



# Central Oregon Irrigation District Pilot Butte Canal EIS Draft Noise and Vibration Technical Report Deschutes County, Oregon

Prepared for

Central Oregon Irrigation District



May 2024

Prepared by

**Parametrix**

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# Central Oregon Irrigation District Pilot Butte Canal EIS Draft Noise and Vibration Technical Report

*Prepared for*

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## CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned.

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*Central Oregon Irrigation District*  
*Pilot Butte Canal EIS*  
*Draft Noise and Vibration Technical Report*  
Central Oregon Irrigation District

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## ACRONYMS, INITIALISMS, AND ABBREVIATIONS

|          |                                        |
|----------|----------------------------------------|
| ac       | acre                                   |
| CFR      | Code of Federal Regulations            |
| COID     | Central Oregon Irrigation District     |
| dB       | decibels                               |
| dBA      | A-weighted decibel                     |
| District | Central Oregon Irrigation District     |
| EIS      | environmental impact statement         |
| FEIS     | final environmental impact statement   |
| GIS      | geographic information system          |
| NRHP     | National Register of Historic Places   |
| NRCS     | Natural Resources Conservation Service |
| ODOT     | Oregon Department of Transportation    |
| ORS      | Oregon Revised Statute                 |



## EXECUTIVE SUMMARY

Sensitive noise and vibration receptors are present along the existing canal alignment and along the alignment options being evaluated, primarily within the urbanized areas of Bend and Redmond. Sensitive noise and vibration receptors include residences, both single-family and multifamily, parks, schools, hospitals, and places of worship where noise and vibration impacts above ambient conditions would be detrimental to the enjoyment of outdoor spaces or disruptive to the function of the facility. Wildlife and livestock would also be considered sensitive noise and vibration receptors, especially during nesting season for migratory birds of concern. Noise and vibration impacts for the Pilot Butte Canal Project are limited to the construction phases. Construction noise would cause a direct impact to noise levels along the canal alignment and its alignment options. The most prevalent noise sources are equipment powered by internal combustion engines (usually diesel) and blasting associated with trench excavation. Vibrations transmitted through the ground during construction operations may annoy people 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.

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.

Mitigation of potential construction noise impacts would 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; the plans would be prepared by a person qualified and experienced in blasting. Blasting in the mass of rock to be excavated would 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.



# 1. INTRODUCTION

As a part of the preparation of the Environmental Impact Statement (EIS) for the Pilot Butte Canal (PBC) Project (Project), this technical report has been prepared to identify and evaluate noise and vibration within the project's Study Area. Noise- and vibration-sensitive receptors include residences, both single-family- and multifamily, parks, schools, hospitals, and places of worship where noise and vibration impacts above ambient conditions would be detrimental to the enjoyment of outdoor spaces or disruptive to the function of the facility. Wildlife and livestock would also be considered sensitive noise and vibration receptors, especially during nesting season for migratory birds of concern. Additional details are presented in Section 5.2, Resource Identification and Evaluation Methods.

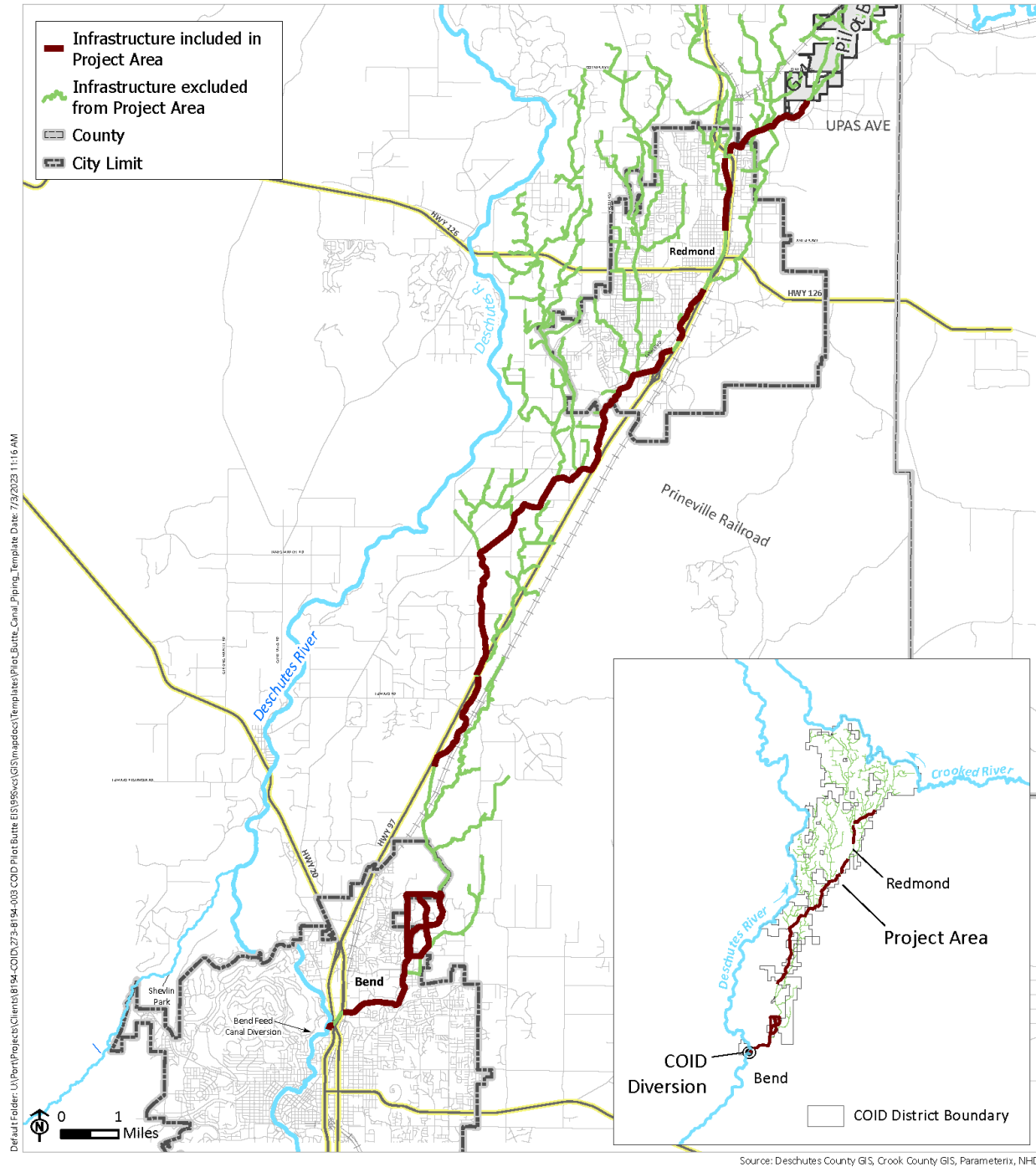
## 1.1 Project Location

The Central Oregon Irrigation District (COID or District) is analyzing piping approximately 18 to 21 miles of the PBC from NE 17th Street in Redmond, Oregon, to the diversion point from the Deschutes River in Bend, Oregon (Figure 1). The piping 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. Additional portions along the existing alignment that have been piped or converted to box culverts during previous construction projects include:

- Major freeway or roadway crossings of US 97, Hwy 20, and Hwy 126, in Bend and Redmond (0.2 miles)
- Within the City of Bend and Deschutes County for the Juniper Ridge hydroelectric facility (3.3 miles)
- Within Deschutes County north of the Juniper Ridge hydroelectric plant (0.1 mile)
- Within urbanized Redmond (1.5 miles)

The portions to be piped for this Project are shown in Figure 1.

