Draft

City of
Sisters, Oregon
Wastewater Facilities Plan Update

2023

anderson perry & associates, inc.

engineering · surveying · natural resources

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WASTEWATER FACILITIES PLAN UPDATE

FOR

CITY OF SISTERS, OREGON

2023

ANDERSON PERRY & ASSOCIATES, INC.

La Grande, Redmond, Hermiston, and Enterprise, Oregon
Walla Walla, Washington

 Job No. 446-08

Table of Contents

TABLES

FIGURES

CHARTS

APPENDICES

Section 1 - Project Planning

General

The City of Sisters, Oregon, owns and operates a conventional gravity wastewater collection system integrated with four existing lift stations, a mechanical screening facility at the headworks, and three wastewater lagoons to process and store municipal wastewater at the wastewater treatment facility (WWTF). The wastewater collection and treatment systems operate under the authority of a Water Pollution Control Facilities (WPCF) Permit issued by the Oregon Department of Environmental Quality (DEQ). The City's WPCF Permit authorizes the use of recycled water that meets, at minimum, Class D treatment criteria as defined by the Oregon Administrative Rules. Discharging to Waters of the State is not permitted. All wastewater must be stored, treated, and disposed of by land application following sound irrigation practices and must conform to a DEQ-approved Recycled Water Use Plan. Between April and October, the City's treated wastewater is land-applied for irrigation purposes on dikes, forested land, and on pastureland at the Lazy Z Ranch near the WWTF using K-Line irrigation.

The City's WPCF Permit expires on December 31, 2025. The WPCF Permit allows a maximum annual average daily influent flow of 0.38 million gallons per day. With the City's anticipated growth, the WPCF Permit will likely require updating to be in accordance with future flows. The WPCF Permit includes current effluent limits for total coliform and *E. coli*, along with influent and recycled water monitoring requirements. However, the WPCF Permit does not include other quantified effluent parameters, such as five-day biochemical oxygen demand or total suspended solids removal efficiencies. Additionally, the WPCF Permit outlines waste disposal limitations, system monitoring and reporting requirements and procedures, compliance conditions and schedules, and special conditions. The current WPCF Permit requirements are discussed in detail in Section 2. A copy of the current WPCF Permit is included in Appendix A.

In the past, the City has been in compliance with permit conditions. The most recent DEQ inspection was conducted on August 25, 2015, and no compliance issues were documented for the permit period. At the time this Wastewater Facilities Plan (WWFP) Update was prepared, a fully certified Level 3 WWTF operator was employed by the City.

Location

The City of Sisters is located on the western side of central Oregon in Deschutes County. The location and vicinity maps are shown on Figure 1-1 and the major wastewater system components are shown on Figure 1-2. The study area encompasses land within the city limits and the urban growth boundary (UGB).

The City is located approximately 22 miles northwest of Bend and 19 miles west of Redmond, along U.S. Highway 20. Deschutes County is bordered by Lane County to the west, Klamath and Lake Counties to the south, Crook County to the east, and Jefferson County to the north. The City is nestled at the eastern edge of the Deschutes National Forest with views of the Three Sisters volcanic peaks, which are part of the Cascade Volcanic Arc, a segment of the Cascade Range.

The elevation of Deschutes County varies from 2,867 feet above mean sea level (AMSL) east of Terrebonne to 10,358 feet AMSL at South Sisters Peak. Elevations in the city limits range between approximately 3,180 feet and 3,230 feet AMSL. The City's WWTF and land application sites are located south-southwest of the City.

The area's popularity has brought considerable growth and many opportunities for the City. The region around the City has become a hub for art, recreation, tourism, and more. The City is primarily a residential community with a significant tourist-based economy. The City has a vibrant commercial district located on either side of U.S. Highway 20 and room for considerable expansion within the industrial district. A zoning system that restricts industrial development to designated areas, while permitting mixed-use residential development in areas zoned for industrial purposes, was developed by the City. The zoning within the city limits and UGB is presented on Figure 1-3.

Transportation

U.S. Highway 20 and Oregon Route 126 merge in Sisters to form Cascade Avenue, the main thoroughfare through the city center. The two highways split east of Sisters, with Oregon Route 126 heading to Redmond and U.S. Highway 20 heading to Bend. West of Sisters, Oregon Route 242 splits off the combined Oregon Route 126 and U.S. Highway 20.

Land Use

Figure 1-3 shows the current zoning in the City and the land use classifications identified within the UGB. Commercial areas are primarily located in the City's core and in the downtown area along U.S. Highway 20. Residential areas surround the City's commercial areas and occupy a vast majority of the land within the UGB. The City's industrial areas are located in the northeastern portion of the UGB near the Sisters Eagle Airport.

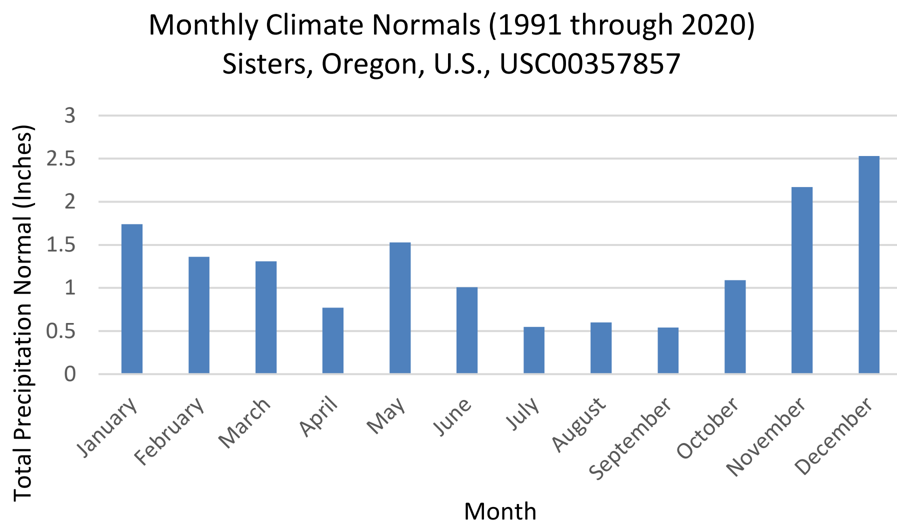
Environmental Resources Present

Climate

The City of Sisters can be characterized as one of the more arid regions of Oregon but with a four-season climate with cold winters; warm, dry summers; and pleasant springs and falls. Surrounding mountain ranges influence the climate in the area considerably. The high surrounding mountains to the west help protect the area from severe storms and intercept a substantial portion of the moisture, so the area remains relatively dry. Most of the precipitation falls in the spring and fall. Heavy snow produces a year-round snowpack in the mountains, with snow starting in November and continuing into February.

Based on the National Oceanic and Atmospheric Administration (NOAA) and Western Regional Climate Center for Sisters, the average monthly low temperature is approximately 20° Fahrenheit (F) (December and January), and the average monthly high temperature is 85°F (July). The area's average annual precipitation is 15.20 inches, and the average snowfall is approximately 30 inches. Using information obtained from NOAA, the 30-year precipitation normal for the City of Sisters are summarized on Chart 1-1. The nearest rain gauge is located in Sisters Oregon.

CHART 1-1
PRECIPITATION 30-YEAR NORMAL



Floodplains

Wychus Creek runs through the City of Sisters as it flows northeast to the Deschutes River downstream of the City of Redmond. According to the Federal Emergency Management Agency (FEMA) Map Service Center, FEMA Flood Insurance Rate Map Panel No. 41017C0245E has been assigned to the City and areas identified for improvement.

Soils

Typically, soils throughout the City are designated as Lundgren sandy loam and Ermabell loamy fine sand. According to a web soil survey on the U.S. Department of Agriculture Natural Resources Conservation Service website for the area encompassing the city limits and the UGB, approximately 65 percent of the area consists of Lundgren sandy loam, Ermabell loamy fine sand, Wanoga-Fremkle-Rock outcrop complex, Omahaling fine sandy loam, and Henkle-Lava flow-Fryrear complex. No digital data are available for the remaining 35 percent; however, its makeup is most likely similar. For a more detailed description of soil types in and around the City of Sisters, refer to the 2016 Recycled Water Use Plan in Appendix B.

Flora and Fauna

Biological resources in the area include numerous fish, bird, and mammal species. The Metolius River, which is incorporated into the larger system surrounding Sisters, passes approximately 30 miles north of the City. The nearest water source is Whychus Creek, which runs through the southern section of the City. Whychus Creek inhabits fish species such as rainbow trout while mammals such as mule deer, elk, bobcats, coyotes, and gray wolves also inhabit this area. The U.S. Fish and Wildlife Service Information for Planning and Consultation (IPaC) tool was utilized to identify endangered species and migratory birds that may exist or could potentially be affected by activities in Sisters. No critical habitats were found within the immediate area; however, it is important to meet all permit requirements to mitigate any negative effects to habitats that endangered species inhabit. The IPaC tool identified two endangered species in the region and nine migratory birds. These species are summarized on Tables1-1 and 1-2.

TABLE 1-1
ENDANGERED SPECIES

Common Name	Scientific Name	Status
Gray wolf	*Canis lupus*	Endangered
Monarch butterfly	*Danaus plexippus*	Candidate

TABLE 1-2
MIGRATORY BIRDS

Common Name	Scientific Name
American white pelican	*Pelecanus erythrorhynchos*
Bald eagle	*Haliaeetus leucocephalus*
Black swift	*Cypseloides niger*
Cassin's finch	*Carpodacus cassinii*
Evening grosbeak	*Coccothraustes vespertinus*
Lewis's woodpecker	*Melanerpes lewis*
Olive-sided flycatcher	*Contopus cooperi*
Pinyon jay	*Gymnorhinus cyanocephalus*
Rufous hummingbird	*Selasphorus rufus*

Population Trends

To estimate future wastewater system demands, population projections must be made. Projections are usually made on the basis of an annual percentage increase estimated from past growth rates tempered by future expectations. Significant population fluctuations are typical in smaller communities, as demonstrated by the City's rapid growth, and it is difficult to accurately predict the population of a smaller community over any extended period of time. The addition or removal of a major business, industry, or recreational facility in the community can significantly affect the population and the overall wastewater system needs.

The period of time over which the population is to be projected usually depends on the type of improvements to be considered. Improvements that will require long-term financing should be designed for no less than the term of the financing. Facilities readily expanded or modified are normally designed for a period of 10 to 20 years. Facilities not easily modified or expanded, such as buried pipelines and storage reservoirs, may be designed for their expected life, which is usually 40 to 50 years or more. This WWFP Update has been written for a 20-year planning period.

Historic Population

The population of the City of Sisters, according to the June 30, 2022, certified estimate by the Portland State University Population Research Center (PRC), is 3,220 for the year 2020 and 3,437 for the year 2022. The PRC is the official source of population data available in Oregon between the official Census data generated at the beginning of each decade. Projections are usually made based on an annual percentage increase estimated from past growth rates combined with future expectations. Overall, the population of the City has increased significantly. The City's average growth rate from 2010 to 2020 was approximately 4.7 percent per year. Historical and forecasted population data are presented on Table 1-3.

TABLE 1-3
HISTORICAL AND FORECASTED POPULATION DATA

Historical			Forecasted				
2010	**2020**	**AAGR (2010-2020)**	**2022**	**2047**	**2072**	**AAGR (2022-2047)**	**AAGR (2047-2072)**
2,040	3,220	4.7 percent	3,437	7,911	14,881	3.3 percent	2.5 percent

AAGR = average annual growth rate

The City of Sisters' population at the 2010 Census was 2,040. The certified population estimate by the PRC for 2020 was 3,220 with a calculated AAGR of 4.7 percent. The AAGR between the years 2022 and 2047 is 3.3 percent and 2.5 percent between the years 2047 and 2072. For the years between 2040 and 2045, the AAGR is approximately 2.76 percent, which follows the PRC population estimates of 6,551 for 2040 and 7,505 for 2045. The historical population plus the projected annual growth rate established by the PRC results in a 20-year (2042) design population estimate of 6,917. This WWFP Update uses 6,917 as the 20-year design population inside the City's UGB.

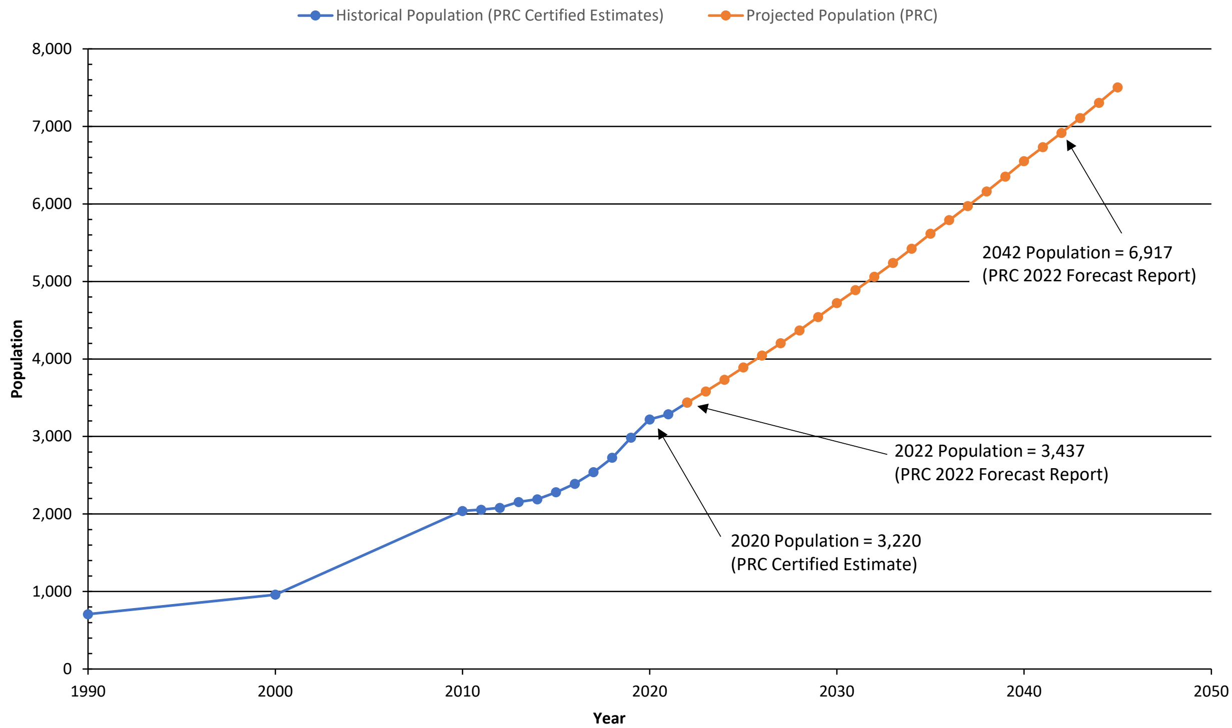
The improvements necessary to the collection system require accurate counts of the entire connected population within the UGB. In addition, areas of potential development outside the UGB could increase the effective service population if incorporated. The potential for growth outside the UGB was considered when analyzing the City's collection, treatment, and disposal systems to help aid in conservative planning. However, specific locations outside the UGB are not identified as a part of this WWFP Update.

Population Projections

In accordance with Oregon Revised Statutes 195.033, the PRC is responsible for establishing and maintaining population forecasts for cities in Oregon. Past population figures from the PRC and the Census show the City's population has increased steadily from 708 in 1990 to 959 in 2000 and 3,220 in 2020. This represents a historical growth rate between 1990 and 2000 of approximately 3.1 percent per year and between 2000 and 2020 of approximately 6.2 percent per year. The City has experienced AAGRs of 6 to 10 percent between 2016 and 2020, which is a significantly higher rate than projected by the PRC and what other areas of Oregon experienced during the same time frame. PRC's population estimate for 2020 of 3,220 is used as the basis for the current population and water use analysis in the development of this WWFP Update.

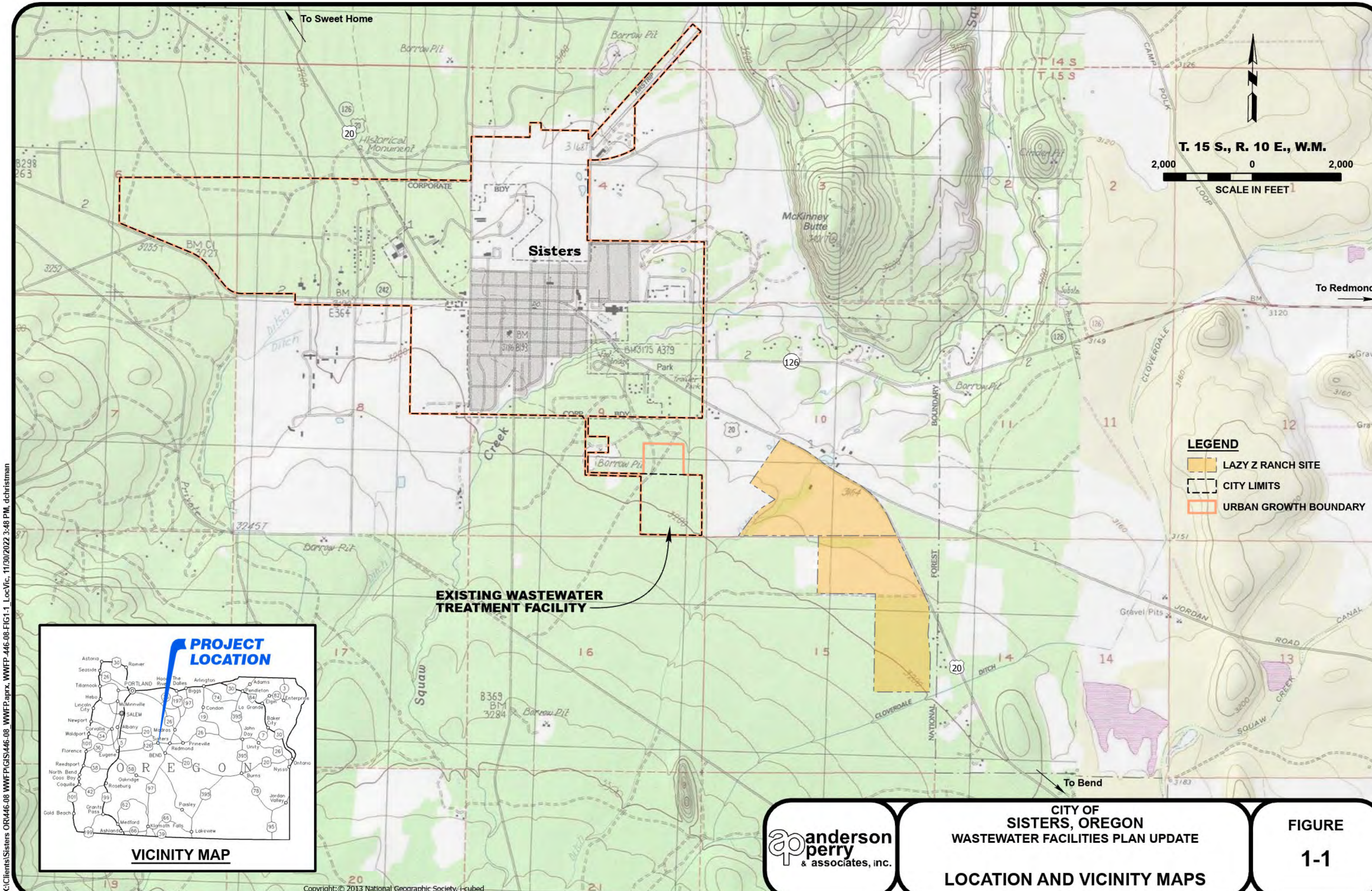
The PRC forecast indicates that the City's population will increase to 6,551 and 7,505 in years 2040 and 2045, respectively. This equates to an annual rate of 2.76 percent between 2040 and 2045. The 2042 population was determined via interpolation. See Chart 1-2 below.

CHART 1-2
HISTORICAL POPULATION



Community Engagement

Throughout the development of this WWFP Update, multiple presentations describing the proposed improvements were presented to the Public Works Advisory Board (PWAB), the City Council, and the Sisters Planning Commission. The development of the WWFP Update was closely coordinated with Public Works staff. The WWFP Update was presented to PWAB on March 8, 2022, and June 14, 2022. The WWFP Update was also presented to the City Council on August 10, 2022, and was subsequently given to the Planning Commission on October 20, 2022.



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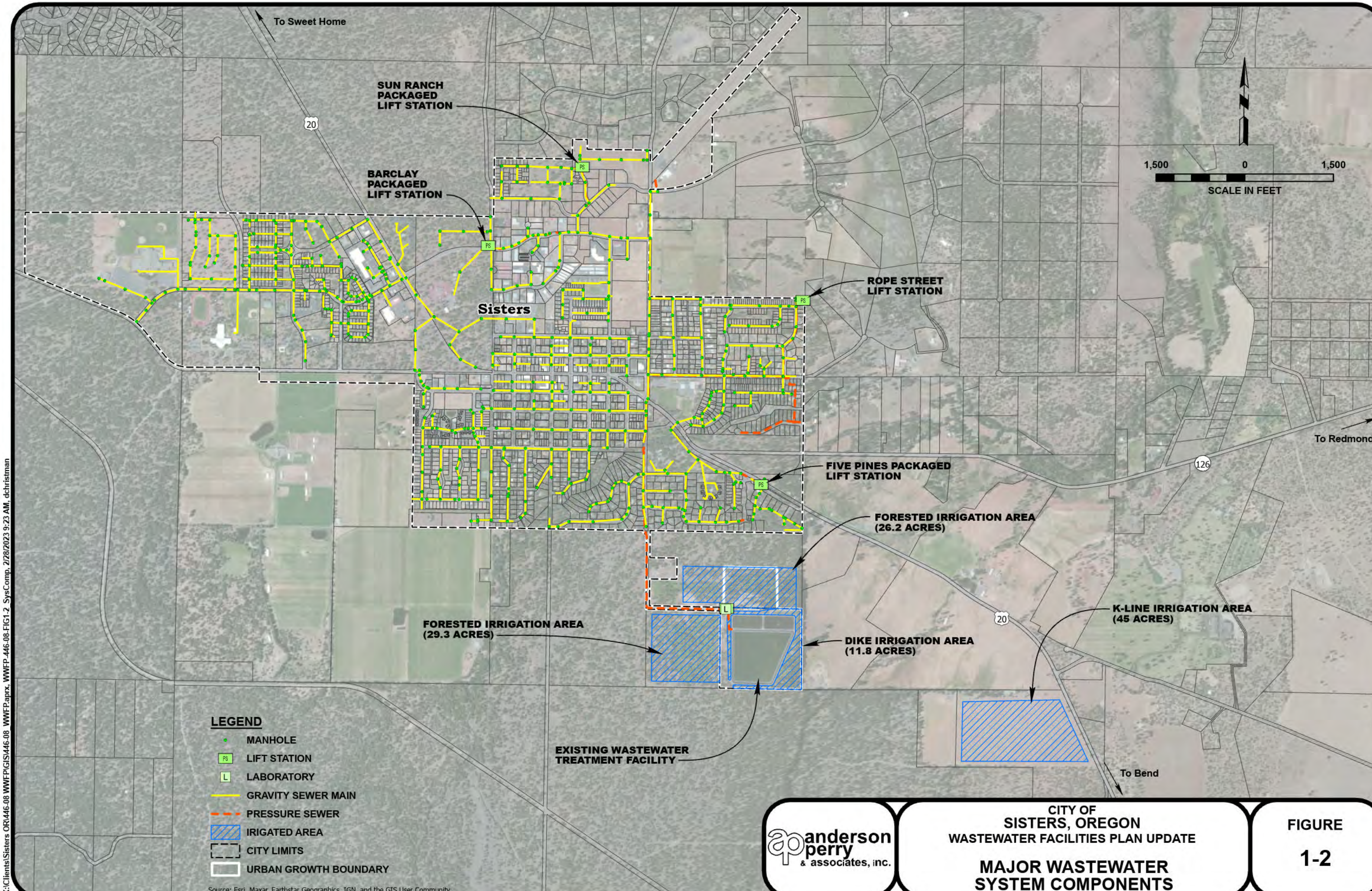

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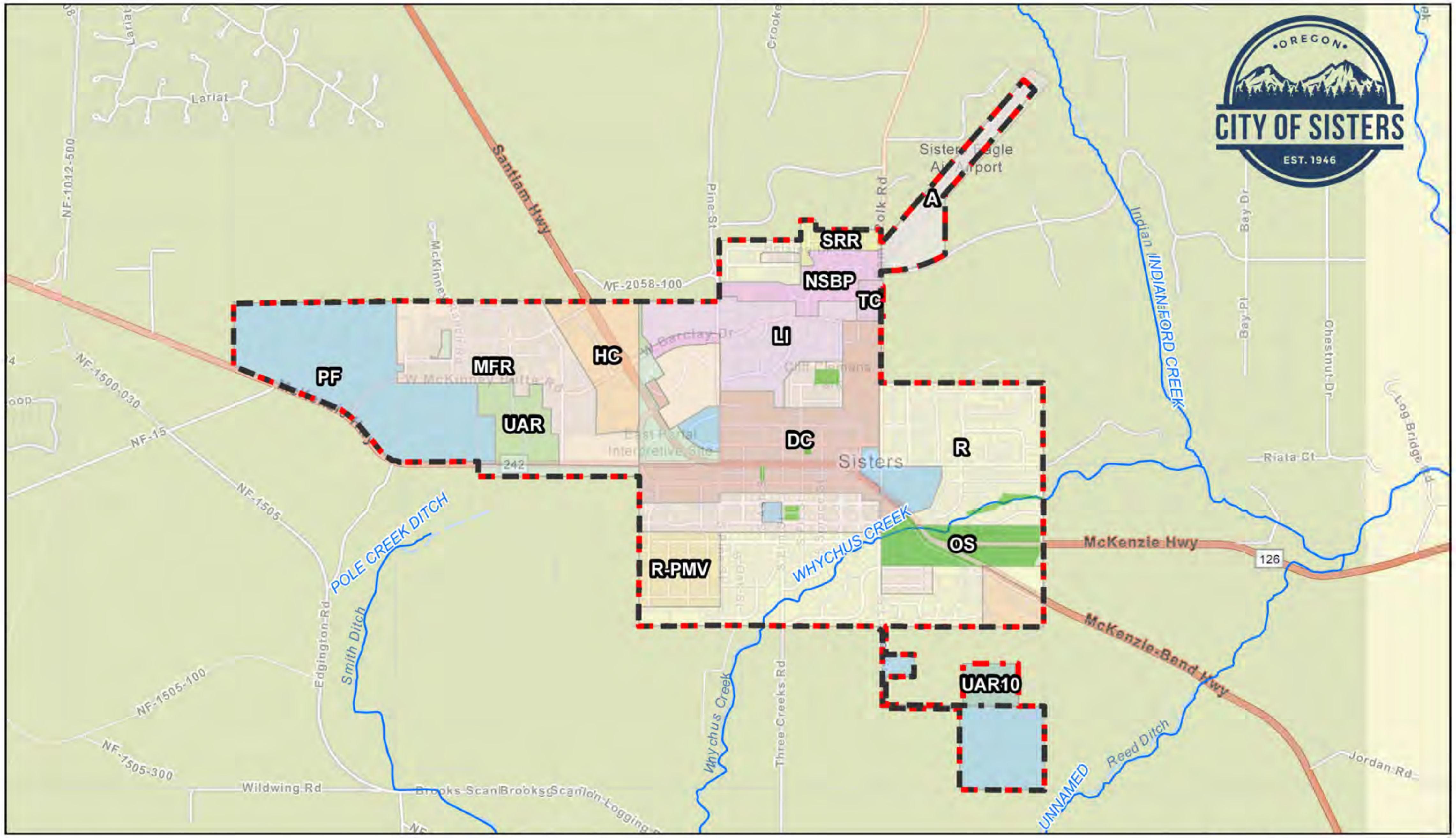
City of Sisters Zoning Map



7/28/2021, 2:52:01 PM

City Limits	Taxlots	Highway Commercial	Light Industrial	Sun Ranch Residential
UGB	Zoning	Tourist Commercial	N. Sisters Bus. Park	R - Pine Meadow Village
Parks	Airport	Open Space	Multi-Family Residential	Urban Area Reserve
Streams	Downtown Commercial	Public Facility	Residential	Urban Area Reserve 10

1:36,112

0 0.2 0.4 0.8 mi

0 0.35 0.7 1.4 km

State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA

City of Sisters

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CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE

ZONING MAP

FIGURE 1-3

Section 2 - Existing Facilities

Introduction

In this section, the existing wastewater collection, treatment, and disposal facilities are described and an evaluation is provided. Additionally, a brief history of the construction of the existing wastewater treatment facility (WWTF) is presented.

History

Wastewater System History

Between 2000 and 2002, the City of Sisters constructed a municipal wastewater system fed by a 12-inch diameter pressure sewer main. The 12-inch pressure sewer main leaves the Rope Street Lift Station where the gravity sewer collection system converges. The polyvinyl chloride (PVC) mains in the gravity collection system vary in diameter from 6 to 24 inches. The gravity collection system also includes four wastewater lift stations. A map of the existing collection system is included as Figure 2-1. Influent sewage is pumped through an electromagnetic flowmeter and into the mechanically cleaned wedge wire screen of the headworks at the WWTF. The WWTF consists of a three-cell aerated lagoon system. Lagoons No. 1 and 2 are aerated and aerated/settling lagoons, respectively, and are each approximately 2.4 acres with operating water depths of 9 feet. Wastewater then enters Lagoon No. 3, which serves as a storage lagoon and is approximately 18 acres in size with a storage volume of approximately 213 acre-feet (69.4 million gallons). Wastewater in the winter holding lagoon (Lagoon No. 3) is held until irrigation is permitted by the Water Pollution Control Facilities (WPCF) Permit, then flow enters the chlorine contact pipe. In the chlorine contact pipe, which was part of the 2001 WWTF construction, wastewater from Lagoon No. 3 is dosed with sodium hypochlorite for disinfection. The volume of the 36-inch diameter and 1,140-foot long chlorine contact pipe allows for more than the necessary 60 minutes of detention time needed before the treated wastewater is pumped to the various land application sites by the irrigation pumps located at the control building. A map of the existing WWTF is included as Figure 2-2, while a process schematic of the existing WWTF is included as Figure 2-3. The City irrigates approximately 112 acres of land, which consists of 55.5 acres of natural forest, 11.8 acres of lagoon dike areas, and 45 acres of pastureland at the Lazy Z Ranch with K-Line irrigation. Since the construction of the WWTF, the aeration system in the primary cell and supervisory control and data acquisition system were both upgraded in 2020, and biosolids were removed in 2021. In 2020, the 7.5 horsepower (Hp) aerators in Lagoon No. 1 were replaced with 15 Hp aerators and the electrical systems were upgraded to accommodate the larger load. In 2007, the City acquired a portion of the Lazy Z Ranch for future wastewater effluent needs. Treated effluent is applied to 45 acres of pastureland at the Lazy Z Ranch through K-Line irrigation installed in 2019. A map of the existing site irrigation is included as Figure 2-4. The proposed Lazy Z Ranch Master Plan's improvements are further detailed in Sections 4 and 5. In addition, biosolids were removed from Lagoon 1 in 2021 and land-applied at the Lazy Z Ranch.

Historical Wastewater Data

This section provides a review of the historical wastewater data for the City's WWTF. Information provided in this section was obtained from the City's Discharge Monitoring Reports (DMRs).

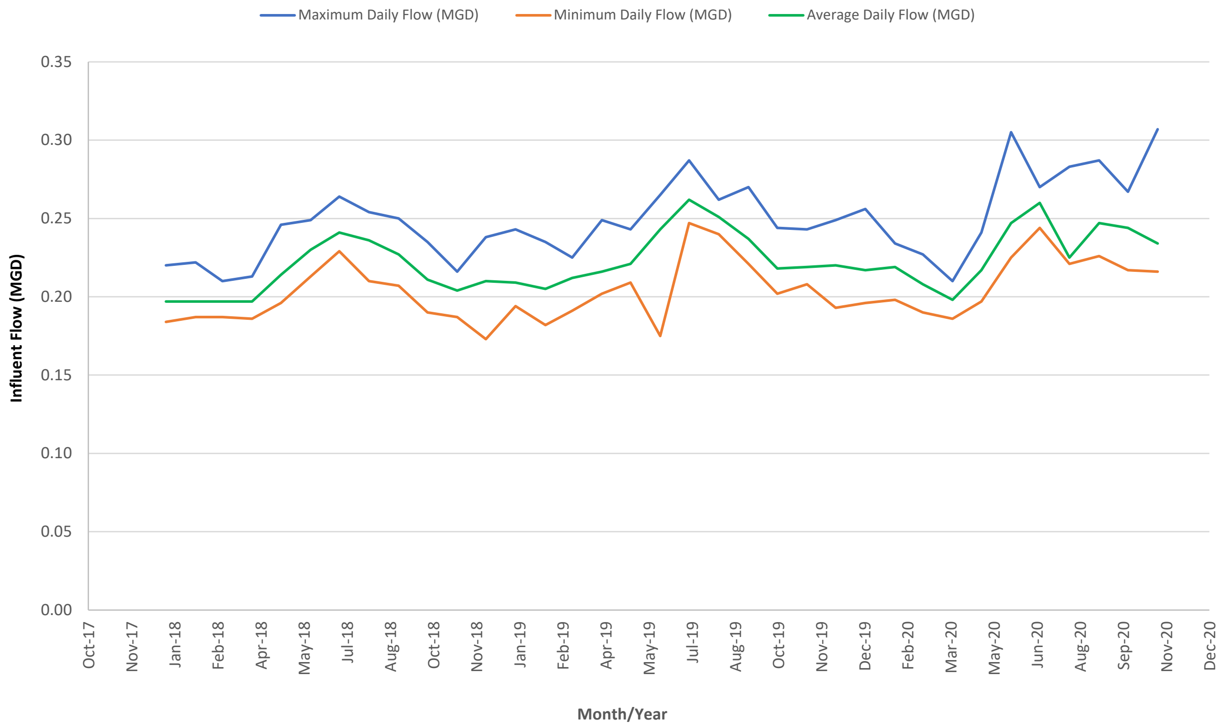
Historic wastewater influent flows and pollutant loadings received at the WWTF for the period between January 2018 and December 2020 are included in a summary of the City's DMRs shown in Appendix C. An understanding of current influent flow and load patterns is necessary to project future flows and loads for the 20-year planning period. These projected influent flows and loads have been utilized to develop design criteria, which are used to size future wastewater system facilities. Effluent design criteria, which define the level of treatment needed and help determine viable effluent discharge methods, are outlined later in this section, while the proposed treatment facility improvements and alternatives are discussed in Section 4.

Wastewater Flows

The City's historical influent flows for the operation period of January 2018 through December 2020, as provided by the DMRs, including maximum, minimum, and average flow characteristics, are shown on Chart 2-1. According to the available data, the maximum daily flow of 0.307 million gallons per day (MGD) occurred in November 2020. The minimum daily flow of 0.173 MGD occurred in December 2018. The average annual flow (AAF) for the period of DMR data was 0.224 MGD or approximately 69 gallons per capita day (gpcd) at the estimated population of 3,220 for 2020.

The flows shown on Chart 2-1 reflect high flows around July that likely correspond to the peak in tourist visitation in the area and the annual events the City holds during the summer. The average base flow was gathered based on the average of the daily flows for a 14-day period with no precipitation. A selected period from April 7, 2020, to April 21, 2020, was utilized. Data were taken from the National Oceanic and Atmospheric Administration daily summaries for Bend, Oregon. No precipitation data were available from a local weather station, requiring the use of data from Bend due to its proximity and weather patterns that are similar to the City of Sisters. Based on the data, the average base flow is 0.196 MGD or approximately 61 gpcd using the 2020 population of 3,220. It is assumed that infiltration and inflow (I/I) is minimal because of the relatively new wastewater collection system. Therefore, the flows for February through April 2020, which are similar to the average, reflect a more accurate representation of actual base wastewater flows. The existing maximum monthly flow of 0.262 MGD was recorded in July 2019.

CHART 2-1
HISTORICAL MONTHLY INFLUENT FLOWS



Data collected from many domestic wastewater systems like the City's indicate that AAFs usually range from 80 to 120 gpcd. The City's AAF is approximately 70 gpcd. As shown on Chart 2-1, the peak flow generally occurs between May and August each year, which is typically when tourist season is occurring.

Infiltration and Inflow

I/I is unwanted flows entering the wastewater collection system. I/I in a collection system can occur during different events at different times of the year. Early spring rain and runoff in the months of March or April elevate groundwater levels, and groundwater, in turn, infiltrates into any available weakness in a wastewater collection system. Specifically, the components of I/I are defined as follows:

- Infiltration - Water entering the collection system and service connections from the ground through such means as, but not limited to, defective pipes, pipe joints, and defective service line connections or manhole walls. Infiltration does not include, and is distinguished from, inflow.
- Inflow - Water discharged into a collection system and service connections from such sources as, but not limited to, roof drains, cellars, yard and area drains, foundation drains, sump pumps, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers and combined sewers, catch basins, stormwater, surface runoff, and street washes or drainage.

- I/I - The total quantity of water from both infiltration and inflow without distinguishing the source.

Most cities have some I/I contributing to their wastewater collection system. Excessive I/I can be a problem because these flows must be treated along with normal wastewater flows and take up valuable treatment capacity at a city's treatment facility, which results in larger facilities required to manage the extraneous flows. Excessive I/I is defined as the quantity of I/I that can be economically eliminated from a collection system by rehabilitation or other means, as determined by a cost analysis that compares the cost effectiveness of correcting the I/I conditions with the total cost for transportation and treatment of I/I.

