pipe and reduced water loss by up to 20 percent. The modernization of the remaining open irrigation infrastructure will conserve up to 6,172 AF of water annually for

instream and agricultural use. The improvements will also reduce the irrigation district’s O&M costs, as well as reduce electricity costs and consumption from pumping.

Tumalo Irrigation District Modernization Project (ongoing and reasonably foreseeable; final plan-EA dated August 2018)

When fully completed, the Tumalo Irrigation District Modernization Project will modernize up to 1.9 miles of the Tumalo Irrigation District’s canals and 66.9 miles of laterals to improve water conservation, water delivery reliability, and public safety. The project will be conducted in phases over 11 years. Multiple phases have already been completed.

By converting open irrigation canals into an underground closed-pipe system, the project will reduce water loss from canals by up to 48 cfs or 4.9 billion gallons per season. Water saved from the project will be permanently protected in the Deschutes River and Tumalo Creek, benefiting fish and wildlife habitat. The project also will deliver water to irrigators in a safer, more efficient manner and reduce energy consumption from pumping.

COID Hydroelectric Plan Developments (reasonably foreseeable)

COID is in the early planning phase for adding two hydroelectric power facilities to the PBC; one at US 97/Veteran’s Way in Redmond and the other at the terminus of the PBC where it transfers irrigation water to NUID. Funding options are currently being explored, but it is anticipated that funds could come from a mix of funds from Energy Trust of Oregon Development Assistance and the State of Oregon Clean Water State Revolving Fund. These hydroelectric power facilities would be integrated with the North Unit Redmond Resiliency Project to maximize regional resiliency benefits.

On-Farm Water Conservation Projects (ongoing and reasonably foreseeable)

On-farm water conservation projects throughout the Deschutes Basin typically consist of smaller efforts implemented on a project-by-project basis that can involve many active collaborators within the Deschutes Basin. These may include the NRCS Oregon Regional Conservation Partnership Program, local soil and water conservation districts, the Deschutes Basin Board of Control, and nongovernmental organizations such as the Deschutes River Conservancy. The projects can range from piping laterals for individual patrons or groups of patrons to renewable energy projects and on-farm irrigation system efficiency projects.

A funding request has been submitted to NRCS through the Regional Conservation Partnership Program (RCPP) for additional funding dedicated to the King Way Section of the PBC. Leveraging Bureau of Reclamation and Oregon Water Resource Department funding, COID and its partners are also planning to pipe two District-owned laterals—the G and G2 laterals—that will directly connect to the King Way Section proposed for piping under this Watershed Plan – EIS. RCPP funding would not be used as match funding for P.L.83-566

6.17.2.2 Biological Resource Perspective

Deschutes Basin Habitat Conservation Plan

On December 31, 2020, USFWS announced its approval of the DBHCP and the issuance of USFWS incidental take permits specific to bull trout (*Salvelinus confluentus*) and Oregon spotted frog (*Rana pretiosa*), both federally listed by USFWS as threatened. NMFS announced its approval of the DBHCP and the issuance of NMFS incidental take permits specific to steelhead (*Oncorhynchus mykiss*) on October 18, 2022. Conservation measures in the DBHCP are designed to minimize and mitigate

impacts caused by the incidental take of listed species that may result from the storage, release, diversion, and return of irrigation water by the irrigation districts in the Upper Deschutes Basin and the City of Prineville for a period of 30 years. The conservation measures in the DBHCP require the entities that are party to the DBHCP to adjust the timing, volume, and duration of irrigation releases to better align with the life history needs of bull trout and frogs while continuing to deliver water for irrigation (USFWS 2021). To enhance Oregon spotted frog habitat, the DBHCP conservation measures require management of Crane Prairie Reservoir for specific minimum and maximum water surface levels year-round, and mandate incrementally increased releases from Wickiup Reservoir during the nonirrigation season. The DBHCP requires minimum winter flows downstream from Wickiup Reservoir of 100 cfs for the first 7 years (2021–2027), which then increase to 300 cfs for years 8 through 12 (2028–2032), and finally to 400 cfs at year 13, in 2033.

6.17.2.3 Transportation Network Perspective

US 97 South Redmond Corridor Project

ODOT and the City of Redmond are collaborating closely with businesses to improve the US 97 South Redmond Corridor (ODOT 2023b). This planning effort will create solutions to benefit the entire community while improving highway safety and operations. The total project cost, source of funding, and construction time frame are still being developed.

US 97 Redmond to Bend Project

This ODOT project addresses safety on a 9-mile-long corridor of US 97 between the cities of Redmond and Bend (ODOT 2023a). The project will identify and prioritize safety improvements for the corridor. Proposed improvements will be incorporated into Deschutes County planning documents. The design phase was expected to be completed by the end of 2019, and construction was anticipated to begin in 2021. The first phase of the project was completed in 2022, and the second phase will start in summer 2024. Once the second phase is complete, US 97 will have a median barrier from Bend north to near 61st Street in Deschutes County.

City of Bend Transportation System Plan Update

The *Transportation System Plan* (City of Bend 2020) is part of the *Bend Comprehensive Plan* (City of Bend 2023). It is dedicated to planning for Bend transportation needs over the next 20 years. The *Transportation System Plan* includes an 18th Street arterial corridor upgrade from Cooley Road to Butler Market Road.

6.17.2.3.1 Deschutes County Transportation Projects

Powell Butte Highway/Butler Market Road Roundabout

Deschutes County is working to install a roundabout at the intersection of Powell Butte Highway and Butler Market Road (Deschutes County 2024c). The intersection is presently a three-legged intersection with stop-sign control on the eastbound approach from Butler Market Road only. The project is identified as a high-priority project in the *Deschutes County Transportation System Plan* (Deschutes County 2023) that is estimated to be completed in fall 2024.

Hamehook Road Bridge Replacement

The Hamehook Road Bridge is northeast of Bend. The timber structure was constructed in 1977 and is deteriorating. Construction of the new bridge is estimated to be completed in 2025 (Deschutes County 2024b).

6.17.2.3.2 *City of Bend Transportation Projects*

Parkway Connection Improvements at Empire, Butler Market, Colorado and Powers

The US 97 Bend Parkway Plan is a multiphase planning process to improve safety, mobility, and active transportation and transit use on US 97 between Tumalo Road and Baker Road, most of which is within the city of Bend (City of Bend 2024b). Project construction is expected to take place from 2028 to 2031.

6.17.2.4 Land Use Development Perspective

6.17.2.4.1 *Bend*

Juniper Ridge

Juniper Ridge is a 500-acre Urban Renewal Area in northeast Bend that is planned for industrial and employment development (City of Bend 2024a). The City is coordinating efforts to develop Juniper Ridge through its Economic Development Department. Planned development in the area includes a new 33-acre City of Bend Public Works campus. The *Juniper Ridge Urban Renewal Plan*, adopted in 2005 and amended in 2019, has a duration of 30 years (City of Bend 2019).

Northeast – Butler Market Village Expansion Area

The Northeast – Butler Market Village Expansion Area was added to the Bend UGB in 2016 (City of Bend 2023). Development within the area is subject to an area plan developed by the City. Central planning concepts within the area plan are to create a new, complete community as a node that sets the stage for urban growth in the future, as well as to increase the mix of housing and other land uses in the area to make existing neighborhoods inside the UGB more complete.

6.17.2.4.2 *Redmond*

Southwest Area Plan

The *Southwest Area Plan* provides guidance for future land uses, densities, neighborhood amenities, and public facilities and services for the land surrounding Ridgeview High School (City of Redmond 2014). It includes land within city limits, land outside of city limits but within the UGB, and land within the Urban Reserve Area. The plan identifies future land use and zoning designations to be implemented upon annexation, desired levels of density, needed public facilities, etc. The plan includes land surrounding the PBC south of Redmond.

6.17.2.4.3 *Deschutes County*

Deschutes 2040 Comprehensive Plan Update

Deschutes County is in the process of updating its comprehensive plan, with an anticipated completion date of February 2024 (Deschutes County 2024a). The updated comprehensive plan will address the current needs of the communities in the county, and it will be used to guide the anticipated growth and development of Deschutes County over the next 20 years. This update includes new policies for the Redmond Urban Reserve Areas.

6.17.2.4.4 Individual Parcel Projects

64994 Deschutes Market Road. The applicant requests approval of a Comprehensive Plan Amendment to change the designation of the properties from Agricultural (AG) to Rural Industrial (RI) and a corresponding zone change to rezone the properties, a total of 20.36 acres, from Exclusive Farm Use (EFU) to Rural Industrial (RI). This proposed project is located adjacent to the PBC north of Bend and is currently going through hearings to determine if a zoning change is allowed. In June 2023, the hearings officer recommended denial of the applicant's request unless the applicant demonstrates the requested Comprehensive Plan Amendment and Zone Change are consistent with Statewide Planning Goal 5. The Board of County Commissioners will conduct a second hearing and make a final decision on the proposal. The Board of County Commissioners hearing date/time has not been set at this time.

6.17.3 Cumulative Effects by Resources

The route options considered for the Project to avoid water resources do not contribute to cumulative effects to individual resources as all route options have short-duration construction impacts.