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**Figure 1. Project Area**

## 1.2 Project Purpose and Need

The purpose of this project is agricultural water management through irrigation water conservation in District-owned infrastructure, improvement of water delivery reliability to District patrons, and reduction of long-term operation and maintenance costs on approximately 21 miles of the District-owned PBC. The Project is needed to address the following watershed problems and resource concerns: water loss in District conveyance systems and water delivery and operation and maintenance inefficiencies. Implementation of the proposed action would address the sponsors' objectives and goals to reduce seepage loss and provide better-managed water diversions for farm use; support agricultural land use; improve streamflow for fish, aquatic, and riparian habitat; and increase public safety.

## 2. PROJECT ALTERNATIVES

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

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

The No Action Alternative would not meet the project purpose and need. Water would continue to be lost to seepage and evaporation in District infrastructure. Inefficiencies in 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. The No Action Alternative would fail to achieve the goal of maximizing sustainable economic development, as identified in the Federal Objective to protect the environment. It would not resolve current water supply problems stemming from the loss of water from District infrastructure. Further, it would not foster the economic well-being of present and future generations through sustainable use and management of water resources to provide water supply and water quality for irrigated agriculture in the Deschutes basin.

### 2.2 Modernization Alternative (Future with Federal Investment)

The Modernization Alternative would focus on a single priority infrastructure modernization project: the District would replace the existing open PBC within the Project Area with a pressurized, closed conduit pipeline system (see Figure 2). When completed, the pipe would extend over approximately 18 to 21 miles of the COID system from the diversion point from the Deschutes River in Bend, Oregon, to NE 17th Street in Redmond, Oregon. 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 (USDA, 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 1.

**Table 1. Project Group and Construction Sequence**

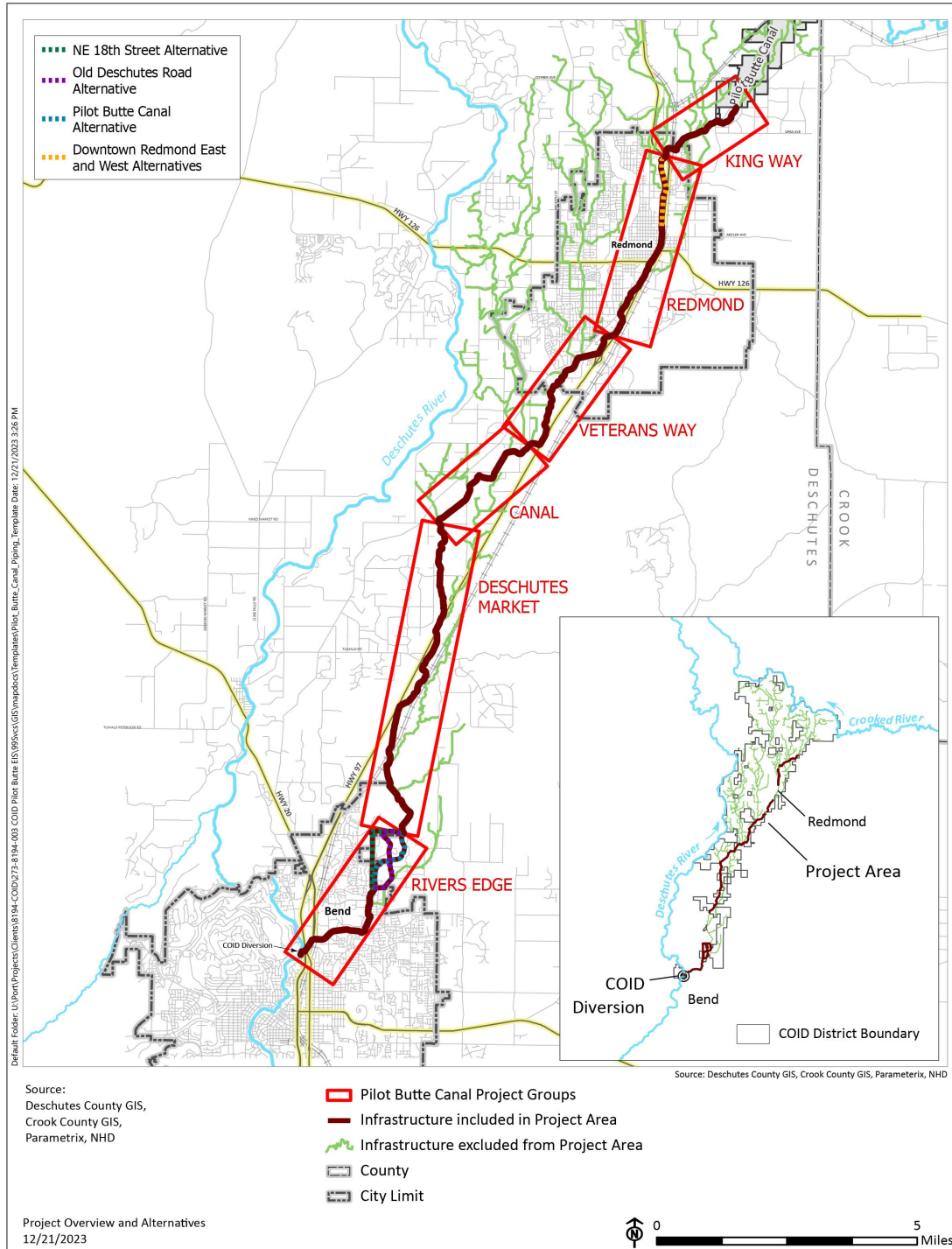
| Project Groups                      | Project Group Length (feet) | Construction Year | Construction Start | Construction End |
|-------------------------------------|-----------------------------|-------------------|--------------------|------------------|
| 1 – King Way                        | 11,000                      | 0                 | October 2026       | April 2027       |
| 2 – Redmond                         |                             |                   |                    |                  |
| Pilot Butte Canal Alignment Option  | 13,500                      | 1                 | October 2027       | April 2028       |
| Watermaster Road Alignment Option   | 13,500                      | 1                 | October 2027       | April 2028       |
| NW Canal Boulevard Alignment Option | 13,500                      | 1                 | October 2027       | April 2028       |
| 3 – Veterans Way                    | 16,700                      | 2                 | October 2028       | April 2029       |
| 4 – Canal                           | 13,900                      | 2                 | October 2028       | April 2029       |
| 5 – Deschutes Market                | 22,000                      | 1                 | October 2027       | April 2028       |
| 6 – Rivers Edge                     |                             |                   |                    |                  |
| Pilot Butte Canal Alignment Option  | 18,100                      | 0                 | October 2026       | April 2027       |
| 18th Street Alignment Option        | 19,300                      | 0                 | October 2026       | April 2027       |
| Old Deschutes Road Alignment Option | 19,800                      | 0                 | October 2026       | April 2027       |

Construction would occur during the non-irrigation season (October to April), with Project Group 1 (King Way) and Project Group 6 (Rivers Edge) construction beginning as early as the 2026–2027 non-irrigation season. The construction sequencing may be changed to provide flexibility for the construction contractor. Construction of each project group is anticipated to require one non-irrigation 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 options. The alignment options are discussed below. Under the Modernization Alternative, federal funding through Public Law 83-566 would be available and would be expected to cover approximately 75% of total costs. The District would cover the remaining 25% 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 National Register of Historic Places (NRHP). In 2019, a Section 106 programmatic agreement was signed by COID, the Oregon State Historic Preservation Office, and the Bureau of Reclamation. The Natural Resources Conservation Service (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.” The 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 2.2.1 and Section 2.2.2, respectively.

For the Modernization Alternative and all alignment options, blasting will be required and could potentially occur at any point along the pipe alignment. 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.