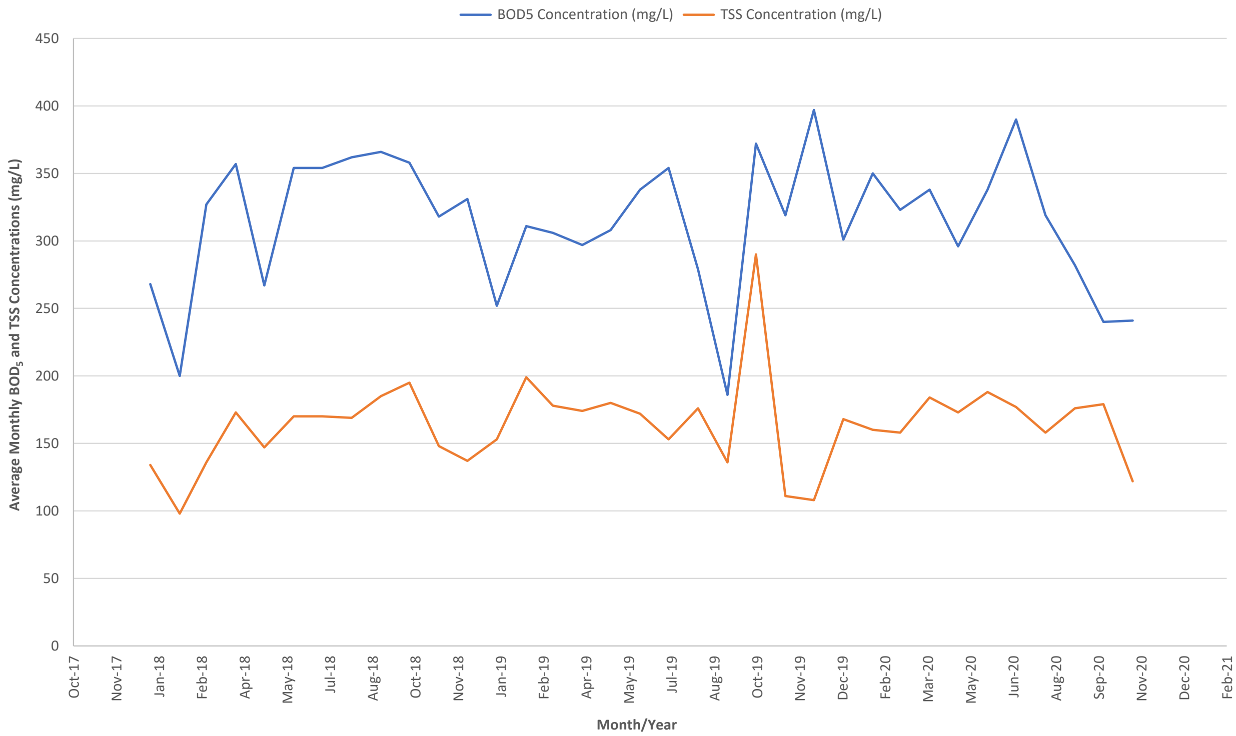
I/I has not been a concern for the City of Sisters. New ASTM D3034 PVC sewer lines were installed in 2001 and air tests were performed on the completed lines. If any I/I sources are found and their removal from the system through a manhole or pipeline repair is completed, the reduction in the total volume of wastewater the City must treat and dispose of may provide additional cost savings to the City.

Based on a review of the City's DMRs and Chart 2-1, there may be some infiltration into the gravity sewer system; however, I/I volumes, if any exist, appear to be minimal. For the years 2018 through 2020, flow trends are similar and do not suggest that I/I is occurring. Furthermore, review of the City's per capita flows from the design criteria show low per capita flows. The wet weather per capita flow indicates no I/I issues. Due to the City's low per capita flows and relatively new and watertight wastewater collection system, I/I was determined not to be a concern and was not analyzed further.

Wastewater Loading

Figure 2-5 shows the average influent mass loadings for five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) based on the DMR records from January 2018 through December 2020. The average monthly concentrations for BOD_5 and TSS are plotted on Chart 2-2 for the analysis period.

CHART 2-2
HISTORICAL AVERAGE MONTHLY FIVE-DAY BIOCHEMICAL OXYGEN DEMAND AND TOTAL SUSPENDED SOLIDS CONCENTRATIONS



The base year 2020 influent BOD_5 of 587 pounds per day (lbs/day) is within expected ranges, though the TSS mass loading of 306 lbs/day is much lower than average. Data collected from many domestic wastewater systems like the City of Sisters' indicate that average BOD_5 and TSS per capita contributions typically range from 0.11 to 0.33 pounds per capita per day (lbs/capita/day), with a typical load of 0.2 lbs/capita/day. The City's average annual mass loadings for BOD_5 and TSS are 0.18 lbs/capita/day or 587 lbs/day, and 0.10 lbs/capita/day or 306 lbs/day, respectively. Typical reasons for low TSS loads are related to I/I issues in the system; however, a similar dilution of the BOD_5 could be expected, as BOD_5 loadings are typically similar to TSS loadings. Based on an analysis of the City's existing influent, a reason for the apparent difference between influent BOD_5 and TSS could not be identified.

For domestic wastewater with minor industrial contribution and moderate I/I, the BOD_5 and TSS concentrations historically tend to range between 190 and 220 milligrams per liter (mg/L), though the increased use of higher efficiency water fixtures and appliances has led to higher concentrations. According to the data, the WWTF's average influent BOD_5 concentration was approximately 314 mg/L and the average influent TSS concentration was approximately 164 mg/L. The BOD_5 concentrations are slightly higher than typical ranges, which is likely due to the minimal I/I, along with the implementation of water efficient fixtures in town. However, as previously discussed, the average influent TSS is below the normal range.

Wastewater Flow Projections

Domestic

Wastewater flow projections for the 2042 design year were made using the existing base flow per capita wastewater contributions and 2042 design year population of 6,917 extrapolated to the end of the 20-year planning period. Due to low per capita flows and the collection system's condition, I/I is not a concern and is anticipated to be minimal. Typically, I/I will remain constant over a planning period because I/I does not generally increase proportionally with population. For these reasons, I/I was not analyzed further.

Industrial

The domestic wastewater flow projections are based solely on growth within the residential and commercial sectors. No separate industrial flow component was considered in projecting future conditions. Certain industries could locate within the City by utilizing the industrial-zoned districts; however, the City mainly focused on the portion of residential and commercial capacity. The calculated capacities show an allowance for limited industrial growth within the City through the planning period. Current plans for the City do not anticipate substantial industrial growth, so a majority of the unused capacity will serve the residential and commercial growth of the City. However, the unused system capacity will not account for high flow and/or load contributing industries, such as food processing or data centers. If a high flow or load contributing industry were to locate within the City of Sisters, the wastewater system would need to be reevaluated to ensure enough capacity is available to accommodate the new industry, or the industry would need to be responsible for a sufficient pre-treatment process or for treatment and disposal/reuse of their own wastewater.

Mass Loadings

Domestic and Commercial

The domestic and commercial design mass loadings (BOD_5 and TSS) to the WWTF were estimated based on the average influent per capita BOD_5 and TSS contributions projected to the end of the 20-year planning period and using the year 2042 design population of 6,917 (i.e., mass loading [BOD_5 or TSS] = contribution [BOD_5 or TSS] lbs/capita/day x 6,917). Using the design mass loadings of 0.18 and 0.10 lbs/capita/day for BOD_5 and TSS, respectively, yields year 2042 domestic mass loadings of 1,260 and 658 lbs/day, respectively. Due to the below average loadings sampled from the City's wastewater system, a modified load was also calculated and included in the design criteria shown on Figure 2-5. Though BOD_5 loading observed is typical for domestic wastewater, the TSS lbs/capita/day were much lower than typical. Additional sampling and observation did not reveal a cause for these low loadings. To provide a more conservative estimate for BOD_5 and TSS, the lbs/capita/day loadings were increased from 0.18 for BOD_5 and 0.10 for TSS to 0.20 for both. The higher modified lbs/capita/day value, therefore, increased the domestic mass modified loadings to 1,383 for both BOD_5 and TSS. These resulting modified design loads were used for analysis of the existing WWTF.

Industrial

As discussed earlier, a separate industrial mass loading component was not considered in projecting future loading conditions. Should any industrial users decide to locate in the City, the City may require the development of an Industrial Pretreatment Program.

Design Criteria

The projected wastewater flows and loadings were summarized on Figure 2-5 as design criteria. These design criteria were used in the evaluation of the existing wastewater facilities and developing recommended improvements. Figure 2-5 summarizes the wastewater flows and loadings for the base year 2020, the current year (as of the writing of this report) of 2022, and the design year of 2042 based on the project population increase. Figure 2-5 should be referred to during the review of subsequent sections of this WWFP Update, as it provides key information about the wastewater system improvements and alternatives developed and evaluated herein.

Conditions of Existing Facilities

Collection System Description and Evaluation

Description

Construction of the City's wastewater collection system occurred between 2000 and 2002. The system consists of a conventional gravity sewer network with collector lines, trunklines, and a few pressurized sewer lines. The majority of the gravity trunklines are oriented to follow the natural grade of the existing ground to allow for gravity conveyance to the Rope Street Lift Station. The collection system also includes three packaged lift stations (Barclay, Sun Ranch, and Five Pines) to help feed the Rope Street Lift Station. From the Rope Street Lift Station, sewage is pumped to the WWTF via a 12-inch pressure sewer main. The 12-inch pressurized sewer main follows S. Locust Street prior to entering the WWTF. Since the City's collection system is relatively new, most of the gravity sewer pipes are of adequate size and material. A map of the existing collection system is shown on Figure 2-1. The map shows the collection system's gravity trunklines and pressure sewer lines, the locations of the City's packaged lift stations, the Rope Street Lift Station, and the WWTF.

Rope Street Lift Station Evaluation

The Rope Street Lift Station is the primary lift station that collects gravity sewer wastewater and pumps it through the 12-inch pressure sewer main to the WWTF. The lift station building is of brick wall construction with enameled fencing and contains a triplex submersible pump configuration. A wetwell is located within the building and accessed through two access hatches. The generator, electrical panel, and gantry crane are also located inside the building. The emergency generator is sized to provide service for the three submersible pumps. A 24-inch influent pipe is connected to the lift station to provide additional wetwell volume under high flow conditions. The Rope Street Lift Station was constructed with the rest of the collection system and WWTF between 2000 and 2002, making the lift station approximately 20 years old, which is the typical life expectancy for lift station equipment and components.

The triplex pumps are KSB wet-installed submersible motor pumps. The operating design parameters for the pumps are 37 Hp, 480-volt, 3-phase, 60-hertz, and provide 450 gallons per minute (gpm). From discussions with the City, the pumps have significant problems with ragging, generally affecting at least one pump per week. All three pumps have been rebuilt, and new impellers were installed in approximately 2010. With the current layout of the lift station, the interior is a Class I, Division 1 classified area; however, the electrical components do not meet code for this classification.

Package Lift Station Analysis

Three satellite, or packaged, lift stations help transfer wastewater to the Rope Street Lift Station. These lift stations are Smith & Loveless, Inc., packaged units with self-priming centrifugal pumps and were installed in 2004. The packaged lift stations are duplex pump systems capable of providing up to 260 gpm with operating designs of 3 Hp, 1,200 revolutions per minute, and 480-volt, 3-phase power. The City has noted that monthly ragging is a current issue from construction debris being fed into one of the packaged lift stations. The packaged lift stations do not have power surge protection. None of the packaged lift stations have on-site backup power; however, City staff are obtaining bids for a portable back-up generator that can be used to power any of the three lift stations.

Subdivision Pressure Sewer Analysis

The wastewater collection system has a couple of additional pressure sewer lines in addition to the pressure sewer main running from the Rope Street Lift Station to the WWTF. Currently, one subdivision, on E. Creekside Court, utilizes a pressure sewer line that connects to a manhole on E. Cascade Avenue. The subdivision has individual grinder pumps to pump effluent to the pressure sewer main along E. Creekside Court. The City expressed the desire to replace the grinder pump pressure sewer system and implement a gravity sewer and lift station setup. Switching to a gravity sewer system would reduce the maintenance and costs associated with the grinder pump system.

Trunkline Analysis

In 2001, the City of Sisters installed all new ASTM D3034 PVC pipe. The sewer lines were air tested and no I/I concerns were noted. Due to the relatively new sewer system, the City's trunkline capacities are anticipated to meet the City's anticipated growth but required analysis to confirm if the future flow demands could be met. For this analysis, identified collection system trunklines were examined to determine the current maximum flow capacities and if they are adequately sized for future demands. As-built drawings of the identified trunklines were gathered by the City to help analyze and determine the current and projected capacity of the collection system.

Early discussions helped identify the trunklines that required an in-depth analysis for the collection system. Areas within the city limits and urban growth boundary anticipated to receive growth and expansion were also discussed. Trunklines in these areas were analyzed as directed by the City and Public Works staff due to their familiarity with problematic areas, along with trunklines Anderson Perry & Associates, Inc., identified due to potential slope issues and collection system trunklines prone to bottlenecking. Potential slope issues for trunklines are caused by inadequate slopes, and locations prone to bottlenecks can be the result of merging flows as flow heads to a common destination, such as a lift station. The trunkline locations were also analyzed due to the surrounding infrastructure and where the highest increase in flows is to be expected. South of Cascade Avenue, the City is predominantly fully developed and is not anticipated to see flows increase. No issues with the collection system were mentioned in discussion of these areas. Within the northern half of the City, additional infrastructure could be easily accommodated, and the start of future growth can be seen. For this reason, most trunklines analyzed were in the northern half of the City. Figure 2-6 shows the locations of the analyzed trunklines.

The trunkline analysis, as previously mentioned, was conducted on the identified collection system trunklines anticipated to be bottlenecks or areas of limited slope in the system. The identified trunklines were the 8-inch PVC lines on Barclay Drive, Larch Street, the southern half of Locust Street, and a short section of W. McKinney Butte Road. For 10-inch PVC, the pipelines of Black Butte Avenue and the northern half of Locust Street were analyzed. For 12-inch PVC lines, E. Diamond Peak Avenue, W. McKinney Butte Road, and Camp Polk Road were included. Lastly, the 15- and 18-inch PVC trunkline along U.S. Highway 20 on the western half of the City was analyzed. The City provided as-built drawings for the identified sections to determine slopes and find bottlenecks. One section of pipe, the 12-inch diameter sewer along W. McKinney Butte Road, did not have as-built drawings available; therefore, the minimum allowable slope outlined in the Washington State Department of Ecology's "Criteria for Sewage Works Design (Orange Book)" for the specific pipe diameter was used. Once the trunkline data were obtained, the maximum capacity of the trunklines was calculated using Manning's equation. All trunklines analyzed met or exceeded the minimum slope outlined in the Orange Book. Once it was determined that all trunklines analyzed met the minimum slope requirements and the maximum capacity was calculated, potential future flows were established.

Flow estimates for residential areas were determined based on average annual per capita flows outlined in the design criteria plus a peaking factor of 4. The Portland State University Population Research Center's average people per household was used to establish a flow rate per residence, and the number of residences or space for additional residences was estimated from satellite imagery and tax lot information included in the City's GIS database. Additional flows were estimated using the Orange Book for stores, businesses, parks, and hotels, to provide an accurate flow estimate. The analysis also investigated flows if full build-out of identified areas were to occur within the 20-year planning period. Once all anticipated flows were estimated for each trunkline analyzed, a comparison against the maximum capacities of the identified trunklines was completed. Based on those comparisons, each trunkline had a capacity exceeding the anticipated flows.

Based on the analyses conducted on the City's trunklines, the anticipated future flows, and the future flows at full build-out, the trunklines appear to have capacity that exceeds the anticipated flows. For further details of the trunkline analysis, refer to Table 2-1 for the location of the analyzed trunklines.

TABLE 2-1
TRUNKLINE ANALYSIS

Name	Slope (ft/ft)	Diameter/ Material	Capacity (MGD)	Projected Flow (MGD)
W. McKinney Butte Road	0.0022	12-inch PVC	0.98	0.55
W. McKinney Butte Road	0.010 to 0.015	8-inch PVC	0.71 to 0.87	0.55
W. U.S. Highway 20	0.0015	15-inch PVC	1.47	0.89
S. Hood Street	0.0012	18-inch PVC	2.14	1.54
E. Black Butte Avenue	0.0028 to 0.0266	10-inch PVC	0.68 to 2.11	0.40
N. Locust Street/Camp Polk Road	0.0028 to 0.0078	10-inch PVC	0.68 to 1.14	0.27
W. Barclay Drive	0.0040 to 0.0361	8-inch PVC	0.45 to 1.35	0.03
E. Barclay Drive	0.0040 to 0.0361	10-inch PVC	0.82 to 2.45	0.23
Camp Polk Road/Barclay Drive	0.0020	12-inch PVC	0.94	0.25
E. Diamond Peak Avenue	0.0025 to 0.0050	12-inch PVC	1.05 to 1.48	0.02

Assumptions:

The trunkline capacities were determined by 65 gpcd average annual flow, a peaking factor of 4.0, a roughness coefficient of 0.013, the trunkline being three-quarters full flow, and an assumed full build-out of areas surrounding the identified trunklines.

Trunkline slopes were determined by as-built drawings provided by the City or assumed as the minimum allowable slope for the identified pipe diameter per the "Recommended Standards for Wastewater Facilities (10 States Standards)."

ft/ft = feet per foot

Wastewater Treatment Facility Description and Evaluation

Description

The City's WWTF was constructed between 2000 and 2002 and consists of a headworks, a three-cell lagoon system (two aerated lagoons and a storage lagoon), and a chlorine contact pipe to provide treatment of the City's domestic wastewater. The lagoons were constructed with exposed 60 mil high density polyethylene liners. Wastewater from Lagoon No. 3 flows through a 1,140-foot long, 36-inch diameter PVC chlorine contact pipe for effluent disinfection prior to land application. Since construction of the WWTF, no major improvements have occurred, except for an aeration system upgrade in 2018. In 2007, the City acquired a portion of the Lazy Z Ranch pastureland to further increase their existing irrigation capacity and provide capability for future expansion of the irrigation capacity of the WWTF.

The first structure in the WWTF is the control building, where wastewater is measured through an electromagnetic flowmeter, followed by the headworks, where influent is screened to remove large solids and inorganic material and the grit is settled out. Wastewater then flows to the first of two aerated lagoons. The second half of Lagoon No. 2 is used for settling. Flow then enters the third lagoon, which is used for holding wastewater until times of water reuse through irrigation. Prior to irrigating, the wastewater travels through a chlorine contact pipe to achieve adequate detention time, then irrigation pumps in the control building distribute treated effluent to land application sites.

Wastewater flows in a series operation starting with Lagoon No. 1 and ending with Lagoon No. 3. Lagoons No. 1 and 2 are aerated and aerated/settling lagoons, respectively, and are approximately 2.4 acres each with water depths of 9 feet. The biological treatment process is aided by six aerators in Lagoon No. 1 that were replaced in 2020 and two aerators in Lagoon No. 2. Wastewater enters Lagoon No. 3, which serves as a storage lagoon. Lagoon No. 3 has three aerators for additional treatment and to aid in odor control, though this cell is primarily used in the winter to store effluent to be land-applied from April 1 to October 31. Wastewater exiting Lagoon No. 3 is disinfected with chlorine at a control structure prior to traveling through the 36-inch diameter chlorine contact pipe. Table 2-2 illustrates the lagoon geometric design criteria. Figures 2-2 and 2-3 provide the general layout and process schematic of the City's WWTF and its associated components described herein, respectively.

TABLE 2-2
LAGOON GEOMETRIC DATA

Parameter	Lagoon No. 1	Lagoon No. 2	Lagoon No. 3
Nominal Dike Height, feet	13	13	16
Minimum Water Depth, feet	10	10	13
Maximum Water Depth, feet	10	10	15
Surface Area, acres	2.41	2.41	18.0
Maximum Usable Storage Volume			
ac-ft	19.5	19.5	213
MG[1]	6.36	6.36	69.44

[1] *MG = ac-ft x 0.326*
ac-ft = acre-feet
MG = million gallons

The City's treatment lagoons (Lagoons No. 1 and 2) can be described as partially mixed aerated lagoons. Typically, partially mixed lagoons provide only enough aeration to satisfy the oxygen requirements of the system. However, due to recent aeration system upgrades in Lagoon No. 1, the aerated lagoons appear to be receiving more aeration or mixing than required to satisfy the minimum oxygen requirements. The surface aerators do not provide energy to keep all TSS in suspension. Therefore, some accumulation of solids occurs during normal operating conditions. Lagoon No. 1 relies on the surface aerators to transfer the needed oxygen and provide some level of mixing. In Lagoon No. 2, the area downstream of the two surface mixers acts as a settlement zone prior to wastewater being disinfected and transferred to the storage pond (Lagoon No. 3).

Existing System Water Balance

To assess the City's lagoon storage and irrigation capacities from the overall operation of the wastewater system, a water balance was developed. A water balance is a means to account for all water entering and leaving the lagoon system. The influent flow is shown as well as the estimated effects of evaporation, precipitation, and outflow irrigation volumes. This balance provides an estimate that accounts for all inflow to and outflow from the system. The water balance for the existing system is shown on Figure 2-7.

According to the existing system water balance, the City currently has a net positive cumulative storage volume of 30 ac-ft; however, this is due to the City purposely keeping 30 ac-ft in the storage lagoon during the winter months to ensure the lagoon aerators can be kept in operation to avoid removing the aerators prior to the lagoon freezing over. The water balance also indicates the WWTF is able to meet current demands. However, the rapid growth the City is experiencing is expected to quickly deplete the storage and irrigation capacities and require additional means to provide capacity to the wastewater treatment system. The proposed improvements water balance provides a representation of the additional storage capacity needed and how the proposed Lazy Z Ranch improvements will provide the necessary capacity. With the forecasted 2042 population, the estimated influent flows were input into the water balance with the associated proposed improvements discussed in the Lazy Z Ranch Master Plan. The storage lagoon will continue to end the irrigation season with approximately 30 ac-ft.

Wastewater Treatment Facility Evaluation

General

The evaluation of all the WWTF processes was undertaken to determine the adequacy of the existing WWTF to meet the current and future wastewater needs of the City of Sisters. The evaluation used published and commonly accepted design criteria related to each process of the system. The design criteria shown on Figure 2-5 were also used extensively in the evaluation.

Preliminary Treatment (Headworks)

The headworks contains two channels, with a manually cleaned coarse bar screen in the bypass channel and a mechanically cleaned wedge wire screen in the other to remove inorganics and debris. Under normal operation, influent is processed through the wedge wire screen. During emergency conditions, such as power loss or during high flow periods, the bypass channel may be utilized to control influent flows. The headworks concrete structure appeared to be in adequate condition as observed during the site visit and kickoff meeting on September 22, 2021.

The wedge wire screen was installed with the WWTF between 2000 and 2002. The screen is a Lakeside Equipment Corporation mechanical unit, with a rotary 1/4-inch bar drum-style screen. During discussions with the City regarding the reliability of their screening unit, the primary concern identified was frequent freezing issues experienced during winter. A secondary concern is the potential for ragging of the aerators. Wedge wire screens have often been ineffective at removing wipes and rags from wastewater, allowing such materials to accumulate in downstream processes and potentially damaging downstream mechanical equipment.

Influent flow is metered using an electromagnetic flowmeter at the control building in the pump room upstream of the wedge wire screen. Per the City’s WPCF Permit, the flowmeter is verified annually to ensure accurate reading.

Lagoon Analysis

As previously mentioned in this section, Lagoons No. 1 and 2 can be described as partially mixed aerated lagoons and are currently providing more than the minimum oxygen requirement due to recent upgrades. However, these upgrades do not provide enough energy to keep all TSS in suspension. For this analysis, the lagoons were treated as partially mixed lagoons providing the minimum required mixing for oxygen transfer, as doing so presents a conservative analysis of the treatment capacity available in the lagoons. Partially mixed aerated lagoons are designed based primarily on aeration requirements, organic loading rate, and detention time. The aeration requirement is defined as the amount of oxygen needed to treat the organic content in the City's wastewater. The organic loading rate is represented by the BOD_5 unit loading rate per acre of lagoon wet area, as indicated on Table 2-3. Typical design criteria for partially mixed aerated lagoons are shown on Table 2-3.

TABLE 2-3
TYPICAL DESIGN CRITERIA FOR PARTIALLY MIXED AERATED LAGOONS[1]

Design Parameter	Unit	Value	
		Range	Typical
Aeration Requirement	lbs O_2/Hp-hr	1 to 2	1.5
Organic Loading Rate	lbs BOD_5/acre-day	50 to 180	125
Detention Time	Days	10 to 30	20

[1] Taken from Wastewater Engineering: Treatment and Reuse, Metcalf and Eddy, Inc., 4th Edition.

lbs O_2/Hp-hr = pounds of oxygen per horsepower per hour

lbs BOD_5/acre-day = pounds of five-day biochemical oxygen demand per acre per day

Additionally, BOD_5 reduction is required for effective and efficient disinfection of wastewater. Adequate aeration and dissolved oxygen are important to ensure overloading does not occur and to mitigate unpleasant odors. Partially mixed aerated lagoon facilities are considered to be adequately sized when they are able to consistently reduce BOD_5 concentrations to 45 mg/L on average or lower. The following equation, based on first-order reaction kinetics, is used to design and analyze the size of partially mixed aerated lagoons:

$$Cn/Co = 1/(1+(kt/n))^n$$

Where Cn is effluent BOD_5 concentration
Co is the influent BOD_5 concentration
k is the reaction rate constant
t is the detention time in days
n is the number of lagoon cells

Depending on available mixing, the reaction rate constant ranges from 0.25 to 1.0 at 20° Celsius (C) wastewater temperature; however, per the "Water Environment Federation Manual of Practice
No. 8 Design of Water Resource Recovery Facilities" (commonly referred to as MOP 8), it has been typical practice to model partially mixed aerated lagoons using a reaction rate constant of 0.276. As such, a base reaction rate constant of 0.276 was used in the analysis of the City's partially mixed aerated lagoons. Because bacterial growth and activity are heavily impacted by the temperature of the wastewater, the following equation was used to adjust the base reaction rate constant:

k = k20*(1.036)^(T-20) Cn/Co = 1/(1+(kt/n))^n

Where k20 is the base reaction rate constant at 20°C, or 0.276
T is the average temperature of the wastewater in the lagoons
k is the temperature adjusted reaction rate constant

Finally, the temperature of the wastewater varies throughout the year. To estimate the lagoon wastewater temperature based on ambient air temperature, Metcalf & Eddy published the following equation:

Tw = (A*f*Ta*Tin)/(A*f+Q)

Where Tw is the temperature of the lagoon water in degrees Fahrenheit (°F)
A is the area of the water surface in square feet
f is a constant of 0.000012
Ta is the average ambient air temperature in °F
Q is the influent wastewater flow rate
Tin is the temperature of the influent flow in °F

Using these equations, an assumed 14°C influent wastewater temperature, and average ambient temperatures for the summer and winter, the wastewater lagoon treatment capacity was modelled and analyzed at various key times throughout the year. Based on this analysis, the City's WWTF has adequate capacity based on its footprint and will require as much as 2,000 lbs/day of oxygen available for proper treatment. If 1.5 lbs O_2/Hp-hr is estimated to be made available by the City's existing aerators, 3,780 pounds of oxygen would be delivered to the two aerated lagoons per day, resulting in more than adequate aeration capacity in the City's lagoons. Additionally, the City's aerated lagoons are anticipated to have a detention time ranging from 25 to 30 days depending on the time of year, thus, the aerated lagoon system would also meet the typical criteria outlined on Table 2-3. To promote conservative analysis of the lagoon capacity, the City's storage lagoon's (Lagoon No. 3's) potential additional treatment of the wastewater was not included.

Though the existing aerators and aerated lagoons appear to be adequately sized to meet the demands at the design year, it is important to note that the aerators in Lagoons No. 2 and 3 are more than 15 years old and are likely reaching the end of their useful life. When the City replaced the six aerators in Lagoon No. 1, the old aerators were kept for use as spare parts to keep Lagoons No. 2 and 3 running longer. The City should schedule replacement of the remaining aerators within the planning period of this report.

Treatment efficiency of lagoons varies due to seasonal changes. Winter "ice-over," spring turnover, and seasonal algae blooms affect treatment. With winter "ice-over" conditions, oxygen transfer is reduced, and anoxic conditions can occur. BOD_5 reductions may become reduced. This is typical of lagoons in the Northwest and can affect the ability to properly treat wastewater. As long as lagoon storage capacity is available, this is generally acceptable. Spring lagoon turnovers as temperatures begin to rise can produce the same results. Algae blooms cause an increase in the pH of the water and create a condition requiring high chlorine demands for disinfection. This too is a natural feature of lagoons in the Northwest. Should algae blooms raise the pH high enough that chlorination rates become excessive or disinfection becomes inconsistent, the City should consider installing a floating cover over the settling cell to inhibit algae growth.

Sludge Processing

Sludge generated from treatment of the City's wastewater settles in each lagoon. Sludge removal is performed as needed, as wastewater treatment results in gradual accumulation of solids over time. Depending on the system, biosolids removal may not be required often, but regular biosolids removal is necessary for adequate wastewater treatment, as excessive solids accumulation reduces treatment capacity and treatment efficacy. However, to spread out the cost of solids removal and reduce the amount of land required for application by reducing the volume of solids removed at a time, the City has elected to remove solids from one lagoon at a time at shorter intervals (five to
ten years) between solids removal. Solids were removed from Lagoon No. 1 in 2019, which cost the City approximately $200,000. Future biosolids removal costs are anticipated to be similar, plus 5 percent inflation per year. The last application of biosolids land-applied at the Lazy Z Ranch site was in 2021. Sludge was hauled in liquid form directly from the lagoon via a tanker truck to the land application site. All accumulated sludge is being stored in the lagoons.

Wastewater Disinfection System

The City disinfects wastewater with a sodium hypochlorite chlorination system. The chlorination room is an isolated room located in the control building where sodium hypochlorite is mixed with potable water and conveyed to the effluent transfer structure located on the western dike of Lagoon No. 3. After chlorine injection, chlorinated wastewater travels through a 1,140-foot long, 36-inch diameter chlorine contact pipe prior to being pumped to the land application sites to allow for adequate chlorine contact time. The major concerns with the chlorine contact pipe are the lack of redundancy for the system and no available method to clean the contact pipe. Regular cleaning of the chlorine contact pipe is important for reducing the amount of chlorine required for proper disinfection. As sediment and other organic materials settle in the contact pipe, they react with the chlorine and use chlorine that would otherwise kill bacteria. Typical practice is to clean out the chlorine contact pipe regularly to improve chlorination efficiency. Per "White's Handbook of Chlorination and Alternative Disinfectants, 5th Edition," by Black and Veatch Corporation, typical chlorine demand for proper disinfection in secondary effluent ranges from 3 to 8 mg/L. As chlorine demands reach or exceed 8 mg/L required for adequate disinfection, it is recommended that the City clean out the chlorine contact pipe and other disinfection components as needed.

Effluent Disposal and Land Application System

Facility Description

The City is permitted to dispose of treated wastewater via land application to natural forest land, lagoon dikes, and pastureland at the Lazy Z Ranch with K-Line irrigation. Currently, the land application sites are located in the vicinity of the WWTF and at the Lazy Z Ranch. The planned improvements for the Lazy Z Ranch will mainly expand and improve existing irrigation infrastructure to the south near McKenzie-Bend Highway. The City is permitted to dispose of treated effluent between April 1 and October 31. The City conveys treated effluent utilizing irrigation pumps to the land application sites through 8-inch headers for forest land and pastures and a 4-inch diameter pipe for dike irrigation mains. Current irrigation consists of production and beneficial reuse of Class D recycled water, as approved by the WPCF Permit. Historically, the City has met the treatment and monitoring requirements associated with Class D recycled water. City staff report no issues with the irrigation system but expressed the desire for the addition of variable frequency drives on the 100 Hp pumps for electrical energy efficiency purposes. Currently, the City owns and operates all land application sites. The existing irrigation system is shown on Figure 2-4.

The land application system consists of irrigation pumps inside the control building located in the northwest corner of the WWTF. The three effluent irrigation pumps, two 100 Hp and one 15 Hp, are capable of a combined pumping rate of approximately 2,125 gpm and convey treated wastewater to the land application sites through an 8-inch header with 6-inch lines to forest and pastureland irrigation and 4-inch lines to dike irrigation locations. Each irrigation location is controlled with an individual valve for flow operation. The irrigation pumps were installed with the WWTF between 2000 and 2002 and are reportedly working satisfactorily. In 2008, the pump motors were rewound. There have been no reports of poor conditions or complaints of inadequate size for proper maintenance of the irrigation pumps for the existing control building that houses the irrigation pumps.

In 2007, the City acquired a portion of the Lazy Z Ranch to dispose of treated effluent and biosolids, which consists of 231 acres of agricultural land approximately 3,000 feet southeast of the WWTF. Treated effluent is applied to 45 acres of pasture through K-Line irrigation installed in 2019.

Permit Requirements and Compliance History

Currently, the City's WWTF is regulated by WPCF Permit No. 101779, which has established effluent limitations and effluent monitoring and testing requirements for the City's WWTF. Discharge to Waters of the State is not permitted. All wastewater must be stored, treated, and disposed of by land application following sound irrigation practices and conform to an Oregon Department of Environmental Quality-approved Recycled Water Use Plan (RWUP).

Current effluent limitations for the City's WWTF are given in the WPCF Permit, a copy of which is included in Appendix A. These limitations are based on parameters of the City's method of disposal. During times of recycled water use, grab samples are taken prior to land application to confirm treated effluent received Class D treatment as defined in Oregon Administrative Rules (OAR) 340-055. Along with grab samples, all monitoring requirements are tested at the required frequencies for the parameters outlined in the WPCF Permit. The City's current WPCF Permit includes influent and recycled water monitoring requirements. Effluent limits for total coliform and *E. coli* are enforced; however, effluent parameters for BOD_5 and TSS only require weekly values and monthly averages to be reported. Additionally, waste disposal limitations, compliance conditions and schedules, and special conditions specific to the City are all outlined in the WPCF Permit. The monthly influent and recycled water use monitoring and reporting requirements the City must adhere to are provided on Tables 2-4 and 2-5. Tables 2-1 and 2-2, along with Appendix A, provide additional information on WPCF Permit requirements.

TABLE 2-4
WATER POLLUTION CONTROL FACILITIES PERMIT INFLUENT MONITORING REQUIREMENTS

Parameter	Time Period	Minimum Frequency	Sample Type	Report
Total Flow (MGD)	Year-round	Daily	Measurement	Daily Totals Monthly Maximum Monthly Minimum Monthly Average Monthly Total
Flowmeter Verification	Year-round	Annually	Verification	Completed or Not Completed (Pass, Fail)
BOD_5 and TSS (mg/L)	Year-round	Weekly	Composite	Monthly Averages Weekly Values
pH (S.U.)	Year-round	Three Times per Week	Grab	Monthly Maximum Monthly Minimum Monthly Average

S.U. = Standard units

TABLE 2-5
WATER POLLUTION CONTROL FACILITIES PERMIT
RECYCLED WATER MONITORING REQUIREMENTS

Parameter	Minimum Frequency	Sample Type
Total Flow (MGD) or Quantity Irrigated (in/ac)	Daily	Measurement
Flowmeter Calibration	Annually	Verification
Chlorine, Total Residual (mg/L)	Daily	Grab
pH	Three Times per Week	Grab
E. coli Bacteria	Once a Week	Grab[1]
Total Coliform	Once a Week	Grab[1]
Total P and Total N	Annually	Grab

[1] *The permittee is only required to sample for either* E. coli *or total coliform, not both, for an individual use. If the permittee is irrigating on crops requiring only Class D quality effluent,* E. coli *must be monitored. If the permittee irrigates/reuses effluent for Class C uses, total coliform must be monitored.*
in/ac = inches per acre
N = nitrogen
P = phosphorus

During times of land application with treated effluent, the City pumps treated effluent to natural forest land, lagoon dikes, and pastureland at the Lazy Z Ranch. Grab samples are taken and tested at the minimum frequencies for the parameters outlined in the WPCF Permit. A Groundwater Monitoring Plan is currently not required for the land application sites. However, under the WPCF Permit, the City is required to submit an Annual Recycled Water Use Report that describes the effectiveness of the recycled water system in complying with the DEQ-approved RWUP, OAR 340-055. Additionally, the City must submit a land application plan that meets the requirements of OAR 340-050-0031(7).

Biosolids, which are a natural byproduct of the wastewater treatment process, accumulate in the City's lagoons. The current method of handling the biosolids accumulation is by removal once every five to ten years, or as the accumulation of biosolids warrants removal. The City previously had the biosolids removed and land-applied at the Lazy Z Ranch site in 2021. The associated biosolids removal cost is approximately $200,000 in 2022 dollars and is anticipated to increase at a 5 percent inflation rate each year. The Lazy Z Ranch land application site is City-owned pastureland where crops of pasture grass are grown. A Groundwater Monitoring Plan is currently not required for the biosolids land application site. When land application of biosolids is not permitted, the biosolids accumulate in the lagoons until land application is permissible.

Treatment and Regulatory Requirements

Liquids Treatment

The City's existing headworks, a three-cell lagoon system (two aerated lagoons and a storage lagoon), and a chlorine contact pipe provide treatment to the City's domestic wastewater. Treated effluent concentration limits are provided by the WPCF Permit. When discharging to the land application site, the City's recycled water must meet Class D recycled water requirements at a minimum. Class D recycled water is a treated wastewater that has been oxidized and disinfected. Class D recycled water shall not exceed a 30-day log mean of 126 *E. coli* organisms per
100 milliliters (mL) and 406 *E. coli* organisms per 100 mL in any single sample for *E. coli*.

Solids Treatment

Currently, the City has an approved Biosolids Management Plan (BMP) with the DEQ. The BMP provides guidelines and regulations the City must follow when disposing of its biosolids.

Compliance History

To date, the City has not had compliance issues with the land application system or site. However, the City's rapid growth and the system nearing capacity will require development of additional land for continued compliance. The Master Plan includes improvements to continue compliance with the City's irrigation.

Financial Status of Existing Facilities

Preliminary Equivalent Dwelling Unit Analysis

When projecting future revenue for a wastewater system, an equivalent dwelling unit (EDU) analysis is usually completed. One EDU is intended to represent the average residential wastewater contribution for a "typical" user for a given city. As an example, each residential connection in Sisters would represent one EDU. A commercial or industrial connection user with wastewater flows similar to the average residential flow would also be considered one EDU. A commercial connection such as a café, with three times the typical wastewater flows as an average residential sewer connection, would be considered three EDUs. The City determines residential EDUs at a rate of one EDU per dwelling and commercial EDUs at a rate of one EDU per 501.337 cubic feet of "winter-average" water use. Winter-average water use is measured as the average water use between the preceding October billing period through the April billing period.