6.17.3.1 Cultural Resources

The Modernization Alternative is anticipated to adversely affect two sections of the PBC previously determined eligible or listed in the NRHP by eliminating the historic character of the open canal design and construction methods. Across the Deschutes Basin, similar modernization actions have also or will also eliminate open canals with historic character. Cumulatively, these actions may remove the majority of these historic resources across the Deschutes Basin, but approved mitigation, such as interpretive signage, materials salvage and display, and detailed historic publications provide interested parties with photo, video, physical, and informational representations of the impacted resources while allowing beneficial irrigation improvements to continue the essential function of the irrigation canal systems. In addition, there may be open canals retained for the foreseeable future as parts of laterals throughout the basin.

6.17.3.2 Land Use

No cumulative impacts are expected from the Modernization Alternative or any of the alternative alignment options. The Modernization Alternative is not anticipated to result in long-term changes to land use. Temporary occupancies needed during construction would be returned to their preconstruction conditions.

6.17.3.3 Parks and Recreation

The Modernization Alternative, when combined with other current or future projects, is not expected to cause cumulative effects to park and recreation resources.

6.17.3.4 Public Safety

The Modernization Alternative, when combined with other current or future projects, is not expected to cause cumulative effects to public safety resources. Piping of the PBC will substantially reduce the risk of flooding that currently exists. Potential safety impacts related to construction are not expected to remain following the completion of construction. Since there are no long-term

impacts on the public safety services, there are no cumulative effects impacts identified for this resource.

6.17.3.5 Neighborhood and Socioeconomic Resources

Improvements at the Butler Market Village Expansion Area could have a short-term impact on the surrounding community if they occur concurrently with the Modernization Alternative. The County projects should not have a cumulative effect on community resources within the Project Area. The No Action Alternative would not change existing conditions. It would not impact surrounding neighborhoods or their respective community resources. Since there are no long-term impacts on the neighborhoods or social services, there are no cumulative effects impacts identified for these resources.

6.17.3.6 Geology, Soils, and Hazardous Materials

Hazardous material contamination in the soil and groundwater throughout the Project Area would not be disturbed, remediated, or mitigated under the No Action Alternative. Therefore, hazardous material contamination would not be different from existing conditions and would not contribute to impacts from past, present, and reasonably foreseeable actions. Similarly, adverse and/or beneficial effects of project construction and operation would not be realized; thus, cumulative effects from reasonably foreseeable actions would not occur as a result of the No Action Alternative.

Operation of the Project, as well as concurrent projects identified in the area, would likely involve some use and handling of hazardous materials and would be required to comply with hazardous material laws and regulations. Therefore, this Project and concurrent projects would likely implement programs to manage hazardous material handling, use, and disposal—programs such as spill response plans to address accidental releases. This makes it unlikely that construction of the projects would have a cumulative adverse impact to hazardous material conditions.

Additionally, the Project and other projects in the area are likely to improve conditions over the long term due to the removal and disposal of some contaminated soils, groundwater, or sediment. As a result, no adverse cumulative impacts to hazardous materials are expected from the Project and the other reasonably foreseeable future projects.

6.17.3.7 Biological Resources

The Modernization Alternative could contribute to cumulative effects on biological resources when considered in combination with other past, present, and reasonably foreseeable actions in the Upper Deschutes Basin.

Under the No Action Alternative, no federal funding would be forthcoming to support the Project, and modernization of the PBC system would not take place. No direct effects on vegetation, wildlife, or aquatic species would result from the Project, and existing conditions would remain unchanged. The No Action Alternative would, therefore, not contribute to cumulative impacts to vegetation, wildlife, or aquatic species.

6.17.3.7.1 Vegetation

Agricultural activities, livestock grazing, vegetation control along roads, and urban and suburban development are responsible for most of the past and ongoing effects on vegetation in the Project Area and in the region. Livestock grazing can introduce and spread weed species, degrade native

vegetation communities, and trample riparian and wetland areas. In addition, vegetation control activities generally include herbicide applications to control vegetation and noxious weeds and the mechanical cutting of vegetation. The amount of vegetation that would be affected by the proposed action is small compared to the area affected by past and ongoing agricultural activities, livestock grazing, vegetation control along roads, and other utility corridors in the area. In addition, these past actions are not expected to change measurably from current conditions and are expected to result in minor cumulative effects.

6.17.3.7.2 Wildlife

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

Some wildlife currently uses the PBC as a water source. The proposed action would cause wildlife to find other water sources, as they did prior to installation of the canals, but would also create connected habitat corridors through which wildlife could travel. Since effects of the proposed action on wildlife would happen incrementally over the several years needed to complete the Project, animals would be able to adapt. Furthermore, because other past, present, and reasonably foreseeable future actions affect wildlife across a broad geographic area in the Deschutes Basin, the cumulative effects on wildlife from the proposed action would be minor.

In addition, vegetation control activities including herbicide applications to control noxious weeds and the mechanical cutting of vegetation are ongoing actions that contribute to wildlife habitat changes. In conjunction with past and ongoing agricultural activities, livestock grazing, vegetation control, and urban and suburban development in the area, the proposed action would have negligible cumulative effects on wildlife habitat available.

6.17.3.7.3 Aquatic Species

Past actions including road construction, road maintenance, and urban and suburban development projects would have minor effects on fish in combination with the proposed action. The potential effects from these past projects in COID and the Deschutes Basin, such as sediment entering waterbodies or aquatic habitat disturbance, would be temporary and likely complete before construction of the proposed action.

Because the COID irrigation diversions are screened and the conveyance systems do not provide adequate habitat for fish and aquatic species, implementation of the Modernization Alternative would not have a direct effect on fish and aquatic species within the COID irrigation infrastructure. Irrigation diversions and reservoir operations are responsible for most of the past and ongoing direct and indirect effects related to water availability and seasonality on fish communities and associated riverine habitat in the waterbodies affected by COID operations.

Ongoing land use activities in the Project Area are not expected to change from current conditions. Future land development projects may cause indirect effects on fish—effects such as sediment inputs, mobilization of contaminants in stormwater runoff from new impervious surfaces, or aquatic habitat disturbance—and could potentially affect waters within the same watershed as the proposed action.

Ongoing and future water management activities would be expected to improve aquatic habitat conditions. These actions include other irrigation piping projects in the Upper Deschutes Basin and the phased implementation of the DBHCP. With the DBHCP, to protect threatened aquatic species irrigation districts in the Upper Deschutes Basin will be modifying both general operations to leave more flow instream and seasonal operation to create higher overall winter streamflows and lower overall summer streamflows. This will leave less water available to support agricultural production. The cumulative water savings made available by modernization of other districts' conveyance systems is expected to conserve substantial amounts of water, allowing more reliable water delivery to agricultural producers while complying with the requirements of the DBHCP conservation measures. The water that would be saved by modernizing the COID conveyance system would have an additive effect on the increased water delivery reliability for agricultural producers, but it would not contribute to cumulative effects on aquatic species or their respective habitats within the Deschutes River system.

As a result, the proposed action, when combined with other future actions, is anticipated to have moderate, beneficial cumulative effects on fish, aquatic species, and available habitat for these species. The Modernization Alternative would not contribute adversely and could contribute beneficially to overall cumulative effects. See Appendix F.7, Water Resources Technical Report, for additional details on the streamflow conservation requirements of the DBHCP and the water savings effects of the proposed action in combination with other past, ongoing, and reasonably foreseeable irrigation modernization projects in the Upper Deschutes Basin.

6.17.3.7.4 Wetlands and Waters

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 development. Seepage from the unlined PBC has contributed to the establishment of wetland plant species and three freshwater emergent wetlands have been identified within or adjacent to the Project Area. The proposed action would eliminate seepage from the PBC into adjacent soils and remove the water source for these potential wetland features during the irrigation season. These potential wetland features would convert from wetland to upland plant communities. Because the PBC—an artificially constructed watercourse—is the only source of wetland hydrology for these features, they are expected to be non-jurisdictional. Reasonably foreseeable future actions in the Project Area that could affect wetland vegetation along irrigation canals include agricultural activities, livestock grazing, vegetation control along roads and utility corridors, and urban and suburban development.

The ongoing implementation and the future full phase-in of the DBHCP will require increased streamflow in the Upper and Middle Deschutes River during the nonirrigation season. Water savings from the proposed action would enable more reliable water delivery to irrigators in light of the DBHCP requirements for conservation of instream flow. Increased streamflow is expected to have beneficial effects on riparian vegetation and Oregon spotted frog habitat in the Upper Deschutes River and negligible effects on riparian vegetation and Oregon spotted frog habitat in Wickiup

Reservoir. Other ongoing and anticipated future irrigation modernization actions (see the aquatic species discussion above), in combination with implementation of the DBHCP, are anticipated to contribute to increased streamflow and associated beneficial effects on riparian vegetation in the Deschutes River system. The Modernization Alternative would contribute no adverse or beneficial effects to the overall cumulative effects on wetlands and waters. Refer to the Water Resources Technical Report (Appendix F.7) for additional details on the streamflow conservation requirements of the DBHCP and the water savings effects of the proposed action in combination with other irrigation modernization projects. The cumulative effects of the proposed action and other past, present, and reasonably foreseeable future projects on wetlands and water-dependent vegetation including invasive moss are expected to be minor.

Cumulative effects in the lower Crooked River and NUID canals as a result of the proposed action or other foreseeable projects are expected to be negligible.

6.17.3.8 Visual Resources

This Modernization Alternative, when combined with other current or future projects, may cause short- or long-term cumulative effects on visual resources. These impacts may be related to the temporary presence of construction equipment or activities during infrastructure or land use development projects, or they may be related to long-term changes in the landscape from the development of new structures or infrastructure visible within the Project Area.