**Figure 2. Project Groups**

## 2.2.1 Deschutes County/North Bend Alignment Options

The Modernization Alternative has four options for piping between Yeoman Road and Cooley Road in Deschutes County and north Bend (see Figure 3).

- No Modernization within this Segment (no piping)
- Pilot Butte Canal Alignment (existing canal alignment)
- NE 18th Street Alignment
- Old Deschutes Road Alignment

### 2.2.1.1 No Modernization within this Segment (No Piping)

This alignment option 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 open canal. This option 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.

### 2.2.1.2 Pilot Butte Canal Alignment (Existing Canal Route)

This alignment option would replace the open channel with pipe directly within the existing open channel 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 channel 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.

### 2.2.1.3 NE 18th Street Alignment

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 a portion of the PBC that is listed in the NRHP. The historic section of canal would be left in place, but it would no longer receive irrigation water from the COID system.

### 2.2.1.4 Old Deschutes Road Alignment

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. This option would avoid impacts to the NRHP-listed portion of PBC. The historic section of canal would be left in place, but it would no longer receive irrigation water from the COID system.

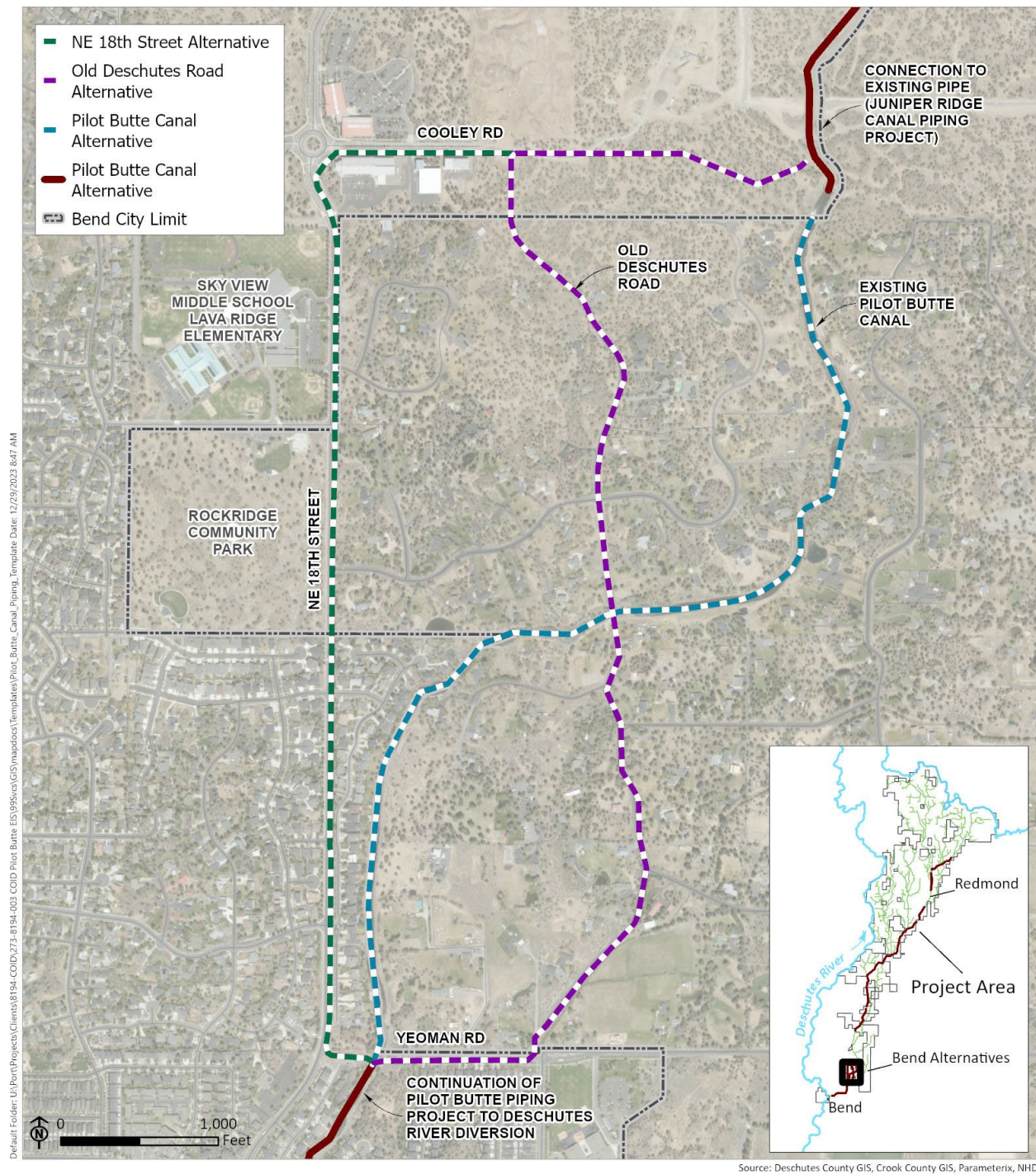


Figure 3. Deschutes County/North Bend Alignment Options

## 2.2.2 City of Redmond Alignment Options

The Modernization Alternative has four options for piping within the NRHP-listed historic Downtown Redmond section between NW Dogwood Avenue and NW Quince Avenue (see Figure 4).

- No Modernization within this Segment (no piping)
- 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

### 2.2.2.1 No Modernization within this Segment (No Piping)

This alignment option would keep the 6,800-foot NRHP-listed stretch of the PBC in Redmond in its current configuration and functionality as an open canal. This option would require installing a pressure reducing station near the intersection of SW Veteran's Way and Hwy 97 to slow the flow velocity as it exits the pressurized pipe so that the existing open canal can function as currently designed.

### 2.2.2.2 Pilot Butte Canal Alignment (Existing Canal Route)

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

### 2.2.2.3 Piping to the east in the Watermaster's Access Road

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 canal would be left in place, but it would no longer receive irrigation water from the COID system.

### 2.2.2.4 Piping to the west within Northwest Canal Boulevard

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 canal would be left in place, but it would no longer receive irrigation water from the COID system.