To estimate the number of EDUs in the City, the City's water consumption for the year 2020 was analyzed, as it was the most recent data available. Since specific sewer connection data were not available when this WWFP Update was prepared, it was assumed that the number of residential sewer connections/EDUs was equal to the number of residential water connections. The number of EDUs for industrial/commercial and City connections has been estimated based on the 2020-21 income from sewer receipts for the 2020-21 fiscal year and the base sewer charge of $40.78 per month per EDU.

Based on the EDU analysis, the City has 1,775 wastewater system accounts that represent 2,228 EDUs. Note that the category of each of these EDUs may differ from what is shown on Table 2-6 due to the assumptions made. Most funding agencies will use this type of EDU analysis as a basis for estimating future yearly revenues and debt capabilities for a city. The EDU determination is intended to equitably distribute wastewater system costs among all users. The EDU determination helps funding agencies determine the maximum loan (debt) amount a city can afford to service.

Although a detailed analysis of the City's current sewer rate structure is beyond the scope of this Wastewater Facilities Plan (WWFP) Update, some discussion of the existing rate structure and current and future wastewater system budgets is included. As a general rule, most utility rate structures include funding for periodic minor system improvements and maintenance items, payroll costs for staff, and a set-aside for future improvements. A summary of the monthly wastewater rate information is presented hereafter. Copies of the City's most recent sewer rate resolutions and sewer fund budget summary were used to summarize this information and can be found in Appendix D.

TABLE 2-6
PRELIMINARY EQUIVALENT DWELLING UNITS ANALYSIS

Connection Type	Total Number of Accounts	Estimated EDUs
Residential	1,477	1,477
Industrial/Commercial	254	751
Total	**1,731**	**2,228**

Income

Operation and maintenance (O&M) of the existing wastewater system is financed through the City's annual budget. Revenue is obtained primarily from sewer user fees. The current monthly wastewater rates at the time this WWFP Update was prepared are summarized on Table 2-7.

TABLE 2-7
MONTHLY WASTEWATER RATE INFORMATION

Type of User	Current Wastewater Rate
Residential and Commercial	$40.78 per EDU

The City has a variable sewer rate structure for businesses, schools, and other facilities based on their water usage. Revenue generated from the City's sewer service fees and connection fees is presented on Table 2-8. Rates are reviewed annually and revised periodically to provide enough revenue to pay the total operation, maintenance, and replacement (OM&R) costs of the wastewater system.

TABLE 2-8
SEWER SERVICE REVENUE

Fiscal Year	Total Revenue from Sewer Service Fees and Investment Income
2018-19	$1,051,510
2019-20	$1,159,290
2020-21	$1,169,503*

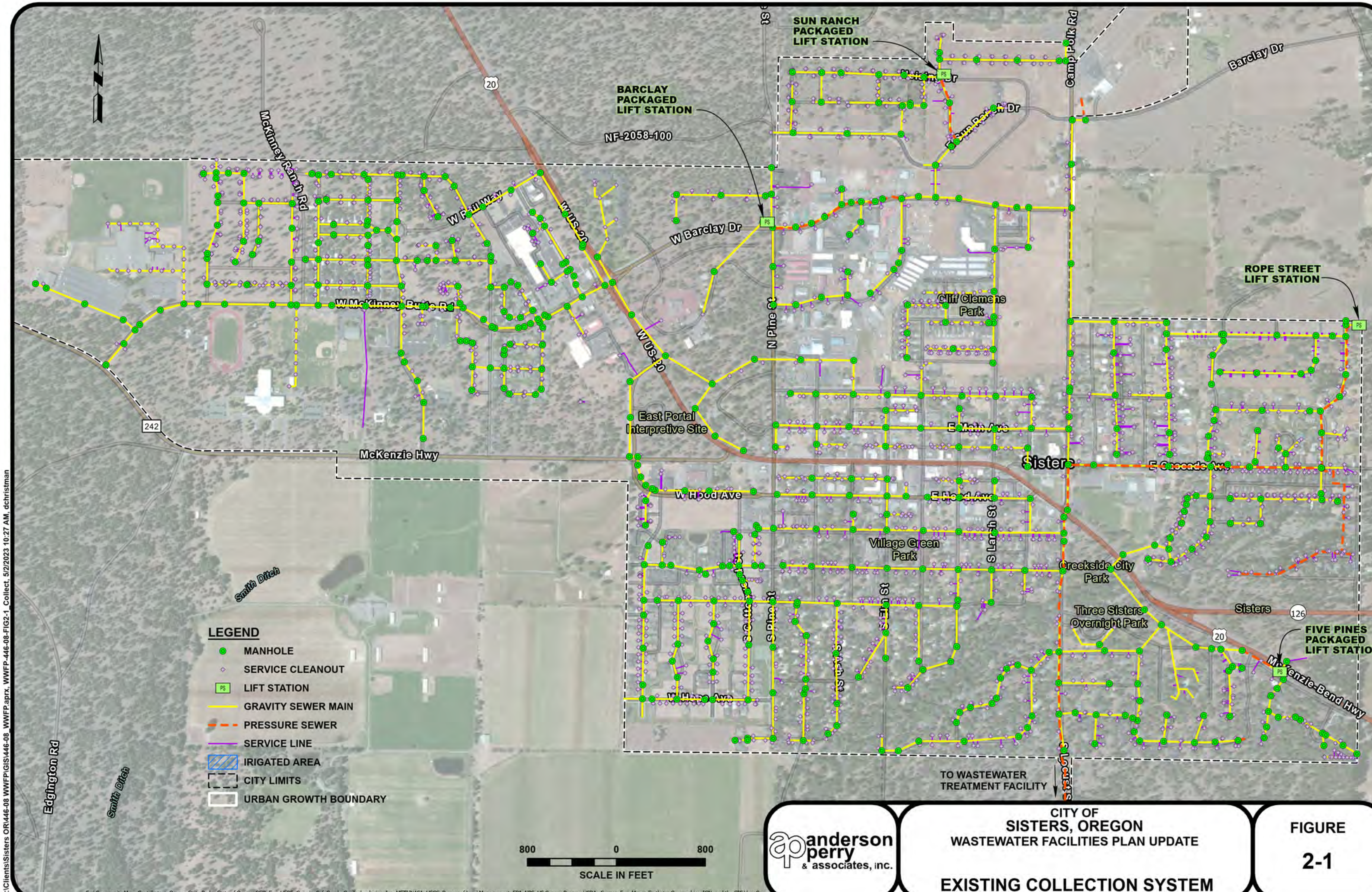
Fiscal Year 2020-21 budget, not actual revenue

Annual Operation and Maintenance Costs

The annual O&M cost for the City's wastewater system is summarized on Table 2-9. The costs presented were obtained from the City's financial statements and include all costs for the wastewater system, such as OM&R, personnel services, debt service, etc. These data are presented to provide insight into the magnitude of costs required to operate the City's existing wastewater system. For funding and other financial analysis, it is recommended that the financial statements be reviewed in detail to refine the costs prior to considering any available revenue for future debt purposes. As shown on Table 2-9, the City's existing sewer debt service costs approximately $332,000 per year.

TABLE 2-9
ANNUAL SEWER OPERATION AND MAINTENANCE COSTS

Expenditure Category	Expenses by Fiscal Year		
	2018-19	2019-20	2020-21
Personnel Services	$251,979	$286,617	$355,501
Materials and Services	$250,472	$290,202	$321,822
Capital Improvements	$4,800	$24,436	$353,000
Debt Service	$333,284	$334,153	$332,245
Transfers Out	$6,800	$12,480	$13,300



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CITY OF
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WASTEWATER FACILITIES PLAN UPDATE

EXISTING COLLECTION SYSTEM

FIGURE
2-1

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WASTEWATER FACILITIES PLAN UPDATE

EXISTING WASTEWATER TREATMENT FACILITY

FIGURE 2-2

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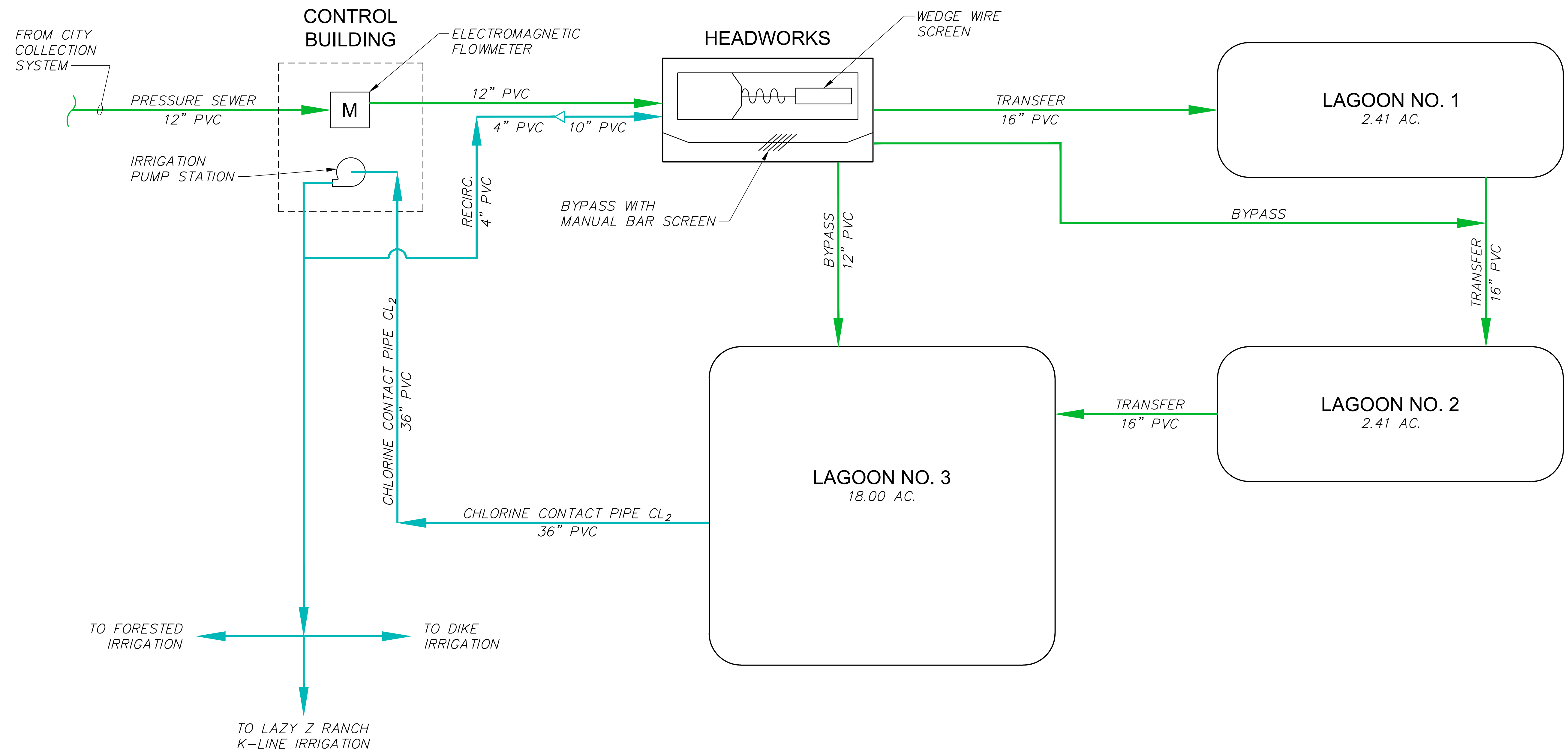

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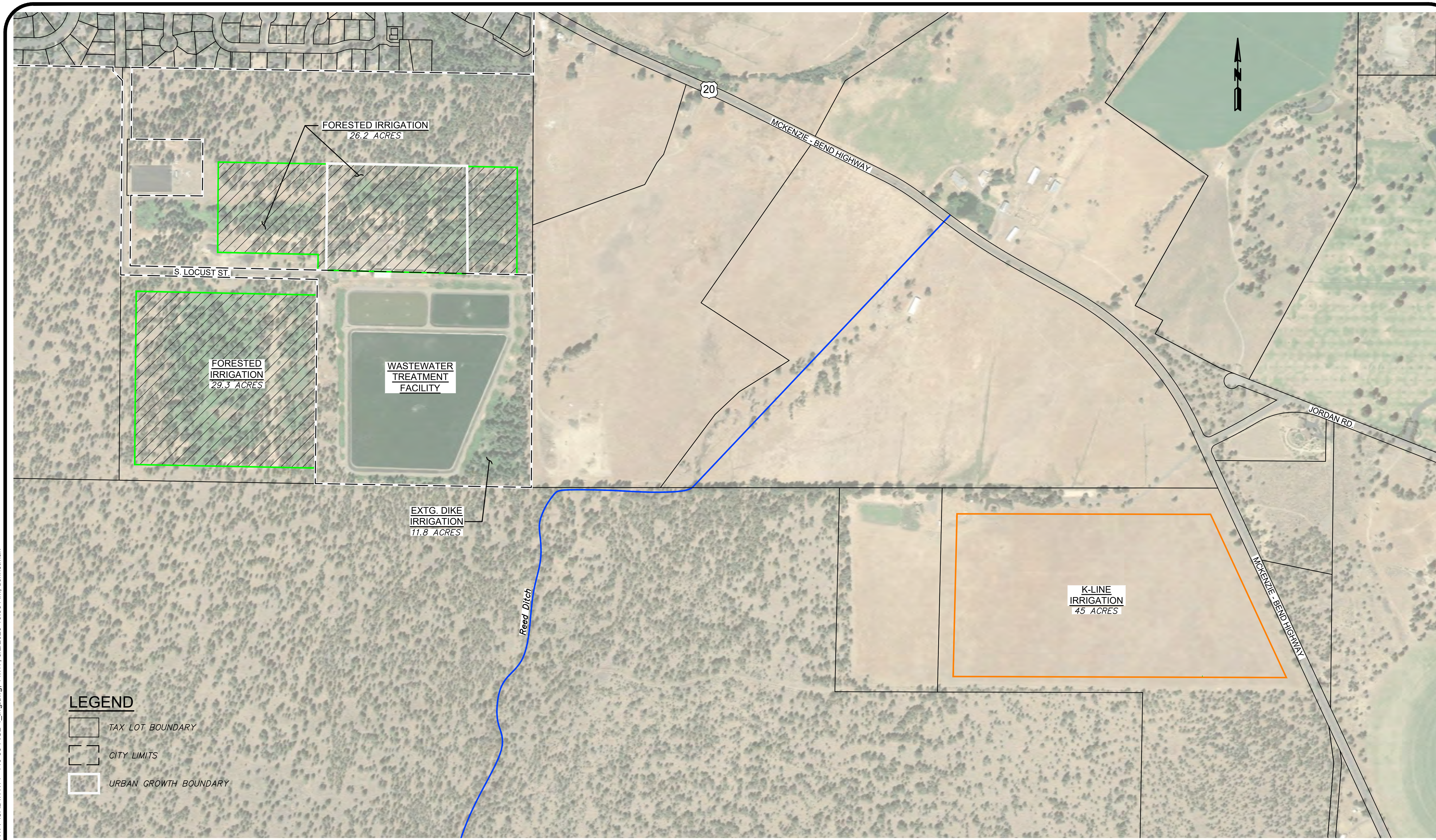
WASTEWATER FACILITIES PLAN UPDATE

WASTEWATER TREATMENT FACILITY EXISTING PROCESS SCHEMATIC

FIGURE
2-3



300 0 300 600 900
SCALE IN FEET

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WASTEWATER FACILITIES PLAN UPDATE

EXISTING SITE IRRIGATION

FIGURE
2-4

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DESIGN CRITERIA

	Base Year 2020	Current Year 2022	Design Year 2042	
Population[1]	3,220	3,437	6,917	
Base Wastewater Flow, MGD[2]	0.196	0.209	0.421	
Per Capita Flow, gpcd	61	61	61	
I/I, MGD[3]	0.028	0.028	0.028	
Average Annual Flow, MGD[4]	0.224	0.237	0.449	
Per Capita Flow, gpcd	70	69	65	
Average Dry Weather Flow, MGD	0.209	0.223	0.434	
Per Capita Flow, gpcd	65	65	63	
Average Wet Weather Flow, MGD	0.237	0.250	0.462	
Per Capita Flow, gpcd	74	73	67	
Maximum Month Flow, MGD	0.281	0.294	0.506	
Per Capita Flow, gpcd	87	86	73	
Peak Hour Flow, MGD[5]	0.896	0.956	1.925	
Per Capita, gpcd	278	278	278	
Average Influent BOD_5, mg/L[6]	314	316	336	Modified Load
lbs/day	587	626	1260	1,383
lbs/capita/day	0.18	0.18	0.18	0.20
Average Influent TSS, mg/L[7]	164	165	176	Modified Load
lbs/day	306	327	658	1,383
lbs/capita/day	0.10	0.10	0.10	0.20

[1] Base year 2020 and current year 2022 populations based on reported estimates by the Portland State University Population Research Center (PRC), June 30, 2022. The 2042 population was projected using an average annual increase of 2.76 percent between the years 2040 and 2045 as determined from the Deschutes County PRC Forecast Summary Table for Sisters, Oregon.

[2] Based on the average of the daily flows for a 14-day period from April 7, 2020, to April 21, 2020. Dates taken were from NOAA Daily Summaries for Bend, Oregon, on precipitation data for Station USC00350694.

[3] I/I assumed not to change from 2020 to 2042.

[4] Based on average monthly flow from DMRs from January 2018 to December 2020.

[5] Based on an assumed factor of 4.0 times the average annual flow.

[6] Based on average data collected from DMRs between January 2018 and December 2020.

BOD_5 = five-day biochemical oxygen demand
DMRs = Discharge Monitoring Reports
gpcd = gallons per capita per day
I/I = infiltration and inflow
lbs/capita/day = pounds per capita per day
lbs/day = pounds per day
MGD = million gallons per day
mg/L = milligrams per liter
NOAA = National Oceanic and Atmospheric Administration
TSS = total suspended solids

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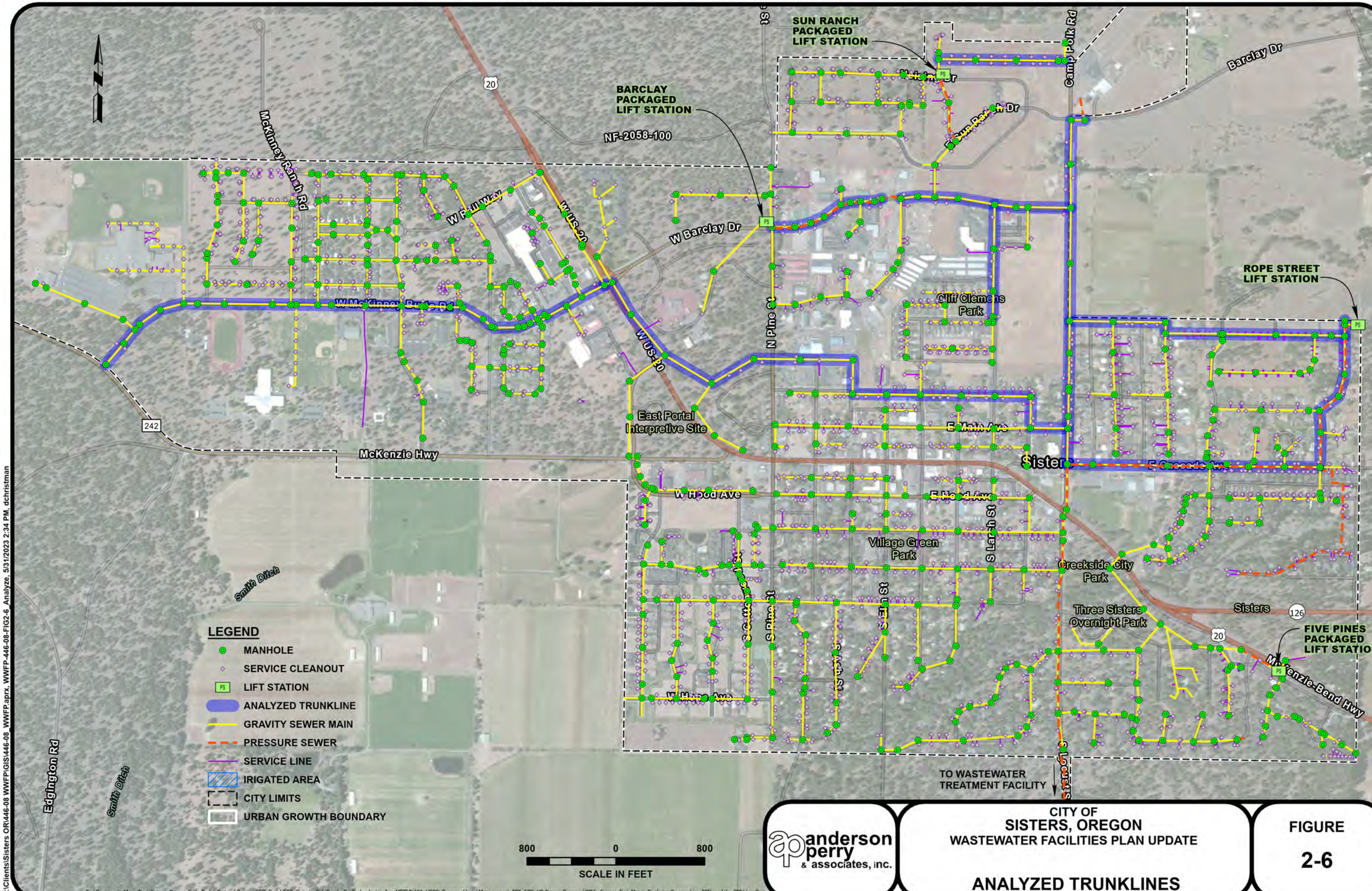
WASTEWATER FACILITIES PLAN UPDATE

DESIGN CRITERIA

FIGURE
2-5



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ANALYZED TRUNKLINES

FIGURE
2-6

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CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
EXISTING SYSTEM WATER BALANCE

Month	Holding Lagoon Initial Volume (ac-ft)	Influent Flow (gpd)[1]	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation (in)[2]	Net (in)	Net Evaporation (ac-ft)	Crop Irrigation Requirements (in)[3]	Crop Irrigation (in)[4]	Forest Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	K-Line Irrigation (ac-ft)	Supplemental Fresh Water (ac-ft)	Final Volume (ac-ft)[5]
October	30.00	227,354	21.63	0.95	1.00	(0.05)	(0.10)	0.44	0.52	14.71	9.33	1.94	0.00	25.55
November	25.55	228,397	21.03	2.10	1.00	1.10	2.09	0.00	0.00	0.00	0.00	0.00	0.00	48.67
December	48.67	229,440	21.83	2.27	1.00	1.27	2.42	0.00	0.00	0.00	0.00	0.00	0.00	72.92
January	72.92	217,968	20.74	2.24	1.00	1.24	2.36	0.00	0.00	0.00	0.00	0.00	0.00	96.01
February	96.01	213,796	18.37	1.45	1.00	0.45	0.86	0.00	0.00	0.00	0.00	0.00	0.00	115.24
March	115.24	221,096	21.03	1.12	1.00	0.12	0.23	0.88	1.04	0.00	0.00	3.88	0.00	132.62
April	132.62	225,268	20.74	0.79	4.25	(3.46)	(6.58)	2.81	3.31	2.96	1.58	12.40	0.00	129.84
May	129.84	230,483	21.93	0.78	6.14	(5.36)	(10.19)	3.51	4.13	11.42	4.85	15.49	0.00	109.81
June	109.81	292,014	26.88	0.61	6.69	(6.08)	(11.56)	3.81	4.48	17.44	6.08	16.81	0.00	84.82
July	84.82	273,242	25.99	0.38	8.66	(8.28)	(15.75)	4.64	5.46	24.42	8.48	20.47	29.51	71.21
August	71.21	261,770	24.90	0.41	7.91	(7.50)	(14.26)	3.92	4.61	31.13	10.51	17.29	22.00	44.92
September	44.92	247,169	22.76	0.40	5.42	(5.02)	(9.55)	2.42	2.85	36.45	9.61	10.68	0.00	1.40
TOTAL		**239,000**	**267.83**	**13.50**	**45.07**	**(31.57)**	**(60.04)**	**22.43**	**26.39**	**138.52**	**50.44**	**98.96**	**51.51**	

Notes:

1 Based on year 2019 DMRs (the highest continuous year of flows from the City's 2018 to 2020 DMR data) and PRC certified population estimate for 2020 population of 3,220 people.

2 From the WRCC for the Bend 7 NE Evaporation Station.

3 From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.

4 From the Reclamation AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.

5 Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators are kept in operation and to avoid the need for removing the unutilized aerators prior to the lagoon freezing over.

ac-ft = acre-feet
DMR = Discharge Monitoring Report
gpd = gallons per day
in = inches
PRC = Portland State University Population Research Center
WRCC = Western Regional Climate Center

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CITY OF
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WASTWATER FACILITES PLAN UPDATE

EXISTING SYSTEM WATER BALANCE

FIGURE
2-7

Section 3 - Need for Project

Introduction/General

As discussed in previous sections, concerns have been identified that show the need for improvements to the City's existing wastewater infrastructure. Though there have not been any known violations to the City's existing Water Pollution Control Facilities (WPCF) Permit, aging infrastructure and substantial growth and population require improvement to the City's existing collection system, wastewater treatment plant, and recycled water disposal system. Information about the identified needs and deficiencies is detailed below.

Health, Sanitation, Environmental Regulations, and Security

As stated previously, there have not been any known violations to the City's existing WPCF Permit, nor have there been any noted concerns regarding the health, sanitation, or security of the City's existing wastewater infrastructure. However, should the capacity of the existing facilities be exceeded in the future, there is potential for regulation violations or negative impact to public health. Additional information about capacity concerns is discussed hereafter.

Aging Infrastructure and Reasonable Growth

The City's wastewater treatment facilities were constructed in the early 2000s. As such, some of the components are starting to show signs of wear and aging. The results of the wastewater treatment facilities evaluation are summarized below.

Wastewater Collection System

The following deficiencies were noted:

- The Rope Steet Lift Station is having ragging issues and the pumps need to be replaced. The lift station building and various items, such as the electrical panel, are old or have deteriorated over time.
- An additional lift station is needed on the west side of the City to relieve capacity from the Rope Street Lift Station.
- The current pressure sewer at E. Creekside Court needs to be replaced with a gravity sewer main and lift station.

Gravity Sewer Infiltration and Inflow

Based on review of the discharge monitoring reports, design criteria per capita flows, and the current collection system condition, the City is not concerned with infiltration and inflow (I/I) being present in the collection system. Typically, the amount of I/I is assumed not to change over a 20-year design period. If I/I becomes an issue, a reduction in I/I flows would increase or recoup the City's ability to properly treat and dispose of its wastewater.

Wastewater Treatment Facility

The following deficiencies were noted:

- The headworks screen is susceptible to freezing issues due to the open channel and no outdoor protection cover. The headworks need to be updated.
- There is no way to clean the chlorine contact basin. A cleaning structure needs to be constructed for future chlorine use.
- The surface aerators in Lagoons No. 2 and 3 are nearing the end of their service life and need to be replaced during the planning period.

Treated Wastewater Disposal/Irrigation System

The following deficiencies were noted:

- Additional disposal and storage capacity is needed to accommodate growth.
- The irrigation pumps need variable frequency drives added to adjust pumping rates.
- To properly land-apply treated wastewater at agronomic rates, all proposed Lazy Z Ranch improvements developed in Phases 1 and 2 need to be constructed/implemented.

Lazy Z Ranch

The identified improvements, along with additional information and a further in-depth review, are included in the Master Plan included in Appendix E.

To continue to meet WPCF Permit requirements and maintain compliance with the Oregon Department of Environmental Quality, the City will need to improve the WWTF disposal area. Keeping up with the City's continued growth and having facilities in place to accommodate that growth is of the highest importance. In Section 4, alternatives to improve the City's WWTF, including the collection and irrigation systems, are developed and evaluated to address the deficiencies identified in this section.

Section 4 - Alternatives Considered

General

In this section, alternatives to improve the wastewater collection, treatment, and disposal systems and irrigation facilities for the City of Sisters are developed and evaluated to address the deficiencies identified in Section 3. First, the wastewater collection system is discussed with improvements and alternatives presented. Next, a discussion of the wastewater treatment facility (WWTF) improvements and any identified alternatives considered in this Wastewater Facilities Plan (WWFP) Update is provided. Following the WWTF improvements, the irrigation improvements and alternatives developed in the Lazy Z Ranch Master Plan and revised throughout the completion of this WWFP Update are discussed. The selected alternatives are detailed further in Section 5.

Design Criteria

Figure 2-5 summarizes basic wastewater design criteria used in this WWFP Update for the base year 2020, current year 2022, and design year 2042. Figure 2-5 shows the 2042 design year's population, flows, and anticipated future influent wastewater strength characteristics. Figure 2-5 should be referred to during the review of subsequent sections of this WWFP Update, as it provides key information on the wastewater system improvements and alternatives developed and evaluated herein. Additional information about how the design criteria were developed is included in Section 2 of this WWFP Update.

Wastewater Collection System Improvements

Rope Street Lift Station Improvements

The Rope Street Lift Station improvements would include replacing the submersible pumps, updating and replacing the electrical and controls, and relocating the standby generator outdoors. An interior wall would be constructed to separate the wetwell from the electrical components so the room housing the electrical components will no longer be classified as Class I, Division 1. Discussion was held regarding the potential to upsize the pumps to provide the additional capacity necessary for the anticipated 2042 flows. However, upsizing the submersible pumps from the current 37 horsepower (Hp) is anticipated to increase operation and maintenance (O&M) costs and substantially decrease the ease of pump serviceability. The generator located inside the building would be relocated to outside the building to provide space for the interior wall and allow the electrical and control room classification to be reduced to Class I, Division 2.

Instead of increasing the pump size at the Rope Street Lift Station, a second large lift station is proposed to be constructed on the west side of the City that pumps directly to the WWTF. Additional information about the Westside Lift Station will be discussed hereafter.

Estimated Total Project Cost

The estimated total project cost for the recommended Rope Street Lift Station improvements is approximately $624,000 (in 2022 dollars). Figure 4-1 provides a breakdown of estimated costs for this alternative.

Advantages

- Simplified O&M and reduces recurring issues.
- Includes new equipment upgrades and provides a barrier to separate the Class I, Division 1 environment of the wetwell area from the electrical components.
- The Rope Street Lift Station would no longer require upsizing to accommodate wastewater flows with the addition of the Westside Lift Station.
- Non-clog submersible pumps would reduce ragging issues, thereby reducing maintenance needs.
- Improved safety and longevity of the lift station, plus the electrical components can generally be repaired and replaced as necessary to increase their expected useful life.
- Rehabilitating the lift station is more cost-effective than completely replacing the lift station with a new lift station.
- The improvements outlined herein are anticipated to help maintain the City's compliance with the Water Pollution Control Facilities (WPCF) Permit requirements throughout the 20-year planning period.

Disadvantages

- Due to implementation of the majority of the improvements within a short time frame, higher capital costs would occur earlier in the planning period.
- The proposed upgrades and rehabilitation of the Rope Street Lift Station would not provide the necessary capacity to accommodate the anticipated 2042 flows; therefore, additional capacity provided by an additional lift station would be required.

Westside Lift Station

The Westside Life Station is a proposed lift station that would be located in the western half of the City to help reduce flow to the Rope Street Lift Station and is considered a high priority for the City. Constructing a new lift station would benefit the wastewater collection system. First, the Rope Street Lift Station would no longer require upsizing of its pumps to handle anticipated flows over the 20-year planning period. The new lift station would also decrease O&M costs, decrease the difficulty of pump maintenance, and improve reliability by the use of smaller pump sizes. Additionally, the Westside Lift Station would create partial redundancy for the collection system and lower the backup of wastewater at a single location in the case of emergency.

During the analysis of the proposed Westside Lift Station, estimates of the anticipated flows were calculated. The total area of the city limits and urban growth boundary (UGB) of the City of Sisters was divided by the area of the City that would contribute sewer flows to be directed to the Westside Lift Station. To free up capacity in the collection system on the north side of the City, the Barclay Lift Station would be redirected to the Westside Lift Station once it has been constructed. The piping for the redirection was previously installed and would simply need to be connected upon the completion of the Westside Lift Station project. The estimated area the Westside Lift Station would serve is approximately 38 percent. Utilizing the 2042 design population's peak hour flow of

1.925 million gallons per day (MGD), the Westside Lift Station could receive an estimated flow of approximately 0.733 MGD. Based on the anticipated flows, the pump capacity of the lift station was determined. Though a duplex lift station could be implemented at the Westside Lift Station, the flows and redundancy requirements involved would likely require a pump much larger than the current pumps at the Rope Street Lift Station. The use of three smaller pumps to meet redundancy requirements would allow easier maintenance of the lift station due to lower pump weights. Therefore, a triplex system was determined to be beneficial for the proposed Westside Lift Station. A triplex system with two pumps operating, each with capacities of 300 gallons per minute, would surpass the anticipated Westside Lift Station flow for the 2042 design criteria. The Westside and Rope Street Lift Stations combined would give the City the capacity it requires. The proposed location of the Westside Lift Station is shown on Figure 4-2. Figure 4-2 presents the new lift station, which includes approximately 4,200 linear feet of pressure sewer that would connect to the existing pressure sewer on Locust Street. With the construction of this new lift station, the Barclay packaged lift station would be rerouted, allowing some of the gravity sewer trunklines in the industrial part of the City to become available.

Estimated Total Project Cost

The estimated total project cost for the proposed Westside Lift Station is approximately $2,165,000 (in 2022 dollars). Figure 4-3 provides a breakdown of estimated costs for this alternative.

Advantages

- Provides the additional capacity needed.
- The collection system would be less reliant on the Rope Street Lift Station, and system capacity would be increased without needing to upsize the Rope Street Lift Station pumps.
- The improvements outlined herein are anticipated to allow the City to continue to meet its WPCF Permit requirements into the 20-year planning period.

Disadvantages

- Due to implementation of the majority of the improvements within a short time frame, higher capital costs would occur earlier in the planning period.

Creekside Court Lift Station

As mentioned in Section 2, the existing pressure sewer and septic tank effluent pumping system in the subdivision on E. Creekside Court is proposed to be abandoned and replaced with a gravity sewer system and lift station setup. The existing pressure sewer would be abandoned with the addition of a gravity line serving the entire subdivision on the east side of the City. The proposed gravity sewer main would run southwest of the cul-de-sac, then south to the McKenzie-Bend Highway via a packaged lift station. A packaged lift station, much like the previous satellite packaged lift stations present in the City's wastewater collection system, would be placed at the cul-de-sac. The new pipeline would connect to an existing manhole near Desperado Trail. Again, this would further improve the redundancy of the wastewater collection system and provide additional capacity. Tying into the pressure sewer main line farther down the line would provide less bottlenecking near the Rope Street Lift Station. In addition, the switch from pressure sewer in the subdivision on E. Creekside Court would provide reduced maintenance and costs associated with the pumps located in the subdivision. The proposed location of the Creekside Court Lift Station is shown on Figure 4-4.

Estimated Total Project Cost

The estimated total project cost for the proposed Creekside Court Lift Station improvements is approximately $1,159,000 (in 2022 dollars). Figure 4-5 provides a breakdown of estimated costs for this alternative.

Advantage

- Reduces O&M components compared to the existing pressure sewer system.

Disadvantage

- Due to implementation of the majority of the improvements within a short time frame, higher capital costs would occur earlier in the planning period.

General Collection System

The trunklines of areas anticipated to see the largest increase in flows throughout the 20-year planning period were analyzed utilizing the as-built drawings provided by the City to confirm possible bottlenecking locations and areas where the anticipated flows may be higher than the existing pipe capacities. The gravity sewer main lines running to lift stations were analyzed, and all other trunklines analyzed are anticipated to have adequate capacity throughout the 20-year planning period. As shown on Table 2-1 and Figure 2-6 in Section 2, many of the analyzed existing trunklines are located near the edge of the city limits and existing UGB. These trunklines could be connected to future sewer lines that may be needed for development that could occur by expansion of the current UGB and annexation. Though these trunklines appear to have capacity in excess of what is anticipated to be required to accommodate projected growth in the next 20 years, it is recommended that more detailed utility feasibility analysis be performed for any proposed development or annexation that may result in an expansion of the UGB.

Due to the relatively new and watertight operating collection system and the results of the trunkline analysis, no improvements were evaluated and further developed. Since infiltration and inflow is not a concern and the pipe material, diameter, and slopes are of sufficient design, the system was determined to have the necessary capacity for the entirety of the 2042 design period. No improvements or cost estimates were prepared.

Although the existing trunklines appear to be adequately sized for the projected flows, there is a concern regarding the 10-inch trunkline that runs along Camp Polk Road and Black Butte Avenue and its ability to serve the industrial part of the City. Current projections, using a peaking factor of 4 and assuming minimum pipe slopes show that the 10-inch trunkline appears to have adequate capacity. However, if a high water-using industry, such as a food processing industry or data center, is added, the trunkline may meet or exceed its capacity faster than expected. As such, it is recommended that the City reanalyze the trunkline and the industrial zone every five years with the regular update to this WWFP Update to ensure that the trunkline's capacity is not exceeded. If flows grow at a rate faster than projected in this area, an additional interceptor line may need to be constructed to intercept flows from the industrial zone at the intersection of Camp Polk Road and Black Butte Avenue and take them along the north edge of the city limits directly to the Rope Street Lift Station.

Wastewater Treatment Facility Operational Improvements

Regardless of the WWTF improvement and effluent disposal alternatives selected by the City, certain issues with components of the existing WWTF need to be addressed, such as freezing and the ragging issues with the headworks, no methods or accessibility available for cleaning the chlorine contact pipe, and replacement of the old aerators in Lagoons No. 2 and 3. All of the proposed improvements for the headworks, chlorine contact pipe, and aerators are shown on Figure 4-6.