When considered alongside other past and future irrigation district modernization projects in the region, piping of the PBC would contribute to a long-term moderate impacts on visual resources. Piping of the PBC and canals in nearby irrigation districts would lead to the loss of the existing open canals as a visual resource throughout the region.

6.17.3.9 Water Resources

The Modernization Alternative could contribute to cumulative effects on water resources when considered in combination with other water resource development and conservation projects in the Upper Deschutes Basin.

Under the No Action Alternative, no federal funding would be forthcoming to support the Project, and modernization of the PBC system would not take place. No new direct effects on water resources would result from the Project, and existing conditions would remain unchanged. The Project would, therefore, not contribute to cumulative impacts to water resources over current conditions.

Under the Modernization Alternative, past actions over the last 120 years that have affected water resources in the Upper Deschutes Basin include urban and agricultural development, construction and maintenance of the roadway network, water impoundment projects, and other irrigation projects. Since the early 1990s, COID and other Deschutes Basin irrigation districts have implemented various water conservation efforts, which have included piping existing irrigation canals, on-farm conservation, water management changes, and changes to crop production. These have resulted in increased streamflow in the Deschutes River and decreased seepage into the groundwater table.

Ongoing and reasonably foreseeable future actions that could affect waterbodies associated with COID operations include on-farm water conservation efforts, additional irrigation piping projects by

COID and other Deschutes Basin irrigation districts that divert water from the Deschutes River, and continued implementation of the DBHCP.

The Modernization Alternative would contribute no adverse or beneficial effects to the overall cumulative effects for streamflow. Other irrigation canal piping projects by COID and other districts may directly or indirectly increase streamflow in the Deschutes River and its tributaries and result in beneficial effects on surface water resources. Ongoing and reasonably foreseeable future irrigation piping projects in the Upper Deschutes Basin are listed in Table 6-4.

The ongoing and reasonably foreseeable irrigation canal and lateral piping projects listed in Table 6-4 could reduce seepage to groundwater in the Project Area by as much as 31,478 AF annually.¹¹ In consideration of the effects of climate variability, the proposed action would have a minor cumulative effects on local groundwater level decreases (Appendix F.7; Gannett and Lite 2013). The effects of local groundwater reduction due to piping may be partially offset by increased streamflow during the nonirrigation season; some of the increased streamflow would likely infiltrate into the regional aquifer.

Cumulative effects on surface water quality could result from nonpoint source pollution such as erosion and runoff associated with construction of the projects listed above. The proposed action would be constructed when there is no water in the canal system; construction timing for other irrigation system piping projects is expected to be similar. Proposed cumulative actions are anticipated to contribute to water quality improvements by reducing nonpoint source pollution from canal bank erosion and agricultural runoff and by increasing streamflow in waterbodies affected by the districts' operations.

The ongoing phase-in to full implementation of the DBHCP would be expected to result in higher overall winter streamflows and lower overall summer streamflows. In combination with the cumulative amount of water conserved instream (or as stored water in Wickiup Reservoir) by other irrigation districts' piping projects, this would contribute to beneficial cumulative impacts to streamflows.

The Modernization Alternative could reduce groundwater infiltration. Other past, present, and reasonably foreseeable future actions are anticipated to result in overall beneficial effects on water resources, although they would also contribute cumulatively to reductions in groundwater levels. Overall, the Modernization Alternative would be expected to have a minor beneficial contribution to overall beneficial cumulative effects on water.

¹¹ This number assumes that the projects listed in Table 6-4 would reduce annual seepage to groundwater as follows (based on their respective plan-EAs): SID: 6,172 AF; NUID: 2,728 AF; AID: 11,083 AF; LPID: 2,103 AF; COID Smith Rock-King Way: 9,392 AF.

Table 6-4. Potential Water Conserved Instream from other Public Law No. 83-566 Projects Occurring in the Deschutes Basin.

Irrigation District	Project	Status ^b	Total Water Conserved Instream (cfs) ^{a,c}	Reach Affected ^{a,c}
Tumalo Irrigation District	TID Infrastructure Modernization Project (NRCS 2018b)	Ongoing and Reasonably Foreseeable	48.0	Approximately 30 cfs would be allocated to Tumalo Creek during the irrigation season, and 18 cfs would be allocated to Crescent Creek during the nonirrigation season. Both creeks are tributaries to the Deschutes River.
Swalley Irrigation District	SID Infrastructure Modernization Project (NRCS 2018a)	Ongoing and Reasonably Foreseeable	15.2	The entire 15.2 cfs would be allocated to the Middle Deschutes River, from RM 164.8 to RM 120, during the irrigation season.
Lone Pine Irrigation District	LPID Infrastructure Modernization Project (NRCS 2021a)	Ongoing and Reasonably Foreseeable	5.2	The entire 5.2 cfs would be allocated to the Upper and Middle Deschutes River, from RM 226.8 to RM 120, during the irrigation season.
North Unit Irrigation District	NUID Infrastructure Modernization Project (NRCS 2023a)	Ongoing and Reasonably Foreseeable	8.4	Up to 6.3 cfs would be allocated to the Upper Deschutes River as live flow to satisfy NUID water rights. Up to 2.1 cfs would be protected and stored in Wickiup Reservoir for use in the Deschutes River below Wickiup Reservoir during the nonirrigation season.
Arnold Irrigation District	AID Main Canal Modernization Project (NRCS 2022b)	Ongoing and reasonably foreseeable	33.8	Up to 33.8 cfs would be protected in the Deschutes River below Wickiup Reservoir during the nonirrigation season through an instream lease.

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Irrigation District	Project	Status ^b	Total Water Conserved Instream (cfs) ^{a,c}	Reach Affected ^{a,c}
Ochoco Irrigation District (OID)	OID Infrastructure Modernization Project	Ongoing	16.0	This project would transfer up to 11.2 cfs of live flow McKay Creek water rights instream. Piping would conserve another estimated 5.9 cfs through seepage reduction; an estimated 4.82 cfs of this will be allocated instream in the Crooked River.
COID	PBC Smith Rock-King Way Piping Project (NRCS 2020a)	Completed	30.3	This first phase of the project would protect up to 29.4 cfs in the Deschutes River below Wickiup Reservoir during the nonirrigation season through an instream lease.
COID	Siphon Power Property Canal Piping Project (COID 2016b)	Completed	5.0	This completed project piped 3,000 linear feet of the Central Oregon Canal in southwest Bend, protecting up to 5 cfs within the Deschutes River.
COID	J and L Laterals Piping Project (NRCS 2020b)	Completed	2.0	This completed RCPP project included piping part of the J Lateral and the L Lateral, which would protect up to 2 cfs in the Deschutes River below Wickiup Reservoir during the nonirrigation season through an instream lease.
COID	G and G2 Laterals Piping Project (Talbot 2025)	Future	3.4	This project, scheduled for winter (nonirrigation) season 2025–2026, will pipe 12,522 linear feet of the G Lateral and 15,350 linear feet of the G2 Lateral in the Smith Rock-King Way area. The project is funded by a Reclamation WaterSmart grant with matching funding from OWRD.

a The numbers presented for the listed irrigation district projects are from the watershed plan–environmental assessments, which have already been authorized.
 b Ongoing projects are currently under construction. Future projects are authorized but not yet initiated.
 c Flows allocated instream during the irrigation season are shown as maximum flows. See each district’s watershed plan–environmental assessment for the anticipated timing and location of instream flows.
 cfs = cubic feet per second; PBC = Pilot Butte Canal; RCPP = NRCS Oregon Regional Conservation Partnership Program; RM = river mile

6.17.3.10 Utilities

No cumulative impacts are expected from the Modernization Alternative related to utility facilities. Utility infrastructure would be replaced to match existing conditions, or it would be improved to meet current design standards.

6.17.3.11 Noise and Vibration

No cumulative impacts for noise and vibration are expected from the Modernization Alternative. The pipe would be underground and would not be a major source of noise or vibration. Once Modernization Alternative is completed, noise levels are expected to return to preconstruction ambient conditions and the Project would not contribute to long-term changes in the ambient noise environment.

6.17.3.12 Right-of-Way, Displacements, and Relocations

No cumulative impacts are expected from the Project. Once the Project is completed, properties and ROW would be returned to preconstruction conditions.

6.17.3.13 Transportation

Improvements at the Butler Market Village Expansion Area could have a short-term impact on the surrounding transportation network if they occur concurrently with the Modernization Alternative. The Deschutes County projects should not have a cumulative effects on the local transportation network within the Project Area. No cumulative impacts are expected from the Modernization Alternative related to transportation facilities. Transportation infrastructure would be replaced to match existing conditions or improved to meet current design standards.

6.17.3.14 Air Quality

The PBC is an irrigation water canal that is not a source of air quality criteria pollutants. The canal would be piped, buried underground, and operationally isolated from ambient atmospheric conditions. No long-term air quality impacts are anticipated as a result of the Modernization Alternative. Therefore, no cumulative effects are anticipated for air quality.

6.17.3.15 Climate Change

Climate change, by its very definition, is a cumulative impact process. To the extent that the Modernization Alternative will assist COID and other irrigation districts with managing scarce water resources and continuing to provide water to irrigation patrons to support sustainable agriculture will lessen the cumulative effect of climate change.