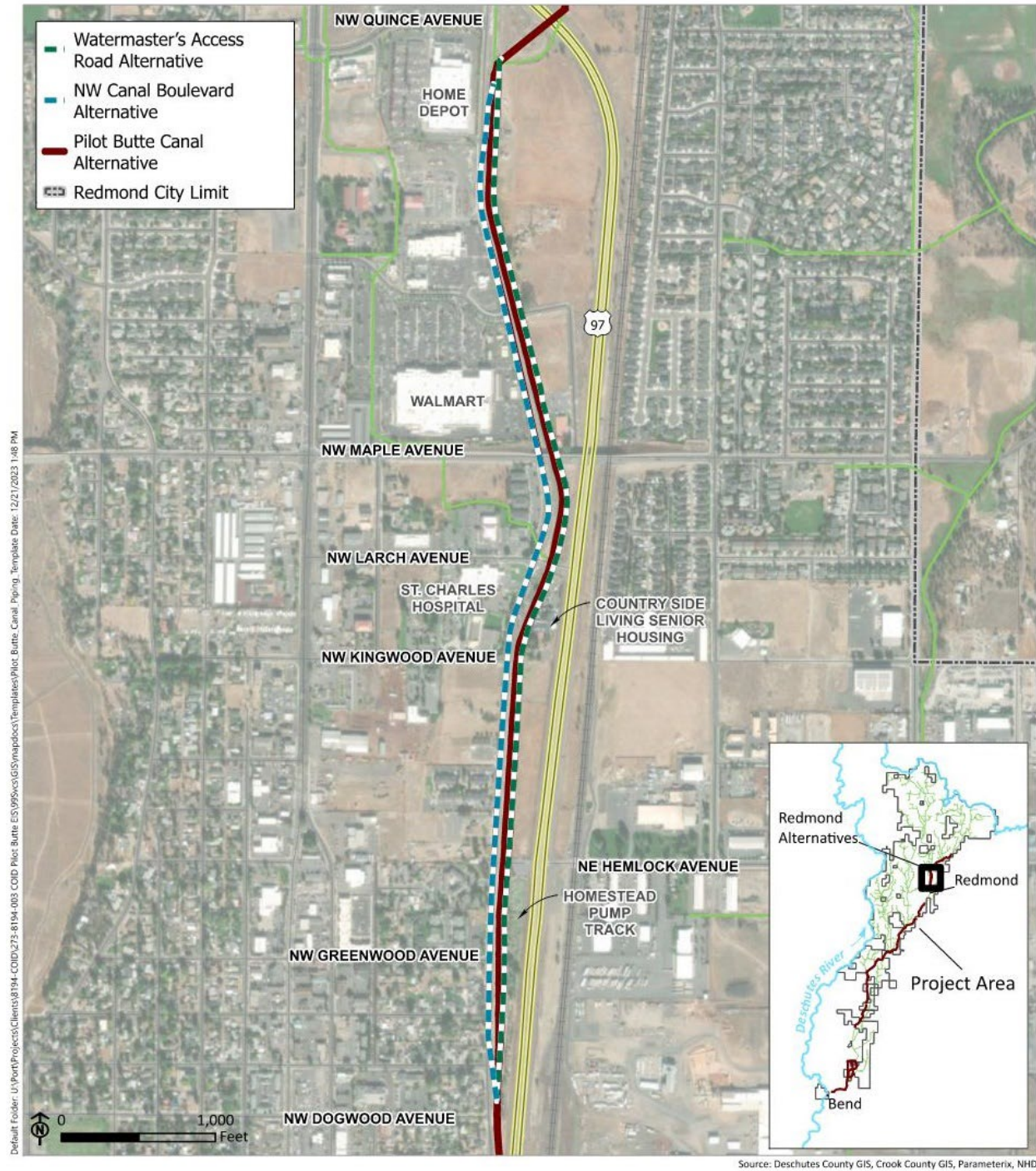


Figure 4. Redmond Alignment Options

### 3. DEFINITIONS

The following terminology is used when discussing geographic areas in this technical report.

**Project Area.** The area within which improvements associated with the project alignment options would occur and the area needed to construct these improvements. The Project Area includes the area needed to construct all permanent infrastructure, including adjacent parcels where modifications would be required for associated work such as utility realignments or upgrades.

**Study Area.** This is the general geographic area within which physical impacts to the environment could occur with the project alternatives. The Study Area is resource-specific and differs depending on the environmental topic being addressed. For all topics, the Study Area encompasses the Project Area, and for some topics (such as for utilities), the geographic extent of the Study Area is the same as that for the Project Area. For other topics (such as transportation) the Study Area is substantially larger to account for impacts that could occur outside of the Project Area. The Study Area for the noise and vibration analysis is defined in Section 5.1. The Study Area includes noise- and vibration-sensitive land uses on parcels immediately adjacent to the existing canal alignment and proposed alignment options that would be the receptors of noise and vibration impacts, including a 70-foot buffer on either side of the canal to account for construction impacts.

**Project vicinity.** The environs surrounding the Project Area. The project vicinity does not have a distinct geographic boundary but is used in general discussion to denote the larger area.

### 4. LEGAL REGULATIONS AND STANDARDS

#### 4.1 Laws, Plans, Policies, and Regulations

Noise and vibration, as well as the use of explosives for blasting, in the Project Area are regulated by a number of federal, state, and local laws, plans, policies, and regulations.

##### 4.1.1 Federal

42 U.S. Code, The Public Health and Welfare, Chapter 85 – Air Pollution Prevention and Control, Subchapter IV – Noise Pollution, Sec. 7641 - Noise abatement subsection (c) Abatement of noise from federal activities:

*In any case where any federal department or agency is carrying out or sponsoring any activity resulting in noise which the administrator of the U.S. Environmental Protection Agency determines amounts to a public nuisance or is otherwise objectionable, such department or agency shall consult with the administrator to determine possible means of abating such noise.*

Blasting and the use of explosives is also addressed in Safety and Health Regulations for Construction, 29 CFR 1926.900 and is administered by the Occupational Safety and Health Administration.

## 4.1.2 State of Oregon

### 4.1.2.1 Chapter 467 – Noise Control

ORS 467.010 through 467.999 provide protection of the health, safety, and welfare of Oregon citizens from the hazards and deterioration of the quality of life imposed by excessive noise emissions. To carry out this purpose, the Legislative Assembly granted to the Environmental Quality Commission the authority to adopt reasonable statewide standards for noise emissions permitted within this state and to implement and enforce compliance with such standards.

### 4.1.2.2 Chapter 480 – Explosives; Flammable Materials; Pressure Vessels

ORS 480.010 through 480.290 provide a regulatory framework for the use, manufacture, sale, possession, and transfer of explosives within the state of Oregon. This section of the revised statutes is regulated under the authority granted to the State Fire Marshall.

## 4.1.3 Deschutes County

The Deschutes County Noise Control Ordinance is found in Chapter 8.08.060(L) of the Deschutes County Code. The County's ordinance restricts general construction noise to between the hours of 7 a.m. and 10 p.m. (Deschutes County 2022).

## 4.1.4 City of Bend

The City of Bend Noise Control Ordinance is found in Section 5.50 of the City of Bend Code. The City's ordinance restricts general construction noise to the hours of 7 a.m. and 10 p.m. (City of Bend 2012).

The City of Bend Blasting Performance Standards are found in Section 16.10.090 of the City of Bend Code. Included in this code are the notification requirements for adjacent landowners.

## 4.1.5 City of Redmond

The City of Redmond Noise Ordinance is found in Section 5.335(15) of the City of Redmond Code. The City's ordinance restricts construction noise to the hours of 7 a.m. and 10 p.m. (City of Redmond 2003).

The City of Redmond Design Review Criteria in Section 8.3035(7)(A)(3) of the City of Redmond Code, General Site Criteria addresses the permitting requirements for blasting.

# 5. AFFECTED ENVIRONMENT

## 5.1 Study Area

This noise and vibration analysis considered two study areas: the immediate Project Area and the larger region. The regional study area considers compatibility with state, county, and local noise and blasting requirements within the boundaries of the city of Bend, city of Redmond, Deschutes County, and the COID service area. The study area includes noise-sensitive land uses on parcels immediately adjacent to the existing canal alignment and proposed alignment options that would be the receptors of noise and

vibration impacts, including a 70-foot buffer on either side of the canal to account for construction impacts.

## 5.2 Resource Identification and Evaluation Methods

### 5.2.1 Published Sources and Databases

Sources used to conduct this analysis include the following:

- Oregon Department of Transportation (ODOT)
  - US 97 and US 20 Bend North Corridor Project, Deschutes County, Oregon, Noise Technical Report Addendum, 2022, ODOT Key 21229, Final, December 2022 (Jacobs 2022)
  - US 97 Bend North Corridor Project Final Environmental Impact Statement and Final Section 4(f) Evaluation (ODOT Region 4 2014)
- Deschutes County GIS
  - Zoning designation
  - Sensitive receptors
- City of Bend GIS
  - Zoning designation
  - Special Planned Districts
  - Historic Districts
  - Sensitive receptors
- City of Redmond GIS
  - Zoning designation
  - Historic Districts
  - Sensitive receptors

### 5.2.2 Field Visits and Surveys

No field visits or surveys were performed as part of this environmental evaluation. Historical noise measurements from recent transportation projects in the Study Area are included.