Headworks Improvements

Currently, the headworks operates using a wedge wire screen with a manual bar screen as a backup for emergency situations. Discussions and some early cost estimates were evaluated with the City regarding the addition of a headworks building or the use of an outdoor protection package. The addition of a headworks building would provide a controlled environment for the headworks screen, eliminating the current freezing issues while providing further storage and protection for any equipment to be stored in the building. The existing wedge wire headworks screen would be replaced with a perforated headworks screen to address the ragging issues. After discussion with the City regarding both options, it was decided that the headworks building was not a feasible option for improving the WWTF. First, the addition of a building has a high cost-to-benefit ratio over the outdoor protection package. Second, the location of the headworks is relatively tight due to it sitting on top of the lagoon dike, thus reducing the space on which a building could be placed. Finally, the removal and replacement of the headworks screen requires space and a building would limit the working area. Therefore, to resolve the headworks freezing and ragging issues, it is recommended that the existing wedge wire headworks screen be replaced with a perforated screen with an associated cold weather package.

Estimated Total Project Cost

The estimated total project cost for the recommended headworks improvements is approximately $471,000 (in 2022 dollars). Figure 4-7 provides a breakdown of estimated costs for this alternative.

Advantages

- Utilizing an outdoor protection package versus constructing a new building is lower in cost and makes replacement of the headworks screen easier.
- The perforated screen would reduce rag accumulation downstream, thus reducing equipment operational issues and maintenance requirements.
- The outdoor weather protection would guard against freezing during winter months.

- The improvements outlined herein would address the City's current issues and provide updated equipment to the headworks throughout the 20-year planning period.

Disadvantages

- Weather protection, especially in the form of heat tape, can require additional maintenance.
- The lack of a building also requires maintenance procedures to occur outside in the elements.

Chlorine Contact System Improvements

Cleaning chlorine contact pipes is a necessary maintenance item, and a variety of options to accomplish this are available. Typically, cleanout structures or fittings are set every 200 to 400 feet to provide access to the chlorine contact pipe(s) and remove buildup.

Installing a vault including the necessary pipe, fittings, etc., to allow access to the chlorine contact pipe for occasional cleaning by flushing or pigging the chlorine contact pipe is recommended. This option would provide a considerably lower cost than other alternatives, along with lower O&M costs compared to a larger wetwell, building, or pumps that would otherwise be installed. Currently, the system does not have automatic dosing of the chlorine; however, this is not a concern due to the high detention times throughout the WWTF and relatively consistent effluent irrigation pumping rates.

Estimated Total Project Cost

The estimated total project cost for the recommended chlorine contact system improvements is approximately $97,000 (in 2022 dollars). Figure 4-8 provides a breakdown of estimated costs for this alternative.

Advantages

- Lower capital costs.
- Simplified O&M.
- The improvements would provide a simple and cost-effective solution for allowing regular cleaning of the chlorine contact pipe.

Disadvantages

- Construction of the improvements would likely need to occur during winter when the City is not irrigating, as the contact pipe must be taken offline to allow for construction.

Lagoons No. 2 and 3 Aerator Replacement

The existing lagoon aerators are near the end of their useful life. The aerators in Lagoons No. 2 and 3 are recommended to be replaced on an as-needed basis, along with the associated electrical improvements necessary to accommodate the new aerators. If the City elects to upsize the 7.5 Hp aerators to 15 Hp aerators, the electrical and controls would require improvements. Although there is not an immediate need to upsize the aerators from a treatment standpoint, operational and maintenance advantages come with having standardized equipment in the WWTF. As such, the cost estimate associated with the replacement of the aerators was developed assuming upsizing to 15 Hp to help with budgeting regardless of the City's decision.

Estimated Total Project Cost

The estimated total project cost for the recommended aerator replacement improvements is approximately $443,000 (in 2022 dollars). Figure 4-9 provides a breakdown of estimated costs for this alternative.

Advantages

- Reduced maintenance frequency.
- Standardization of equipment at the WWTF.

Treatment Facility Effluent Disposal and Irrigation Improvements

In this section, the WWTF effluent disposal improvements and alternatives are discussed. The existing WWTF has served the City effectively for many years. However, as discussed in Section 2 and in the Master Plan, the WWTF's current storage and irrigation systems are nearing capacity.

In evaluating improvements and potential alternatives developed in the Master Plan, existing system flows, WPCF Permit requirements, and future water quality and quantity limiting parameters were considered. Facilities have been sized using maximum monthly flows. Criteria used to evaluate the alternatives are described and cost estimates for each alternative were developed.

The Master Plan provides a water balance, which utilized the proposed storage and irrigation volumes the phased improvements are anticipated to provide to determine if adequate storage and irrigation for the 2042 design period is achieved. The water balance shows the means of wastewater influent and outflow from the lagoon system to the land application sites. The proposed water balance and details on the assumptions used for the water balances are provided on Figure 4-10. The proposed improvements for both phases of the Master Plan are shown on Figure 4-11 for reference. Improvements and alternatives discussed previously are summarized below.

Lazy Z Ranch Master Plan Summary

The Master Plan was prepared in August 2021 by Anderson Perry & Associates, Inc., for the City of Sisters. The Master Plan introduced options for recycled water use and alternatives for beneficial reuse by utilizing the Lazy Z Ranch after the remaining land is acquired. The methods described below are from the Master Plan found in Appendix E. From these options and alternatives, the City outlined desired improvements and determined phases for improvement implementation. All desired improvements outlined were placed into two phases. Originally, Phase 1 was to include Pivot 1, Pivot 2, and general irrigation, while Phase 2 was to include the wetlands, forested ponds and streams, and a future wheel line. However, based on Portland State University's Population Research Center data for the population forecast updated on June 30, 2022, revisions to the phases and timing of improvements were deemed necessary. Based on these new estimates, additional storage and disposal capacity is anticipated to be necessary much earlier in the planning period. The identified improvements from the Master Plan are as follows, including a summary of how the new phasing of improvements will be implemented.

Methods of Irrigation and Irrigation Uses

K-Line Irrigation

K-Line irrigation offers advantages in capital cost and flexibility. This form of irrigation consists of impact sprinklers mounted in protective pods made of durable plastic. The sprinklers are connected to each other via flexible hoses that allow the sprinklers to be oriented in a variety of ways to fit the shape of the irrigation site. This flexibility is one of the key advantages of the K-Line system. Additionally, capital costs for K-Line systems are typically low. However, the K-Line system requires more operational attention, as the pods must be manually moved from location to location in the irrigation area to cover the entire area. The typical practice is to move the system after every 24 hours of irrigation. Additionally, the sprinklers used in K-Line systems are small and often plastic, making them more susceptible to blockages and increasing maintenance requirements. Due to the operational disadvantages associated with K-Line systems, the City has expressed interest in replacing its existing K-Lines with more robust, operationally friendly infrastructure.

Center Pivot Irrigation

Center pivot irrigation offers advantages in its minimal maintenance requirements and automated operation. This form of irrigation uses a movable pipe structure that rotates around a central pivot point. The pipe structure is mounted on drive towers that use electric motorized wheels to rotate the structure. These systems can be set to automatically run with different run times and rotational speeds. The key advantages of center pivot systems include automation of the system, which minimizes operational requirements, along with durability, resulting in low maintenance requirements. However, this system has a higher capital cost than other systems and is limited to irrigate circular or rectangular areas of land. Additionally, center pivot systems are generally more visible than other systems.

Wheel Line Irrigation

Wheel line irrigation offers a mid-level option between K-Line irrigation and center pivot irrigation. While a wheel line is more expensive than a K-Line system, the capital cost for wheel line irrigation is typically lower than center pivot irrigation. Similar to the K-Line irrigation system, a wheel line is often moved every 24 hours and requires operator attention to do so. However, the wheel line infrastructure is generally more durable than the K-Line system and typically requires less maintenance.

Crop Irrigation

Crop irrigation is a beneficial use frequently used in many rural communities. Though the type of crop that can be irrigated with recycled water varies with the quality of recycled water per Oregon Administrative Rules (OAR) 340-055 (e.g., Class D recycled water cannot be used to irrigate crops for human consumption), crops tend to use more water and make better use of the nitrogen found in recycled water. Currently, the City contracts out the harvest of the pasture grass grown at the Lazy Z Ranch.

Forested Area Irrigation

Currently, the City irrigates the naturally forested areas near the WWTF using a solid set irrigation system. These areas generally consist of pine trees with juniper trees mixed in. Though irrigating forested areas does not generally require as much water as the irrigation of pasture areas or crops, irrigation of forested areas better allows preservation of the natural beauty of the area. Additionally, the City is recognized as a Tree City, referring to their commitment to preserving local forested areas. Since the City already has irrigation infrastructure in place, maintaining the existing infrastructure and continuing to irrigate the forested areas would be advantageous.

Dike Irrigation

In addition to irrigating the forested areas near the WWTF, the City irrigates the dikes and embankments surrounding the City's wastewater treatment lagoons. Grass grown on the dikes is cut every year after the irrigation season. Irrigation and maintenance of grass on the dikes helps inhibit weed growth and is more aesthetically appealing compared to covering the dikes with rock or leaving the earthwork exposed. Additionally, the growth of grass on the lagoon dikes helps protect against erosion.

Recycled Water Wetlands

Recycled water wetlands are either lined or unlined to provide additional disposal. The soils at the Lazy Z Ranch are highly permeable and not conducive to the development of an unlined wetland, so only a lined wetland would likely be utilized. Wetlands provide beneficial use of recycled water via disposal of the water (through evaporation and transpiration) and additional treatment/polishing of the water via natural processes that improve its quality. Additionally, wetlands provide habitat for wildlife along with public interaction through trail systems, educational interpretive hubs, and wildlife viewing.

Forested Ponds and Streams

Forested ponds and streams may also be lined or unlined for additional disposal. As mentioned in the Recycled Water Wetlands paragraph above, the area has highly permeable soils, resulting in the need for lined ponds and streams. Recycled water disposal would primarily occur via evaporation. Advantages of using forested ponds and streams for disposal of recycled water include additional nature trails and hiking areas, enhancing natural habitat for wildlife, and enhancing the natural beauty of the Lazy Z Ranch and surrounding area. The primary disadvantage of using forested ponds and streams is they are not specifically listed in OAR 340-055 as an approved beneficial use for polished Class D recycled water. As a result, specific procedures mentioned in the Master Plan would need to be followed. As discussed in the Master Plan, the forested ponds and streams would only follow the lined wetlands. The lined wetlands would be sized to provide additional polishing and disinfection.

Lazy Z Ranch Master Plan Phase 1 Improvements

The improvements determined as part of the revised Phase 1 from the Master Plan include the installation of Pivot 2, which is a quarter pivot that would provide approximately 23 acres of irrigated land, and the construction of 16 acres of wetlands, 4 wet acres of forested ponds, and 2 miles of streams. This combination will provide an immediate increase in irrigation and storage volume for the City, along with providing additional recreational activities. The quarter pivot, and the addition of the half pivot as part of Phase 2 of the Lazy Z Ranch improvements, are to replace the existing K-Line irrigation system in the pastureland. With the City's largest concern being the capacity of the WWTF, this improvements phase provides the largest storage and irrigation option within the entire Lazy Z Ranch.

Lazy Z Ranch Master Plan Phase 2 Improvements

The improvements chosen as part of the revised Phase 2 include a half pivot providing approximately 47 acres of irrigation and wheel line irrigation of 14 acres. These improvements provide the remaining irrigation capacity the City will eventually need and utilize the entire site of the Lazy Z Ranch. These improvements will be included in later development as determined by the City during a Public Works Advisory Board presentation and meeting.

Updated Lazy Z Ranch Phase 1

As previously discussed, the improvements proposed for expanding the disposal and irrigation capacity for the WWTF has two proposed phases. Both phases were revised throughout the preparation of this WWFP Update. Phase 1 improvements include the installation of Pivot 2, which is a quarter pivot that would provide approximately 23 acres of irrigated land and the construction of 16 acres of wetlands, 4 wet acres of forested ponds, and 2 miles of streams. Phase 1 would provide approximately 50 acre-feet (ac-ft) of additional capacity to the overall irrigation system. Assuming an average depth of 1-1/2 feet throughout the wetlands, the added storage capacity of Phase 1 is approximately 75 ac-ft. All improvements in Phase 1 are anticipated to be implemented within the next five years. The rapid population growth the City has experienced and is anticipated to continue to experience requires upgrades to continue to meet WPCF Permit requirements throughout the 20-year planning period. The Phase 1 improvements would provide a larger, more immediate increase in storage and irrigation capacity while adding recreational benefits to the City. The revised timeline and implementation of the Master Plan improvements should allow the City to maintain compliance with its WPCF Permit. Since the WPCF Permit is set to expire on December 31, 2025, having the necessary storage and irrigation capacity is necessary for the system's operation and provides further reasoning to implement the Phase 1 improvements within the next five years.

Estimated Total Project Cost

The estimated total project cost for the revised Lazy Z Ranch Phase 1 improvements is approximately $5,200,000 (in 2022 dollars). Figure 4-12 provides a breakdown of estimated costs for this alternative.

Advantages

- The majority of the improvements would be made early in the design period, providing the City with a large amount of storage and irrigation capacity along with providing additional recreational opportunities in the City.
- The improvements in Phase 1 address the City's concern with wastewater storage.

Disadvantages

- Higher capital costs would occur earlier in the planning period due to the majority of the improvements being implemented within a short time frame.

Updated Lazy Z Ranch Phase 2

Phase 2 of the revised Lazy Z Ranch proposed improvements includes the second of the two pivots. Pivot 1 is anticipated to provide 47 acres of irrigation, and the installation of wheel line irrigation is anticipated to provide 14 acres of irrigation. Phase 2 would utilize the remaining capacity and site of the Lazy Z Ranch. An additional 61 acres is anticipated to be implemented in the next five to ten years. Additional advantages and disadvantages of different phasing options are discussed in greater detail in the Master Plan found in Appendix E.

Estimated Total Project Cost

The estimated total project cost for the revised Lazy Z Ranch Phase 2 improvements is approximately $550,000 (in 2022 dollars). Figure 4-12 provides a breakdown of estimated costs for this alternative.

Advantages

- Utilization of the additional capacity from the improvements along with additional recreational opportunities in the City.
- Rehabilitation and improvement of systems that require excessive maintenance.
- The improvements outlined herein are anticipated to allow the City to continue to meet WPCF Permit requirements into the 20-year planning period.

Disadvantages

- Higher capital costs would occur earlier in the planning period due to the majority of the improvements outlined in the Master Plan and the WWFP Update being implemented within a short time frame.

Biosolids Removal

Biosolids removal is a necessary part of the lagoon wastewater treatment process. It is recommended that biosolids be removed every five to ten years, unless necessary at a different interval. The estimated total project cost for the removal of biosolids is approximately $200,000, with a projected increase of 5 percent per year beginning in 2022.

Summary

The most critical of the proposed improvements outlined in this section are those required to address the substantial growth the City has been experiencing. Each alternative discussed in this section was presented to the City for review and selection. The improvements selected by the City, along with a proposed Capital Improvements Plan, are further examined in Section 6.

Environmental Impacts

Preliminary Environmental Review

Introduction

This section presents a preliminary environmental review of the selected wastewater system improvements. As the project is developed further and funding sources are researched, a more detailed report should be completed to meet specific agency requirements.

Affected Environment/Environmental Consequences

Land Use

The City of Sisters is located in northwestern Deschutes County in central Oregon. The majority of land in the immediate vicinity is privately owned and is used for livestock grazing or irrigated crop farming. Located at an elevation of 3,182 feet above mean sea level, the area is located in the shadow of the Three Sisters volcanic peaks and is known as the gateway to the Cascades.

The proposed collection system and WWTF improvements are within the city limits and the urban growth boundary (UGB). These improvements are not anticipated to require a Conditional Use Permit (CUP). However, the improvements to the Lazy Z Ranch are located outside the UGB and will require a CUP.

Important Farmland

The soils in the area of the City of Sisters are generally considered good for farming and agriculture. The primary soil types in the vicinity are summarized on Table 4-1. In general, the soils are classified in variations of loam, with some variety due to the volcanic history of the region.

TABLE 4-1
FARMLAND CLASSIFICATION, SUMMARY BY MAP UNIT, DESCHUTES COUNTY, OREGON

Map Unit Symbol	Map Unit Name	Rating
18D	Bluesters gravelly sandy loam, 15 to 50 percent slopes	Farmland of Statewide Importance
47A	Ermabell loamy fine sand, 0 to 3 percent slopes	Farmland of Statewide Importance
62D	Henkle-Lava flows-Fryrear complex, 15 to 50 percent slopes	Not Prime Farmland

Map Unit Symbol	Map Unit Name	Rating
85A	Lundgren sandy loam, 0 to 3 percent slopes	Farmland of Statewide Importance
94A	Omahaling fine sandy loam, 0 to 5 percent slopes	Farmland of Statewide Importance
157C	Wanoga-Fremkle-Rock outcrop complex, 0 to 15 percent slopes	Farmland of Statewide Importance
159C	Wilt sandy loam, 0 to 15 percent slopes	Farmland of Statewide Importance

As stated earlier, the proposed collection system and WWTF improvements are located within the UGB. However, the improvements to the Lazy Z Ranch are located outside the city limits on land zoned Exclusive Farm Use - Sisters/Cloverdale Subzone (EFUSC), adjacent to land zoned Forest Use 1. Though the irrigation infrastructure meets the permitted uses for this zoning, the implementation of the ponds, streams, and associated parks appears to require a CUP per Chapter 18.16.030 of the Deschutes County Code. The construction of wetlands appears to be a permitted use for EFUSC-zoned areas.

Floodplains

As shown on the Federal Emergency Management Agency's Flood Insurance Rate Map Panel No. 41017C0245E, the Special Flood Hazard Areas (SFHAs), or areas subject to flooding during a 100-year flood event, are relatively small and generally limited to the immediate vicinity of Wychus Creek. Most of the proposed improvements are well outside the SFHAs. However, the Creekside Court Lift Station improvements are located near the creek and associated SFHAs. Care must be taken during design and construction of the lift station to locate the lift station wetwell, valve vault (if applicable), and all electrical, controls, and appurtenances outside the SFHAs. No permanent impacts to the 100-year flood zone are anticipated. Any activity within floodplains, if deemed necessary during design, will be required to comply with applicable local floodplain development standards.

Wetlands

The National Wetlands Inventory Map identified some freshwater emergent wetlands and Whychus Creek within the vicinity, specifically northwest of the Lazy Z Ranch property. A wetland determination/delineation should be completed prior to construction of the Lazy Z Ranch improvements. Wetlands will be avoided if possible. If avoidance is impracticable or unfeasible, permits will be obtained and appropriate environmental documents prepared prior to construction.

Cultural/Historical Resources

A search of the National Register of Historic Places was conducted. Two historic buildings appear to be listed within the City of Sisters. The majority of the proposed improvements will be located in existing rights-of-way that have been previously disturbed.

Additional requirements may be necessary depending on federal involvement (funding or permits), which may necessitate compliance with Section 106 of the National Historic Preservation Act. If no federal nexus is identified, the project must still comply with Oregon Revised Statutes (ORS) 97.740, ORS 358.905-358.961, and ORS 390.235 and OAR 736-051-0090, which protects Native American cairns, graves, and associated items; items of cultural patrimony; and archaeological sites on non-federal and private lands. Additional archaeological surveying, testing, and/or permitting may be required to comply with state laws.

Biological Resources

Important fish and wildlife habitat in the area includes the Wychus Creek and associated riparian areas. Riparian areas are critical to the health of streams, as riparian vegetation provides shade and temperature regulation for the streams, provides cover for aquatic organisms, and stabilizes streambanks to prevent erosion.

No crossings are anticipated to be required as a part of any of the proposed improvements. No impacts to any threatened, endangered, or rare species or habitat are anticipated. If impacts to waterbodies are unavoidable, appropriate permits and mitigation will be completed.

Water Quality

Wychus Creek is the primary surface waterbody located in the vicinity of the City of Sisters. Some of the proposed collection system improvements will occur in the vicinity of this waterbody, although no impacts are anticipated. Best management practices will be employed to control potential erosion and sedimentation that could temporarily impact water quality.

Impacts to Groundwater

The project area does not lie in a Sole Source Aquifer or Critical Groundwater Area. The project is located within the Deschutes Groundwater Mitigation Area, which regulates groundwater withdrawal and mitigation. This project does not involve any groundwater removal, so Deschutes Groundwater Mitigation Area regulations do not apply. No impacts to groundwater are anticipated. However, it is best practice to install groundwater monitoring wells downgradient of irrigation sites and the unlined wetland sites to monitor and verify groundwater is not being negatively impacted.

Socioeconomic/Environmental Justice

No elderly or minority populations residing adjacent to the area will be impacted by the project. No business or residential relocations will be required as part of the project.

Completion of the project is necessary to provide adequate wastewater conveyance, treatment, and disposal for the anticipated population growth over the 20-year planning period.

Air

The collection system improvements fall within the city limits and UGB and, as such, are subject to the City of Sisters' ordinances. Dust concerns can usually be addressed by spraying water on the affected areas as needed to reduce dust.

The project has the potential to temporarily affect air quality. Short-term impacts include emissions from equipment operation and dust generated from construction activities. No substantial particulate matter or detrimental emissions will be released as a result of the project. It is unlikely that the Oregon Department of Environmental Quality (DEQ) will require air quality permits for the project.

Noise

The proposed improvements will not emit additional noise. However, construction activities will create significant intermittent and temporary noise. To minimize impacts, work will generally be confined to the project area during daylight hours. Construction activities will be subject to any City and/or County noise ordinances.

Traffic

During construction, temporary increases in traffic due to construction vehicles may occur. No permanent or long-term impacts to transportation are anticipated as a result of most of the proposed improvements, with the exception of the access to the proposed parking areas for some of the Lazy Z Ranch improvements. Access to this site is via a state highway. As a result, collaboration with the Oregon Department of Transportation will be required during the design and construction of the Lazy Z Ranch Phase 1 improvements, and any required access permit and/or traffic study requirements must be met.

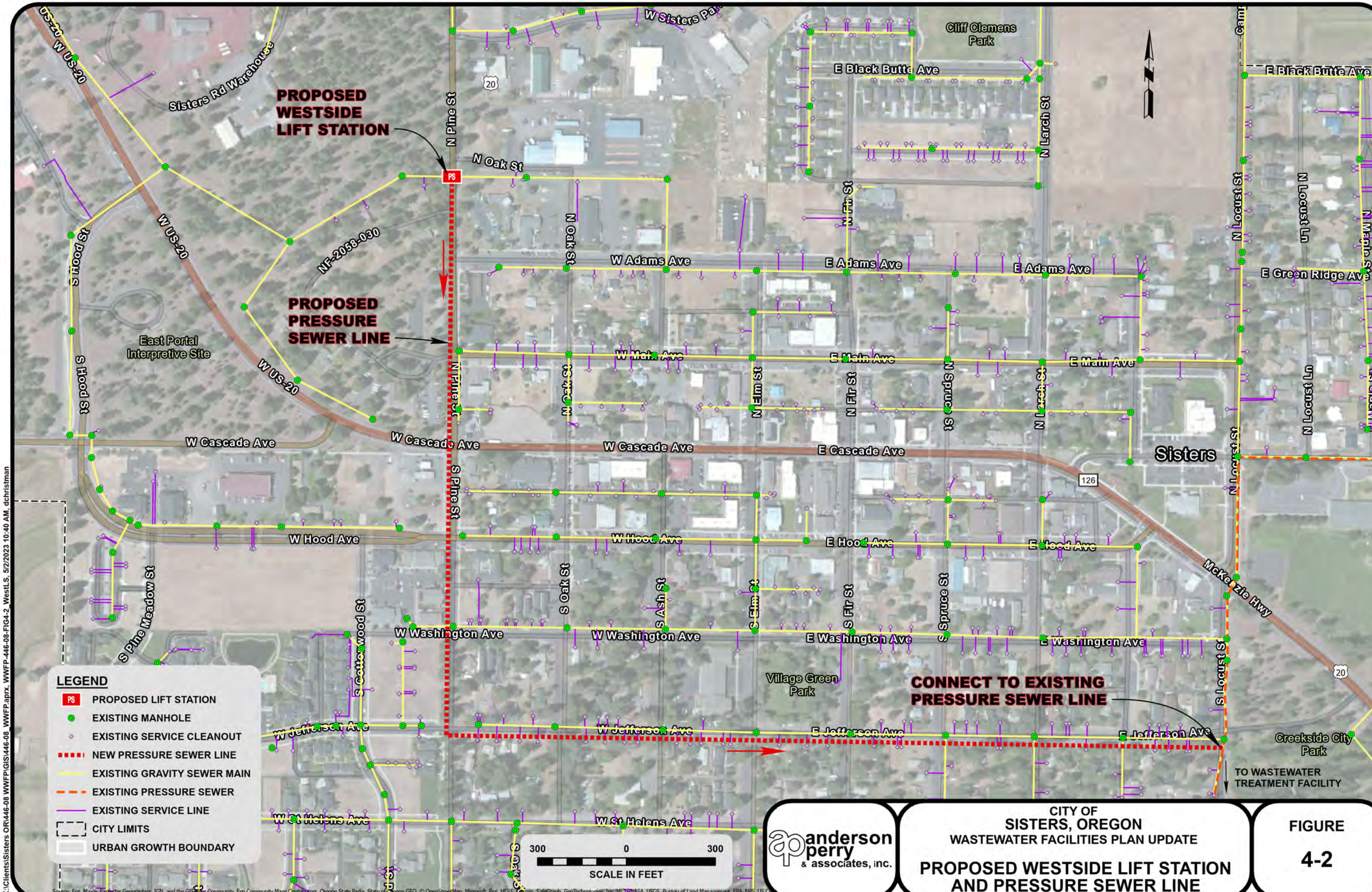
Hazardous Material

The potential for buried asbestos cement (AC) pipe exists in the work areas, as some of the City's original water pipes were composed of AC. The proposed lift station improvements and associated piping modifications may cross or expose existing AC lines, abandoned or otherwise.

Environmental records were reviewed for identified hazardous and solid waste sites, cleanup sites, and leaking and underground storage tanks using information on the DEQ Environmental Cleanup Site Information (ECSI) website. According to the ECSI database, 15 cleanup sites are located in the vicinity of the City of Sisters. Of the 15 sites, ten have no further action required. Of the five remaining cleanup sites, contaminated groundwater has been suspected in Township 15 South, Range 10 East. The Lazy Z Ranch improvements are located in this region; however, the use of groundwater is not anticipated to be required as a result of these improvements. Additionally, a cleanup site south of Township 15, Range 10, Section 5 has been identified, along with the old Forest Service Whychus Pit. None of these records appear to be adjacent to the project.

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
ROPE STREET LIFT STATION IMPROVEMENTS
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 23,000	All Req'd	$ 23,000
2	Removal and Demolition of Existing Equipment and Components	LS	25,000	All Req'd	25,000
3	Wetwell Improvements	LS	10,000	All Req'd	10,000
4	New Submersible Pumps and Accessories	LS	170,000	All Req'd	170,000
5	Heating, Ventilation, and Air Conditioning and Piping Modifications	LS	60,000	All Req'd	60,000
6	Structure Modifications	LS	50,000	All Req'd	50,000
7	Electrical and Controls	LS	100,000	All Req'd	100,000
8	Generator Improvements	LS	35,000	All Req'd	35,000
	Subtotal Estimated Construction Cost				**$ 473,000**
	Construction Contingency (15%)				70,000
	Total Estimated Construction Cost				**$ 543,000**
	Preliminary, Design, and Construction Engineering (15%)				81,000
	TOTAL ESTIMATED IMPROVEMENTS COST (2022 DOLLARS)				**$ 624,000**



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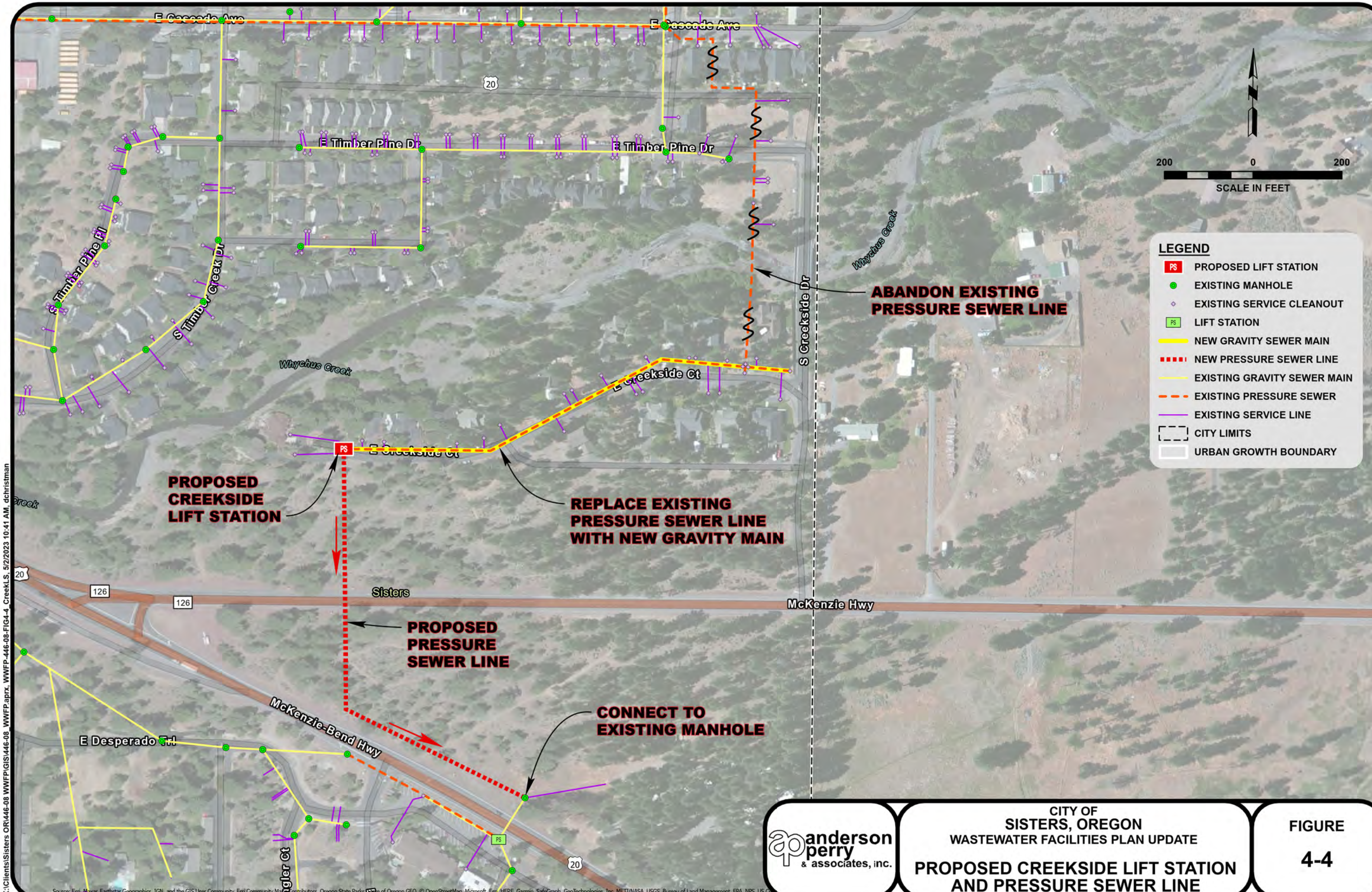
CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
WESTSIDE LIFT STATION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 76,000	All Req'd	$ 76,000
2	Traffic Control	LS	50,000	All Req'd	50,000
3	Site Work	LS	40,000	All Req'd	40,000
4	Concrete Masonry Unit Building and Furnishings	LS	130,000	All Req'd	130,000
5	Crushed Surfacing	CY	20	250	5,000
6	Precast Concrete Wetwell	LS	30,000	All Req'd	30,000
7	Valve Vault	LS	10,000	All Req'd	10,000
8	Submersible Pumps, Rails, and Appurtenances	LS	125,000	All Req'd	125,000
9	Mechanical Work including Piping, Valves, Fittings, and Appurtenances	LS	55,000	All Req'd	55,000
10	Gantry Crane	LS	10,000	All Req'd	10,000
11	Electrical Work	LS	100,000	All Req'd	100,000
12	Control and Instrumentation Work	LS	135,000	All Req'd	135,000
13	Standby Power Generator System	LS	120,000	All Req'd	120,000
14	Heating, Ventilation, and Air Conditioning	LS	50,000	All Req'd	50,000
15	Potable Water System	LS	5,000	All Req'd	5,000
16	8-inch Pressure Sewer	LF	80	4,500	360,000
17	Natural Ground Surface Restoration	SY	20	2,600	52,000
18	Asphalt Surface Restoration	TON	130	2,000	260,000
19	Fencing	LS	15,000	All Req'd	15,000
20	Painting	LS	10,000	All Req'd	10,000
	Subtotal Estimated Construction Cost				**$ 1,638,000**
	Construction Contingency (15%)				245,000
	Total Estimated Construction Cost				**$ 1,883,000**
	Preliminary, Design, and Construction Engineering (15%)				282,000
	TOTAL ESTIMATED IMPROVEMENTS COST (2022 DOLLARS)				**$ 2,165,000**



CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE

PROPOSED CREEKSIDE LIFT STATION AND PRESSURE SEWER LINE

FIGURE 4-4

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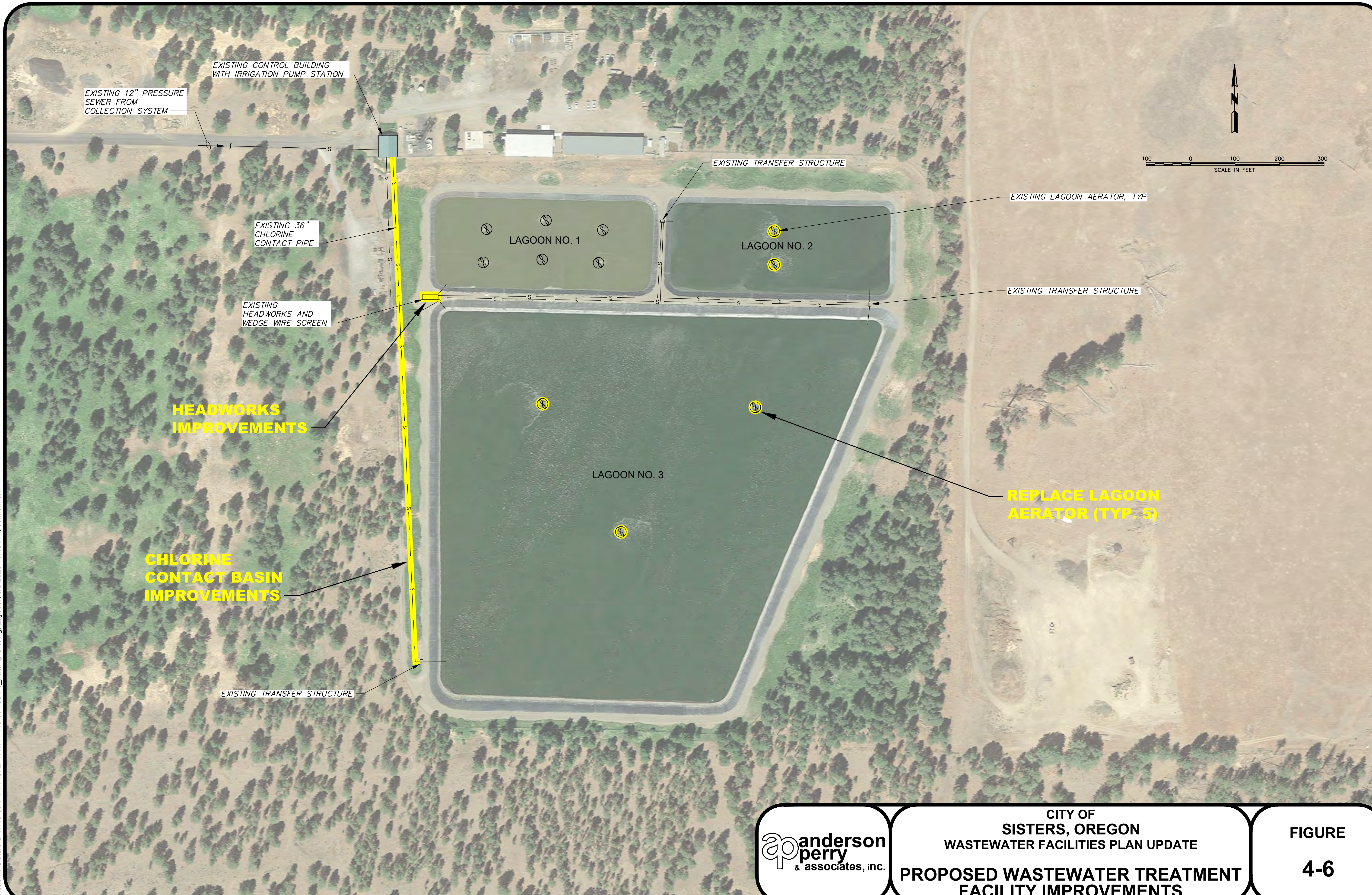
CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
CREEKSIDE COURT LIFT STATION
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 42,000	All Req'd	$ 42,000
2	Temporary Protection, Direction of Traffic, and Project Safety	LS	5,000	All Req'd	5,000
3	Site Work	LS	25,000	All Req'd	25,000
4	Removal and Demolition of Existing Pumps and Controls	EA	5,000	23	115,000
5	Precast Concrete Wetwell	LS	30,000	All Req'd	30,000
6	Packaged Lift Station with Pumps, Controls, and Appurtenances	LS	120,000	All Req'd	120,000
7	Crushed Surfacing for Lift Station Site	CY	50	20	1,000
8	Mechanical Work including Piping, Valves, Fittings, and Appurtenances	LS	55,000	All Req'd	55,000
9	4-inch Gravity Sewer Services	LF	50	380	19,000
10	8-inch Gravity Sewer Main	LF	90	1,400	126,000
11	6-inch Pressure Sewer Main	LF	65	1,100	71,500
12	Gravel Surface Restoration	SY	20	2,400	48,000
13	Manhole	EA	6,500	5	32,500
14	McKenzie Highway Bore Crossing	LS	98,000	All Req'd	98,000
15	Electrical Service	LS	50,000	All Req'd	50,000
16	Asphalt Surface Restoration	Ton	130	300	39,000
				Subtotal Estimated Construction Cost	**$ 877,000**
				Construction Contingency (15%)	131,000
				Total Estimated Construction Cost	**$ 1,008,000**
				Preliminary, Design, and Construction Engineering (15%)	151,000
				TOTAL ESTIMATED IMPROVEMENTS COST (2022 DOLLARS)	**$ 1,159,000**



anderson perry & associates, inc.

CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE

PROPOSED WASTEWATER TREATMENT FACILITY IMPROVEMENTS

FIGURE
4-6

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CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
HEADWORKS IMPROVEMENTS
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 17,000	All Req'd	$ 17,000
2	Project Safety/Quality Control	LS	10,000	All Req'd	10,000
3	Removal and Demolition of Existing Equipment and Components	LS	10,000	All Req'd	10,000
4	Screen and Accessories	LS	200,000	All Req'd	200,000
5	Headworks Piping, Fittings, Valving, etc.	LS	15,000	All Req'd	15,000
6	Bypass Pumping, Piping, and Controls	LS	5,000	All Req'd	5,000
7	Electrical and Instrumentation	LS	50,000	All Req'd	50,000
8	Screen Weatherproofing	LS	50,000	All Req'd	50,000
	Subtotal Estimated Construction Cost				**$ 357,000**
	Construction Contingency (15%)				53,000
	Total Estimated Construction Cost				**$ 410,000**
	Preliminary, Design, and Construction Engineering (15%)				61,000
	TOTAL ESTIMATED IMPROVEMENTS COST (2022 DOLLARS)				**$ 471,000**

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CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE

HEADWORKS IMPROVEMENTS
PRELIMINARY COST ESTIMATE

FIGURE 4-7

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
CHLORINE CONTACT SYSTEM IMPROVEMENTS
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 4,000	All Req'd	$ 4,000
2	Project Safety/Quality Control	LS	2,000	All Req'd	2,000
3	Site Work	LS	20,000	All Req'd	20,000
4	Precast Concrete Vault	LS	10,000	All Req'd	10,000
5	Mechanical Work including Piping, Valves, Fittings, and Appurtenances	LS	20,000	All Req'd	20,000
6	Vault Connection to Existing Chlorine Contact Pipe	LS	5,000	All Req'd	5,000
7	Bypass Pumping, Piping, and Controls	LS	10,000	All Req'd	10,000
8	Surface Restoration	CY	20	150	3,000
	Subtotal Estimated Construction Cost				**$ 74,000**
	Construction Contingency (15%)				11,000
	Total Estimated Construction Cost				**$ 85,000**
	Preliminary, Design, and Construction Engineering (15%)				12,000
	TOTAL ESTIMATED IMPROVEMENTS COST (2022 DOLLARS)				**$ 97,000**

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CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
CHLORINE CONTACT SYSTEM IMPROVEMENTS PRELIMINARY COST ESTIMATE

FIGURE 4-8

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
LAGOONS NO. 2 AND 3 AERATOR REPLACEMENT
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 16,000	All Req'd	$ 16,000
2	Project Safety/Quality Control	LS	5,000	All Req'd	5,000
3	Removal and Demolition of Existing Equipment and Components	LS	15,000	All Req'd	15,000
4	Pond Aerators and Accessories	LS	200,000	All Req'd	200,000
5	Electrical Work	LS	50,000	All Req'd	50,000
6	Controls and Instrumentation	LS	50,000	All Req'd	50,000
				Subtotal Estimated Construction Cost	**$ 336,000**
				Construction Contingency (15%)	50,000
				Total Estimated Construction Cost	**$ 386,000**
				Preliminary, Design, and Construction Engineering (15%)	57,000
				TOTAL ESTIMATED IMPROVEMENTS COST (2022 DOLLARS)	**$ 443,000**

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
PROPOSED IMPROVEMENTS WATER BALANCE

Month	Holding Lagoon Initial Volume (ac-ft)	Influent Flow (gpd)[1]	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation (in)[2]	Net (in)	Net WWTF Evaporation (ac-ft)	Net Forested Ponds Evaporation (ac-ft)	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Pasture Irrigation Requirements (in)[3]	Pasture Irrigation (in)[4]	Forest Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Fresh Water (ac-ft)	Final Volume (ac-ft)[5]
October	30.00	457,562	43.53	0.95	1.00	(0.05)	(0.10)	(0.02)	0.00	(0.07)	0.00	0.44	0.52	20.87	9.33	2.03	0.98	0.60	0.00	39.54
November	39.54	459,660	42.32	2.10	1.00	1.10	2.09	0.37	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	85.78
December	85.78	461,759	43.93	2.27	1.00	1.27	2.42	0.42	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	134.24
January	134.24	438,671	41.73	2.24	1.00	1.24	2.36	0.41	0.00	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	180.40
February	180.40	430,276	36.97	1.45	1.00	0.45	0.86	0.15	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	218.98
March	218.98	444,968	42.33	1.12	1.00	0.12	0.23	0.04	0.00	0.16	0.00	0.88	1.04	0.00	0.00	4.06	1.96	1.21	0.00	254.51
April	254.51	453,364	41.74	0.79	4.25	(3.46)	(6.58)	(1.15)	0.00	(4.61)	0.00	2.81	3.31	4.20	1.58	12.98	6.25	3.86	0.00	255.03
May	255.03	463,858	44.13	0.78	6.14	(5.36)	(10.19)	(1.79)	0.00	(7.15)	0.00	3.51	4.13	16.21	4.85	16.21	7.81	4.82	0.00	230.14
June	230.14	587,694	54.11	0.61	6.69	(6.08)	(11.56)	(2.03)	0.00	(8.11)	0.00	3.81	4.48	24.74	6.08	17.59	8.48	5.23	0.00	200.43
July	200.43	549,913	52.32	0.38	8.66	(8.28)	(15.75)	(2.76)	0.00	(11.04)	0.00	4.64	5.46	34.65	8.48	21.43	10.33	6.37	0.00	141.96
August	141.96	526,825	50.12	0.41	7.91	(7.50)	(14.26)	(2.50)	0.00	(10.00)	0.00	3.92	4.61	44.17	10.51	18.10	8.72	5.38	4.88	83.31
September	83.31	497,441	45.80	0.40	5.42	(5.02)	(9.55)	(1.67)	0.00	(6.69)	0.00	2.42	2.85	51.71	9.61	11.17	5.39	3.32	0.00	30.00
	TOTAL	**481,000**	**539.03**	**13.50**	**45.07**	**(31.57)**	**(60.04)**	**(10.52)**	**0.00**	**(42.09)**	**0.00**	**22.43**	**26.39**	**196.55**	**50.44**	**103.57**	**49.92**	**30.79**	**4.88**	

Notes:
1 Based on PRC forecast population estimate for 2042 population of 6,917 people.
2 From the WRCC for the Bend 7 NE Evaporation Station.
3 From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.
4 From the Reclamation AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.
5 Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators are kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac-ft = acre-feet
gpd = gallons per day
in = inches
PRC = Portland State University Population Research Center
WRCC = Western Regional Climate Center
WWTF = wastewater treatment facility

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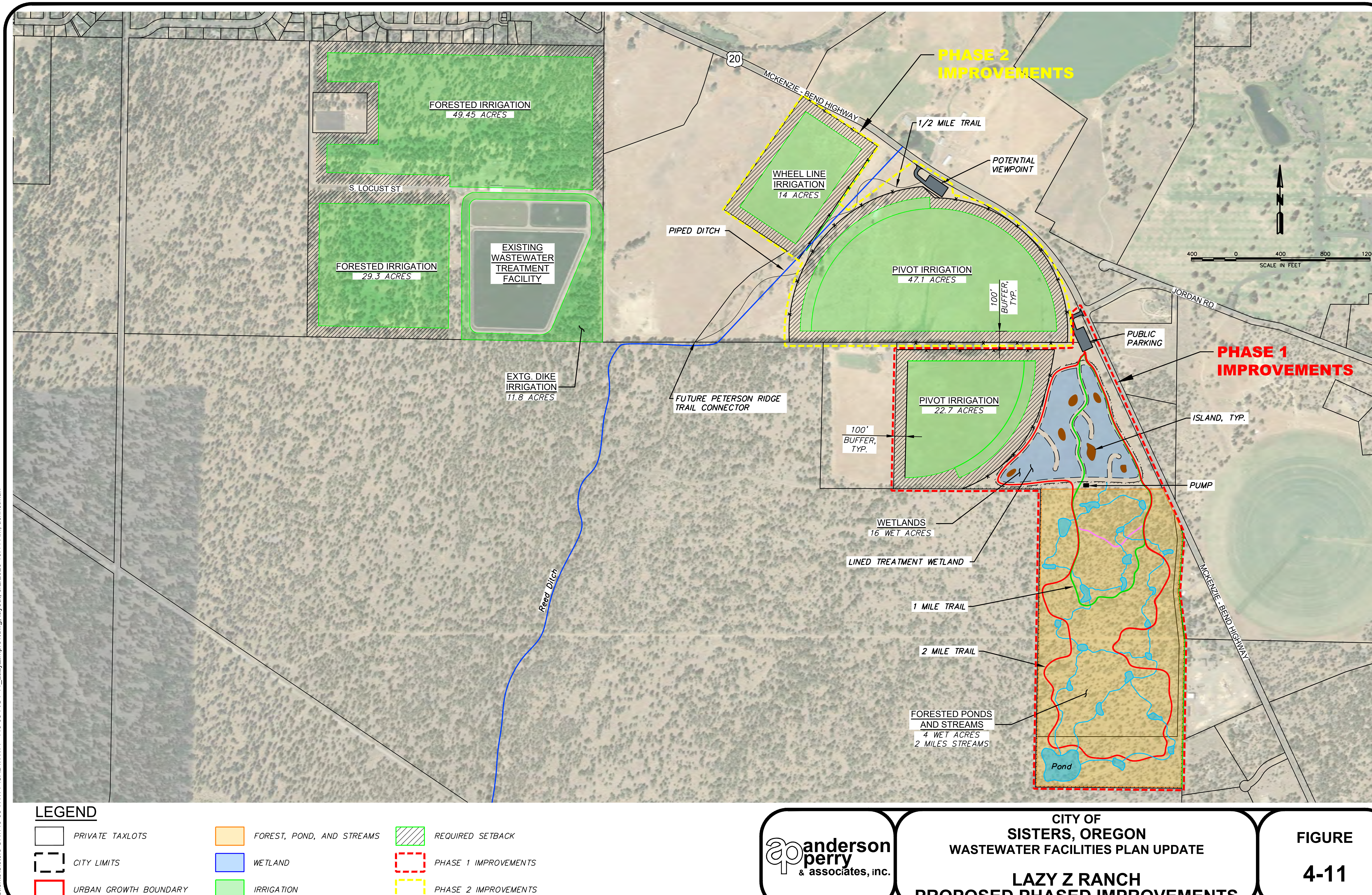
CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
PROPOSED IMPROVEMENTS
WATER BALANCE

FIGURE
4-10



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CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE

LAZY Z RANCH
PROPOSED PHASED IMPROVEMENTS

FIGURE 4-11

X:\Clients\Sisters OR\446-08 WWFP\CAD\WWFP-446-08-FIG4-11_LazyZImprov.dwg, layout, 5/2/2023 10:44 AM, dchristman

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
LAZY Z RANCH PHASE 1 AND 2 IMPROVEMENTS
PRELIMINARY COST ESTIMATE
(YEAR 2022 COSTS)

Beneficial Use	Cost
Wetland	$ 1,270,000
Forested Ponds and Streams	1,750,000
Pivot 1	320,000
Pivot 2	270,000
General	510,000
Future Wheel Line	140,000
Subtotal	**$ 4,260,000**
Contingency, Engineering, and Administration (35%)	1,490,000
Total	**$ 5,750,000**

Phase 1

Beneficial Use	Cost
Pivot 1	$ 320,000
Wetland	1,270,000
Forested Ponds and Streams	1,750,000
General	510,000
Subtotal	**$ 3,850,000**
Contingency, Engineering, and Administration (35%)	1,350,000
Total	**$ 5,200,000**

Phase 2

Beneficial Use	Cost
Pivot 2	$ 270,000
Future Wheel Line	140,000
Subtotal	**$ 410,000**
Contingency, Engineering, and Administration (35%)	140,000
Total	**$ 550,000**

Section 5 - Selection of an Alternative

Introduction

As shown in the previous section, the majority of needed improvements were relatively straightforward to evaluate. The City is not currently in need of a new wastewater treatment facility; as such, alternatives for replacing their existing aerated lagoon system were not considered at this time. However, several improvements are needed to address aging infrastructure, increase capacity in the collection system, and improve the City's disposal capacity. As such, the selected improvements are presented in the form of a capital improvements plan. Following is additional discussion and rationale behind the selected alternatives presented in the previous section.

Cost and Effectiveness Certification

The following is discussion about cost implications considered with the development of the various improvement alternatives. This discussion is organized by facility.

Collection System Improvements

The Rope Street Lift Station requires updates due to electrical code issues, ongoing maintenance concerns, and deterioration of equipment due to age. Options considered included the complete replacement of the lift station; however, much of the infrastructure is in good shape and should be reused. As such, the most cost-effective and responsible option is to rehabilitate the existing lift station.

The Westside Lift Station is required to free capacity in multiple locations of the City's collection system and aid the City in meeting the growing demands anticipated to occur based on the population projections discussed previously. The new lift station will be constructed to match the renovated Rope Street Lift Station to allow standardization of equipment between the two lift stations. Standardizing equipment in this manner allows the City to have fewer replacement components on hand, which reduces both direct costs and implicit costs.

Wastewater Treatment Facility Improvements

The proposed headworks improvements, though relatively lower priority, have been considered to provide the most cost-effective option for improvement. Simply providing a cold weather package is much less expensive than constructing a building around the headworks. Though such cold weather protection packages introduce an additional component that requires maintenance, the construction of a building over the headworks would also provide additional components requiring maintenance attention.

Treatment Facility Effluent Disposal and Irrigation Improvements

The discussion and comparison of alternatives are presented in greater detail in the Lazy Z Ranch Master Plan, included in Appendix E. As discussed in the Master Plan, the selected alternatives for expanding the City's effluent disposal capacity were among the most cost-effective, both from a capital cost point of view and an operation and maintenance (O&M) point of view, that still meet the City's goals for the Lazy Z Ranch property.

Non-monetary Factors

Several non-monetary factors have led to the proposed alternatives selected as a part of the development of this WWFP. Discussion about some of these factors is organized by facility below.

Collection System Improvements

Many of the improvements for the Rope Street Lift Station are driven by a need to meet updated electrical code requirements. Doing so will improve safety at the lift station. In addition, the replacement of the lift station pumps and other components requiring substantial operator attention will reduce the frequency of operator contact with wastewater due to related maintenance activities.

The Westside Lift Station Improvements will provide some resilience to the City's wastewater collection system. With its implementation, less flow will go to the Rope Street Lift Station, and less of the City will rely on the Rope Street Lift Station for wastewater service. Additionally, the City has opted to construct the Westside Lift Station to emulate the rehabilitated Rope Street Lift Station to promote operator familiarity and allow for greater standardization in the City's collection system.

The Creekside Court Lift Station's construction will provide substantially more reliable wastewater service to the Creekside Court community. The City will receive fewer calls from residents having issues with their wastewater system, as the grinder pumps will all be taken offline, thus reducing potential points of conflict between public works staff and the residents. Additionally, removing the grinder pumps and centralizing the system in this location will reduce the potential for untreated wastewater to spill into the environment or come into contact with the public.

Wastewater Treatment Facility Improvements

Most of the proposed improvements for the wastewater treatment facility are intended to improve the ease of O&M at the WWTF. The weatherproof package on the headworks screen will improve functionality and better protect the equipment from the elements, while the installation of a perforated-plate screen will better protect the downstream aerators. The addition of a cleanout port on the chlorine contact pipe will make it easier to clean the chlorine contact pipe regularly, which will in turn improve disinfection efficacy. The replacement of the aerators will not only standardize the equipment but will also improve the treatment efficacy of the City's aerated lagoons and effectively increase the City's wastewater treatment capacity.

Treatment Facility Effluent Disposal and Irrigation Improvements

The proposed improvements will provide substantial benefit to multiple aspects of life for the City of Sisters. First, the proposed improvements will help address the City's concerns with effluent storage and disposal capacity. In addition, the construction of the wetlands and forested ponds and streams will provide additional wildlife habitat for a large variety of species while expanding the City's existing parks system.

Section 6 - Proposed Project

Introduction

This section presents the selected improvements to meet the wastewater collection, treatment, and disposal needs of the City of Sisters for the 20-year planning period. These improvements were selected by the City after careful consideration of the various impacts, objectives, and criteria discussed in Section 4 and the review, evaluation, and consideration of associated cost estimates.

Preliminary Project Design

Based on discussions with the City, the preferred wastewater treatment facility (WWTF) improvement alternatives have been identified, with aggressive implementation schedules identified for most of the proposed improvements to help keep pace with the City's extensive growth. The collection system improvements will also be implemented early in the planning period with the construction of new lift stations (Westside and Creekside Court) and the rehabilitation of the Rope Street Lift Station. This approach will continue to provide the means to have the necessary capacity in the collection, treatment, and disposal systems. The improvements will help avoid potential future regulations associated with the Water Pollution Control Facilities Permit. The City has pursued land needed for the new irrigation systems outlined in the Lazy Z Ranch Master Plan. As a result, and after discussion with the City, the following preferred improvements have been identified. A map containing all the proposed capital improvements is shown on Figure 6-1 for reference.

Collection System Improvements

The proposed improvements to the City's existing wastewater collection system consist of the following:

- Rope Street Lift Station to be rehabilitated to address current issues.
- Westside Lift Station to be constructed to provide system capacity.
- Creekside Court Lift Station to be constructed, along with the abandonment of the pressure sewer in the subdivision on E. Creekside Court to reduce the City's maintenance issues.

Wastewater Treatment Facility Improvements

The proposed improvements to the City's existing WWTF consist of the following:

- Replace the wedge wire headworks screen with a perforated screen and install an outdoor weather protection package.
- Install a vault with blind flange at the north end of the chlorine contact pipe for periodic flushing and cleaning.
- Replace the aerators in Lagoons No. 2 and 3 and update the electrical equipment to ensure compatibility with the new aerators.
- Install variable frequency drives on the irrigation pumps to allow adjustment of irrigation pumping rates.

Treated Wastewater Disposal System Improvements

The proposed improvements to the City's treated effluent disposal and irrigation systems consist of the following:

Phase 1

- Install Pivot 2, the quarter pivot, providing 23 acres of irrigation.
- Construct 16 acres of wetlands.
- Construct 4 wet acres of forested ponds and 2 miles of streams.

Phase 2

- Install Pivot 1, the half pivot, providing 47 acres of irrigation.
- Install the wheel line, providing 14 acres of irrigation.

Project Schedule

For the City of Sisters to successfully implement the selected wastewater system improvements (WWSI) presented herein, the City will need to coordinate directly with the Oregon Department of Environmental Quality (DEQ), U.S. Department of Agriculture Rural Development (RD), and Business Oregon to pursue federal, state, and potentially local financing opportunities provided through low interest loans and potential grants. It is recommended the City pursue funding for the full project, seeking to utilize available low interest loan and grant funds.

The City has elected to proceed with the WWSI project. Once the DEQ has approved this WWFP Update, their approval will be included in Appendix F. The following implementation plan outlines the key steps for project implementation. The following outlines only the major steps that need to be followed.

Item No.	Implementation Item	Time Frame
1.	Submit draft WWFP Update to City and agencies for review.	May 2023
2.	Finalize and adopt the WWFP Update.	Spring/Summer 2023
3.	Attend One Stop meeting.	Summer 2023
4.	Prepare and submit funding application(s) to appropriate agency(ies).	Summer/Fall 2023
5.	Finalize project funding.	Winter 2024
6.	Design system improvements.	Winter 2024 through Summer 2024
7.	Submit design documents for agency(ies) review.	Summer 2024
8.	Advertise, bid, and award construction project.	Winter 2024-25
9.	Project construction.	Winter 2025 through Winter 2026
10.	Project startup and construction completion.	Spring 2026
11.	Project closeout.	Summer 2026

Item No.	Implementation Item	Time Frame
12.	Monitor system performance to determine impact of improvements, report impacts to the DEQ, and determine the need for future improvements.	Two years after project closeout

It should be noted that these implementation steps assume the City is able to secure project funding in summer/fall 2023 and that project design occurs in 2023 concurrent with the pursuit of funding. Should delays occur in securing project funding, completion of the project will likely be delayed. The key to implementing the City's WWSI project, as outlined herein, is the ability of the City to acquire low interest loan funding. The City will have to work closely with its citizens to inform them of the system needs and the need for an increase in sewer user costs.

The WWSI discussed and evaluated in this WWFP Update are to provide the City of Sisters with a reliable and quality wastewater system. The outlined improvements are anticipated to meet the current and future needs of the City throughout the 20-year design and into the future.

Permit Requirements

As shown on Figure 6-1, the majority of the proposed improvements are located within the city limits. City building permits will be acquired as appropriate. Proposed improvements on the Lazy Z Ranch are located outside the city limits on parcels zoned by Douglas County as Exclusive Farm Use (EFU). Both the construction of wetlands and the application of biosolids and treated wastewater are approved uses for EFU zones. However, the implementation of ponds, streams, and associated parks is anticipated to require a Conditional Use Permit (CUP) per Chapter 18.16.030 of the Deschutes County Code. As such, a CUP is anticipated to be required.

Where needed, access permits, Joint Permit Applications, and county building permits will be acquired. Any projects resulting in total ground disturbance of 1 acre or more will acquire a general stormwater discharge permit.

Sustainability Considerations

The improvements selected by the City of Sisters provide aspects of sustainability including water and energy efficiency and system resiliency.

Water and Energy Efficiency

The proposed improvements will aid in reducing inefficiencies that currently exist within the wastewater collection, treatment, and disposal systems. The Lazy Z Ranch improvements will provide needed irrigation and storage capacity, the collection system will receive updated equipment and lift station redundancy, and the WWTF will have current issues addressed and provide maintenance relief, helping extend the life of the complete wastewater system. Also, the proposed improvements will upgrade or replace the existing electrical equipment; add lift station capacity; upgrade lift station pumps, headworks screen, and aerators to new, more efficient models; and provide ease of operation. These improvements will also help reduce the overall power consumption for each improvement of identified equipment.

Other (System Resiliency)

The proposed system improvements will provide the City with the ability to easily maintain its current wastewater collection, treatment, and disposal/irrigation systems, since most of the equipment will be newly upgraded or see the addition of similar products. The WWTF will continue to operate in a similar manner as before but with the addition of a few components to the overall system. However, most of the outlined improvements follow previously installed and utilized components, such as the packaged lift station at E. Creekside Court, which will bring a level of familiarity for system operators. Maintenance will be reduced to simpler tasks due to the installation of new equipment, and the focus will be standard upkeep of components instead of problem solving. The wastewater collection, treatment, and disposal/irrigation systems will be more resilient upon completion of the proposed improvements.

Total Project Cost Estimate

Based on discussions with City staff, the City Council, and the Public Works Advisory Board, a proposed Capital Improvements Plan has been identified. Table 6-1 summarizes this plan, including proposed implementation time frames and associated project costs.

TABLE 6-1
CAPITAL IMPROVEMENTS PLAN AND TIME FRAME

Improvement	Implementation Time Frame	Anticipated Cost (2022 Dollars)
Lazy Z Ranch Phase 1	Less than Five Years	$5,130,000
Rope Street Lift Station Improvements	Less than Five Years	$624,000
Westside Lift Station	Less than Five Years	$2,165,000
Creekside Court Lift Station	Less than Five Years	$1,159,000
Biosolids Removal	Five to Ten Years	$200,000
Lagoons No. 2 and 3 Aerator Replacement	Five to Ten Years	$443,000
Lazy Z Ranch Phase 2	More than Ten Years	$620,000
Chlorine Contact System Improvements	More than Ten Years	$97,000
Headworks Improvements	More than Ten Years	$471,000
TOTAL IMPROVEMENTS COST		**$10,909,000**

Summary of Estimated Total Costs

The estimated total project costs are summarized on Table 6-1. The year 2022 cost shown on Table 6-1 was estimated utilizing associated rates of 2019 and prior with a 5 percent inflation rate per year to the projected year 2022, as this provides the City with a more consistent anticipated cost for the capital improvements. The rates are also shown as if all capital improvements were constructed during the same construction period although some improvements are slated for a later date. The total year 2022 estimated project cost is $10,909,000.

Debt Repayment and Financing Options

State and Federal Grant and Loan Programs

A number of state and federal grant and loan programs can provide assistance on municipal improvement projects to Oregon cities. These programs offer various levels of funding aimed at different types of projects. These include programs administered by RD, the U.S. Economic Development Administration (EDA), Business Oregon, the DEQ, and others. These agencies can provide low interest loan funding, and possibly grant funding, to assist communities with public works projects. Most of these agencies will require an increase in sewer rates to support a loan for WWSI, both as a condition of receiving monies and prior to being considered for grant funds. It should be noted that the monthly user rates discussed in this section can represent a combination of monthly usage fees and taxes.

The following section briefly summarizes the primary funding programs potentially available to assist the City of Sisters with a WWSI project.

Summary of State Funding Programs

Business Oregon Finance Programs

Community Development Block Grant Program

The primary objective of the Community Development Block Grant (CDBG) program is the development of viable (livable) urban communities by expanding economic opportunities and providing decent housing and a suitable living environment principally for persons of low and moderate income.

This is a grant program. The state receives an annual allocation from the U.S. Department of Housing and Urban Development for the CDBG program. Grant funding is subject to applicant need, availability of funds, and any other restrictions in the state's Method of Distribution (i.e., program guidelines). It is not possible to determine how much, if any, grant funds may be awarded prior to an analysis of the application and financial information.

Eligibility for the CDBG program requires a low to moderate percent income of more than 51 percent. The City of Sisters' percentage of low to moderate income is 42.41 percent, based on the 2021 Low to Moderate Income Summary data used by the CDBG program, so it appears that funding from the CDBG program is not available to the City at this time.

Water/Wastewater Financing Program

This is a loan and grant program that provides for the design and construction of public infrastructure when needed to ensure compliance with the Safe Drinking Water Act (SDWA) or the Clean Water Act (CWA). To be eligible, a system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency associated with the SDWA or the CWA.

While primarily a loan program, grants are available for municipalities that meet eligibility criteria. Loan/grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources, current and projected utility rates, and other factors). One criterion utilized by Business Oregon finance programs is an affordability index rate. The affordability index rate is calculated by taking a city's median household income (MHI), multiplying it by 1.25 percent, and dividing by 12 months to obtain an estimated monthly cost. The calculated cost is assumed to be what the users in the community can afford to pay in utility charges. The affordability index is often utilized as a minimum threshold for eligibility for grants and low interest loans. Sisters' MHI is discussed later in this section.

The maximum loan term for this program is 25 years or the useful life of the infrastructure financed, whichever is less. Loan amounts are determined by financial review and may be offered through a combination of direct and/or bond funded loans. Loans are generally repaid with utility revenues or voter approved bond issues. A limited tax general obligation pledge may also be required. "Creditworthy" borrowers may be funded through the sale of state revenue bonds.

Due to the City not having a current or anticipated compliance issue, funding from the Water/Wastewater Financing Program is not likely.

Special Public Works Fund

The Special Public Works Fund (SPWF) program was established by the Oregon Legislature in 1985 to provide primarily loan funding for municipally owned infrastructures and other facilities that support economic and community development in Oregon. Loans and grants are available to municipalities for planning, designing, purchasing, improving, and constructing municipally owned facilities.

For design and construction projects, loans are primarily available; however, grants are available for projects that will create and/or retain traded-sector jobs. A traded-sector industry sells its goods or services into nationally or internationally competitive markets. Loans range in size from less than $100,000 to $10 million. The SPWF can offer very attractive interest rates that reflect tax-exempt market rates for very good quality creditors. Loan terms can be up to 25 years or the useful life of the project, whichever is less. The maximum grant award is $500,000 or 85 percent of the project cost, whichever is less. The grant amount per project is based on up to $5,000 per eligible job created or retained. Since job creation or retention is not a main goal of the City's selected improvements project, the SPWF will likely not be a viable alternative for the City.

For Business Oregon Programs - Contact Regional Development Officer

Since program eligibility and funds availability may change from year to year, potential applicants are encouraged to contact their respective regional development officer to obtain the most accurate and up-to-date information for each program.

Clean Water State Revolving Fund Loan Program

Oregon's Clean Water State Revolving Fund (CWSRF) program, administered by the DEQ, supports communities by funding projects that improve water quality and environmental outcomes for the state of Oregon. The program is dedicated to working with small communities and on projects that increase financial and environmental sustainability, climate resiliency, and water and energy efficiency.

The CWSRF program offers below-market rate loans and bond purchases to public agencies for planning, design, construction, and implementation of the following water quality improvement projects:

- Wastewater collection, treatment, water reuse, and disposal systems.
- Nonpoint source water pollution control projects.
- Development and implementation of management plans for federally designated estuaries in Oregon (Tillamook Bay and the lower Columbia River).

The U.S. Environmental Protection Agency requires the CWSRF program to develop a project priority list. Currently, the DEQ awards funding without regard to project score or ranking because the program has sufficient funds to finance all projects ready to proceed. This ensures the fund is utilized in a timely manner. In the event the program does not have sufficient funds available to offer funding to all projects that are ready to proceed, the DEQ will award funding to projects that are ready to proceed in priority order based on project score.

The CWSRF program charges interest rates that are calculated based on criteria defined in Oregon Administrative Rules 340-054-0065. Different interest rates and other financial terms apply to different types of loans and to loans of differing repayment periods. Rates are adjusted quarterly, based on the average Bond Buyer rates of the previous quarter, as published by the Federal Reserve. The average interest rate on CWSRF loans in 2021 was less than 2 percent, though rates are increasing due to the current economic environment. Current interest rates can be found on the DEQ's website: https://www.oregon.gov/deq/wq/cwsrf/Pages/CWSRF-Rates.aspx. Once a loan is signed, the interest rate is fixed for the life of the loan.

For design and construction loans, an annual fee equal to 0.5 percent of the unpaid balance is collected once annually. A loan reserve equal to one-half of the debt service is called out in the borrower's financial statements.

The CWSRF program can also sometimes provide principal forgiveness in combination with a loan for eligible communities. To be eligible, the project must either support a community with an MHI below the statewide rate or meet Green Project guidelines. The CWSRF program has a limited amount of money available for principal forgiveness each year. If the community is eligible and money is available at the time of loan signing, the DEQ can offer principal forgiveness for 50 percent of the loan amount, for a maximum amount of $500,000. Based on the 2020 American Community Survey 5-year Estimates, the 2020 MHI for the City of Sisters was $75,662, while the 2020 MHI for the state of Oregon was $65,667.

The CWSRF program is anticipated to be a low-interest loan source for the City of Sisters.

Summary of Federal Grant and Loan Programs

Rural Development

RD can provide financial assistance to communities with a population of less than 10,000 through both loans and direct grants. Under the loan program, the agency purchases local bonds. The interest rate for these bonds is dependent on the MHI of the community and other factors and varies from year to year based on other economic factors nationally. The market interest rate varies but has recently been approximately 2.5 to 3.5 percent with a repayment period of up to 40 years. Applying for this type of funding is a lengthy process involving development of an environmental report and a detailed funding application.

RD presently requires communities to establish average residential user costs in the range of similar systems with similar demographics. The objective of the RD loan/grant program is to keep the cost for utilities in small, rural communities at a level similar to what other communities are paying. Based on the City's MHI, it will likely not qualify for RD grants.

Another of the agency's requirements is that loan recipients establish a reserve fund of 10 percent of the bond repayment during the first 10 years of the project, which can make the net interest rate higher. The RD program requires either revenue or general obligation bonds to be established through the agency for the project (refer to the Local Financing Options section of this section for further discussion). These bonds can usually be purchased for a period of 40 years if grant funding is also received. A loan from RD may be an option for the City of Sisters to implement WWSI.

U.S. Economic Development Administration

The EDA has grant and loan funds like those available through Business Oregon's SPWF program. Monies are available to public agencies to fund projects that stimulate the economy of an area, and the overall goal of the program is to create or retain jobs. The EDA helps fund public works improvement projects in areas where new industries are locating or plan to locate in the future. In addition, the agency has a program known as the Public Works Impact Program to fund projects in areas with extremely high rates of unemployment. This program is targeted toward creating additional jobs and reducing the unemployment rate in the area. Unless the City's WWSI can be linked directly to industrial expansion or job retention, the City will likely not be in a competitive position to receive funding under these EDA programs.

Funding Summary

The DEQ's CWSRF program and RD appear to be the most attractive funding sources for the City's WWSI project. These programs appear to be funding sources that can provide the needed funds to potentially make the proposed improvements financially feasible for the City.

It is important for the City to consult with funding agencies early in the project development stages to understand which funding programs would provide the most attractive funding package for the proposed improvements. This consultation with funding agencies is usually done at a One Stop meeting, which is described in more detail later in this section. The remainder of this section focuses on evaluating loan capacities and funding options for the City's WWSI project, assuming the project is funded with a loan only and considering the programs' eligibility criteria described above.

Debt Capacity

To determine the City's ability to fund a WWSI project, Figures 7-1 and 7-2 were prepared. Figure 7-1 outlines the amount of debt capacity the City could service via their monthly sewer receipts, while Figure 7-2 outlines the amount of system development charge (SDC) revenue that would be required to service and/or offset loans of various quantities. Several assumptions were made, as follows:

- Wastewater user fee revenue is based on 2,228 equivalent dwelling units (EDUs).
- Wastewater system expenditures for the budget year 2021-22 were set at $1,362,568 per year. The budget year 2021-22 was used, as this was the most recent budget information available as provided by the City.
- Future debt service was calculated based on RD financing of 4 percent interest for a 40-year repayment period, a typical Business Oregon loan at 4 percent interest for a 20-year repayment period, and a CWSRF loan at 3 percent interest for a 20-year repayment period, depending on which financing program is able to assist the City.

Since the majority of the proposed improvements are required to increase the capacity of the City's wastewater collection, treatment, and disposal systems due to the substantial growth occurring and that is projected to continue, the majority of the proposed improvements are eligible for reimbursement by SDC revenue. Based on the components of each proposed improvements project that are required to address the need for additional capacity, Table 6-2 summarizes the amount of each capital improvement that would be eligible for different City revenue sources.

TABLE 6-2
CAPITAL IMPROVEMENTS BREAKDOWN BY REVENUE STREAM

Improvement	Anticipated Cost (2022 Dollars)	Sewer Operating Fund Eligible	Sewer Development Charge Eligible	Park Development Fund Eligible
Lazy Z Ranch Phase 1	$5,130,000	$0	$4,617,000	$513,000
Rope Street Lift Station Improvements	$624,000	$624,000	$0	$0
Westside Lift Station	$2,165,000	$0	$2,165,000	$0
Creekside Court Lift Station	$1,159,000	$1,159,000	$0	$0
Biosolids Removal	$200,000	$200,000	$0	$0
Lagoons No. 2 and 3 Aerator Replacement	$443,000	$221,500	$221,500	$0
Lazy Z Ranch Phase 2	$620,000	$0	$620,000	$0
Chlorine Contact System Improvements	$97,000	$97,000	$0	$0
Headworks Improvements	$471,000	$471,000	$0	$0
TOTAL IMPROVEMENTS COST	**$10,909,000**	**$2,772,500**	**$7,623,500**	**$513,000**

As shown on Table 6-2, approximately $7,623,500 (approximately 70 percent of the projected costs associated with the Capital Improvements Plan [CIP]) would be eligible for SDC revenue reimbursement. Additionally, based on the CIP outlined on Table 6-1 in Section 6 and the information presented on Table 6-2, a total of $9,078,000 is anticipated to be required for the short-term improvements (all projects planned for implementation within the next five years). Of the $9,078,000, $1,783,000 must be entirely paid for by the Sewer Operating Fund, while $6,782,000 would be eligible for SDC reimbursement and $513,000 would be eligible for reimbursement from the City's Park Development Fund.

Based on the financing information available when this WWFP Update was prepared and on Figures 7-1 and 7-2, wastewater rates could be approximately $60 per month for the estimated total project cost of $9,078,000, if the entire project were funded with only a loan and no reserve or SDC funds were used to reduce the loan. However, the City has already accumulated a Sewer Operating Fund reserve of more than $1.5 million and an SDC reserve of approximately $2.5 million. Additionally, the City has an annual capital improvements budget of $353,000 and secured, via an agreement with the U.S. Forest Service, approximately $200,000 for construction of the Westside Lift Station. To adequately cover the $7,623,500 of SDC-eligible project costs without using the City's Sewer Operating Fund but instead allocating the $2.5 million dollars of SDC reserve to help cover the construction costs, the City would likely need to generate approximately $475,000 in annual SDC revenue based on the interest rate assumptions outlined above. Due to the existing economic climate, interest rates have been rising. As such, it is key the City set up a One Stop meeting with funding agencies as soon as possible to begin the process for securing low-interest loans.

Additional analysis should be performed during the next revision of this WWFP Update to determine the funding requirements and/or rate impacts for the remaining projects outlined in the CIP presented on Table 6-1. As these additional costs are much smaller than the short-term projects and the need for these projects may occur after existing debt service has been paid off, these long-term projects are anticipated to have a much lower impact on the City's sewer rates.

Therefore, the City's portion of the debt service income would be less than shown herein. In addition, retiring of an older existing debt payment will free up income to help support new debt. These potential rates confirm that it is important for the City to pursue lower interest rates to assist with project financing. As the City meets with the funding agencies and applies for loans, a more precise estimation of the impact to the City's sewer rates can be determined.