6.17.3.16 Wild and Scenic Rivers

Changes in seasonal flow regimes resulting from implementation of the DBHCP may be visibly evident in designated wild and scenic sections of the Deschutes River. These would likely be most perceptible in the Upper Deschutes Wild and Scenic River, immediately below Wickiup Reservoir and upstream from the Project Area. Improvements associated with other ongoing and reasonably foreseeable future actions, including ongoing land development in the Deschutes Basin and system modernization projects by other irrigation districts, could potentially result in impacts to wild and scenic rivers if construction activities or permanent improvements are visible from designated wild

and scenic river corridors. The Modernization Alternative would take place a minimum of more than 4 miles from the closest designated wild and scenic river corridor. Construction activities, equipment, and permanent improvements would not be visible from any designated wild and scenic river corridors. As a result, implementation of the proposed action would not contribute to cumulative impacts on wild and scenic rivers.

6.17.3.17 Ecosystem Services

All reasonably foreseeable actions regarding the modernization of irrigation infrastructure in the Deschutes Basin would work in concert to conserve water and improve water availability to irrigators. Past and ongoing actions described in the sections above have also contributed to water availability for irrigation and instream flow. Past, ongoing, and reasonably foreseeable actions in the Deschutes Basin could all impact ecosystem services. However, implementation of the proposed action when combined with other future actions is anticipated to have a beneficial cumulative effect on all ecosystem services assessed.

7 Consultation, Coordination, and Public Participation

In the development of the Draft Plan-EIS, COID 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.

A Preliminary Investigative 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 Report, project sponsors conducted initial coordination with natural resource agencies and stakeholders in the Deschutes Basin.

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

Public Announcements

- NRCS public notice for Informal Scoping Online Public Meeting (October 5, 2021)
- NRCS Scoping Letters for Formal Scoping Public Meeting (Mailed July 12, 2022)
- Bend Bulletin
 - Notice of Informal Scoping Online Public Meeting (October 5, 2021; October 19, 2021; BendBulletin.com: October 19, 2021)
 - Notice of Formal Scoping Public Meeting (July 1, 2022; July 6, 2022; July 15, 2022)
- COID website notice (July 22, 2022)
- Postcard to COID patrons
 - Notice of Informal Scoping Online Public Meeting (September 21, 2021)
 - Notice of Formal Scoping Public Meeting (July 19, 2022)
- NRCS news release for Formal Scoping Public Meeting (July 22, 2022)

Public Involvement Website

Information about the proposed project was added to the website coidpiping.com to inform the public and includes the following information:

- Overview of the NRCS Pub. L. No. 83-566 funding program.
- Overview of NEPA and EIS public participation process.
- Frequently Asked Questions.
- Background on COID, the Draft Plan-EIS and appendices, the System Improvement Plan, 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

Public scoping is addressed in detail in Chapter 3.

7.1 List of Persons and Agencies Consulted

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

Table 7-1. Agency Consultation and Communication Record.

Date	Contact, Agency	Communication
May 16, 2022	Mike Petrozza, NRCS-OR	Sent initial APE concurrence request for COID EIS project to OR State Historic Preservation Office (SHPO) and potentially interested Indian Tribes.
August 17, 2022	William Abadie, U.S. Army Corps of Engineers (USACE)	Request to Gary Diridoni at NRCS to be a cooperating federal agency on the EIS (this request was rescinded by the USACE on November 16, 2022 – see below).
November 16, 2022	Melanie O’Meara, USACE	Email to Gary Diridoni at NRCS rescinding request to be a cooperating federal agency due to no USACE regulatory involvement.
January 27, 2023	Mike Petrozza, NRCS-OR	Sent revised APE concurrence request for COID EIS project to SHPO.
March 8, 2023	Jamie French, OR SHPO	Communication to Michael Petrozza at NRCS notifying of concurrence with APE.
November 7, 2023	Mike Petrozza, NRCS-OR	Submission of Historic Properties Resources survey to OR SHPO.
December 11, 2023	Robert Olguin, OR SHPO	Letter to Mike Petrozza at NRCS notifying that SHPO had no comments on historic properties/built environment survey.
April 29, 2024	Jo Reese, AINW for NRCS-OR	Letters to Grand Ronde, Burns Paiute, and Warm Springs Tribes to notify about planned fieldwork and ask for comments and coordination.

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Date	Contact, Agency	Communication
September 5, 2024	Rachel Gebauer, NRCS-OR	Submittal to OR SHPO of Oregon Trunk Railway findings of no adverse effect.
September 30, 2024	Rachel Gebauer, NRCS-OR	Letter to OR SHPO confirming new Programmatic Agreement consultation period.
October 23, 2024	Rachel Gebauer, NRCS-OR	Letter to OR SHPO confirming NRCS's intention to continue consultation on the Programmatic Agreement.
November 1, 2024	Jennifer (Jen) O'Reilly, USFWS	Web meeting with NRCS and USFWS. Discussed the draft proposed action (piping all PBC from NE 17th Street in Redmond to the diversion point from Deschutes River in Bend) and anticipated lack of effects to species under jurisdiction of the ESA. Discussion of proposed No Effect Determination for ESA species.
November 6, 2024	Rachel Gebauer, NRCS-OR	Letter to OR SHPO, Bureau of Reclamation, ACHP, and COID including proposed amendment language for the Programmatic Agreement.
November 11, 2024	Rachel Gebauer, NRCS	Submitted archaeological survey for the COID EIS project to OR SHPO.
November 20, 2024	Rachel Gebauer, NRCS	Submission of archaeological survey to Burns Paiute, Confederated Tribes of the Grand Ronde, and Confederated Tribes of the Warm Springs Reservation.
November 25, 2024	Ian Johnson, OR SHPO	Letter responding to proposed Programmatic Agreement amendments and potential process.
November 26, 2024	Rachel Gebauer, NRCS	Letter response to OR SHPO letter of 11/25/2024, comments on the Programmatic Agreement and mitigation alternatives.
November 26, 2024	Cheryl Pouley, Confederated Tribes of the Grand Ronde	Letter to Rachel Gebauer at NRCS, response to submission of cultural resources report, deferred comment on undertaking.

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Date	Contact, Agency	Communication
December 11, 2024	Rachel Gebauer, NRCS	Letter requesting an extension for the Programmatic Agreement.
December 12, 2024	Jamie French, OR SHPO	Letter to Rachel Gebauer at NRCS, acknowledgment of cultural resources report (#35050). Awaiting determination of eligibility for selected alternative.
January 15, 2025	Rachel Gebauer, NRCS	Letter to OR SHPO with a revised draft Programmatic Agreement.
February 3, 2025	Ian Johnson, OR SHPO	Letter of comments on Programmatic Agreements.
February 23, 2025	Ian Johnson, OR SHPO	Letter to Rachel Gebauer at NRCS, approved draft amendment of PA-173 conditional to consultation.
April 14, 2025	Rachel Gebauer, NRCS	Findings of Effect Document for COID Pilot Butte Canal SHPO Case # 22-0850, PA-173.
April 17, 2025	Rachel Gebauer, NRCS	COID Pilot Butte Canal Determination of Effect and PA Amendment, submission to Tracy Kennedy, Chair, Burns Paiute Tribe.
April 17, 2025	Rachel Gebauer, NRCS	COID Pilot Butte Canal Determination of Effect and PA Amendment, submission to Jonathan W. Smith Sr., Chair, Confederated Tribes of the Warm Springs Reservation in Oregon.
May 13, 2025	Robert Olguin	Letter to Rachel Gebauer at NRCS, concurrence for finding of adverse effect, (COID) Central Oregon Project System of Canals, Laterals, and Associated Irrigation Features and Facilities, Deschutes County.
April 25, 2025	Rachel Gebauer, NRCS	Letters to Consulting Parties (Historic Landmarks Commission City of Redmond, Deschutes County Historical Society, Historic Landmarks Commission City of Bend, Historic Landmarks Commission Deschutes County, and Restore Oregon) including the revised Programmatic Agreement and mitigation approach and requesting comments.

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Date	Contact, Agency	Communication
April 29, 2025	Tayna Saltzman, Deschutes County	Email to NRCS indicating Deschutes County would not be providing comments.
April 29, 2025	Heidi Kennedy, City of Bend	Email indicating no comments from the City of Bend.
June 18, 2025	Rachel Gebauer, NRCS	Follow up emails to Megan Peninger, City of Redmond requesting comments. No comments were received.
August 27, 2025	Jennifer (Jen) O'Reilly, USFWS	Follow up email coordination requesting concurrence on a determination of w for ESA listed species. USFWS responded that because saved water exceeding the amount needed to meet the minimum winter release would be left in Wickiup Reservoir during Year 7 of DBHCP implementation, a Not Likely to Adversely Affect, fully beneficial effects determination for Oregon spotted frog may be more appropriate.

7.2 Review of Draft Plan-EIS

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

8 Preferred Alternative

8.1 Selection and Rationale for the Preferred Alternative

A detailed Preferred Alternative Evaluation Process is presented in Appendix E.4. The steps in developing and selecting the Preferred Alternative included the following:

- Assembling the preliminary range of alternatives.
- Refining the range of alternatives to be evaluated.
- Developing evaluation criteria.
- Developing criteria weighting.
- Developing rating descriptions.
- Scoring the alternatives.

The Modernization Alternative would replace the existing open PBC within the Project Area with a closed-conduit pipeline system. The Modernization Alternative was refined to have six alternative alignment options that are described in Chapter 5. Under the Modernization Alternative, federal funding through Pub. L. No. 83-566 would be available for project implementation. Depending on the alternative alignment options chosen, after completion up to approximately 21 miles of the PBC system from NE 17th Street in Redmond, Oregon, to the diversion point from the Deschutes River in Bend, Oregon, would be piped. The Modernization Alternative would extend from the piped section of the PBC approved under the 2020 Smith Rock-King Way Infrastructure Modernization Project Final Watershed Plan–Environmental Assessment.