## 5.3 Affected Environment

### 5.3.1 Existing Zoning

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 the Draft Land Use Technical Report.

Zoning designations of concern for potential noise and vibration impacts during construction include:

- Deschutes County
  - Residential, 2.5-Acre Minimum
  - Rural Residential
- City of Bend
  - Residential Urban Standard Density
  - Residential Urban Medium Density
  - Public Facility
  - Lava Ridge Refinement Plan Area
  - Historic Districts
- City of Redmond
  - Limited Residential
  - General Residential
  - Park
  - Special Service Commercial
  - Historic Districts

Zoning and land use are shown in below in Figure 5 through Figure 8.

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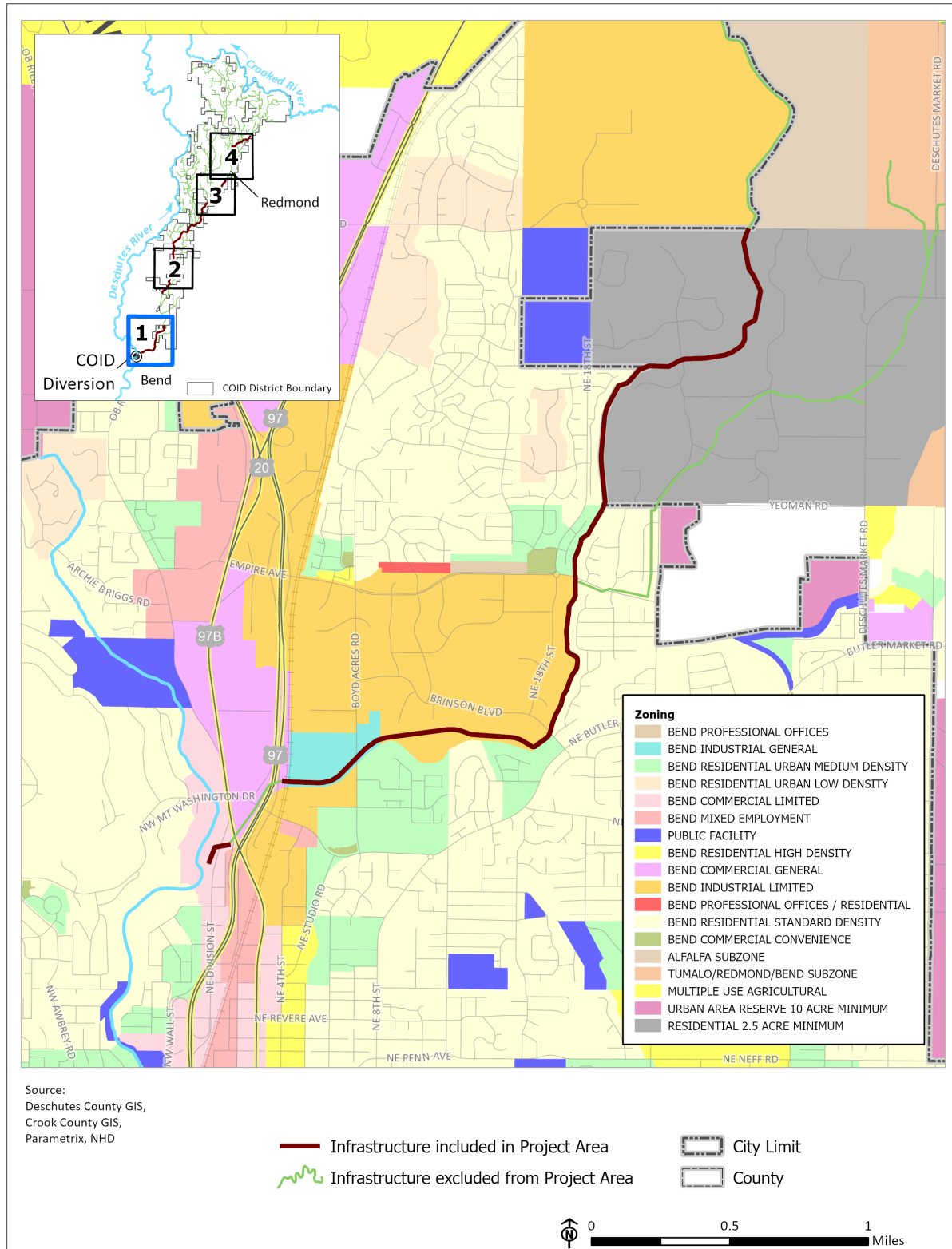


Figure 5. Existing Land Use Zones – Tile 1

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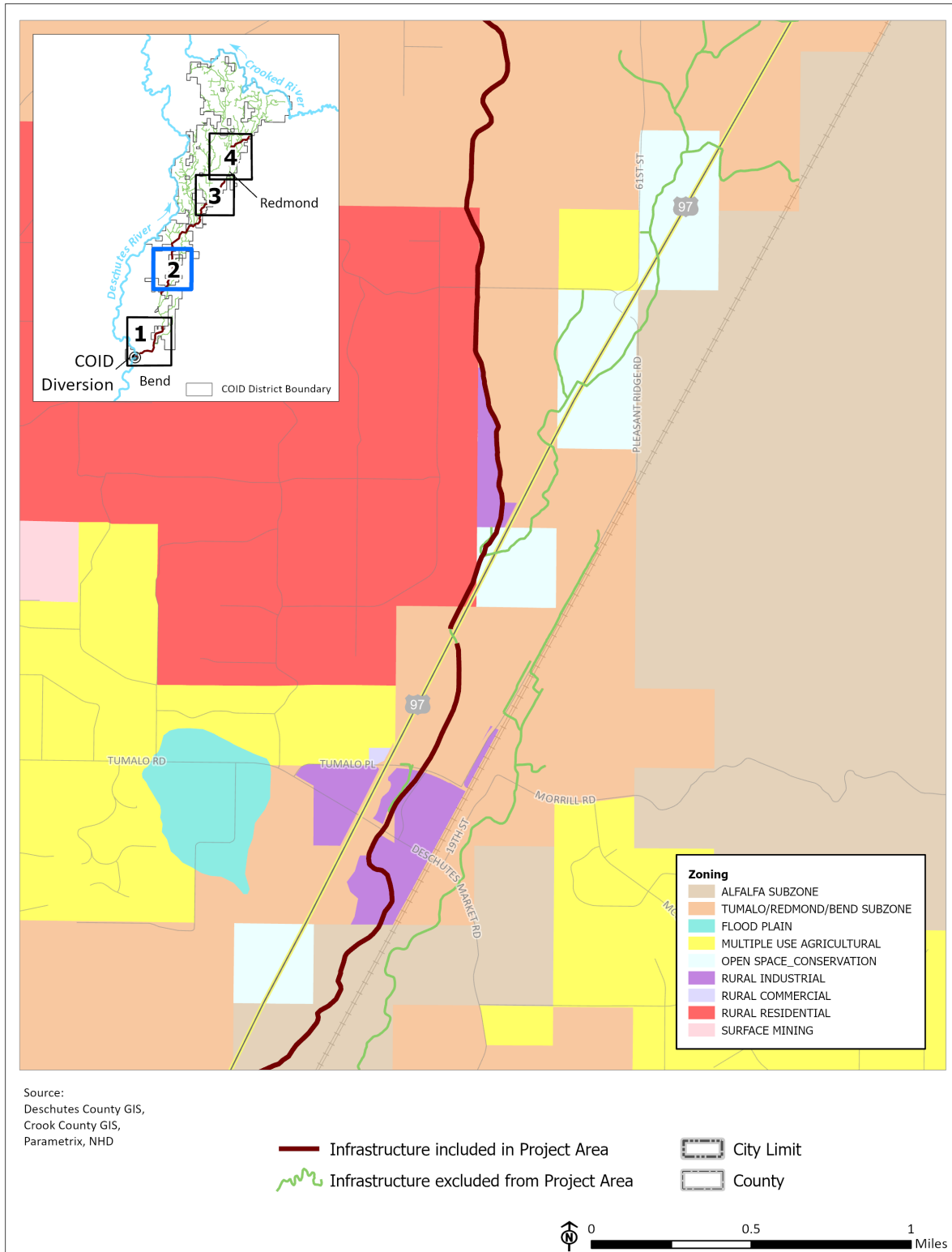