It is important to note that the estimated loan capacities shown on Figure 7-1 are based on the current EDU estimate and may need to be verified as project funding proceeds. It should be recognized that this is only a preliminary analysis and the financial assumptions and figures presented in this WWFP Update should be refined as project implementation proceeds in the future and as agreements are drafted with funding agencies.

Project Funding Options

To complete all the recommended improvements, low interest loan funds will need to be acquired. Actual funding amounts and breakdowns will be based on a financial review completed by each agency and could vary from the estimated amounts shown herein. Other potential funding measures may be available to the City to reduce the potential rate increase impact on the City's customers. It will be important for the City to work directly with a Business Oregon regional development officer, RD area specialist, and DEQ finance administrators to evaluate these options.

Project One Stop Meeting

To evaluate all potential project funding options, a One Stop meeting is generally requested by a city. One Stop meetings are often scheduled in Salem or the city, upon request, where representatives of RD, Business Oregon, and other funding agencies meet with the city to discuss the project and funding needs. This joint meeting provides a forum to evaluate and identify the most suitable funding package for the project and the city. After the meeting, the city is usually invited to submit a funding application to the preferred funding program(s) identified in the One Stop meeting.

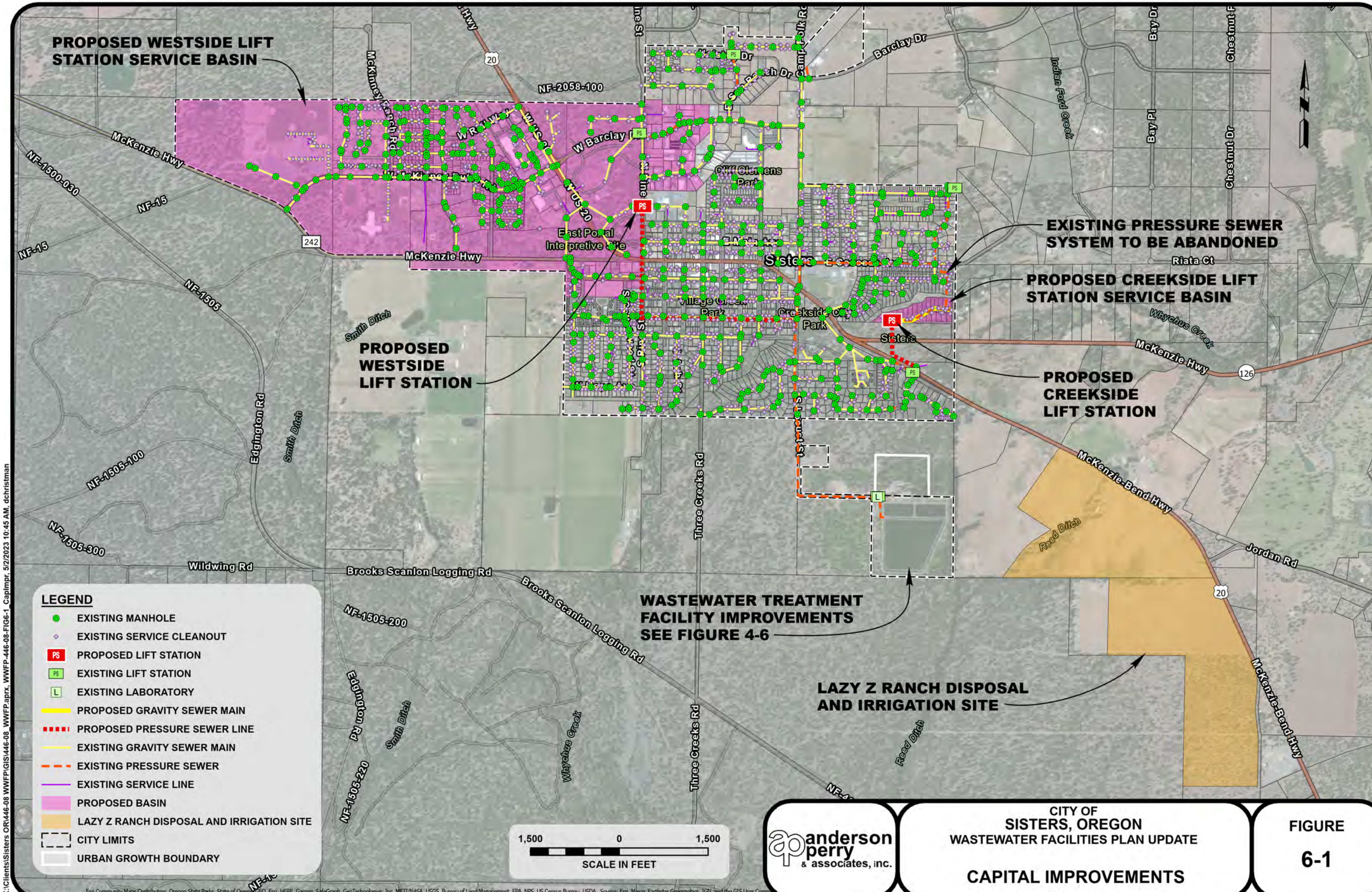
Local Financing Options

Regardless of the ultimate project scope and agency from which loan funds may be obtained, the City of Sisters may need to develop authorization to incur debt (i.e., bonding) for the needed project improvements. The need to develop authorization to incur debt depends on funding agency requirements and provisions in the City Charter. RD requires a city to obtain bonding authorization to incur debt.

There are generally two options a city may use for its bonding authority: general obligation bonds and revenue bonds. General obligation bonds require a vote of the people to give the City the authority to repay the debt service through tax assessments, sewer rate revenues, or a combination of both. The taxing authority of the City provides the guarantee for the debt. Revenue bonds are financed through revenues of the wastewater system. Authority to issue revenue bonds can come in two forms. One would be through a local bond election similar to that needed to sell a general obligation bond, and the second would be through council action authorizing the sale of revenue bonds, if the City Charter allows. If citizens do not object to the bonding authority resolution during a 60-day remonstrance period, the City would have authority to sell these revenue bonds.

The RD program accepts either revenue bonds or general obligation bonds. Bonding is not required for the Business Oregon and CWSRF programs. Due to current tax measure limitations in the state of Oregon, careful consultation with experienced, licensed bonding attorneys needs to be made if the City of Sisters begins the process of obtaining bonding authority for the proposed WWSI. It would be wise for the City to consult their City Charter and attorney to see if debt for the wastewater system can be assumed.

In addition, the City can utilize SDCs to help fund projects that address growth-related capacity needs. SDCs are charges established by a city that developers must pay in order to connect to the sewer system.



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Section 7 - Conclusions and Recommendations

Based on the Capital Improvements Plan, included on Table 7-1, a majority of the proposed improvements will be implemented in the short term. As a result, the City will want to pursue funding quickly to allow the expeditious implementation of the short-term capital improvements.

TABLE 7-1
CAPITAL IMPROVEMENTS PLAN

Improvement	Implementation Time Frame	Anticipated Cost (2022 Dollars)
Lazy Z Ranch Phase 1	Less than Five Years	$5,130,000
Rope Street Lift Station Improvements	Less than Five Years	$624,000
Westside Lift Station	Less than Five Years	$2,165,000
Creekside Court Lift Station	Less than Five Years	$1,159,000
Biosolids Removal	Five to Ten Years	$200,000
Lagoons No. 2 and 3 Aerator Replacement	Five to Ten Years	$443,000
Lazy Z Ranch Phase 2	More than Ten Years	$620,000
Chlorine Contact System Improvements	More than Ten Years	$97,000
Headworks Improvements	More than Ten Years	$471,000
TOTAL IMPROVEMENTS COST		**$10,909,000**

As discussed previously, the City of Sisters will need to coordinate directly with the Oregon Department of Environmental Quality (DEQ), U.S. Department of Agriculture Rural Development, and Business Oregon to pursue federal, state, and potentially local financing opportunities provided through low interest loans and potential grants. The proposed project implementation schedule has been included as Table 7-2.

TABLE 7-2
PROJECT IMPLEMENTATION PLAN

Item No.	Implementation Item	Time Frame
1.	Submit draft Wastewater Facilities Plan (WWFP) Update to City and agencies for review.	May 2023
2.	Finalize and adopt the WWFP Update.	Spring/Summer 2023
3.	Attend One Stop meeting.	Summer 2023
4.	Prepare and submit funding application(s) to appropriate agency(ies).	Summer/Fall 2023
5.	Finalize project funding.	Winter 2024
6.	Design system improvements.	Winter 2024 through Summer 2024
7.	Submit design documents for agency(ies) review.	Summer 2024
8.	Advertise, bid, and award construction project.	Winter 2024-25
9.	Project construction.	Winter 2025 through Winter 2026
10.	Project startup and construction completion.	Spring 2026
11.	Project closeout.	Summer 2026

Item No.	Implementation Item	Time Frame
12.	Monitor system performance to determine impact of improvements, report impacts to the DEQ, and determine the need for future improvements.	Two years after project closeout

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
PRELIMINARY SEWER RATE ANALYSIS FOR LOAN CAPACITY

RATE[1]		REVENUE		EXPENDITURES			FINANCING OPTIONS		
Account Charge (per month)	Total EDUs	Sewer Receipts[2]	Other[3]	Estimated OM&R Costs[4]	Existing Debt Service[5]	Revenue Available for Future Debt Service[6]	RD Loan Capacity[7]	Typical Business Oregon Loan Capacity[8]	CWSRF Loan Capacity[9]
$ 40.78	2,228	$ 1,090,500.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 159,932.00	$ -	$ -	$ -
$ 49.00	2,228	$ 1,310,064.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 379,496.00	$ 7,511,000.00	$ 5,157,000.00	$ 5,646,000.00
$ 50.00	2,228	$ 1,336,800.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 406,232.00	$ 8,040,000.00	$ 5,521,000.00	$ 6,044,000.00
$ 51.00	2,228	$ 1,363,536.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 432,968.00	$ 8,570,000.00	$ 5,884,000.00	$ 6,441,000.00
$ 52.00	2,228	$ 1,390,272.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 459,704.00	$ 9,099,000.00	$ 6,248,000.00	$ 6,839,000.00
$ 53.00	2,228	$ 1,417,008.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 486,440.00	$ 9,628,000.00	$ 6,611,000.00	$ 7,237,000.00
$ 54.00	2,228	$ 1,443,744.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 513,176.00	$ 10,157,000.00	$ 6,974,000.00	$ 7,635,000.00
$ 55.00	2,228	$ 1,470,480.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 539,912.00	$ 10,686,000.00	$ 7,338,000.00	$ 8,033,000.00
$ 56.00	2,228	$ 1,497,216.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 566,648.00	$ 11,216,000.00	$ 7,701,000.00	$ 8,430,000.00
$ 57.00	2,228	$ 1,523,952.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 593,384.00	$ 11,745,000.00	$ 8,064,000.00	$ 8,828,000.00
$ 58.00	2,228	$ 1,550,688.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 620,120.00	$ 12,274,000.00	$ 8,428,000.00	$ 9,226,000.00
$ 59.00	2,228	$ 1,577,424.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 646,856.00	$ 12,803,000.00	$ 8,791,000.00	$ 9,624,000.00
$ 60.00	2,228	$ 1,604,160.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 673,592.00	$ 13,332,000.00	$ 9,154,000.00	$ 10,021,000.00
$ 61.00	2,228	$ 1,630,896.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 700,328.00	$ 13,861,000.00	$ 9,518,000.00	$ 10,419,000.00
$ 62.00	2,228	$ 1,657,632.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 727,064.00	$ 14,391,000.00	$ 9,881,000.00	$ 10,817,000.00
$ 63.00	2,228	$ 1,684,368.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 753,800.00	$ 14,920,000.00	$ 10,244,000.00	$ 11,215,000.00
$ 64.00	2,228	$ 1,711,104.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 780,536.00	$ 15,449,000.00	$ 10,608,000.00	$ 11,612,000.00
$ 65.00	2,228	$ 1,737,840.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 807,272.00	$ 15,978,000.00	$ 10,971,000.00	$ 12,010,000.00
$ 66.00	2,228	$ 1,764,576.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 834,008.00	$ 16,507,000.00	$ 11,334,000.00	$ 12,408,000.00
$ 67.00	2,228	$ 1,791,312.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 860,744.00	$ 17,037,000.00	$ 11,698,000.00	$ 12,806,000.00
$ 68.00	2,228	$ 1,818,048.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 887,480.00	$ 17,566,000.00	$ 12,061,000.00	$ 13,203,000.00
$ 69.00	2,228	$ 1,844,784.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 914,216.00	$ 18,095,000.00	$ 12,424,000.00	$ 13,601,000.00
$ 70.00	2,228	$ 1,871,520.00	$ 79,000.00	$ 677,323.00	$ 332,245.00	$ 940,952.00	$ 18,624,000.00	$ 12,788,000.00	$ 13,999,000.00

Notes:

[1] The current base rate for wastewater is $40.78 per month per EDU.

[2] Budgeted revenue for the 2021-22 fiscal year from sewer receipts.

[3] Budgeted revenue for the 2021-22 fiscal year from service charges, licenses and fees, intergovernmental income, interest/loan proceeds, and miscellaneous income sources.

[4] Budgeted OM&R costs for the 2021-22 fiscal year (includes personnel services, materials and services, and capital improvements).

[5] Budgeted debt service for the 2021-22 fiscal year.

[6] Revenue available for future debt service = Sewer Receipts + Other revenue sources - Estimated OM&R Costs - Existing Debt Service. Does not include future increases in OM&R costs.

[7] Assumes loan funding at 4 percent for 40 years (does not assume any reserve payment). Values rounded to nearest $1,000.

[8] Assumes loan funding at 4 percent for 20 years (does not assume any reserve payment). Values rounded to nearest $1,000.

[9] Assumes loan funding at 3 percent for 20 years (does not assume any reserve payment). Values rounded to nearest $1,000.

CWSRF = Clean Water State Revolving Fund
EDU = equivalent dwelling unit
OM&R = Operation, maintenance, and replacement
RD = Rural Development

anderson perry & associates, inc.

CITY OF
SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
PRELIMINARY SEWER RATE ANALYSIS
FOR LOAN CAPACITY

FIGURE
7-1

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
PRELIMINARY SYSTEM DEVELOPMENT CHARGE REVENUE ANALYSIS
FOR LOAN CAPACITY

REVENUE ANALYSIS			FINANCING OPTIONS		
SDC Revenue[1]	Existing Debt Service[2]	Revenue Available for Future Debt Service[3]	RD Loan Capacity[4]	Typical Business Oregon Loan Capacity[5]	CWSRF Loan Capacity[6]
$ 150,000.00	$ 76,000.00	$ 74,000.00	$ -	$ -	$ -
$ 175,000.00	$ 76,000.00	$ 99,000.00	$ 1,959,000.00	$ 1,345,000.00	$ 1,473,000.00
$ 200,000.00	$ 76,000.00	$ 124,000.00	$ 2,454,000.00	$ 1,685,000.00	$ 1,845,000.00
$ 225,000.00	$ 76,000.00	$ 149,000.00	$ 2,949,000.00	$ 2,025,000.00	$ 2,217,000.00
$ 250,000.00	$ 76,000.00	$ 174,000.00	$ 3,444,000.00	$ 2,365,000.00	$ 2,589,000.00
$ 275,000.00	$ 76,000.00	$ 199,000.00	$ 3,939,000.00	$ 2,704,000.00	$ 2,961,000.00
$ 300,000.00	$ 76,000.00	$ 224,000.00	$ 4,434,000.00	$ 3,044,000.00	$ 3,333,000.00
$ 325,000.00	$ 76,000.00	$ 249,000.00	$ 4,928,000.00	$ 3,384,000.00	$ 3,704,000.00
$ 350,000.00	$ 76,000.00	$ 274,000.00	$ 5,423,000.00	$ 3,724,000.00	$ 4,076,000.00
$ 375,000.00	$ 76,000.00	$ 299,000.00	$ 5,918,000.00	$ 4,064,000.00	$ 4,448,000.00
$ 400,000.00	$ 76,000.00	$ 324,000.00	$ 6,413,000.00	$ 4,403,000.00	$ 4,820,000.00
$ 425,000.00	$ 76,000.00	$ 349,000.00	$ 6,908,000.00	$ 4,743,000.00	$ 5,192,000.00
$ 450,000.00	$ 76,000.00	$ 374,000.00	$ 7,402,000.00	$ 5,083,000.00	$ 5,564,000.00
$ 475,000.00	$ 76,000.00	$ 399,000.00	$ 7,897,000.00	$ 5,423,000.00	$ 5,936,000.00
$ 500,000.00	$ 76,000.00	$ 424,000.00	$ 8,392,000.00	$ 5,762,000.00	$ 6,308,000.00
$ 525,000.00	$ 76,000.00	$ 449,000.00	$ 8,887,000.00	$ 6,102,000.00	$ 6,680,000.00
$ 550,000.00	$ 76,000.00	$ 474,000.00	$ 9,382,000.00	$ 6,442,000.00	$ 7,052,000.00
$ 575,000.00	$ 76,000.00	$ 499,000.00	$ 9,877,000.00	$ 6,782,000.00	$ 7,424,000.00
$ 600,000.00	$ 76,000.00	$ 524,000.00	$ 10,371,000.00	$ 7,121,000.00	$ 7,796,000.00
$ 625,000.00	$ 76,000.00	$ 549,000.00	$ 10,866,000.00	$ 7,461,000.00	$ 8,168,000.00
$ 650,000.00	$ 76,000.00	$ 574,000.00	$ 11,361,000.00	$ 7,801,000.00	$ 8,540,000.00
$ 675,000.00	$ 76,000.00	$ 599,000.00	$ 11,856,000.00	$ 8,141,000.00	$ 8,912,000.00
$ 700,000.00	$ 76,000.00	$ 624,000.00	$ 12,351,000.00	$ 8,480,000.00	$ 9,284,000.00

Notes:

[1]SDC Revenue quantity does not necessarily reflect an actual regular revenue but is instead meant to demonstrate hypothetical revenues required for various loan repayments.

[2]Existing debt service is from the City's purchase of the Lazy Z Ranch property.

[3]Revenue available for future debt service = SDC Revenue - Existing Debt Service.

[4]Assumes loan funding at 4 percent for 40 years (does not assume any reserve payment). Values rounded to nearest $1,000.

[5]Assumes loan funding at 4 percent for 20 years (does not assume any reserve payment). Values rounded to nearest $1,000.

[6]Assumes loan funding at 3 percent for 20 years (does not assume any reserve payment). Values rounded to nearest $1,000.

CWSRF = Clean Water State Revolving Fund
RD = Rural Development
SDC = System Development Charge

Appendices Table of Contents

APPENDIX A
Water Pollution Control Facilities Permit

WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
475 NE Bellevue Dr. Suite 110, Bend, OR 97701
Telephone: 541-388-6146
(541) 388-6146
Issued pursuant to ORS 468B.050

ISSUED TO:

City of Sisters
P.O. Box 39
Sisters, OR 97759

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Method of Disposal
Domestic Sewage	001	Recycled Water Reuse

SYSTEM TYPE AND LOCATION:

Domestic Sewage Lagoons
912 S. Locust Street
T15S, R10 EWM, S09; TL 1002
Longitude -121.538480;
Latitude 44.280506
Sisters, Oregon

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub-Basin: Upper Deschutes
LLID: 1213357444600-20.47-N
County: Deschutes
Nearest surface stream which would receive waste if it were to discharge: Whychus Creek formally called Squaw Creek

Treatment System Class: I
Collection System Class: II

Issued in response to Application No. 968002 received December 17, 2010.

This permit is issued based on the land use findings in the permit record.

Don Butcher, Water Quality Permit Manager
Eastern Region

January 22, 2016
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

All direct a discharge to surface waters is prohibited.

SCHEDULE A

Waste Disposal Limitations

1. The permittee is authorized to construct, operate, and maintain wastewater collection, treatment and disposal systems to serve the City of Sisters in accordance with the conditions set forth in this permit.

2. The wastewater collections, treatment and land application system must not be hydraulically or organically loaded in excess of their respective, DEQ approved design capacities. At full build-out, however, the annual average daily influent flow must not exceed 0.38 MGD.

3. All wastewater treatment and disposal systems must be operated in compliance with the following conditions:

   a. No discharge to state waters is permitted. All wastewater must be stored and treated for disposal by land application following sound irrigation practices.

   b. Recycled Wastewater
      i. Prior to land application of the recycled water, it must receive at least Class D treatment as defined in OAR 340-055. Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample. Class C recycled water must not exceed a 7 day median of 23 organisms/100 milliliters and no two consecutive samples must exceed 240 organisms/100 milliliters.
      ii. Irrigation must conform to a Recycled Water Use Plan approved by DEQ and meet the required setbacks as defined in OAR 340-055.
      iii. The City of Sisters must restrict public access to the reuse site(s) for the protection of public health.
      iv. Treated effluent may only be irrigated on land between April 1 through October 31 for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices unless otherwise approved in writing by DEQ.
      v. Recycled water equipment must be operated so as to prevent:
         (A) Prolonged ponding of treated recycled water on the ground surface;
         (B) Surface runoff or subsurface drainage through drainage tile;
         (C) The creation of odors, fly and mosquito breeding or other nuisance conditions;
         (D) The overloading of land with nutrients, organics, or other pollutant parameters; and
         (E) Impairment of existing or potential beneficial uses of groundwater.
         (F) Until otherwise approved in writing by the Department via a revised reclaimed water use plan, treated effluent must only be reused on Class D beneficial uses.

4. The storage lagoon must be lowered sufficiently by the end of the irrigation season to ensure maximum practicable storage capacity during the non-irrigation months.

5. The permittee must, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

6. No activities must be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR 340-040).

SCHEDULE B

1. System Monitoring Requirements

The permittee must monitor the operation and efficiency of all treatment and disposal facilities. Sampling and measurements taken as required herein must be representative of the nature of the wastewater, and must be taken under normal operating conditions. Unless otherwise agreed to in writing by the Department of Environmental Quality, data collected, and submitted must include but not necessarily be limited to the following parameters and minimum frequencies:

a. Influent Monitoring and Reporting Requirements

Table B 1: Influent Monitoring

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Required Action	Report
Total Flow (MGD)	Year-round	Daily	Measurement	Daily totals Monthly maximum Monthly minimum Monthly average Monthly total
Flow Meter Verification	Year-round	Annually	Verification	Completed or not completed (Pass, Fail)
BOD_5 and TSS (mg/L)	Year-round	Weekly	Composite	Monthly averages Weekly values
pH (S.U.)	Year-round	3/week	Grab	Monthly maximum Monthly minimum Monthly average

b. Recycled Water Monitoring Requirements:

Table B2: Recycled Water Monitoring

Item or Parameter	Minimum Frequency	Sample Type/Required Action
Total Flow (MGD) or Quantity Irrigated (in/ac)	Daily	Measurement
Flow Meter Calibration	Annually	Verification
Chlorine, Total Residual (mg/L)	Daily	Grab
pH	3/Week	Grab
E. coli Bacteria	1/Week	Grab*
Total Coliform	1/Week	Grab*
Total P and Total N	Annually	Grab
Annual Irigation		

*The permittee is only required to sample for either E. coli or total coliform, but not both for an individual use. If the permittee is irrigating on crops requiring only Class D quality effluent, E. coli must be monitored. If the permittee irrigates/reuses effluent for Class C uses, total coliform must be monitored.

2. Reporting Procedures

a. Monitoring results must be reported on DEQ approved forms. Reports must be submitted to DEQ's Eastern Region – Bend office by the 15th day of the following month.

b. State monitoring reports must identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports must also identify each system classification as found on page one of this permit.

c. Monitoring reports must also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

d. The laboratory used by the permittee to analyze samples must have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results must be included in the report, but not used in calculations required by this permit. When possible, the permittee must re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

e. By no later than January 15 of each year, the permittee must submit to DEQ an annual report describing the effectiveness of the recycle water system to comply with the approved recycle water use plan, the rules of Division 55, and the limitations and conditions of this permit applicable to reuse of recycled water. The review is to provide a summary of land application conducted at each site which is adequate to demonstrate that reuse water was applied agronomically and/or hydraulic loading rates, and that required site management practices were followed.

SCHEDULE C

Compliance Conditions and Schedules

a. Within 180 days the permittee must update their recycled water use plan for DEQ approval. A recycled water use plan must describe how the wastewater treatment system owner will comply with OAR 340-055 (refer to OAR 340-055-0025).

b. The permittee is expected to meet the compliance date that have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director or his authorized representative may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. Prior to constructing or modifying any wastewater control facilities, detailed plans and specifications shall be approved in writing by DEQ. After approval of the plans, all construction shall be in strict conformance with the plans unless otherwise approved in writing by DEQ.

2. Within 6 months of such time as the sewage lagoons require removal of accumulated biosolids, the permittee shall submit a biosolids management plan that complies with the Department's biosolids management regulations as established in OAR 340-50.

3. This permit may be modified to incorporate any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

4. The permittee must, during all times of disposal, provide personnel to ensure the continuous performance of the disposal system within the limitations of this permit. In the event that any condition of this permit or DEQ rules are violated, the permittee must immediately take action to correct the violation and to notify DEQ **within 24 hours** at: DEQ's Eastern Region Water Quality Program Office (541) 388-6146.

   Response: In response to a notification, DEQ may conduct an investigation to evaluate the nature and extent of the problem, and may require additional corrective actions, as necessary. Compliance with this requirement does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

5. All materials and equipment, including but not limited to tanks, pumps, controls, valves, etc. must be installed, operated, and maintained in accordance with manufacturer's minimum specifications.

6. The permittee must immediately notify the DEQ Bend office (phone 388-6146) of any occurrence of surfacing sewage so corrective action can be coordinated between the permittee and DEQ. When the DEQ offices are not open, the permittee must report the incident to the Oregon Emergency Response System (phone 1-800-452-0311).

7. Emergency Response and Public Notification Plan

   a. The permittee must develop, and maintain and implement an Emergency Response and Public Notification Plan (the Plan) per Schedule F, Section B, and Conditions 5 & 6. The permit holder must develop the plan within six months of permit issuance and update the Plan annually to ensure that telephone and email contact information for applicable public agencies are current and accurate. An updated copy of the plan must be kept on file at the wastewater treatment facility for Department review. The latest plan revision date must be listed on the Plan cover along with the reviewer's initials or signature.

8. Recycled Water Use Plan

a. In order to distribute recycled water for reuse, the permittee must develop, have and maintain and implement a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025. The permittee must submit substantial modifications to an existing plan to DEQ for approval at least 60 days prior to making the proposed changes. Conditions in the Plan are enforceable requirements under this permit.

9. The permittee must meet the requirements for use of recycled water under Division 55, including the following:

a. All recycled water must be managed in accordance with the approved Recycled Water Use Plan. No substantial changes must be made in the approved plan without written approval by DEQ.

b. The permittee must notify DEQ within 24 hours if it is determined that the treated effluent is being used in a manner not in compliance with OAR 340-055. When the DEQ offices are not open, the permittee must report the incident of noncompliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

c. No recycled water must be made available to a person proposing to recycle unless that person certifies in writing that they have read and understand the provisions in Division 55. This written certification must be kept on file by the sewage treatment system owner and be made available to DEQ for inspection.

e. Treated effluent must not be irrigated on ground that is frozen, snow-covered, or saturated with water. The volume of irrigated effluent and its total nitrogen loading must not exceed that established in a DEQ-approved recycled water use plan.

f. Unless otherwise approved in writing by DEQ, a vegetative cover must be maintained on the land irrigation area at all times. Vegetation is to be periodically cut and removed to ensure maximum evapotranspiration and nutrient capture.

10. Operator Certification

The permittee must comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and designate a supervisor whose certification corresponds with the classification of the collection and/or treatment system as specified on page 1 of this permit.

a. Definitions

i. "Supervise" means to have full and active responsibility for the daily onsite technical operation of a wastewater treatment system or wastewater collection system.
ii. "Supervisor" or "designated operator", means the operator delegated authority by the permittee for establishing and executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system in accordance with the policies of the owner of the system and any permit requirements.
iii. "Shift Supervisor" means the operator delegated authority by the permittee for executing the specific practice and procedures for operating the wastewater treatment

system or wastewater collection system when the system is operated on more than one daily shift.

iv. "System" includes both the collection system and the treatment systems.

b. The permittee must have its system supervised by one or more operators who hold a valid certificate for the type of wastewater treatment or wastewater collection system, and at a grade equal to or greater than the wastewater system's classification as specified on page 1 of this permit.

c. The permittee's wastewater system may not be without the designated supervisor for more than 30 days. During this period, there must be another person available to supervisor who is certified at no more than one grade lower than the classification of the wastewater system. The permittee must delegate authority to this operator to supervise the operation of the system.

d. If the wastewater system has more than one daily shift, the permittee must have another properly certified operator available to supervisor operation of the system. Each shift supervisor, if any, must be certified at no more than one grade lower than the system classification.

e. The permittee is not required to have a supervisor on site at all times; however, the supervisor must be available to the permittee and operator at all times.

f. The permittee must notify DEQ in writing of the name of the system supervisor. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of operator in charge. As of this writing, the notice of replacement or re-designation must be sent to Water Quality Division, Operator Certification Program, 2020 SW 4th Avenue, Suite 400, Portland, OR 97201. This address may be updated in writing by DEQ during the term of this permit.

g. When compliance with paragraph (c) of Item 8 in this section is not possible or practicable because the system supervisor is not available or the position is vacated unexpectedly, and another certified operator is not qualified to assume supervisory responsibility, the Director may grant a time extension for compliance with the requirements in response to a written request from the system owner. The Director will not grant an extension longer than 120 days unless the system owner documents the existence of extraordinary circumstances.

11. DEQ may reopen the Schedules in this permit, if necessary, to include new or revised conditions.

12. If warranted, at any time, DEQ may evaluate the need for or require a full assessment of the facilty's impact on groundwater quality.

SCHEDULE F

WPCF GENERAL CONDITIONS – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit

The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and grounds for an enforcement action. Failure to comply is also grounds for the Department to modify, revoke, or deny renewal of a permit.

2. Property Rights and Other Legal Requirements

Issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other rights, or any infringement of federal, tribal, state, or local laws or regulations.

3. Liability

The Department of Environmental Quality or its officers, agents, or employees may not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities or systems because of this permit.

4. Permit Actions

After notice by the Department, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any term or condition of this permit, any applicable rule or statute, or any order of the Commission;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.

5. Transfer of Permit

This permit may not be transferred to a third party without prior written approval from the Department. The Department may approve transfers where the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of this permit and the rules of the Commission. A transfer application and filing fee must be submitted to the Department.

6. Permit Fees

The permittee must pay the fees required by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

At all times the permittee must maintain in good working order and properly operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to comply with the terms and conditions of this permit.

2. Standard Operation and Maintenance

All waste collection, control, treatment, and disposal facilities or systems must be operated in a manner consistent with the following:

a. At all times, all facilities or systems must be operated as efficiently as possible in a manner that will prevent discharges, health hazards, and nuisance conditions.

b. All screenings, grit, and sludge must be disposed of in a manner approved by the Department to prevent any pollutant from the materials from reaching waters of the state, creating a public health hazard, or causing a nuisance condition.

c. Bypassing untreated waste is generally prohibited. Bypassing may not occur without prior written permission from the Department except where unavoidable to prevent loss of life, personal injury, or severe property damage.

3. Noncompliance and Notification Procedures

If the permittee is unable to comply with conditions of this permit because of surfacing sewage; a breakdown of equipment, facilities or systems; an accident caused by human error or negligence; or any other cause such as an act of nature, the permittee must:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department's Regional office so that an investigation can be made to evaluate the impact and the corrective actions taken, and to determine any additional action that must be taken.

c. Within 5 days of the time the permittee becomes aware of the circumstances, the permittee must submit to the Department a detailed written report describing the breakdown, the actual quantity and quality of waste discharged, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or liability for failure to comply.

4. Wastewater System Personnel

The permittee must provide an adequate operating staff that is duly qualified to carry out the operation, maintenance, and monitoring requirements to assure continuous compliance with the conditions of this permit.

5. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B.6. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

6. Emergency Response and Public Notification Plan

The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:

a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

SECTION C. MONITORING AND RECORDS

1. Inspection and Entry

The permittee must at all reasonable times allow authorized representatives of the Department to:

a. Enter upon the permittee's premises where a waste source or disposal system is located or where any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy any records required by this permit;

c. Inspect any treatment or disposal system, practices, operations, monitoring equipment, or monitoring method regulated or required by this permit; or

d. Sample or monitor any substances or permit parameters at any location at reasonable times for the purpose of assuring permit compliance or as otherwise authorized by state law...

2. Averaging of Measurements

Calculations of averages of measurements required for all parameters except bacteria must use an arithmetic mean; bacteria must be averaged as specified in the permit.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures specified in the most recent edition of **Standard Methods for the Examination of Water and Wastewater**, unless other test procedures have been approved in writing by the Department and specified in this permit.

4. Representative Sampling

Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge when discharging or land applying. Monitoring points must not be changed without notification to and the approval of DEQ.

5. Retention of Records

The permittee must retain records of all monitoring and maintenance information, including all calibrations, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. The Department may extend this period at any time.

SECTION D. REPORTING REQUIREMENTS

1. Plan Submittal

Pursuant to Oregon Revised Statute 468B.055, unless specifically exempted by rule, construction, installation, or modification of disposal systems, treatment works, or sewerage systems may not commence until plans and specifications are submitted to aud approved in writing by the Department. All construction, installation, or modification shall be in strict conformance with the Department's written approval of the plans.

2. Change in Discharge

Whenever a facility expansion, production increase, or process modification is expected to result in a change in the character of pollutants to be discharged or in a new or increased discharge that will exceed the conditions of this permit, a new application must be submitted together with the necessary reports, plans, and specifications for the proposed changes. A change may not be made until plans have been approved and a new permit or permit modification has been issued.

3. Signatory Requirements

All applications, reports, or information submitted to the Department must be signed and certified by the official applicant of record (owner) or authorized designee.

4. Twenty-Four Hour Reporting

The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.

(1) Oral Reporting within 24 hours.

i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to DEQ.

a) The location of the overflow;
b) The receiving water (if there is one);
c) An estimate of the volume of the overflow;
d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and
e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:

a) The OERS incident number (if applicable) along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:

a) The OERS incident number (if applicable);
b) The cause or suspected cause of the overflow;
c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:

i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
ii. Any upset that exceeds any effluent limitation in this permit;
iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:

i. A description of the noncompliance and its cause;
ii. The period of noncompliance, including exact dates and times;
iii. The estimated time noncompliance is expected to continue if it has not been corrected;
iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
v. Public notification steps taken, pursuant to General Condition B.6.

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received
within 24 hours.

SECTION E. DEFINITIONS

1. *BOD_5* means five-day biochemical oxygen demand.
2. *TSS* means total suspended solids.
3. *FC* means fecal coliform bacteria.
4. *NH_3-N* means Ammonia Nitrogen.
5. *NO_3-N* means Nitrate Nitrogen.
6. *NO_2-N* means Nitrite Nitrogen.
7. *TKN* means Total Kjeldahl Nitrogen.
8. *Cl* means Chloride.
9. *TN* means Total Nitrogen.
10. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
11. *Total residual chlorine* means combined chlorine forms plus free residual chlorine.
12. *mg/l* means milligrams per liter.
13. *ug/l* means micrograms per liter.
14. *kg* means kilograms.
15. *GPD* means gallons per day.
16. *MGD* means million gallons per day.
17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
18. *Composite sample* means a combination of samples collected, generally at equal flow or time intervals over a 24-hour period.
19. *Week* means a calendar week of Sunday through Saturday.
20. *Month* means a calendar month.
21. *Quarter* means January through March, April through June, July through September, or October through December.

Permit Evaluation Report

Oregon Department of Environmental Quality
Eastern Region – Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

State of Oregon Department of Environmental Quality

Permittee:	City of Sisters P.O. Box 39 Sisters, OR 97759
File Information:	File Number: 81850 Permit Number: 101779 Expiration Date: December 31, 2025
Source Contact:	Paul Bertagna 541-323-5212
Facility Name & Location:	Sisters Wastewater Treatment Plant 912 S. Locust Street; Sisters OR 97759 T15S, R10EWM, S09; Tax Lot 1002 and 1002A1 Longitude -121.538480; Latitude 44.280506 Deschutes County
LLID:	LLID: 1213357444600-20.47-N
Receiving Stream/Basin:	Whychus Creek (no discharge) – formally called Squaw Creek; USGS Deschutes Basin; Upper Deschutes Sub-basin
Proposed Action:	Issue Permit Application Number: 968002 Date Received: December 17, 2010
Source Category:	Domestic
Sources Covered:	Domestic Sewage Lagoon and Irrigation Reuse
Permit Type:	WPCF-Domestic
Permit Writer:	Lawrence Brown REHS Environmental Health Specialist Date Prepared: November 13, 2015

Introduction

The City of Sisters operates a domestic sewage wastewater collection and treatment system under a DEQ Water Pollution Control Facility (WPCF) permit #101779 which was last issued on July 12, 2005. This permit has an expiration date of February 28, 2011. However, because DEQ received a timely WPCF permit renewal application from the City of Sisters their permit remains in effect pursuant to OAR 340-045-0040.

In response to the City of Sisters permit renewal application, I have drafted a proposed permit for permit issuance. My evaluation report describes any concerns as well as permit requirements for effluent limitations, monitoring and reporting, compliance schedules, and special conditions necessary to carry out state and federal law.

Land Use Approval

On file is a signed land use compatibility statement from the Deschutes County Planning Department dated July 26, 1999 for a municipal wastewater treatment facility indicating that the use is compatible with the Land Conservation and Development Commission-acknowledged comprehensive plan or complies with statewide planning goals.

Wastewater Treatment Facilities Description

The City of Sisters wastewater treatment system consists of a collection system that collects sewage and directs it to various pump stations where sewage is then pumped to a three-cell aerated lagoon system with winter holding capacity. The wastewater treatment plant and effluent reuse site for the City of Sisters is located on the south ½ of Section 9, Township 15 South, Range 10 East of the Willamette Meridian.