The project team identified the criteria to be used to evaluate the project alternatives and help inform the recommendation of a preferred alternative. To draft the criteria, they first considered the communities' interests, values, concerns and goals related to the Project. This feedback informed the initial draft criteria that the project team discussed and revised through several meetings. They also considered input from the participating agencies and COID patrons before finalizing the evaluation criteria. The criteria topics are listed below and described in detail in Appendix E.4:

- Irrigation Water and Delivery.
- Principles, Requirements, and Guidelines per Pub. L. No. 83-566.
- Natural Resources, Climate Change, and Sustainability.
- Historic Resources.
- Community Quality of Life (including socioeconomics and parks and recreational resources).
- Easements and Property Acquisition.
- Construction Impacts.

After the criteria were approved, the project team weighted the criteria. While the criteria express overall goals for specific issues (e.g., minimize temporary and permanent impacts to rural residential quality of life), weighting ensures that the criteria reflect their relative importance to the communities' interests, values, concerns, and goals related to the Project.

8.2 Measures to be Installed

Based on scoring results, the project team made its recommendation on a Preferred Alternative in fall 2024. The recommendation was for the Modernization Alternative with the following alignment options:

- Pilot Butte Canal Alternative Alignment option in the city of Bend.
- Pilot Butte Canal Alternative Alignment option in the city of Redmond.

Although the PBC alignment option would have the greatest impact to historical resources (adverse effect) and would remove a visual resource that is important to the community and quality of life, these alignment options would meet the purpose and need to maximize irrigation water delivery, satisfy the Principles, Requirements and Guidelines of the Water Resources Development Act of 2007 (Pub. L. No. 110-114), support the sustainable use of water resources that are becoming more scarce as a result of climate change, and avoid the need to obtain new easements and ROW. The temporary construction impacts would be minimized by not constructing in roadways, thereby avoiding the need for extensive utility relocations, transportation system disruptions, and impacts to sensitive community and social resources.

The Preferred Alternative would replace the existing open PBC within the Project Area with a pressurized, 10- to 11-foot-outer-diameter, closed-conduit pipeline system. Approximately 18.5 miles of new pipe would be installed through this Modernization Alternative, and approximately 2.5 miles is already piped as part of previous actions. When completed, the pipe would extend over approximately 21 miles of the COID system from the diversion point from the Deschutes River in Bend, Oregon, to NE 17th Street in Redmond, Oregon.

Implementation of the Preferred Alternative would improve water delivery reliability for COID patrons, save an estimated 136 cfs (43,544 AF) from seepage loss during the irrigation season, pass an estimated 43,544 acre-feet of water to NUID, reduce COID's O&M costs, reduce electricity costs from pumping, and improve public safety.

8.3 Avoidance, Minimization, and Compensatory Mitigation Measures

Project design features and BMPs would be applied during construction of the Preferred Alternative to avoid and minimize effects on environmental and social resources. Potential measures that could be included as construction-phase BMPs are described in Appendix E.2.

8.4 Land Rights and Easements

Prior to construction and where needed, COID would coordinate with landowners and obtain all necessary easements or agreements, including TCEs.

8.5 Permits and Compliance

See Table 8-1 through Table 8-6 for a list of potentially required permits, and refer to Appendix E.3 for a detailed discussion of local, state, and federal permit and compliance requirements for planning and implementation of the Modernization Alternative. The individual technical reports in Appendix F also contain detailed discussions of local and county, state, and federal compliance requirements for planning and implementation of the Modernization Alternative.

Table 8-1. Potentially Required Permits – Deschutes County.

Regulation or Permit Type	Reviewing Agency	Applicability
Land Use Compatibility Statement (LUCS)	Deschutes County Planning Department	Under OAR Chapter 340, Division 18, a LUCS would be submitted for County approval prior to construction. The LUCS is required to support documentation for various state permits from DEQ (1200-C permit) and Oregon Department of State Lands (DSL; Removal-Fill permit).
Land Use Permit	Deschutes County Planning Department	The Suburban Low Density Residential (SR 2-1/2) zone does not list irrigation infrastructure as an outright permitted, conditional, or prohibited use. Further coordination with the County to determine the proper permitting procedures for piping in this segment of the canal is needed.
Public Right-of-Way Permit	Deschutes County Road Department	Required for the nine county roads being crossed by the piped PBC described in the Modernization Alternative.

Table 8-2. Potentially Required Permits – City of Bend.

Regulation or Permit Type	Reviewing Agency	Applicability
Land Use Compatibility Statement	Bend Planning Division	The LUCS is required supporting documentation for various state permits from DEQ (1200-C permit) and DSL (Removal-Fill permit).
Land Use Permit	Bend Planning Division	City of Bend zoning designations including Commercial Limited (CL), Commercial General (CG), Residential Urban Medium Density (RM), Residential Urban Standard Density (RS), and Public Facility (PF) do not identify irrigation infrastructure as an outright permitted, conditional, or prohibited use within the zones. Further coordination with the City of Bend is recommended to determine the appropriate permitting procedures for each of these zones.
Tier 3 Right-of-Way Permits	Bend Community Development Department	Required for the five city streets being crossed by the piped PBC described in the Modernization Alternative.

Table 8-3. Potentially Required Permits – City of Redmond.

Regulation or Permit Type	Reviewing Agency	Applicability
Land Use Compatibility Statement	Redmond Community Development Department	The LUCS is required supporting documentation for various state permits from DEQ (1200-C permit) and DSL (Removal-Fill permit).
Land Use Permit	Redmond Community Development Department	City of Redmond zoning designations including Strip Service Commercial (C1), Central Business District Commercial (C2), Special Service Commercial (C3), and General Residential (R4) do not identify irrigation infrastructure as an outright permitted, conditional, or prohibited use within the zones. Further coordination with the City of Redmond is recommended to determine the appropriate permitting procedures for each of these zones.
Minor Site Development Permit	Redmond Engineering Department	Required for the 14 city streets being crossed by the piped PBC described in the Modernization Alternative.

Table 8-4. Potentially Required Permits – BNSF Railway.

Regulation or Permit Type	Reviewing Agency	Applicability
Utility License Agreements	BNSF Railway Engineering Department	When utility facilities are installed, relocated, removed, or maintained along or across all BNSF Railway property.
Temporary Occupancy Permit	BNSF Railway Engineering Department	If surveying is necessary for the completion of an application in order to enter BNSF Railway ROW.

Table 8-5. Potentially Required Permits – State of Oregon.

Regulation or Permit Type	Reviewing Agency	Applicability
Oregon Removal-Fill Permit	Oregon Department of State Lands	Required for removal or fill within waters of the State, including wetlands, streams, and estuaries.
CWA Section 401 Water Quality Certification	Oregon Department of Environmental Quality	Required for fill within waters of the United States and prior to issuance of Section 404 CWA permit from USACE.

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Regulation or Permit Type	Reviewing Agency	Applicability
Oregon Construction Stormwater Permit - 1200-CA	Oregon Department of Environmental Quality	Required for construction sites disturbing one acre or more.
Oregon State Endangered Species Act	Oregon Department of Fish and Wildlife	Voluntary incentives encouraging appropriate species management, coordinated planning, habitat protection and restoration, and other means as appropriate, in a manner consistent with the provisions of ORS 496.182(1).
Utility Encroachment Permit	Oregon Department of Transportation, Maintenance District 10	For an activity such as utility installation along or across a state highway, or an activity that requires the use of the state highway for other than a normal transportation activity.

Table 8-6. Potentially Required Permits – Federal.

Regulation or Permit Type	Reviewing Agency	Applicability
Clean Water Act (CWA) Section 404 Permit	U.S. Army Corps of Engineers	Required for fill within waters of the United States, including wetlands, streams, and estuaries. If less than 0.5 acres of impact, project can generally be permitted under various Nationwide Permits (streamlined process), otherwise would require an individual permit.
Endangered Species Act Section 7 Consultation	National Marine Fisheries Service and U.S. Fish and Wildlife Service	Required when a federal action (federal funding or a permit) may affect an ESA-listed species or designated critical habitat. Listed species and habitats would likely include anadromous salmonids, steelhead, and others.
Magnuson-Stevens Fishery Conservation Management Act	National Marine Fisheries Service	Required when federal actions may adversely affect essential fish habitat, defined as those waters and substrate necessary to specific fish for “spawning, breeding, and feeding, for growth to maturity.” Conducted along with ESA consultation.
Bald and Golden Eagle Protection Act	U.S. Fish and Wildlife Service	Required when known active nests of bald or golden eagles are within vicinity.

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Regulation or Permit Type	Reviewing Agency	Applicability
Migratory Bird Treaty Act	U.S. Fish and Wildlife Service	Requires that all entities refrain from actions to pursue, hunt, take, kill, sell, purchase, transport, or receive any migratory birds (including parts, nests, eggs, or other products, manufactured or not). This includes destruction of active nests during vegetation clearing or other construction activities. Nests may be present in natural areas or associated with structures or other built features. Vegetation clearing and grubbing outside of the nesting season is allowable (August 1–January 31).
Section 106 National Historic Preservation Act	Oregon State Historic Preservation Office	Requires federal agencies that fund or provide permit approvals for projects to assess effects on historic properties and includes coordination with tribes that may attach religious or cultural importance to them.
National Environmental Policy Act	Lead Federal Agency; Likely NRCS	Required for federal agency actions to assess potential effects on the built and natural environment. Documentation ranges from a categorical exclusion checklist to a multiyear, multistakeholder environmental impact statement. Federal NEPA lead would be determined based on primary funding source or lead permitting agency. Note: USACE 404/10 permit normally requires internal NEPA review by USACE. This would not require NEPA documentation on permittee's behalf.