Figure 6. Existing Land Use Zones – Tile 2



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Draft Noise and Vibration Technical Report  
Central Oregon Irrigation District

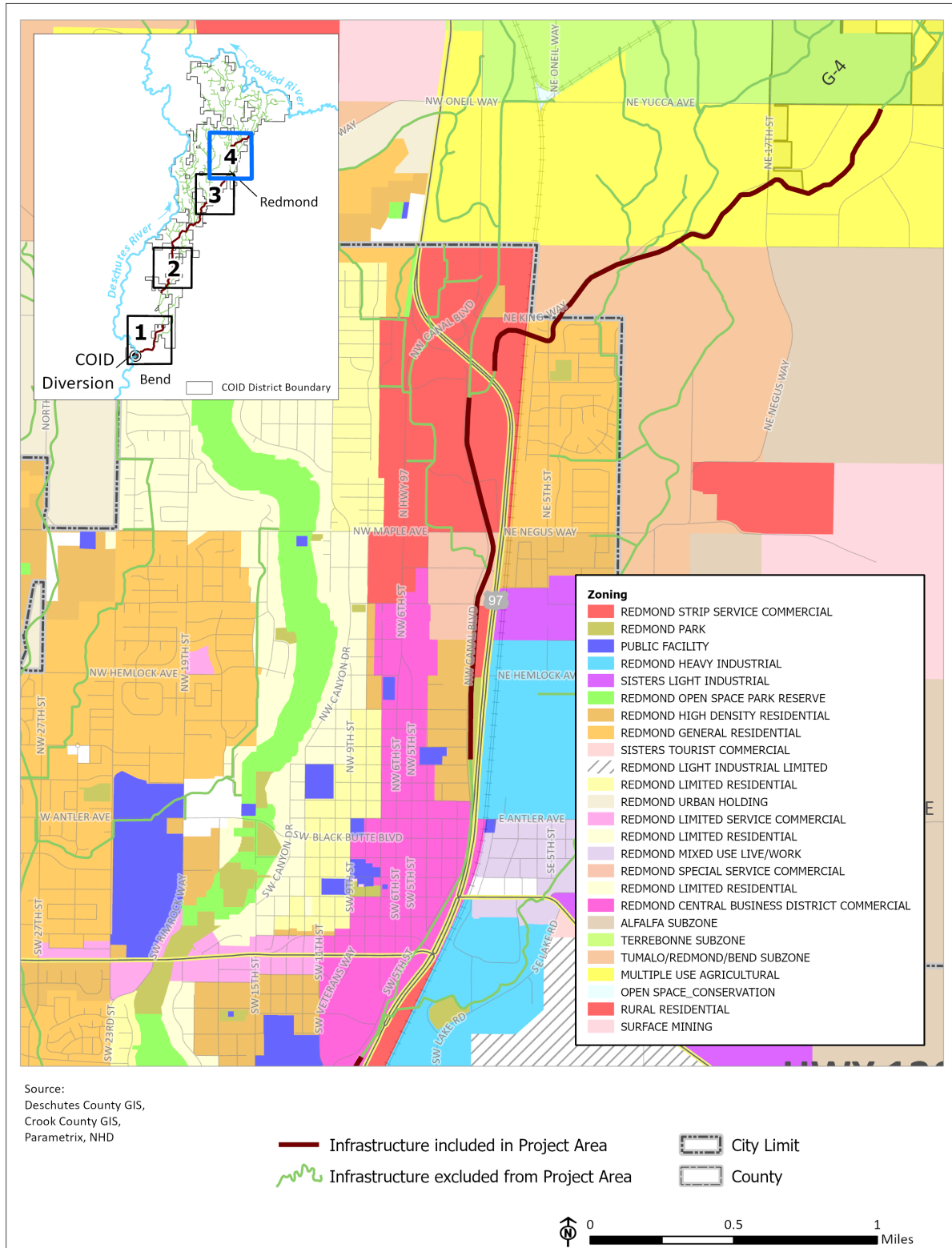


Figure 8. Existing Land Use Zones – Tile 4

## 5.3.2 Existing Land Use

### 5.3.2.1 Existing Pilot Butte Canal Alignment in Bend, Deschutes County, and Redmond

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 PBC existing alignment in Bend, from Yeoman Road to approximately Old Deschutes Road, is listed in the National Register of Historic Places.

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 PBC existing alignment in central Redmond, from NW Dogwood Avenue to NW Quince Avenue, is listed in the National Register of Historic Places. Central Redmond also contains the Redmond Downtown Historic District to the west of the PBC existing alignment. In Deschutes County north of Redmond, Diamond Bar Ranch Park is near the alignment.

The Redmond Downtown 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.

### 5.3.2.2 Deschutes County/North Bend Segment Option Area

#### NE 18th Street Alignment

The NE 18th Street alignment option does not currently have any District infrastructure, but it is a route that is under consideration for piping. The NE 18th Street alignment option abuts single-family residential, park, and institutional (elementary and middle school) uses. A portion of land alongside the proposed alignment is currently vacant land, but is planned for industrial and other employment uses, including a future public works facility as part of the Juniper Ridge Special Planned District. This alignment option shares its route with existing roads for much of its length.

Schools in Bend along this proposed alignment include Lava Ridge Elementary School and Sky View Middle School. Parks in Bend along this alignment include Rockridge Community Park (Figure 9).

#### Old Deschutes Road Alignment

The Old Deschutes Road alignment option abuts single-family residential, agricultural, and open space uses. A portion of land alongside the alignment is currently vacant land, but is planned for industrial and other employment uses, including a future public works facility as part of the Juniper Ridge Special Planned District. This alignment option shares its route with existing roads for much of its length.

Schools in Bend near this alignment include Lava Ridge Elementary School and Sky View Middle School. Parks in Bend near this alignment include Rockridge Community Park.



### 5.3.2.3 City of Redmond Option Area

#### NW Canal Boulevard and Watermaster Road Alignments

The NW Canal Boulevard alignment option abuts single-family and multifamily residential, commercial, big-box retail, and institutional land uses. The St. Charles Redmond Hospital complex abuts NW Canal Boulevard between NW Kingwood Avenue and NW Larch Avenue (Figure 10).

### 5.3.3 Existing Noise Levels

No existing ambient noise studies were conducted for this technical report. The most recent study within the general Study Area was performed as part of the 2014 ODOT US 97 North Bend Corridor Project Final Environmental Impact Statement (FEIS). Noise measurements were collected primarily along the east side of US 97 and east of the BNSF Railway tracks in northern Bend at noise-sensitive land uses. Six of these monitoring locations are within the southern portion of the COID Study Area and are shown in Figure 11. The measured noise levels are presented in Table 2.