Treatment is provided with two 2.41 acre aerated lagoons followed by an 18 acre storage lagoon and 100.3 acres of land utilized for automated land irrigation reuse purposes (88.5 acres of natural forest land and 11.8 acres of lagoon dikes consisting of pasture grass). The land reuse system diverts the majority of the effluent to the natural forest area. Prior to land application of the recycled water to the forest area, it must receive at least Class D treatment as defined in OAR 340-055.

The City of Sisters uses chlorination to meet this treatment level Class D where Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and no more than 406 E. coli organisms per 100 milliliters in any single sample. With this level of treatment it is required that the site be restricted to public access for public health protection. Managing access and exposure to recycled water is the primary mechanism for protection of public health at reuse sites.

The City is currently limited to the quantity of treated effluent that can be land applied on the existing 100.3 acre land application reuse site. For future increase in flows the City looked at expanding their irrigation reuse sites to include the Lazy Z Ranch. This would allow for expansion of waste water disposal capacity and provide in-stream benefits to Whychus Creek by transferring irrigation water rights back to Whychus Creek.

The City of Sisters then purchased the Lazy Z Ranch property which includes both: T15, R10, S10; TL 704 (105.26 acres) and T15, R10, S15; TL 200 (125.68 acres) for a total of 230.94 acres. However, only TL 200 has received land use approval, to date, from Deschutes County - signed and dated August 6, 2008. The use of effluent on this property was found to be in compliance with applicable local land use regulations.

In November of 2006, DEQ evaluated the Lazy Z Ranch site for the use of recycled water for beneficial purposes. The soils mostly consist of a sandy loam to loamy sand ranging 30 to 45 inches in soil depth. DEQ determined that the site appeared to be suitable for the land application of treated effluent and should be able to support a crop for nutrient removal. However, before using this site the City is required to update their recycled water reuse plan for DEQ approval.

Environmental Issues
The aquifer, which will receive the percolate from the spray field is about 15 feet below the ground surface during the growing season. In review of their recycled water reuse plan and past operations DEQ has determined that the application rates and site management practices for the land application activities are protective of public health and have a low potential for adversely impacting groundwater quality.

Based on DEQ's screening criteria for groundwater review no further groundwater information is needed at this time. However, DEQ may evaluate the need for a full assessment of the facility's impact on groundwater quality at the next permit renewal or sooner if there is any evidence of an adverse impact resulting from the facilities operation or the facility fails to operate in accordance with permit conditions.

Compliance History
The most recent DEQ inspection was conducted on August 25, 2015. The City of Sisters was found to be in compliance with permit conditions. Additionally, no compliance issues have been documented in file for the permit period.

As a permit condition, the permittee must report incidents of noncompliance.

PROPOSED PERMIT LIMITS AND CONDITIONS

Schedule A - Waste Disposal Limitations
No discharge to state waters is permitted. All wastewater is treated in aerated lagoons, stored through the non-irrigation season and irrigated on DEQ approved land application sites following sound irrigation management practices. Additionally, the wastewater collections, treatment and land application system must not be hydraulically or organically loaded in excess of their respective, DEQ approved design capacities. Recycled water must conform to a recycled water use plan approved by DEQ. Prior to land application recycled water must be treated to at least Class D as stipulated in OAR 340-055.

Effluent is irrigated at agronomic rates and only during the irrigation season. In addition, the lagoon cells are lined to prevent leakage. Based upon this, the Department believes the proposed facility will have no adverse impact on groundwater quality and therefore complies with the Department's groundwater protection regulations in OAR 340-40.

Schedule B - Minimum Monitoring and Reporting Requirements
The monitoring requirements of Schedule B are the primary means of ensuring that permit limitations are being met. The monitoring data also provides DEQ with information to evaluate the performance of the wastewater treatment facility. The authority to require periodic reporting by permittee's is included in ORS 468.065(5). The proposed monitoring and reporting requirements are based upon DEQ's monitoring and reporting requirements for similar facilities of this type and size.

Schedule C - Compliance Conditions and Schedules:
DEQ is requesting that the permittee submit an updated water reuse plan for DEQ approval.

Schedule D - Special Conditions:
Prior to constructing new or modifying existing wastewater systems, detailed plans and specifications must be submitted to DEQ for review and approval in writing. Qualified personnel must also be available to operate and maintain the wastewater treatment system to help ensure that the wastewater treatment facility functions as designed. Additionally, this section includes operator certification requirements to assure an appropriate operator for this type of wastewater system. The operator certification level as

listed on the front page of the permit was calculated using DEQ's Certified Operator Determination Worksheet – See Appendix A of this evaluation report. This is a change from the prior permit where the number of people served has increased putting the collection system in a Class II category.

This schedule also contains the normal conditions for facilities that reuse reclaimed wastewater. DEQ is not requiring a biosolids management plan at this time since the system will not routinely remove, treat and dispose of biosolids. A plan will be required, however, at such time as biosolids are needed to be removed from the system.

Schedule F – General Conditions:
This schedule includes conditions and definitions that are applicable to all WPCF permits in Oregon of this type.

Public Participation
The City of Sisters has submitted a complete permit renewal application. DEQ should send the draft permit documents to the applicant for review and comment, and then proceed with a Category II permitting action for public notification.

Appendix A – Certified Operator Determination Worksheet

Oregon Department of Environmental Quality

Wastewater System Classification Worksheet for Operator Certification

STEP 1: Criteria for Classifying Wastewater Treatment Systems (OAR 340-049-0025)

Wastewater System Common Name:	Sisters Wastewater Treatment Plant		
Location:	912 S. Locust St.; Sisters OR 97759	Region:	Eastern Region
County:	Deschutes	Date:	
Facility ID:	File #81850; Permit #101779	Classified by:	LMB
Design ADWF (Influent MDG):	0.38 MGD	**WWC Class:**	II
Design Population*:	3747	WWT Class:	I
Design BOD (Influent lbs/day):		or SWWS:	
		If SWWS, connections:	
Is this a change from a prior classification?	Yes	Total Points:	26

1. Design Population	3747	or Population Equivalent		
Based on:	Flow (gallons/person/day)	99.3	BOD (pounds/person/day)	0.256

2,001 to 5,000	1.5	1.5
2. Average Dry Weather Flow (Design Capacity)		
Greater than 0.1 to 0.5 MGD	1.5	1.5
3. Unit Processes		
Preliminary Treatment and Plant Hydraulics		
Grit Removal (mechanical)	2.0	2.0
Screen(s) (in-situ or mechanical, coarse solids only)	1.0	1.0
Pump/Lift Station(s) (pumping of main flow)	2.0	2.0
Secondary, Advanced, and Tertiary Treatment		
Stabilization Lagoons (1 or more cells with primary aeration)	7.0	7.0
Disinfection		
Liquid Chlorine Disinfection	2.0	2.0
6. Sampling and Laboratory Testing		
Sample for BOD, Total Suspended Solids (performed by outside lab)	2.0	
BOD or Total Suspended Solids analysis (performed at treatment plant)	4.0	4.0
Bacteriological analysis (performed by outside lab)	1.0	
Bacteriological analysis (performed at wastewater treatment plant lab)	2.0	
Nutrient, Heavy Metals, or Organic analysis (performed by outside lab)	*3.0	1.0
STEP 2: Complexity Reflected in OAR 340-049 0020(4)		
Note: *This step may justify a higher classification. Points shown are given as guidance.*		
Class B, C, D and Non-disinfected Recycle (surface & subsurface)	3.0	3.0
Standby power	1.0 - 3.0	1.0
Description:		
	Total	26.0

Small Wastewater Treatment and Collection Systems			
less than 500 design population or < 150 connections, and 30 total points or less			
Wastewater Treatment Systems		**Wastewater Collection Systems**	
Class I:	30 total points or less	**Class I:**	1,500 or less design population
Class II:	31-55 total points	**Class II:**	1,501 15,000 design population
Class III:	56-75 total points	**Class III:**	15,001 to 50,000 design population
Class IV:	76 or more points	**Class IV:**	50,001 or more design population

APPENDIX B
2016 Recycled Water Use Plan

Oregon Department of Environmental Quality

RECYCLED WATER USE PLAN SUMMARY

Directions: Check (✓) appropriate boxes for tables and provide brief narrative where necessary. Submit with Recycled Water Use Plan to DEQ.

State of Oregon Department of Environmental Quality

APPLICANT INFORMATION

Facility Name: City of Sisters Waste Water Treatment Plant
Address: 912 S. Locust Street, Sisters OR 97759
Contact Name/Phone Number: Paul Bertagna/541-323-5212

TYPE OF WASTEWATER TREATMENT PLANT

☐	Activated Sludge	☐	Re-circulating Gravel/Sand Filter
☐	Mechanically Aerated Lagoon	☐	Rotating Biological Filter
☑	Aerated Lagoon	☐	Other (Specify):

Average Dry Weather Flow, million gallons per day (MGD): ______________________

TREATMENT CLASS IN ACCORDANCE WITH OAR 340-055-0012

☐	Class A	☐	Class C
☐	Class B	☑	Class D
☐	Non-Disinfected water		

TREATMENT EFFICIENCY CAPABILITY DURING REUSE

☐	Tertiary Treatment	☐	85% or more BOD/TSS removal
☐	95% or more BOD/TSS removal	☐	Rotating Biological Filter
☐	90% or more BOD/TSS removal	☑	Other (Specify): 80% TSS removal efficiency

DISINFECTION METHOD

☑	Chlorine injection just prior to irrigation
☐	Chlorine injection with storage of recycled water
☐	Chlorine injection after storage just prior to irrigation
☐	UV exposure just prior to irrigation
☐	UV exposure with storage of recycled water
☐	UV exposure after storage just prior to irrigation
☐	Other (specify):

STORAGE IMPOUNDMENT

	Y	N
Is there a storage facility proposed for this project?	☐	☑
If yes, at the WWTP	☐	☑
If yes, located at a location other than the WWTP	☐	☑
If yes to either of the above, specify the location and length of time the storage facility will be used:		

ARE THERE ALARMS FOR VARIOUS UNIT PROCESSES?	Y	N
Are alarms independent of the normal power supply of the plant?	☐	☑
Failure of a disinfection treatment process?	☑	☐
Failure of a clarification process? N/A	☐	☐
Failure of a coagulation process? N/A	☐	☐
Failure of a filtration process? N/A	☐	☐
Are the alarms on separate circuit breakers from the reuse pumps?	☑	☐
Is the Recycled Water back-up generator tested regularly? N/A	☐	☐

IN THE EVENT OF POWER LOSS:	Y	N
Can the plant continue to discharge?	☐	☑
Can there be any irrigation of non-disinfected water?	☐	☑
If no to either of the above, specify control measures that will be in place to stop the irrigation as soon as possible. The irrigation pumps cannot operate without power so the entire system will not run and the auto-dialer will call out to our on-call personnel that there has been a power outage.		

RECYCLED WATER WILL BE BENEFICIALLY USED FOR THE FOLLOWING (CHECK ALL THAT APPLY):

✓	Beneficial Purpose	Class A	Class B	Class C	Class D	Class ND
	Irrigation					
☑	Fodder, fiber, seed crops not intended for human ingestion, commercial timber	Y	Y	Y	Y	Y
☐	Firewood, ornamental nursery stock, Christmas trees	Y	Y	Y	Y	N
☐	Sod	Y	Y	Y	Y	N
☐	Pasture for animals	Y	Y	Y	Y	N
☐	Processed food crops	Y	Y	Y	N	N
☐	Orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil	Y	Y	Y	N	N
☐	Golf courses, cemeteries, highway medians, industrial or business campuses	Y	Y	Y	N	N
☐	Any agricultural or horticultural use	Y	N	N	N	N
☐	Parks, playgrounds, school yards, residential landscapes, other landscapes accessible to the public	Y	N	N	N	N
☐	**Industrial, Commercial, or Construction**					
☐	Industrial cooling	Y	Y	Y	N	N
☐	Rock crushing, aggregate washing, mixing concrete	Y	Y	Y	N	N
☐	Dust control	Y	Y	Y	N	N
☐	Nonstructural fire fighting using aircraft	Y	Y	Y	N	N
☐	Street sweeping or sanitary sewer flushing	Y	Y	Y	N	N
☐	Stand alone fire suppression systems in commercial and residential buildings	Y	Y	N	N	N
☐	Non-residential toilet or urinal flushing, floor drain trap priming	Y	Y	N	N	N
☐	Commercial car washing	Y	N	N	N	N
☐	Fountains when the water is not intended for human consumption	Y	N	N	N	N

✓	Beneficial Purpose	Class				
		A	B	C	D	ND
☐	**Impoundments or Artificial Groundwater Recharge**					
☐	Water supply for landscape impoundments including, but not limited to, golf course water ponds and non-residential landscape ponds	Y	Y	Y	N	N
☐	Restricted recreational impoundments	Y	Y	N	N	N
☐	Nonrestricted recreational impoundments including, but not limited to, recreational lakes, water features accessible to the public, and public fishing ponds	Y	N	N	N	N
☐	Artificial groundwater recharge	Y	N	N	N	N
☐	**Other (describe):**					

PAGES 4 & 5 REQUIRED FOR IRRIGATION ONLY

THE IRRIGATION AREA WILL BE USED FOR THE FOLLOWING (CHECK ALL THAT APPLY):

☑	Crops (specify types): Orchard Grass
☐	Pasture
☑	Forest
☐	Public access areas (specify types):
☐	Natural areas (specify species or mix):
☐	Other (specify):

APPLICATION RATE	**Y**	**N**
Will irrigation be controlled not to exceed the water consumption rate of the crop being grown?	☑	☐
Will irrigation be controlled not to exceed the nutrient requirements of the crop being grown?	☑	☐

What is the proposed application rate of the recycled water? Varies, see RWUP Section 7.0
Acreage of irrigation site Varies, see RWUP Section 7.0
The months that irrigation will be permitted April to October
If irrigation occurs with Class C recycled water at nighttime, will the public access be restricted to allow for sunlight contact on irrigated water? ☐ Yes ☐ No N/A
If so, specify length of time ____________

TRANSMISSION & DISTRIBUTION LINES/PIPES	**Y**	**N**
At the end of the irrigation day, will the transport lines/pipes be drained back to the wastewater treatment facility?	☐	☑
Is there a gate/ball shut off valve at the irrigation pump?	☑	☐
Is there an in line pressure relief valve to by-pass reuse water back into the source basin if there is a line transmission plug?	☐	☑
At the cessation of the irrigation season, will the transport lines/pipes be flushed and cleaned?	☐	☑
Is there a gate/ball shut off valve at the irrigation field, or at each irrigation zone?	☑	☐

ZONED LAND USE OF IRRIGATION SITE (CHECK ALL THAT APPLY)

☑	Exclusive Farm Use (EFU)	☐	Industrial
☐	Forestry	☐	State/Federal lands
☐	Rural Residential	☐	Other (Specify):

ZONED LAND USE OF AREA AROUND IRRIGATION SITE (CHECK ALL THAT APPLY)

☑	Exclusive Farm Use (EFU)	☐	Industrial
☐	Forestry	☐	State/Federal lands
☐	Rural Residential	☐	Other (Specify):

Prevailing wind direction during irrigation season (specify): North
Will irrigation be restricted when winds exceed 10 MPH?: Yes

THE NEAREST DEVELOPED PROPERTY FROM IRRIGATION SITE (ft):

North boundary: 1455' to TL 1510100000708
South boundary: 155' to TL 1510140000800 (SOUTHEAST)
East boundary: 120' to TL 1510140000400 AND TL 151040000300
West boundary: 1385' to TL 1510000001401 (NORTHWEST)
What is the nearest developed property downwind of irrigation site (specify type and distance): TL 1510100000708, Single Family Residence, zoned EFUSC.
Are there any playgrounds, schools, or public parks within ½ mile of irrigation site? (specify): No.

DOMESTIC WELLS

	Y	N
Are there any domestic wells or other domestic water sources located within the irrigation site?	☐	☑
Are there any domestic wells or other domestic water sources located within 150', 100, or 50' of the irrigation site?	☐	☑
If yes to either of the above, identify the number of wells or sources and identify their location on the attached site plan.		

POTENTIAL RUN-OFF POINTS ARE LOCATED AT THE (CHECK ALL THAT APPLY):

☐	North boundary (specify): ALL RUNOFF WILL BE CONTROLLED ON SITE
☐	South boundary (specify):
☐	East boundary (specify):
☐	West boundary (specify):

PUBLIC ACCESS WILL BE CONTROLLED BY THE FOLLOWING (CHECK ALL THAT APPLY):

☑	No trespassing or warning signs (specify spacing): 200'
☑	Fencing (specify type): Barb Wire
☐	Other (specify):

BARRIERS ON BOUNDARIES THAT MAY MITIGATE AEROSOL DRIFT (CHECK ALL THAT APPLY)

☑	Natural vegetation (specify height and width): Ponderosa Pine and Juniper, up to 2' diameter, and 50' height.
☐	Natural topography (specify):
☐	Tree or fence row (specify height):
☑	Other (specify): native shrubs and grasses
☐	None:

IRRIGATION METHOD (CHECK ALL THAT APPLY)

☑	Set sprinkler heads with spray height of 20'____ and spray diameter of 140'_____
☐	Wheel irrigation line with spray height of _____ and spray diameter of ______
☐	Big gun irrigation with spray height of _____ and spray diameter of ______
☐	Other (specify):

IRRIGATION EQUIPMENT SPECIFICATIONS (insert more rows as needed)

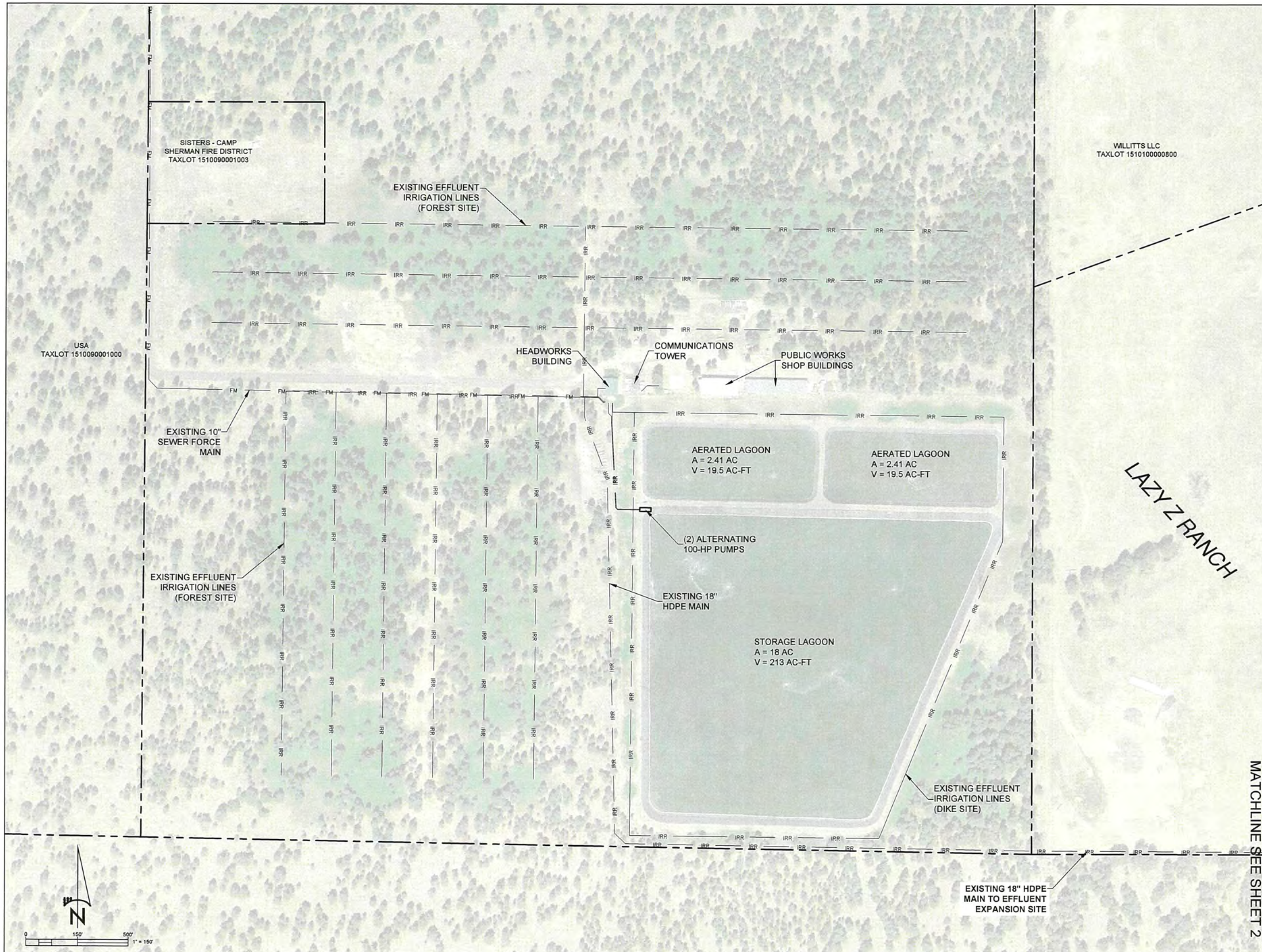
Sprinkler head types (brand and model)	Irrigation zones/cells	PSI operating ranges
RAINBIRD, RAIN GUN SR3003/F3002	4 - 6 Zones	40 TO 100 PSI

REQUIRED ATTACHEMENTS:

1. Overhead scale diagram/plan view of the wastewater treatment plant that identifies the treatment and disinfection components of the plant.
2. Overhead scale diagram/plan view of the transport line from wastewater treatment plant to the reuse area.
3. Overhead scale diagram/plan of the irrigation site showing surrounding properties and irrigation system layout.
4. A full copy of the Recycled Water Use Plan.

HEALTH DIVISION REVIEW COMMENTS:

Print Form



SITE NOTES:

GENERAL:

OWNER/APPLICANT:	CITY OF SISTERS
PROPERTY:	WASTE WATER TREATMENT PLANT
PROPERTY ADDRESS:	1000 SOUTH LOCUST ST., SISTERS, OR, 97759
PROPERTY SIZE:	108.60 ACRES
ZONING:	F1, PF, UAR10
TAXLOT NUMBER:	1510090001002

NOTE: SEE FIGURE 2: PROCESS SCHEMATIC IN THE RECYCLED WATER USE PLAN FOR TREATMENT AND DISINFECTION COMPONENTS OF THE PLANT.

LEGEND:

PROPERTY LINE
SETBACK LINE
IRR EXISTING IRRIGATION LINE
FM EXISTING SEWER FORCE MAIN

PRELIMINARY - NOT FOR CONSTRUCTION

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
0" 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER ... OREGON ... 31, 2007 ... J. HUFFMAN
PRELIMINARY
RENEWS: JUNE 30, 2017

CITY OF SISTERS INCORPORATED 1946

BECON
549 SW MILL VIEW WAY, SUITE 105
BEND, OREGON 97702
(541) 633-3140
www.beconeng.com

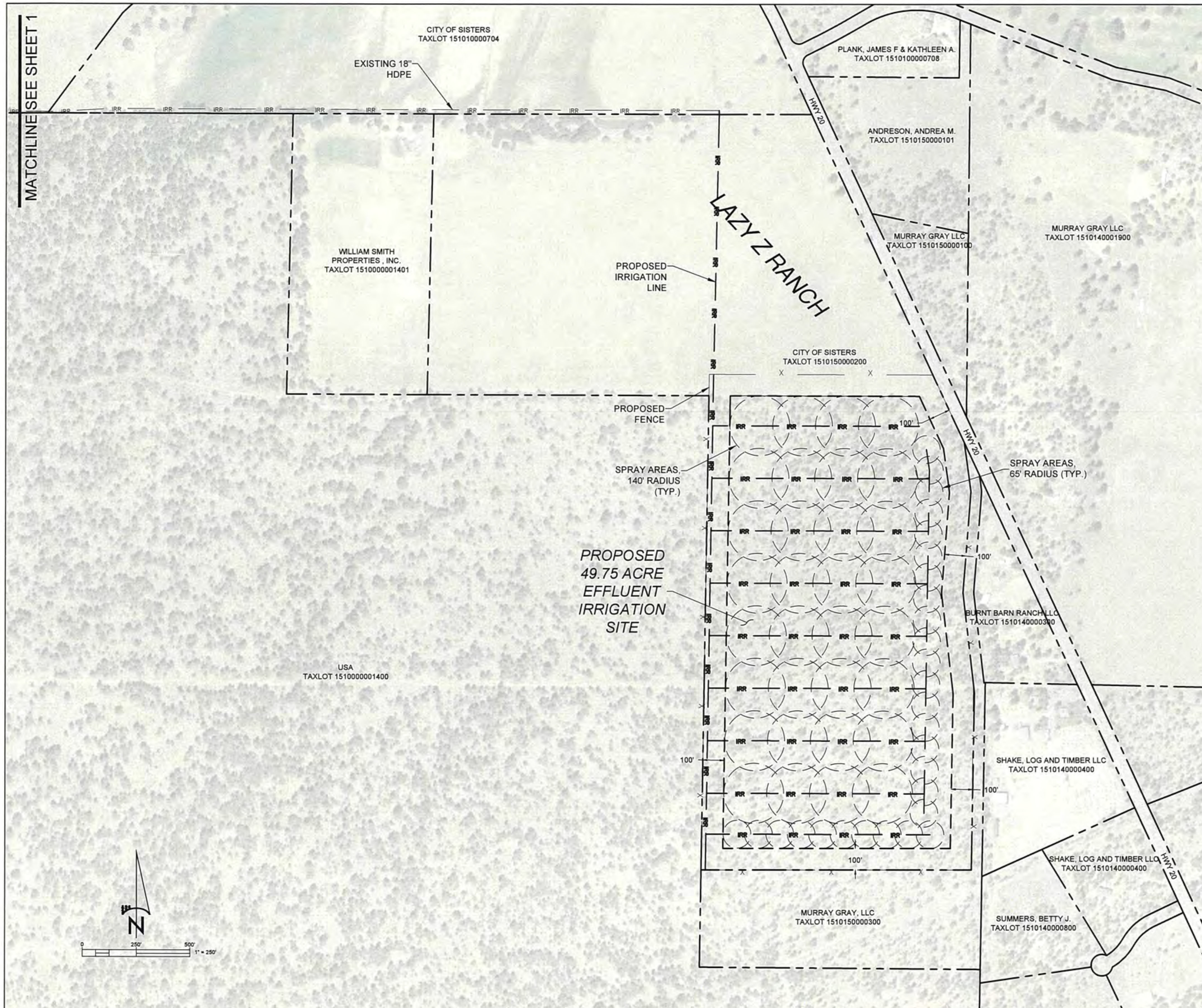
DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:
EJH	JLB	EJH	1" = 150'
DATE: 09 - 22 - 2016		PROJECT NO: 13702.119	

CITY OF SISTERS
RECYCLED WATER USE PHASE 1 EXPANSION

WASTE WATER TREATMENT PLANT

DRAWING NO. P1

SHEET NO. 1 of 2



SITE NOTES

GENERAL:

OWNER/APPLICANT:	CITY OF SISTERS
PROPERTY:	LAZY Z RANCH
PROPERTY ADDRESS:	68355 HWY 20, SISTERS, OR, 97759
PROPERTY SIZE:	125.68 ACRES
ZONING:	EFUSC
TAXLOT NUMBER:	1510150000200

PHASE 1 EFFLUENT IRRIGATION EXPANSION:

PROJECT AREA:	49.75 ACRES
IRRIGATION PIPE:	≈ 12,660 - LF
PROPERTY LINE SETBACK:	100 - FT

LEGEND:

- PROPERTY LINE
- SETBACK LINE
- IRR — PROPOSED EFFLUENT IRRIGATION LINE
- X — PROPOSED FENCE
- IRR — EXISTING IRRIGATION LINE
- SPRAY AREA

PRELIMINARY - NOT FOR CONSTRUCTION

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
0" 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — OREGON — J. HUFFMAN — PRELIMINARY
RENEWS: JUNE 30, 2017

CITY OF SISTERS INCORPORATED 1946

BECON
549 SW MILL VIEW WAY, SUITE 105
BEND, OREGON 97702
(541) 633-3140
www.beconeng.com

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:
EJH	JLB	EJH	1" = 250'
DATE: 09 - 22 - 2016		PROJECT NO: 13702.119	

CITY OF SISTERS
RECYCLED WATER USE PHASE 1 EXPANSION

SITE PLAN

DRAWING NO. P2

SHEET NO. 2 of 2

2016 Recycled Water Use Plan

City of Sisters, Oregon

October 2016

PREPARED BY:

BECON CIVIL ENGINEERING AND LAND SURVEYING

549 SW MILL VIEW WAY, 105

BEND, OREGON 97702

TABLE OF CONTENTS

Recycled Water Use Plan
For
City of Sisters
WPCF Permit No. 101779
File No. 81850

Facility: City of Sisters Wastewater Treatment Plant
912 S. Locust Street
Sisters, Oregon 97759

Physical Address:
1000 South Locust Street
Sisters, Oregon 97759

Mailing Address:
520 East Cascade, PO Box 39
Sisters, Oregon 97759

Contact: Paul Bertagna
Phone: 541.323.5212
Email: pbertagna@ci.sisters.or.us

October 2016

1.0 INTRODUCTION

1.1 OVERVIEW

The City of Sisters wastewater system operates under a Water Pollution Control Facilities Permit, Number 101779, which was last issued on January 22, 2016. An initial Wastewater Recycled Water use Plan was completed in April of 2002 by HGE Inc. for the irrigation of 100.3-Acres of land in the South ½ of Section 9. For future increase in flows the City is expanding their irrigation reuse sites to include the Lazy Z Ranch property. The property is City owned and includes both: T15, R10, S10; TL 704 (100.26 acres) and T15, R10, S15; TL 200 (125.68 acres) for a total of 225.64 acres. However, only TL 200 has received land use approval, to date, from Deschutes County - signed and dated August 6, 2008. The permit conditions require submission of an updated Recycled Water Use Plan (RWUP) prior to effluent discharge to the new site.

The City of Sisters 2016 Wastewater Capital Facilities plan identify the need to expand their effluent irrigation facilitates to obtain capacity for future flows. A wastewater reuse and conservation planning study, by Newton Consultants, Inc. (2013) was used to determine the feasibility for effluent irrigation in the Lazy Z property. Shown in Figure 1 are the City's existing wastewater system facilities and proposed irrigation expansion sites. Phase 1 (planned for 2017), Phase 2 (planned for 2031), and future phases (after 2035) are incorporated into this Recycled Water Use Plan update.

Recycled water usage of treated effluent will allow the City of Sisters to meet water quality standards of the State of Oregon, and to maintain compliance with conditions of the Water Pollution Control Facilities Permit. ***This RWUP supersedes any previous plans.***

1.2 CONTACTS

The City of Sisters is the end user and recycled water generator for the waste water treatment plant (WWTP), located at the following address:

1000 S Locust St.
Sisters, Oregon 97759

Paul Bertagna is the Public Works Director and WWTP operator, his contact information is listed below:

Director of Public Works
Paul Bertagna
(541) 323-5212
pbertagna@ci.sisters.or.us

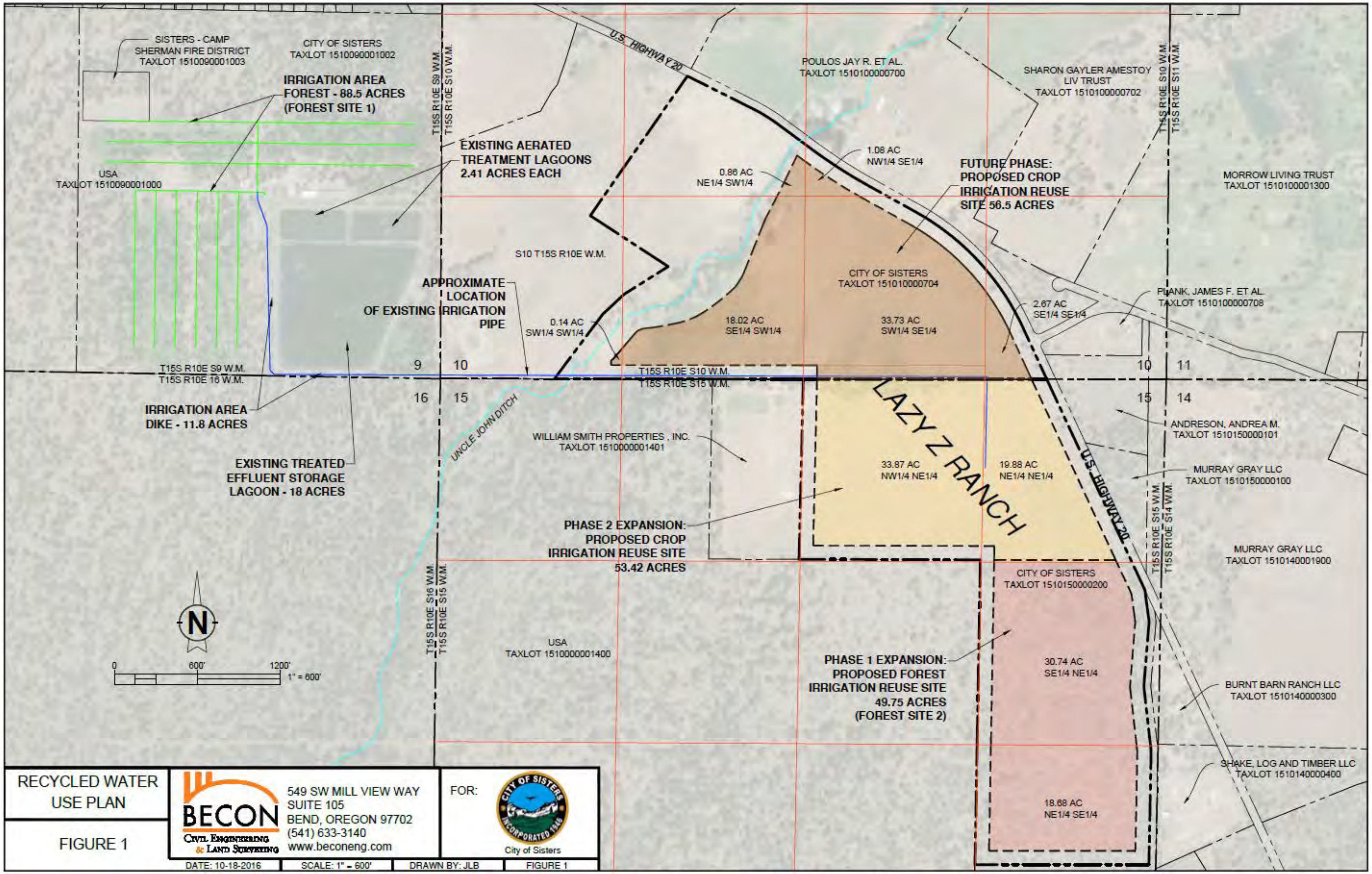


Figure 1: Recycled Water Use Plan Exhibit Map

2.0 BENEFICIAL PURPOSES

Beneficial purposes lie at the core of the recycled water use program and can influence wastewater treatment, monitoring, as well as public health and environmental concerns.

Beneficial Purpose	Class of Water	Quantity (mgd)	Frequency
• Irrigation of orchard grass • Compliance with WPCF permit, and to provide capacity for future wastewater flows.	D	0.522 mgd	April – October

3.0 WASTEWATER TREATMENT

3.1 EXISTING WASTEWATER SYSTEM

The City wastewater system has been operating since 2002. Gravity collection system piping varies from 6" to 24" diameter PVC wastewater mains, with four (4) wastewater pump stations. A 12" diameter pressure main of 9350 lineal feet carries wastewater flows from Pump Station # 1 in the City, directly to the Wastewater Treatment Plant. The wastewater treatment plant is a 3-cell aerated lagoon system with winter holding. Two aerated treatment cells are 2.41 acres, providing for a capacity of 19.5 Ac. Ft. An 18-acre aerated winter holding lagoon is provided for storage, containing 213 Ac. Ft. of storage.

Total inflow for the 2015 year was 70.8 million gallons, with a summer average of 233,570 gpd (gallons per day) and winter average of 153,770 gpd. Shown in Figure 2 is the process schematic for the City of Sisters WWTP.

3.2 EXISTING EFFLUENT IRRIGATION SYSTEM

The existing recycled water use irrigation site is a 108.60-Acre site on the South ½ of Section 9, T15S, 10E, W.M. Land reuse of the stored water is provided on 88.5 acres of natural forest and 11.8 acres of dike and lawn areas (100.3-Acres Total). Application is applied at agronomic rates. The existing (year 2002) recycled water use plan limits irrigation to 13.2 and 47.4 million gallons of dike and forest irrigation respectively. The treatment plant produces Class D quality for both the treated and recycled water. A full copy of the approved WPCF permit is in Appendix C of this document.

The irrigation site surrounds the wastewater treatment and holding ponds. Three separate irrigation systems are provided. Each of the two forest irrigation sites is served by a 10-inch diameter PVC irrigation header from the effluent pumps located in the control building. The dike irrigation system is fed through a looped 4-inch diameter irrigation system. A marking ribbon is buried with the pipe to indicate non-potable water. Two alternating 100 HP pumps are provided to deliver treated recycled water to the forest irrigation system, and a single 15 HP pump is provided to deliver water to the dike irrigation system. An existing pipeline exists on the Lazy Z Ranch property (see Figure I), which may be used for irrigation purposes.