8.6 Costs

Table 8-8 (NWPM 506.11, Economic Table 1) presents the total project cost of \$356,591,000 for the Preferred Alternative. Pub. L. No. 83-566 funds would support \$270,215,000 of the total project cost, where the \$86,376,000 remainder of the cost would be contributed by other, non-federal funds. Table 8-9 (NWPM 506.12, Economic Table 2) itemizes the costs for each project feature and the distribution of how the costs would be shared by the sponsors and NRCS for each cost item.

- Construction costs account for all material, labor, and equipment necessary for the installation of canal piping associated with the Preferred Alternative. These costs were estimated based on costs for similar installations at other irrigation districts in Oregon. The planning construction costs were estimated using the best available information about the proposed 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 proposed project

8.7 Installation and Financing

The following sections present further details regarding installation of and financing the Preferred Alternative. See Table 8-7 for a summary of the construction-phasing timeline and funding sources for the Preferred Alternative.

8.7.1 Framework for Carrying out the Plan

The Preferred Alternative would be implemented in a planned sequence as discussed in the sections below. 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.

8.7.2 Planned Sequence of Installation

COID would obtain all approvals and permits for the Project prior to the start of construction. The entire Project would be completed over a 3-year period commencing in 2026 and ending by 2029. COID developed an appropriate construction-phasing schedule that addresses COID priorities while working within engineering and funding constraints to meet COID, patron, and community development needs.

Table 8-7. Construction Timeline and Installation Costs by Funding Source for the Modernization Alternative, Deschutes Watershed, Oregon, 2025 Dollars.

Construction Phase	Construction Year	Pub. L. No. 83-566 Funds	Other, Non-Federal Funds	Total Construction Costs
1	1	\$25,866,000	\$8,379,000	\$34,245,000
2	2	\$43,810,000	\$13,981,000	\$57,791,000
3	3	\$42,620,000	\$13,571,000	\$56,191,000
4	3	\$34,442,000	\$10,997,000	\$45,439,000
5	2	\$56,024,000	\$17,888,000	\$73,912,000
6	1	\$67,453,000	\$21,560,000	\$89,013,000
Total	Project	\$270,215,000.00	\$86,376,000.00	\$356,591,000.00

Note Price Base: 2025 dollars

8.7.3 Responsibilities

NRCS is responsible for leading the planning efforts, providing engineering design and construction oversight assistance, and certifying completion of the Project. COID would be responsible for engineering design, project administration, environmental permitting, contracting, construction implementation, and acquisition of easements. COID 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 Plan-EIS.

8.7.4 Contracting

Irrigation modernization projects would be completed using NRCS funding mechanisms. COID would be primarily responsible for overseeing and administering the construction of the Project in coordination with NRCS. COID will bear, as a sponsor responsibility, all of its own project administration costs to include contract administration as part of installation costs. The cost of administering construction contracts as part of project installation are costs to be borne by COID.

8.7.5 Real Property and Relocations

Any real property acquisition needed would be completed in conjunction with landowners prior to authorization. All construction would be completed under either existing COID-operated and -maintained easements or the newly obtained easement agreements as described in Section 6.12.2.

8.7.6 Financing

NRCS would provide up to 75 percent of the total project cost for the Preferred Alternative.¹² COID 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 8-8 presents the 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. COID received a RCPP grant in 2024; this grant funding would not be used for the twenty-five percent Pub. L. No. 83-566 match obligation. Total federal funding for any portion of Preferred Alternative construction would not exceed the seventy-five percent construction cost-share limit. O&M costs after project completion would be provided through COID revenues.

8.7.7 Conditions for Providing Assistance

Conditions for COID to receive program funds for the proposed project include completion of a Final Plan-EIS and NRCS issuing a record of decision, 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.

8.8 Operations and Maintenance

COID would be responsible for project O&M 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 COID. The agreement would continue through the design life of the Project and could be modified with NRCS approval.

¹² NRCS reserves the authority and right to discontinue or reduce program benefits based on changes in agency priorities, funding availability, or the failure of COID to fulfill the provisions of their agreement.

Project sponsors and NRCS would conduct annual inspections of project measures to ensure the quality of ongoing O&M. COID would be in charge of scheduling O&M inspections and be responsible for necessary work, including all repairs and replacements. COID O&M would include a pump and canal piping inspection program that would systematically cover inspection of the proposed 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. During the winter months outside of the irrigation season, COID would perform system component maintenance including valve battery changes, magnetic meter maintenance, COID operational valve maintenance, air and vacuum valve maintenance, pressure-reducing station filter maintenance, and valve repairs. COID would expand its current vegetation and weed management to include the areas on top of the newly piped system. All procedures would be followed as specified in the O&M agreement between project sponsors and NRCS.

8.9 Economic and Structural Tables

A summary of the economic analysis of the Preferred Alternative (NED Modernization Alternative) and Future Without Project is provided in Section 5.3. The full NED analysis can be found in Appendix D.1. The costs and benefits associated with the project are detailed in the following tables in this section. Table 8-8 (NWPM 506.11, Economic Table 1) presents the projected installation costs and the percentages of costs to be shared by the sponsors and NRCS for the project.

Table 8-9 (NWPM Economic Table 2, 506.12) presents the project's cost as well as the proportion of P.L. 83-566 funding and other funding sources. The average annual NED costs are shown in Table 8-10 (NWPM 506.18, Economic Table 3).

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Table 8-8. Economic Table 1 – Estimated Installation Cost of the Preferred Alternative, Water Resource Project Measures, Deschutes Watershed, Oregon, 2025\$.^{1,2}

Works of Improvement	Number				Estimated Costs						
					Public Law 83-566 Funds			Other Funds			Total Costs
	Unit	Federal land	Non-Federal land	Total	Federal land	Non-Federal land	Total Public Law 83-566 Funds	Federal land	Non-Federal land	Total Other Funds	
King Way	feet	0	10,955	10,955	\$0	\$25,866,000	\$25,866,000	\$0	\$8,379,000	\$8,379,000	\$34,245,000
Redmond											
Pilot Butte Canal	feet	0	13,500	13,500	\$0	\$43,810,000	\$43,810,000	\$0	\$13,981,000	\$13,981,000	\$57,791,000
Watermaster Rd	feet	0	13,500	13,500	\$0	\$47,027,000	\$47,027,000	\$0	\$15,085,000	\$15,085,000	\$62,112,000
NW Canal Blvd	feet	0	13,500	13,500	\$0	\$50,920,000	\$50,920,000	\$0	\$16,130,000	\$16,130,000	\$67,050,000
Veterans Way	feet	0	16,650	16,650	\$0	\$42,620,000	\$42,620,000	\$0	\$13,571,000	\$13,571,000	\$56,191,000
Canal	feet	1,350	12,500	13,850	\$3,357,000	\$31,085,000	\$34,442,000	\$1,072,000	\$9,925,000	\$10,997,000	\$45,439,000
Deschutes Market	feet	1,570	20,430	22,000	\$3,998,000	\$52,026,000	\$56,024,000	\$1,277,000	\$16,611,000	\$17,888,000	\$73,912,000
Rivers Edge											
18th Street	feet	0	19,325	19,325	\$0	\$82,206,000	\$82,206,000	\$0	\$26,185,000	\$26,185,000	\$108,391,000
Pilot Butte Canal	feet	0	18,100	18,100	\$0	\$67,453,000	\$67,453,000	\$0	\$21,560,000	\$21,560,000	\$89,013,000
Old Deschutes Rd	feet	0	19,825	19,825	\$0	\$80,015,000	\$80,015,000	\$0	\$25,351,000	\$25,351,000	\$105,366,000
Minimum total	feet	2,920	92,135	95,055	\$7,355,000	\$262,860,000	\$270,215,000	\$2,349,000	\$84,027,000	\$86,376,000	\$356,591,000
Maximum total	feet	2,920	93,860	96,780	\$7,355,000	\$284,723,000	\$292,078,000	\$2,349,000	\$90,801,000	\$93,150,000	\$385,228,000
Preferred Alternative	feet	2,920	92,135	95,055	\$7,355,000	\$262,860,000	\$270,215,000	\$2,349,000	\$84,027,000	\$86,376,000	\$356,591,000

Notes: Totals may not sum due to rounding.

Prepared: September 2025

^{1/} Price base: 2025 dollars.

^{2/} Project cost as identified by KPFF, updated to 2025 dollars with additional engineering considerations, project administration, and technical assistance costs based on NRCS-OR guidance.