**Table 2. Measured Noise Levels, 2014**

| Monitoring Location | 2014 FEIS Measured Noise Level (dBA) |
|---------------------|--------------------------------------|
| ST08-1              | 44                                   |
| ST08-2              | 49                                   |
| ST08-3              | 53                                   |
| ST08-4              | 57                                   |
| ST08-5              | 53                                   |
| ST08-9              | 56                                   |

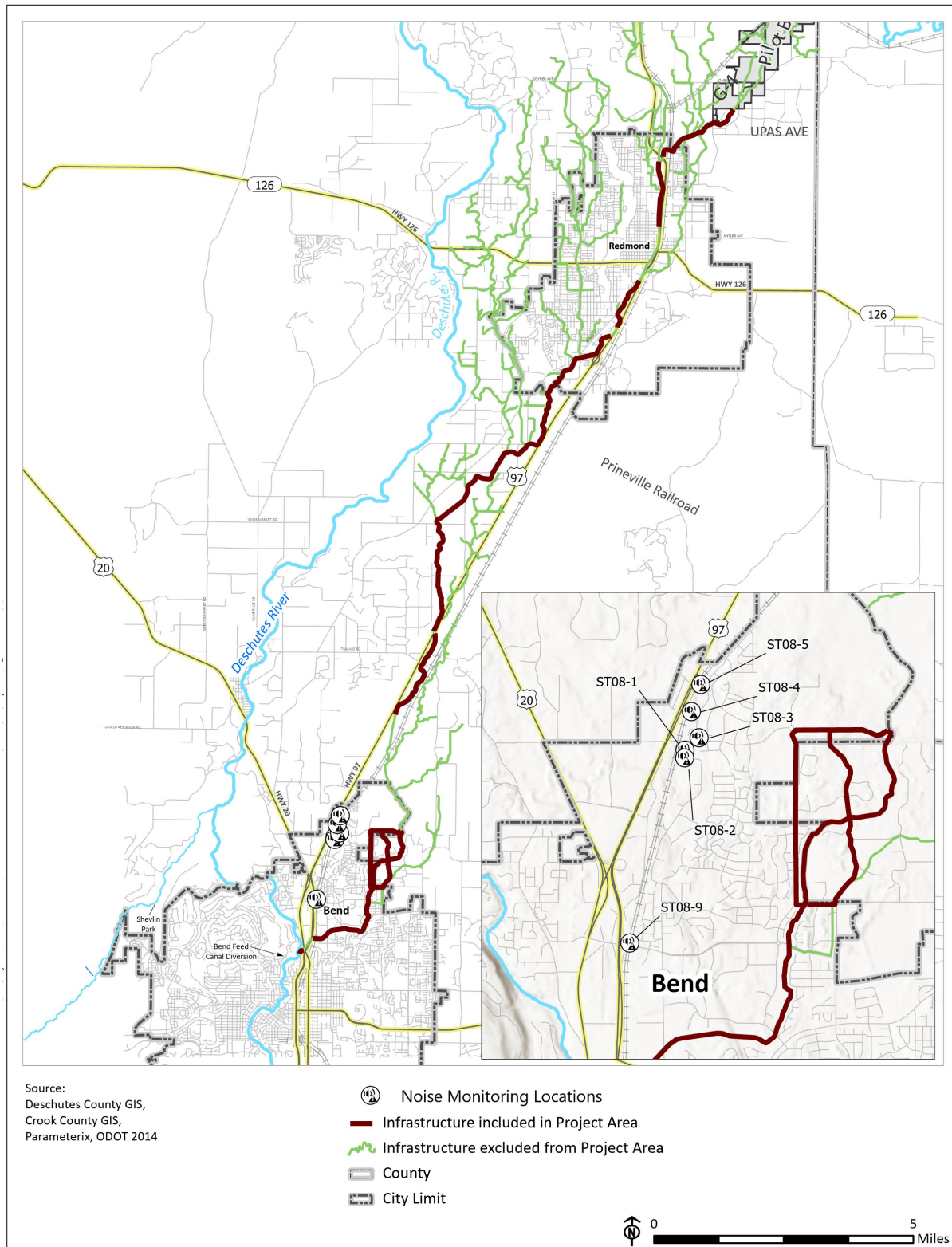
dBA = A-weighted decibels; FEIS = final environmental impact statement

The criteria for evaluating measured noise levels used in the ODOT US 97 North Bend Corridor Project are contained in 23 CFR Part 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise.

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).



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**Figure 11. Existing Noise Monitoring Locations**

### 5.3.4 Non-Roadway Related Noise Sources in the Project Area

Long-term measurements were reported in the 2014 FEIS and identified that the noise from the railroad contributes to the overall existing noise levels at residences located in proximity to the railroad tracks. It was determined that railroad-related noise is dominant in front-row receivers along the BNSF Railway. Additionally, areas within 600 to 800 feet of the active railroad are periodically exposed to railroad noise that is louder than roadway traffic noise during the peak noise hour of the day.

The Noise Technical Report from the 2014 FEIS also noted that the BNSF Railway expected to expand services in approximately 10 years. Data from 2023 indicate that there are three daytime trains and three nighttime trains for a total of six trains per day (USDOT 2024).

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 (Mead and Hunt 2018).

## 6. IMPACT ASSESSMENT METHODOLOGY AND DATA SOURCES

### 6.1 Long-Term Impact Assessment Methods

All existing noise and vibration receptors within the Project Area are evaluated for potential long-term impacts. Project design and engineering and anticipated construction and operation and maintenance are evaluated alongside property boundary maps to determine potential physical impacts. No long-term impacts to sound and vibration are expected from the PBC piping project. The pipe would be underground and would not be a major source of noise.

### 6.2 Short-Term Impact Assessment Methods

Short-term impacts are primarily related to the effects of construction during the PBC piping project that would be temporary in nature. These impacts could include substantially increased levels of noise and vibration due to the need for excavation into very shallow basalt rock. Excavation methods and means would likely include blasting. Several of the alignment options would place the construction activity immediately adjacent to sensitive noise and vibration receptors. Impacts could occur from detours or increased traffic due to construction disruptions, or from locating construction staging areas on or adjacent to residential, commercial, or other noise-sensitive land uses.

### 6.3 Indirect Impact Assessment Methods

Indirect impacts are changes in noise and vibration levels based on how the project alternatives would affect existing and future receptors in the Project Area. No indirect impacts are expected from the PBC piping project due to the lack of long-term direct impacts as described in Section 6.1.

### 6.4 Cumulative Impact Assessment Methods

The cumulative impacts analysis addresses the long-term and short-term cumulative impacts of the project alternatives. Other projects considered in the analysis include major transportation,

development, utility infrastructure, and environmental enhancement projects recently constructed, under development, or scheduled for construction, as well as the planned projects that are reasonably likely to be constructed.

No cumulative impacts are expected from the PBC piping project. The pipe would be underground and would not be a major source of noise. Once the piping project is completed, noise levels are expected to return to preconstruction ambient conditions and the piping project would not contribute to long-term changes in the ambient noise environment.

## 7. ENVIRONMENTAL CONSEQUENCES

### 7.1 Long-Term Impacts

#### 7.1.1 No Action Alternative

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.

#### 7.1.2 Modernization Alternative (Full Piping)

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

### 7.2 Short Term (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., see Table 3) 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.

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.

**Table 3. Typical Construction Equipment Noise Levels**

| Types of Activities  | Types of Equipment | Range of Noise Levels<br>at 50 Feet (in dBA) |
|----------------------|--------------------|----------------------------------------------|
| Materials Handling   | Concrete Mixer     | 85                                           |
|                      | Concrete Pump      | 82                                           |
|                      | Crane, Movable     | 85                                           |
| Stationary Equipment | Pump               | 77                                           |
|                      | Generator          | 82                                           |
|                      | Compressor         | 80                                           |
| Impact Equipment     | Rock Drill         | 90                                           |
|                      | Blasting           | 98                                           |
| Land Clearing        | Bulldozer          | 85                                           |
|                      | Dump Truck         | 84                                           |
| Grading              | Scraper            | 85                                           |
|                      | Bulldozer          | 85                                           |
| Paving               | Paver              | 85                                           |
|                      | Dump Truck         | 85                                           |

Source: FHWA 2006.

dBA = A-weighted decibels

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 (ExpertCivil n.d.).