^{3/} Federal agency responsible for assisting in installation of works of improvement

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Table 8-9. Economic Table 2 – Estimated Preferred Alternative Cost Distribution, Water Resource Project Measures, Deschutes Watershed, Oregon, 2025\$.^{1,2}

Works of Improvement	Installation Cost – Public Law 83-566				Installation Cost – Other Funds					Total Costs
	Construction	Engineering	Project Admin ¹	Total Public Law 83-566	Construction	Engineering	Project Admin	Permitting	Total Other Costs	
King Way	\$22,271,000	\$405,000	\$3,190,000	\$25,866,000	\$7,424,000	\$135,000	\$620,000	\$200,000	\$8,379,000	\$34,245,000
Redmond										
Pilot Butte Canal ³	\$37,779,000	\$680,000	\$5,351,000	\$43,810,000	\$12,593,000	\$227,000	\$1,051,000	\$110,000	\$13,981,000	\$57,791,000
Watermaster Rd	\$40,534,000	\$738,000	\$5,755,000	\$47,027,000	\$13,511,000	\$246,000	\$1,128,000	\$200,000	\$15,085,000	\$62,112,000
NW Canal Blvd	\$43,894,000	\$799,000	\$6,227,000	\$50,920,000	\$14,632,000	\$266,000	\$1,222,000	\$10,000	\$16,130,000	\$67,050,000
Veterans Way	\$36,731,000	\$669,000	\$5,220,000	\$42,620,000	\$12,243,000	\$223,000	\$1,022,000	\$83,000	\$13,571,000	\$56,191,000
Canal	\$29,672,000	\$540,000	\$4,230,000	\$34,442,000	\$9,891,000	\$180,000	\$826,000	\$100,000	\$10,997,000	\$45,439,000
Deschutes Market	\$48,300,000	\$879,000	\$6,845,000	\$56,024,000	\$16,101,000	\$293,000	\$1,344,000	\$150,000	\$17,888,000	\$73,912,000
Rivers Edge										
18th Street	\$70,897,000	\$1,290,000	\$10,019,000	\$82,206,000	\$23,632,000	\$430,000	\$1,973,000	\$150,000	\$26,185,000	\$108,391,000
Pilot Butte Canal	\$58,164,000	\$1,059,000	\$8,230,000	\$67,453,000	\$19,388,000	\$353,000	\$1,619,000	\$200,000	\$21,560,000	\$89,013,000
Old Deschutes Rd	\$69,006,000	\$1,256,000	\$9,753,000	\$80,015,000	\$23,002,000	\$419,000	\$1,920,000	\$10,000	\$25,351,000	\$105,366,000
Minimum total	\$232,917,000	\$4,232,000	\$33,066,000	\$270,215,000	\$77,640,000	\$1,411,000	\$6,482,000	\$553,000	\$86,376,000	\$356,591,000
Maximum total	\$251,765,000	\$4,582,000	\$35,731,000	\$292,078,000	\$83,923,000	\$1,527,000	\$7,007,000	\$933,000	\$93,150,000	\$385,228,000
Preferred Alternative	\$232,917,000	\$4,232,000	\$33,066,000	\$270,215,000	\$77,640,000	\$1,411,000	\$6,482,000	\$843,000	\$86,376,000	\$356,591,000

Note: Total may not sum due to rounding.

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1/ Includes project administration and technical assistance.

2/ The minimum and maximum totals are calculated by summing the minimum or maximum values within the Redmond and Rivers Edge alignments and the remaining project groups. The Preferred Alternative consists of the Pilot Butte Canal alignments in the Redmond and Rivers Edge project groups.

3/ Construction costs for the Redmond Pilot Butte Canal alignment include cultural mitigation costs of \$559,400.

Table 8-10. Economic Table 4 – Estimated Average Annual NED Costs, Deschutes Watershed, Oregon, 2025\$.^{1,2}

Project Group	Project Outlays (Amortization of Installation Cost)	O&M Costs	Total
King Way	\$1,052,000	\$7,000	\$1,059,000
Redmond			
Pilot Butte Canal	\$1,724,000	\$8,000	\$1,732,000
Watermaster Rd	\$1,853,000	\$8,000	\$1,861,000
NW Canal Blvd	\$2,000,000	\$8,000	\$2,008,000
Veterans Way	\$1,627,000	\$11,000	\$1,638,000
Canal	\$1,316,000	\$9,000	\$1,325,000
Deschutes Market	\$2,205,000	\$15,000	\$2,220,000
Rivers Edge			
18th Street	\$3,330,000	\$13,000	\$3,343,000
Pilot Butte Canal	\$2,735,000	\$12,000	\$2,747,000
Old Deschutes Rd	\$3,237,000	\$14,000	\$3,251,000
Minimum total	\$10,659,000	\$62,000	\$10,721,000
Maximum total	\$11,530,000	\$64,000	\$11,593,000
Preferred Alternative	\$10,659,000	\$62,000	\$10,721,000

Note: Total may not sum due to rounding.

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1/Price base: 2025 dollars amortized over 100 years at a discount rate of 3.0 percent.

The Preferred Alternative damage reduction benefits include increased instream flow, reduced O&M costs, increased hydropower production, and avoided carbon emissions. Table 8-11 (NWPM 506.20, Economic Table 4) presents the average annual watershed protection damage reduction benefits.

Using the resulting benefits and costs from the previous two tables, Table 8-12 (NWPM 506.21, Economic Table 5) presents a comparison of the NED average annual benefits and average annual costs.

Table 8-11. Economic Table 5a – Estimated Average Annual Watershed Protection Damage Reduction Benefits Central Oregon Irrigation District Watershed Plan, Deschutes Watershed, Oregon, 2025\$.^{1,2}

Item	Agricultural Benefit to Patrons/ Surrounding Community	Non-Agricultural Benefit
King Way		
On-Site Benefits		
Agricultural Damage Reduction	\$1,010,000	
District OMR Savings	\$43,000	
Patron Energy Savings	\$11,000	
Avoided Property Damage	\$37,000	
On-site Subtotal	\$1,101,000	
Off-Site Benefits		
Off-site Subtotal		\$0
Total Quantified Benefits	\$1,101,000	
Redmond		
On-Site Benefits		
Agricultural Damage Reduction	\$505,000	
District OMR Savings	\$47,000	
Patron Energy Savings	\$113,000	
Avoided Property Damage	\$3,895,000	
On-site Subtotal	\$4,561,000	
Off-Site Benefits		
Off-site Subtotal		\$0
Total Quantified Benefits	\$4,560,000	
Veterans Way		
On-Site Benefits		
Agricultural Damage Reduction	\$2,088,000	
District OMR Savings	\$62,000	
Patron Energy Savings	\$3,000	
Avoided Property Damage	\$57,000	
On-site Subtotal	\$2,210,000	
Off-Site Benefits		
Avoided Carbon Emissions		\$0
Off-site Subtotal		\$0
Total Quantified Benefits	\$2,210,000	

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Item	Agricultural Benefit to Patrons/ Surrounding Community	Non-Agricultural Benefit
Canal		
On-Site Benefits		
Agricultural Damage Reduction	\$2,136,000	
District OMR Savings	\$51,000	
Patron Energy Savings	\$4,000	
Avoided Property Damage	\$47,000	
On-site Subtotal	\$2,238,000	
Off-Site Benefits		
Avoided Carbon Emissions		\$0
Off-site Subtotal		\$0
Total Quantified Benefits	\$2,238,000	
Deschutes Market		
On-Site Benefits		
Agricultural Damage Reduction	\$2,097,000	
District OMR Savings	\$84,000	
Patron Energy Savings	\$2,000	
Avoided Property Damage	\$75,000	
On-site Subtotal	\$2,258,000	
Off-Site Benefits		
Avoided Carbon Emissions		\$0
Off-site Subtotal		\$0
Total Quantified Benefits	\$2,258,000	
Rivers Edge		
On-Site Benefits		
Agricultural Damage Reduction	\$3,028,000	
District OMR Savings	\$71,000	
Patron Energy Savings	\$1,000	
Avoided Property Damage	\$62,000	
On-site Subtotal	\$3,162,000	
Off-Site Benefits		
Avoided Carbon Emissions		\$0
Off-site Subtotal		\$0
Total Quantified Benefits	\$3,162,000	

Note: Total may not sum due to rounding.

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1/Price base: 2025 dollars amortized over 100 years at a discount rate of 3.0 percent.

Table 8-12. Economic Table 6 – Estimated Average Annual Watershed Protection Damage Reduction Benefits of the Modernization Alternatives, Deschutes Watershed, Oregon, 2025\$¹

Project Group	Agriculture-related				Average Annual Benefits	Average Annual Cost	Benefit - Cost Ratio
	Agricultural Yield Enhancement	District OMR Savings	Patron Pump Energy Savings	Avoided Property Damage			
King Way	\$1,010,000	\$43,000	\$11,000	\$37,000	\$1,101,000	\$1,059,000	1.0
Redmond (Pilot Butte Canal)	\$505,000	\$47,000	\$113,000	\$3,895,000	\$4,560,000	\$1,732,000	2.6
Veterans Way	\$2,088,000	\$62,000	\$3,000	\$57,000	\$2,210,000	\$1,638,000	1.3
Canal	\$2,136,000	\$51,000	\$4,000	\$47,000	\$2,238,000	\$1,325,000	1.7
Deschutes Market	\$2,097,000	\$84,000	\$2,000	\$75,000	\$2,258,000	\$2,220,000	1.0
Rivers Edge (Pilot Butte Canal)	\$3,028,000	\$71,000	\$1,000	\$62,000	\$3,162,000	\$2,747,000	1.2
Total	\$10,864,000	\$358,000	\$134,000	\$4,173,000	\$15,529,000	\$10,721,000	1.4

Note: Totals may not sum due to rounding.
1/ Price base: 2025 dollars amortized over 100 years at a discount rate of 3.0 percent.

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10 List of Preparers

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

Table 10-1. List of Preparers.

Name	Title	Education	Professional Experience (years)	Area Responsible For
Farmers Conservation Alliance Watershed Plan-EIS Team				
Raija Bushnell	Watershed Planning Program Manager	M.P.A. Natural Resource Policy M.S.E.S. Natural Resource Management B.A. Political Science	9	General
Preston Brown, PMP	Senior Project Manager	B.S. Biological Systems Engineering	15	General
NRCS - Oregon				
Gary Diridoni	Natural Resource Specialist	Fisheries Management Graduate Certificate B.S. Wildlife Management B.S. Interdisciplinary Studies, Ecosystem Conservation	20	General
Antonio Bentivoglio	Natural Resource Specialist	M.A., Biology	25	General
Rachel Smith Gebauer M.A., RPA	Acting State Cultural Resource Specialist/ Archaeologist	M.A., Anthropology (Archaeology)	25	Cultural Resources

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Name	Title	Education	Professional Experience (years)	Area Responsible For
Louis Landre	Agricultural Economist	M.S. Applied Economics B.S. Biology	25	Economic and Socioeconomic Analysis, Alternative Analysis, Overall Watershed Planning
Employees from Firms Under Contract with FCA or COID				
Winston Oakley; Highland Economics	Economist	M.S. Applied Economics	10	Neighborhoods and Socioeconomics
Barbara Wyse; Highland Economics	Principal and Senior Economist	M.S. Applied Economics	20	Neighborhoods and Socioeconomics
Shane Phelps; Parametrix	EP&C Division Manager	M.S. Environmental Science; B.S. Zoology	29	General
Jennifer Hughes; Parametrix	Senior Planner	Master of Urban and Regional Planning; B.S. Physical Geography	23	Neighborhoods and Socioeconomics; Review of Built Environment Subjects
Peter Geiger; Parametrix	Senior Planner	M.Sc. Physics; B.S. Physics	37	Utilities; Noise and Vibration; Air Quality; Alternatives Analysis
Cassandra Dobson; Parametrix	Planner IV	MURP, Land Use Specialty B.A. Political Science	6	Land Use; Parks and Recreation; Visual Resources
Sabrina Robinson; Parametrix	Planner II	B.A. Political Science	5	Neighborhoods and Socioeconomics,
Shira DeGrood, RG; Parametrix	Senior Scientist	M.S. Biogeochemistry	18	Geology, Soils, and Hazardous Materials
Kelly Carini; Parametrix	Scientist II	B.A. Environmental Science	8	Geology, Soils, and Hazardous Materials

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Name	Title	Education	Professional Experience (years)	Area Responsible For
Taya K. MacLean, PWS; Parametrix	Senior Scientist	B.S. Forestry and Natural Resources Management; M.S. Biology	23	Biological Resources
Jason Medema; Parametrix	Senior Planner	B.A. International Affairs M.S. Environmental Studies	20	Biological Resources; Water Resources
Chloe Kott; Parametrix	Scientist II	E.P. Environmental Professional; B.A. Fish, Wildlife, Conservation Biology	6	Biological Resources
Rick Malin, RG; Parametrix	Senior Hydrogeologist	M.S. Geohydrology / Geology	35	Water Resources
Dave Munsell; Parametrix	Designer IV	B.S. Civil Engineering	34	Utilities
Josh Ahman; Parametrix	Senior Planner	Master of Urban and Regional Planning	16	Right-of-Way, Displacements, and Relocations Resources
Jessie Rykels-Wilson, PE; Parametrix	Senior Engineer	B.S. Civil Engineering; PE, OR - Civil	17	Transportation
Kendra Ely, PE; Parametrix	Engineer IV	B.S. Civil Engineering; PE, OR - Civil	8	Transportation
Mark Wharry, PE; KPFF	Principal	B.A., Economic MS, Civil Engineering	38	Preliminary engineering design
Eric Melle, PE; KPFF	Associate	B.S. Civil Engineering - Northeastern University	22	Preliminary engineering design

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Name	Title	Education	Professional Experience (years)	Area Responsible For
Kevin Crew, PE; Black Rock Consulting, Inc.	President	B.S. Engineering	38	Engineering support

11 Distribution List

A Notice of Availability for the Plan-EIS will be distributed to federal, state, and local agencies, community representatives, and area nongovernmental organizations.

Governmental organizations and agencies to be notified:

- City of Bend
- City of Redmond
- Deschutes County
- Jefferson County
- Oregon Governor’s Office
- 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 Water Resources Department (OWRD)
- Oregon Watershed Enhancement Board
- Business Oregon
- State Historic Preservation Office (SHPO)
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Land Management (BLM)
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service (USFWS)

Other organizations and individuals to be notified:

- COID patrons
- Bend Parks and Recreation

- Central Oregon Land Watch
- Coalition for the Deschutes
- Deschutes River Conservancy
- Upper Deschutes Watershed Council
- Trout Unlimited
- WaterWatch of Oregon
- Interested public

In accordance with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, NRCS will contact the Burns Paiute Tribe, Confederated Tribes of Warm Springs Reservation of Oregon, and the Confederated Tribes of the Grand Ronde regarding the availability of the Draft Plan-EIS.

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

12 Acronyms, Abbreviations, and Short-forms

AF – acre-feet

AID – Arnold Irrigation District

APE – Area of Potential Effects

BGEPA – Bald and Golden Eagle Protection Act

BLM – Bureau of Land Management

BMP – Best Management Practice

CERCLA – Comprehensive Environmental Response, Compensation and Liability Act

CEQ – Council on Environmental Quality

CFR – Code of Federal Regulations

CFS – Cubic Feet/Second

COID – Central Oregon Irrigation District

CWA – Clean Water Act

DBHCP – Deschutes Basin Habitat Conservation Plan

DEQ – Oregon Department of Environmental Quality

DM – Department Manual

DSL – Oregon Department of State Lands

EA – Environmental Assessment

EFH – Essential Fish Habitat

EFU – Exclusive Farm Use

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EIS – environmental impact statement

EPA – U.S. Environmental Protection Agency

ESA – Endangered Species Act

FCA – Farmers Conservation Alliance

FEMA – Federal Emergency Management Agency

FR – Forestry/Rangeland Zoning

GC – General Commercial Zoning

LUCS – Land Use Compatibility Statement

LPID – Lone Pine Irrigation District

LWCF – Land and Water Conservation Fund

MOA – memorandum of agreement

MBTA – Migratory Bird Treaty Act

NFA – no further action

NED – National Economic Development

NEPA – National Environmental Policy Act

NHPA – National Historic Preservation Act

NRHP – National Register of Historic Places

NMFS – National Marine Fisheries Service

NOAA – National Oceanic and Atmospheric Administration

NRCS – National Resources Conservation Service

NUID – North Unit Irrigation District

NWPM – National Watershed Program Manual

O&M – Operation and Maintenance

OAR – Oregon Administrative Rules

ODA – Oregon Department of Agriculture

ODFW – Oregon Department of Fish and Wildlife

ODOT – Oregon Department of Transportation

ORBIC – Oregon Biodiversity Information Center

ORS – Oregon Revised Statutes

OTR – Oregon Trunk Railway

OWRD – Oregon Water Resources Department

PBC – Pilot Butte Canal

Pub. L. No. 83-566 – USDA-NRCS Watershed Protection and Flood Prevention Act, Public Law Number 83-566

Plan-EA – Watershed Plan–Environmental Assessment

Plan-EIS – Watershed Plan–Environmental Impact Statement

Project – Central Oregon Irrigation District Pilot Butte Canal Infrastructure Modernization Project

Project Area – The Project Area consists of the existing District infrastructure to be modernized, areas where new infrastructure could be built as part of various alternative alignment options, and associated rights-of-way and/or easements where construction would take place.

Reclamation – United States Bureau of Reclamation

RM – river mile

ROW – right-of-way

SHPO – State Historic Preservation Office

SIP – system improvement plan

TCE – temporary construction easements

TPHO – Tribal Historic Preservation Office

UGB – urban growth boundary

USACE – U.S. Army Corps of Engineers

U.S.C. – U.S. Code

USDA – U.S. Department of Agriculture

USFS – U.S. Forest Service

USFWS – U.S. Fish and Wildlife Service

13 Appendices

Appendices are provided in a separate document.

Appendix A. Comments and Responses on the Draft Plan-EIS
(to be included in the Final Plan-EIS)

Appendix B. Watershed Project Map

Appendix C. Supporting Maps

Appendix D. Investigation and Analysis Report

D.1 National Economic Development Analysis

Appendix E. Other Supporting Information

E.1 Additional Supporting Information for Cultural Resources

E.2 Avoidance, Minimization, and Compensatory Mitigation Measures for the Preferred Alternative

E.3 Potential Local, State, and Federal Permit and Compliance Requirements for the Modernization Alternative

E.4 Preferred Alternative Evaluation Memo

Appendix F. Technical Reports

F.1 Draft Land Use Technical Report May 2024

F.2. Draft Parks and Recreation Technical Report May 2024

F.3 Draft Neighborhoods and Socioeconomics Technical Report December 2024

F.4 Draft Geology, Soils, and Hazardous Materials Technical Report May 2024

F.5 Draft Biological Resources Technical Report October 2025

F.6 Draft Visual Resources Technical Report May 2024

F.7 Draft Water Resources Technical Report October 2025

F.8 Draft Utilities Technical Report May 2024

F.9 Draft Noise and Vibration Technical Report May 2024

F.10 Draft Right-of-Way, Displacements, and Relocations Technical Report May 2024

F.11 Draft Transportation Technical Report May 2024