### 7.2.1 Modernization Alternative (Full Piping)

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 the Hazardous Materials, Soils, and Geology Technical Report. 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. 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.

### 7.2.1.1 Deschutes County/North Bend Route Options

#### No Modernization within this Segment (No Piping)

No noise or vibration impacts would be expected in this segment under this option, as no construction would occur. The canal would continue to operate as it does under current conditions. This would have the least impact to adjacent noise- and vibration-sensitive receptors for all of the Deschutes County/North Bend route options.

#### Pilot Butte Canal Alignment

There are 79 single-family residences that abut this alignment. No other sensitive noise receptors were identified along this alignment. These residences would be impacted by noise and vibration during a single construction season during the winter months (mid-October to mid-April). This would have the second-highest noise and vibration impacts of the Deschutes County/North Bend route options.

#### NE 18th Street Alignment

Along this option, there are 71 single-family residences that abut this alignment. Three other sensitive noise receptors were identified along this alignment: Rockridge Community Park, Skyview Middle School, and Lava Ridge Elementary School. Four commercial businesses were identified near the Cooley Road – NE 18th Street roundabout; however, these are not typically considered noise-sensitive receptors. These residences, schools, and a park would be impacted by noise and vibration during a single construction season during the winter months. This would have the highest noise and vibration impacts of the Deschutes County/North Bend route options.

#### Old Deschutes Road Alignment

Along this option, there are 45 single-family residences that abut this alignment. No other sensitive noise uses were identified along this alignment. These residences would be impacted by noise and vibration during a single construction season during the winter months. This would have the third-highest noise and vibration impacts of the Deschutes County/North Bend route options.

### 7.2.1.2 City of Redmond Option

#### No Modernization within this Segment (No Piping)

No noise or vibration impacts would be expected in this segment under this option as no construction would occur. The canal would continue to operate as it does under current conditions. This option would have the least impact to adjacent noise- and vibration-sensitive receptors of all of the City of Redmond route options.

#### Pilot Butte Canal Alignment (Existing Canal Alignment)

Sensitive noise receptors along this alignment option are buffered by NW Canal Boulevard. There are 10 single-family residences between NW Elm Avenue and NW Hemlock Avenue and two multifamily residential complexes (Redmond Triangle Apartments and Aspen Villas); all are on the west side of NW Canal Boulevard. Other sensitive land uses along NW Canal Boulevard include a religious facility (Kingdom Hall Jehovah's Witness) and the St. Charles Redmond Hospital complex between NW Kingwood Avenue and NW Larch Avenue. These noise-sensitive receptors would be impacted by noise and vibration during a single construction season during the winter months. The hospital complex

could be especially susceptible to vibration impacts which may interfere with diagnostic imaging and microsurgery procedures. This would have the second-highest impact to adjacent noise- and vibration-sensitive receptors of all of the City of Redmond route options.

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

The same noise-sensitive receptors are present along this alignment option as for the existing PBC alignment but would have an additional buffering distance from noise- and vibration-sensitive receptors (approximately 50 feet) given that the excavation would be east of the existing PBC alignment. The impacts would generally be the same as those listed above for the PBC alignment. This would have the third-highest impact to adjacent noise- and vibration-sensitive receptors for all of the City of Redmond route options.

### Piping to the west within NW Canal Boulevard

The same noise-sensitive receptors are present along this alignment option as for the existing canal alignment, but the excavation would be closer to the noise- and vibration-sensitive receptors (approximately 75 feet). In addition, the construction duration would increase due to the need to relocate utilities prior to canal piping and to complete the total reconstruction of NW Canal Boulevard. The impacts would generally be more severe and of longer duration as those listed above for the PBC alignment. This option would have the highest impact to adjacent noise- and vibration-sensitive receptors of all of the City of Redmond route options.

## 7.2.2 Potential Off-Site Staging Areas

The construction contractor may use one or more off-site staging areas outside the Study Area 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 route alignment options. Whether, where, and how to use such sites would be the choice of the contractor; therefore, the actual site or sites cannot be known at this time. Given this uncertainty, detailed analysis of impacts is not possible at this time. It is assumed that because of regulatory and time constraints on the contractor, any site they choose would need to be already developed with road access. It is also assumed that the contractor would be responsible for relevant permitting or mitigation that could be required for use of a chosen site. The EIS identifies the types of impacts that could occur from off-site staging, based on the above assumptions. This analysis is not intended to “clear” any specific site, but rather to ensure disclosure of the general types of impacts.

The following types of impacts could occur from off-site staging:

- Additional construction noise would be generated by equipment at the staging/stockpiling areas and along material haul routes, adding to the total project noise levels.

If a contractor chooses to use an off-site staging area, the following local, state, and federal regulations could apply. The time during the day that construction staging can occur is between the hours of 7 a.m. and 10 p.m. Work outside of that time window would require a noise variance from either the City of Bend, the City of Redmond, or Deschutes County.

## 7.3 Cumulative Effects

No cumulative impacts for noise and vibration are expected from the PBC piping project. The pipe would be underground and would not be a major source of noise or vibration. Once the piping project is

completed, noise levels are expected to return to preconstruction ambient conditions and the piping project would not contribute to long-term changes in the ambient noise environment.

## 7.4 Compliance with Laws, Regulations, and Standards

The time during the day that construction can occur is between the hours of 7 a.m. and 10 p.m. Work outside of that time window would require a noise variance from either the City of Bend, the City of Redmond, or Deschutes County. If blasting is to be performed in the city of Redmond, a permit would be required. Notification to adjacent and nearby landowners would be required for all jurisdictions.

## 7.5 Conclusion

Noise and vibration impacts are limited to short-term construction activities. Although these may be locally significant due to the need to excavate and/or blast into bedrock, construction noise is intermittent and depends on the type of operation, location, and function of the equipment, and the equipment usage cycle. Once the piping project is completed, noise levels are expected to return to preconstruction ambient conditions and the piping project would not contribute to long-term changes in the ambient noise environment.

# 8. MITIGATION MEASURES

## 8.1 Common to the Modernization Alternative

Mitigation of potential construction noise impacts shall 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 person qualified and experienced in blasting. Blasting in the mass of rock to be excavated shall 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.

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 above-ground 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 notification, in writing, once, at least 48 hours before blasting begins and again on the day the blasting operations occur.

## 8.2 Pilot Butte Canal Option – Deschutes County/North Bend Section

Notification of adjacent and nearby residences of all planned construction activities.

## 8.3 NE 18th Street Option

Notification of adjacent and nearby residences and other noise- and vibration-sensitive land uses of all planned construction activities.

## 8.4 Old Deschutes Road Option

Notification of adjacent and nearby residences of all planned construction activities.

## 8.5 Pilot Butte Canal Option – Redmond Section

Notification of adjacent and nearby residences and other noise- and vibration-sensitive land uses of all planned construction activities.

## 8.6 Watermaster Road Option

Notification of adjacent and nearby residences and other noise- and vibration-sensitive land uses of all planned construction activities.

## 8.7 NW Canal Boulevard Option

Notification of adjacent and nearby residences and other noise- and vibration-sensitive land uses of all planned construction activities.

# 9. CONTACTS AND COORDINATION

No individuals or organizations were contacted as part of the preparation of this technical report.

10. PREPARERS

| Name         | Professional Affiliation | Education                      | Years of Experience |
|--------------|--------------------------|--------------------------------|---------------------|
| Peter Geiger | Parametrix               | M.Sc., Physics<br>B.S. Physics | 36                  |

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