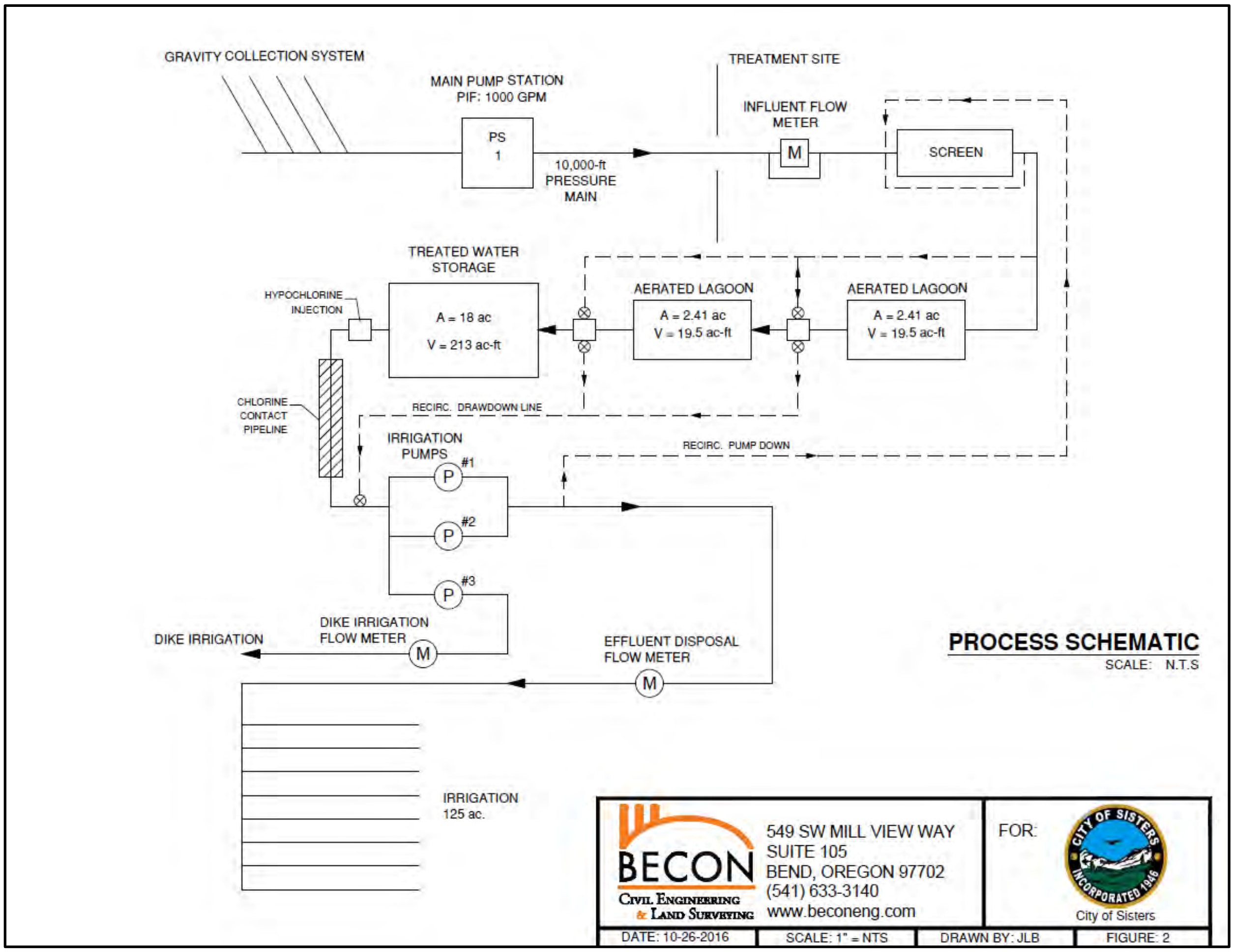


Figure 2: Water Treatment Plant Schematic

3.3 INFLUENT FLOW MEASUREMENT AND SAMPLING

Influent flow measurement is provided in the pump room of the control building for the wastewater treatment plant. The meter is an 8" ASA electromagnetic flow meter which has been calibrated annually since installation. Influent sampling is provided by an ISCO 3710FR refrigerated sampler located in the pump room of the control building at the treatment plant. This is a 24-hour composite sampler which provides composite data for influent BODs and TSS.

3.4 DISINFECTION FACILITIES

Disinfection of effluent at the Sisters plant is provided by chlorination, specifically through sodium hypo-chlorite. Equipment includes a Lightnin chemical mixer, a 500-gallon polyethylene sodium hypo-chlorite tank, a Wallace & Tiernan chemical feed pump, a Grundgs Fost back-up chemical feed pump, a Gas Mastrrr 3-hp flash mixer, a vacuum regulator, rate controller, ejector water supply system, and a chlorine contact pipeline. The chlorine contact pipeline is 1,140 feet of 36" PVC piping buried in the dike along the west side of lagoon # 1 and the holding pond. A Gas Mastrrr Series 32 chlorine induction feeder-flash mixer is provided in the transfer structure from the holding pond to the chlorine contact pipeline. This unit provides a positive flash mix of sodium hypo- chlorite solution which flows through the chlorine contact pipeline toward the land reuse system. A sampling tap is provided on the effluent (reuse) piping to allow for sampling of effluent pumped from the reuse pumps to either of the two reuse systems provided. Disinfection facilities are controlled through the SCADA system with the PLC provided.

3.5 EFFLUENT REUSE SYSTEM

The effluent reuse facilities are intended to discharge treated and disinfected effluent for land reuse through irrigation of both forest land and lagoon dikes and lawns on the treatment plant site. The effluent reuse system that is in place includes a holding pond for storage, a chlorine contact line for effluent disinfection, three irrigation pumps, a re-circulation system, and a sprinkler system to provide reuse on treatment plant lagoon dikes and lawn areas, and on 88.5 acres of forest land. Additional area for reuse is set aside for buffer to adjacent properties on the North, East and South boundaries of the treatment plant site, in compliance with Oregon DEQ regulations.

Prior to land reuse, the effluent is disinfected in 1,140 feet of 36" chlorine contact line, which provides for a minimum detention time of 60 minutes at peak discharge flows of 1,000 gpm. Sodium hypochlorite from the 500 gallon HDPE storage tank is mixed with effluent from Lagoon No. 3, in the chlorine contact facility. Effluent is discharged to forest land and pond dikes and lawn areas from April 1 to October 31 and stored in the holding pond during the remaining months. The storage lagoon must be lowered sufficiently by the end of the irrigation season to ensure maximum practicable storage capacity during the no irrigation months.

The land reuse system diverts the majority of the effluent to 88.5 acres of forest land, and the remaining to the treatment plant lagoon dikes and lawn areas (11.8 acres). The effluent is pumped to these locations using three pumps. Two 100 HP, 1000 gpm capacity pumps transport effluent to the forest land, while one 15 HP, 125 gpm capacity pushes the water to the dike. The effluent is carried to the forest land in a 10" main line which branches out into 8" lines across the irrigation area. There are flow meters stationed after the pumping facility that are measuring the quantity of effluent traveling to both the forest land and dike.

Both effluent reuse systems provided for discharge from the Sisters WWTP are controlled through the SCADA system, with the Programmable Logic Controller provided. Both the SCADA system and the PLC have been in use since the plant became operational, and equipment of this type and age becomes outdated, is not supported and difficult to repair due to availability of parts. Both the SCADA system and the PLC will need to be replaced in the near future.

3.6 EFFLUENT FLOW MEASUREMENT AND SAMPLING

Effluent flow measurements are provided in the pump room of the control building for the WWTP. Two meters are provided, with one on the dike and lawn reuse system, and one on the forest reuse system. Each meter is an ASA model IF6 electromagnetic flow meter, which have been calibrated annually since installation. Grab samples are taken out of the transfer structure before the effluent enters the chlorine contact line. These samples are then tested for concentration of E.coli. Flow measurements are recorded in the SCADA system provided. Flowmeter performance has been excellent, all the units were rebuilt in 2007 due to the pump building inadvertently flooding. All flow meters are flow tested and calibrated annually to ensure accuracy within specifications.

4.0 RECYCLED WATER MONITORING AND SAMPLING

OAR 340-055 defines the regulations for land application of recycled water.

i. Prior to land application of the recycled water, it must receive at least Class D treatment as defined in OAR 340-055. Class D recycled water must not exceed a 30-day log mean day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample. Class C recycled water must not exceed a 7 day median of 23 organisms/100 milliliters and no two consecutive samples must exceed 240 organisms/100 milliliters.

ii. Irrigation must conform to a Recycled Water Use Plan approved by DEQ and meet the required setbacks as defined in OAR 340-055.

iii. The City of Sisters must restrict public access to the reuse site(s) for the protection of public health.

iv. Treated effluent may only be irrigated on land between April 1 through October 31 for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices unless otherwise approved in writing by DEQ.

v. Recycled water equipment must be operated so as to prevent:

   a) Prolonged ponding of treated recycled water on the ground surface;

   b) Surface runoff or subsurface drainage through drainage tile;

   c) The creation of odors, fly and mosquito breeding or other nuisance conditions;

   d) The overloading of land with nutrients, organics, or other pollutant parameters; and

   e) Impairment of existing or potential beneficial uses of groundwater.

   f) Until otherwise approved in writing by the Department via a revised reclaimed water use plan, treated effluent must only be reused on Class D beneficial uses.

4.1 EFFLUENT MONITORING

Monthly discharge monitoring reports (DMR) are sent to the DEQ before the 15th day of the following month providing monitoring and sampling information for the WWTP including the reuse facility as required by the WPCF permit and summarized in Table 1. The recycled water applied to the irrigation field is measured daily when the system is in use. During the irrigation operation in 2015 there was a total of 5.46 and 72.57 million gallons applied to the dike and forest respectively.

Table 1: Recycled Monitoring Program

Item or Parameter	Minimum Frequency	Type of Sample
Total Inflow to WWTP	Daily	Measurement
Total reuse flows (recycled water)	Daily	Measurement
Flow Meter Verification	Annually	Verification
E. Coli	Weekly	Grab
Nitrogen Nitrate (NH_3-N)	Annually	Grab
Inspect Lagoon	Daily	Visual
Inspect Lagoon Liner	Daily	Visual

4.2 WATER QUALITY

Operations have experienced no problems in meeting permit conditions for E. coli. Effluent nutrient data for August 2015 indicated the following: Nitrate Nitrogen (NO_3-N): 0.03 mg/l. Nutrient levels are reasonable and do not raise concerns regarding system performance or effluent loadings.

5.0 SYSTEM MAINTENANCE AND CONTINGENCY PROCEDURES

The WWTP recycled water facilities will be maintained, per OAR 340-055-0025(1)(f), as well as a description of contingency procedures, per OAR 340-055-0025 (1)(d). The City of Sisters has submitted system maintenance and contingency procedures to Oregon DEQ as part of the submittal documents for the WPCF permit in 2002. The City maintains copies of the system maintenance and contingency procedures and are available upon request.

6.0 PUBLIC HEALTH AND ENVIRONMENTAL CONTROLS

6.1 ACCESS AND EXPOSURE CONTROLS

The irrigation sites are on City owned property with the required setbacks for Class D recycled water. Public access is prevented from entry into the existing and proposed area by barb wire fences around the irrigation site, a 6 foot chain link site with barb wire around the treatment plant site, and locked gates for both. Signs are posted around the perimeter of the irrigation field to indicate the water is not safe for drinking and that effluent is being applied as irrigation. Access and exposure are addressed as follows:

- Staff are the only people authorized to enter the site.
- The general public does not have access to the site.
- There are no grazing animals allowed on the site.
- The irrigation water is not used for sod, nursey stock or Christmas trees.
- The irrigation water is not used for commercial or industrial uses.
- The irrigation site is posted.
- All supervisors and staff working near the site are educated regarding access restrictions for this land application site.
- Irrigation over spray shall be monitored during windy days to ensure the buffer zones are not violated. When wind velocities exceed 10 mph, irrigation should stop or be reduced to prevent over spray on neighboring properties if this situation was to occur.
- When winds are high staff will assure that the buffer zones are not violated or the irrigation system will be turned off.
- The lagoon is fenced and gated.

6.2 SETBACKS

The required setbacks for Class D recycled water are as follows (per ORS 340-055-0012):

- 100 feet from the property line
- 100 feet from a water supply
- 70 feet from food preparation sites or drinking fountains.

6.3 NOTIFICATION

OAR 340-055 requires notification of recycled water use. There are two audiences for notification: personnel and the public. The notification methods used for each audience are as follows:

- Personnel:
  - ➢ Employees who will be working near the site are educated about the recycled water reuse program.
  - ➢ The irrigation site is posted with signs.
- The general public is notified through the WPCF permitting process through the Oregon Department of Environmental Quality.

6.4 SITE MANAGEMENT PRACTICES

Site management practices include the following:

- When using recycled water for irrigation, the perimeter of the site is posted with signs indicating that recycled water is not safe for drinking.
- When the ground is frozen, no irrigation is done.
- If the wind is high, no irrigation is done.
- Irrigation is done only when maintenance staff are on duty.
- Irrigation of fodder, fiber, seed crops not intended for human ingestion, sod, commercial timber, firewood, ornamental nursery stock, or Christmas trees is prohibited for three days before harvesting.

7.0 LAND APPLICATION PLAN

OAR 340-055-0025(2)(a) establishes additional requirements for recycled water use plans when conventional irrigation is used. In general, this includes a site characterization, description of the irrigation system, soils and crops, application rates, site management practices and public access control. Some of these items have already been described, such as the system description (Section 3), and site management and public access control (Section 6). The reader may refer to earlier sections of this plan for these items.

7.1 PROPOSED EFFLUENT IRRIGATION EXPANSION

The proposed recycled water use irrigation site, also known as the Lazy Z Ranch property, is approximately 225.6-Acres and located directly east from the existing Wastewater Treatment Plant. The site is divided into 2 lots, T15, R10, S10; TL (Taxlot) 704 (100.26 acres) and T15, R10, S15; TL 200 (125.68 acres) for a total of 225.64 acres (See Figure 1). The city anticipates using the 49.75-Acres forested area (Phase 1) and a 53.42-Acre crop land area (Phase 2) for effluent irrigation.

The Lazy Z Ranch property provides multiple possibilities for effluent reuse expansion. Both forest irrigation and crop irrigation sites are available. Both Phase 1 and Phase 2 have been incorporated into this Recycle Water Use Plan update.

A flow balance is provided in Table A and Table B (see Appendix B), considering available holding capacity and effluent reuse through the constructed irrigation systems described previously. The flow balance was developed assuming a lifetime for the effluent system of 10 and 20 years, to the year 2025 and 2035 respectively. Assuming that growth projections are accurate, and that estimated agronomic usage of the recycled water are accurate, the existing facilities cannot provide adequate area for disposal of flows.

In the 2025 water balance (Table A) the existing effluent irrigation system will continue to operate at threshold levels (see Table 1). The Phase 1 expansion site (Forest Site 2) will operate at irrigation rates necessary to lower the holding pond storage to the initial depth (6’). As shown in the 2035 water balance (Table B), the forest sites and the dike will operate at the irrigation application limit. The crop site will operate at irrigation rates required to lower the holding pond storage to the initial depth (6.0’). Irrigation discharge may be modified if necessary as long as the application rates in Table 2 are not exceeded on any give season, peak month, and peak day.

7.1.1 Phase 1 – Forest Irrigation Effluent Expansion – TL 200

A 49.75-Acre forested area is available for effluent irrigation at the southeast corner of the Lazy Z Ranch property. The Phase 1 effluent expansion will be fully implemented during 2017. Phase 1 is included in the 2025 and 2035 water balance computations for this Recycled Water Use Plan update (Table A and B).

7.1.2 Phase 2 – Future Crop Irrigation Effluent Expansion – TL 200

A 53.42-Acre crop land area is available for effluent irrigation in the southeast portion of the Lazy Z Ranch property. It is anticipated that this area would have a permitted application rate of 25.5 inches per year and could be connected to the existing pipeline which terminates in the center of the site. A wastewater reuse study by Newton Consultants Inc., completed in June 2013, identified multiple crop irrigation applications, grass crop is assumed. The City anticipates to implement Phase 2 by 2031. Phase 2 was incorporated into the water balance computations for 2035 conditions. Phase 2 will conform to DEQ requirements for Class D recycled water.

7.1.3 Future Phase – Future Crop Irrigation Effluent Expansion – TL 704

An additional 56.5-Acres of land is available for crop irrigation. The wastewater reuse study by Newton Consultants Inc., identified multiple crop irrigation applications, all to take place after 2035. The Future Phase was included in the water balance computations for 2035 conditions. The future phase will conform to DEQ requirements for Class D recycled water.

7.2 SITE CHARACTERIZATION

A USGS topo map, NRCS soil maps, and soil series descriptions for the proposed area described are included in Appendix A**.** The proposed irrigation expansion site (TL 200 described above) is located at 68355 HWY 20, Sisters, Oregon 97759. The site has the following characteristics:

- Land Use Zone: Exclusive Farm Use (to be rezoned to Public Facilities prior to any irrigation expansion activity).
- Size: 125.68 Acres

Rain fall and evaporation data was obtained from the Western Regional Climate Center (WRCC 2016).

- Annual Average Rainfall: 13.5 inches
- Annual Evaporation: 51.68 inches
- Average Annual Temperatures: average annual max – 84.4°F, average annual Min – 20.9°F
- Topography: Slope is roughly 0 – 2.5%
- Elevation: 3180-FT to 3230-FT
- Setbacks from property Line: 100-FT
- Not located in a flood plain.
- Depth to Groundwater: Based on City well logs, depth varies from 63 – 113 feet.
- Winter ground can be frozen.
- Winds can be moderate. Prevailing wind direction is north per the National Oceanic and Atmospheric Administration (NOAA 2016).

The 2002 Wastewater Reclaimed Water Use Plan calculated an application rate of 28.79-in/acre per season in the Dike and 14.3-inches/acre per season in the forest (an efficiency coefficient of 70% was applied to compensate for evaporation losses during the application). The City now uses an efficiency coefficient of 75% for all future planning purposes. Application rate limits (using a 75% efficiency coefficient) per the Soil and Water Reuse Reports, prepared by Wert & Associates, Inc. (1998 and 2007) are shown in Table 2 below:

Table 2: Irrigation Application Rate Limits

Application	Dike	Forest	Crop
Seasonal Amount	34”	19.1”	34”

Peak Month (July)	8.3”	7.3”	8.3”
Peak Daily	0.4”	0.2”	0.4”

7.3 PHASE 1: FOREST EFFLUENT IRRIGATION EXPANSION

The City will expand their irrigation to the 49.75 – Acre site at the southeast corner of the Lazy Z Ranch Property. Using data from existing Lagoons, the wastewater will contain:

NO_{3-}	0.5 mg/l
NH_4	0.5 mg/l
TKN	9.0 mg/l
Total Nitrogen:	10 mg/l

- Water Application:
  - ➢ There are no Oregon State University extension bulletins for water consumption of the existing stand of ponderosa pine, lodgepole pine, pine-sage, and bitter brush. Literature review was made by Wert and Associates, Inc. (1998) to determine application rates.
  - ➢ Total Irrigated area is 49.75 – Acres with Setbacks.
  - ➢ See water balance computations in Appendix B for application rates per month.
  - ➢ The peak daily irrigation rate shall be 0.2”, or 290,096 gpd.
  - ➢ The total irrigation volume is 19.10 inches over a 7-month period (April – October). The amount applied through irrigation is within the applications rate limits (see Table 2).
- Nitrogen Loading:
  - ➢ Based on literature and Wert and Associates, Inc. (1998) concluded that applying 1.3 Acre-Feet of wastewater to the existing forest will add 35 lbs of available nitrogen per acre. Based on this result, 2132 lbs of organic nitrogen loading will be applied to the site per year.
  - ➢ Total volume applied is 25,802,683 gallons or 97,637,780 liters.

    Nitrogen loading in mg: 967,060,000 mg

    Total concentration = 9.9 mg/l (less than 10 mg/L)
- Cropping Program:
  - ➢ The site will be mowed 2 to 3 times per irrigation season. Mowing’s will be disposed of or moved to a non-irrigation site. Herbicides will be applied annually to control weeds.

7.4 PHASE 2: CROP EFFLUENT IRRGATION EXPANSION

The 53.42-Acre site will be planted with hay/alfalfa/grass. No other crops are proposed. Using data from existing Lagoons, the wastewater will contain:

NO3	0.5 mg/l
NH_4	0.5 mg/l
TKN	9.0 mg/l
Total Nitrogen:	10 mg/l

- Water Application:
  - Consumptive use rates by month for pasture grasses grown in the Bend/Sisters are were taken from Oregon State University Extension Bulletin 8530.
  - Total irrigated area is 53.42 – Acres (with setbacks).
  - The crop will require about 3” of water per month (see water balance computation in Appendix B).
  - The peak daily irrigation rate shall be 0.4 inches or 580,193 gpd (see Table 2).
  - The total irrigation volume is 19.50 inches over a 7-month period (April – October). The amount applied through irrigation is within the applications rate limits (see Table 2).
- Nitrogen Loading:
  - Per the 2007 Soil and Water Reuse Report by Wert and Associates, Inc., the average organic concentration of 10 mg/l or 27 lbs of nitrogen per 1 Acre-Foot of wastewater. Oregon State University recommends orchard grass for the site. For orchard grass, 3 Acre-Feet/Acre of wastewater will be applied which will contain 81 pounds of organic nitrogen per acre.
  - The calculated irrigation discharge is 19.5 inches per year, or 86.8 Acre-Feet, which is equivalent to 2344 lbs of organic nitrogen loading per year.
  - Total volume applied is 11,695,352 gallons or 44,271,723 liters.

    Nitrogen loading in mg: 1,063,200,000 mg

    Total concentration = 5.6 mg/l (less than 10 mg/L)
  - The orchard grass will need an additional 119 lb/acre of nitrogen fertilizer.
- Cropping Program:
  - The crop will absorb nutrients, be harvested and be removed from the site for beneficial use.

7.5 IRRIGATION MANAGEMENT AND SCHEDULING

7.5.1 Irrigation Site: Startup

During each startup of either irrigation system, the chief operator should make certain that disinfection facilities are fully operational, and should verify that water quality testing is provided to assure compliance with the WPCF permit conditions. This will require activation of the chlorination system provided, and testing to assure that permit conditions are being met prior to discharge of the treated effluent for reuse purposes.

7.5.2 Irrigation Site: Field Observations

During April through October, field observations should be made daily, or when effluent reuse is being utilized, of the site for evidence of runoff. All irrigation water must percolate into the ground for usage by the disposal site. The irrigation rate must be maintained at agronomic rates. Aerosol drift from the application site should be observed and reported if excessive distances are observed. A wind monitoring system is provided from the weather station, and should function to limit irrigation during periods when excessive wind conditions are experienced on site.

7.5.3 Recording: Verification of Permit Conditions prior to Disposal

The City should maintain records of water quality testing at any time that effluent reuse is anticipated for either of the irrigation sites provided. Compliance will be required for both E.coli, and for total coliform, and actual testing data should be reported on the Daily Monitoring Report, for submittal to the Oregon Department of Environmental Quality on a monthly basis.

7.5.4 Recording: Flow Meter Records, Pump Time and Rainfall

The City should maintain influent and effluent flow meter records for all flow meters provided, with information provided through physical measurements verified against records maintained in the SCADA system provided. Similar records should be maintained for daily pump times and rainfall monitored during the irrigation period. Operational records and rainfall shall be recorded in order to review final management of reclaimed water usage and potential operational requirements. Since irrigation needs will be limited to specific application periods, the irrigation equipment can be operated through the SCADA system to apply effluent reuse when irrigation can best be applied for beneficial usage, with storage being maintained in the interim.

7.5.5 Operational Conditions

City staff should maintain records for operational conditions on the effluent reuse sites. Records shall include: 1) amount of effluent applied to each irrigation site, 2) ability to control storage and irrigation needs, and 3) agricultural concerns or benefits with water available for effluent reuse.

7.5.6 Summary of Record-Keeping

Reporting of water quality testing as addressed by the WPCF permit, (E. coli and coliform), irrigation site field observations, and operational conditions will be important for long term operation of the reclaimed water use site. Effluent flow meter readings and rainfall will need to be recorded daily.

- A summary of the reporting needs is as follows:
- Daily influent flows, in gpd, into the Wastewater Treatment Facility
- Daily water quality E.coli numbers to show compliance with permit conditions
- Daily water quality coliform numbers to show compliance with permit conditions
- Daily effluent flow meter records for the effluent irrigation and disposal systems
- Daily pump records, in hours, for each of the irrigation pumps being utilized
- Daily rainfall volumes, in 1/100th inches
- Irrigation rates and volumes on a daily basis
- Field observations of potential locations for runoff, and photos of any runoff occurrences

7.6 SITE MONITORING PLAN

Soil sampling will be used to monitor the nutrient balance with regards to the soil fertility of the sites. Soil sampling will take place at all forest and crop effluent irrigation sites. The sampling procedure shall be per section 7.6.1, or per the latest Oregon State University (OSU) Extension Service soil sampling guide.

7.6.1 General Soil Sampling Procedures

On forest sites sampling shall be done along one irrigation line for uniformity and consistency. On crop sites sampling shall be done in a simple random pattern. At least 30 samples shall be taken from each effluent irrigation site. Sampling shall be conducted every two years in the forest sites and annually in the crop sites. Sampling will take place at the end of each irrigation season (November). The soil sampling process is listed below:

1. Proper information and materials shall be obtained (Education Extension from OSU).
2. Proper sampling tools/equipment shall be used (e.g. soil auger, shovel, bucket etc.). Equipment must be clean, specifically free of fertilizer. Galvanized buckets or rusted tools/equipment shall not be used. Tools shall be used properly.
3. Unusual areas shall be avoided. This includes but is not limited to abandoned farmsteads, feed lots, manure piles, fences eroded knolls, low areas, and salty or wet spots shall be avoided or sampled separately.
4. Sites shall be divided into areas for sampling. (i.e. Forest Site 1, Forest Site 2, Crop Site 1 etc.).
5. Samples shall be taken to a 3-ft depth at 1-ft increments (1st sample at 1-ft depth, 2nd sample at 2-ft depth etc.).
6. Composite samples shall be analyzed for each site. The composite sample is a mixture of all the samples within the site. The composite sample shall be well mixed.
7. Moist soil samples shall be kept cool at all times (during and after sampling). Samples can be frozen or refrigerated for extended periods of time without adverse effects. If samples cannot be refrigerated or frozen after collection, they shall be air dried or taken directly to the testing laboratory.
8. All data shall be collected, stored, and documented.

7.6.2 Soil Sample Analysis

The City shall sample for nitrate (NO_{3-}), nitrite (NO_{2-}), ammonia (NH_4), Total Kjeldahl Nitrogen (TKN), and phosphorus (P). Samples shall be sent to laboratories that are certified by the North American Proficiency Testing (NAPT) program. The NH_4 will be lost to vitalization when it is irrigated. Most of the nitrogen will be in the form of algae cells. When the algae is spread on the soil it will be mineralized into forms available to plants. (Wert, 2007).

REFERENCES

*References available upon request.

Huffman, E.J. “Wastewater System Capital Facilities Plan Update.” *City of Sisters*. (February 2016).

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Nored, R.D. “Wastewater Reclaimed Water Use Plan.” *HGE, Inc.* (April 2002).

Wert, S. “Soil and Water Reuse Report for Sister Wastewater Project.” *Wert & Associates, Inc.* (February 1998).Print.

Wert, S. “Soil and Water Reuse Report for Sister Wastewater Project.” *Wert & Associates, Inc.* (February 2007).Print.

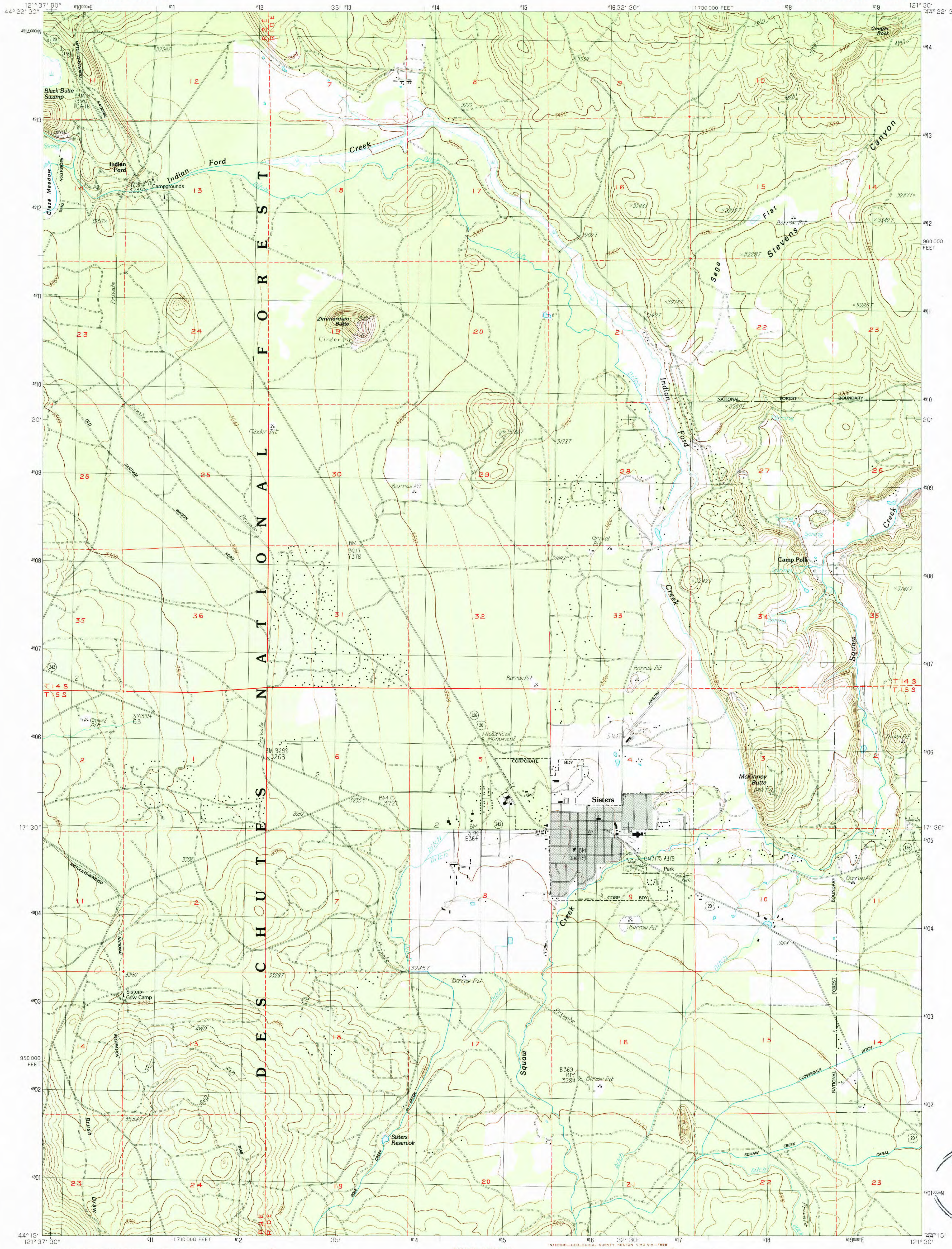
WRCC. “Period of Record Monthly Climate Summary.” *Western Regional Climate Center*. < http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or7857> (Accessed August 2016). Web.

APPENDIX A

- USGS Topo Maps
- NRCS soil maps, and soil series descriptions

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SISTERS QUADRANGLE
OREGON—DESCHUTES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY .... USGS, NOS/NOAA AND STATE OF OREGON
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1957
FIELD CHECKED 1959
LIMITED REVISION FROM AERIAL PHOTOGRAPHS TAKEN 1982 AND 84
FIELD CHECKED....1985. MAP EDITED 1988
PROJECTION .... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 10
10,000-FOOT STATE GRID TICKS ....OREG., SOUTH ZONE
UTM GRID DECLINATION .... 1°00′ EAST
1980 MAGNETIC NORTH DECLINATION .... 19°00′ EAST
VERTICAL DATUM .. NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (21 meters north and 92 meters east)

There may be private inholdings within the boundaries of any Federal and State Reservation shown on this map

Public Land Survey System is shown as published in 1959 and verified or supplemented in 1985

No distinction made between houses, barns, and other buildings

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of field check.
T

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET

To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by 0.3048

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

OREGON
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Black Butte
2 Little Squaw Back
3 Squaw Back Ridge
4 Black Crater
5 Henkle Butte
6 Trout Creek Butte
7 Three Creek Butte
8 Tumalo Dam

ADJOINING 7.5′ QUADRANGLE NAMES

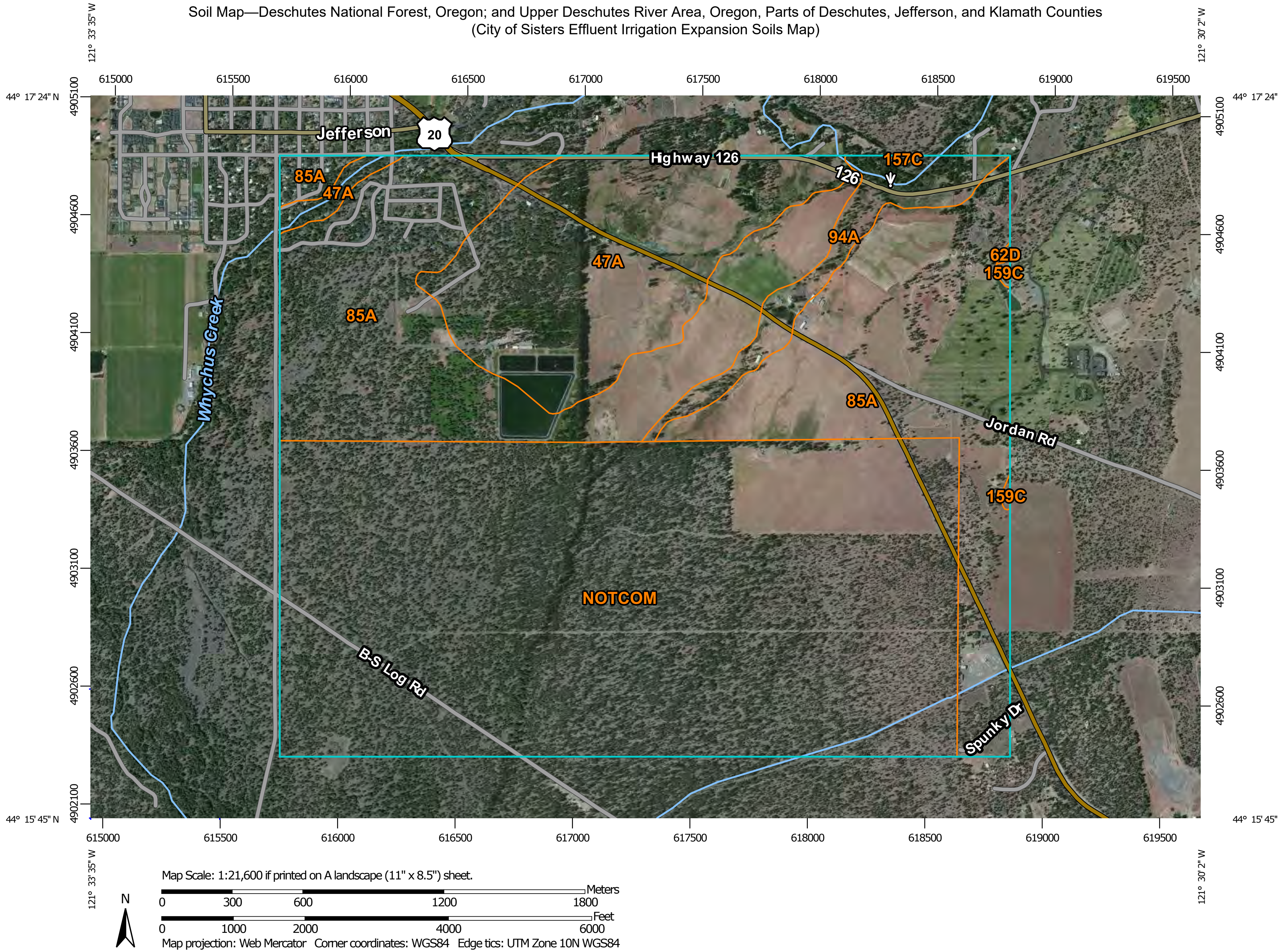
ROAD LEGEND

Improved Road
Unimproved Road
Trail
Interstate Route U.S. Route State Route

SISTERS, OREG.
PROVISIONAL EDITION 1988

44121-C5-TF-024

Soil Map—Deschutes National Forest, Oregon; and Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties
(City of Sisters Effluent Irrigation Expansion Soils Map)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Deschutes National Forest, Oregon
Survey Area Data: Version 2, Dec 5, 2013

Soil Survey Area: Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties
Survey Area Data: Version 11, Sep 18, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 20, 2010—Sep 4, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Deschutes National Forest, Oregon (OR605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
NOTCOM	No Digital Data Available	960.8	48.8%
Subtotals for Soil Survey Area		**960.8**	**48.8%**
Totals for Area of Interest		**1,967.4**	**100.0%**

Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties (OR620)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
47A	Ermabell loamy fine sand, 0 to 3 percent slopes	283.0	14.4%
62D	Henkle-Lava flows-Fryrear complex, 15 to 50 percent slopes	0.7	0.0%
85A	Lundgren sandy loam, 0 to 3 percent slopes	658.1	33.5%
94A	Omahaling fine sandy loam, 0 to 5 percent slopes	61.9	3.1%
157C	Wanoga-Fremkle-Rock outcrop complex, 0 to 15 percent slopes	0.7	0.0%
159C	Wilt sandy loam, 0 to 15 percent slopes	2.2	0.1%
Subtotals for Soil Survey Area		**1,006.6**	**51.2%**
Totals for Area of Interest		**1,967.4**	**100.0%**

APPENDIX B

- Water balance computations for 2025 and 2035 conditions.

City of Sisters Recycled Water Use Plan

Table I

Water Balance for Aerated Treatment, Holding, and Irrigation (2025 Conditions) - Balance Including Evaporation on Treatment and Holding Ponds

Holding Pond Constants:
*Assume 6' Water on 10/01 for Start

Treatment Pond Constants:
Water Surface Area 4.82 ac

Annual Irrigation:

Forest Irrigation Site 1	88.5	ac
Forest Irrigation Site 2	49.75	ac
Dike Irrigation	11.8	ac

Crop: Forest Land With Dike Irrigation System

Crop Irrigation Req.

Dike	25.5	in/acre
Forest Site 1	14.3	in/acre
Forest Site 2	10.5	in/acre

Mo.	Holding Pond Initial Volume (Ac-ft)	Initial Depth flow (ft) [1]	Influent Flow (gpd)	Monthly Influent Flow (Ac-ft)	Rainfall (in)	Evaporation from Ponds (in)	Net (in)	Net Ponds Evap. (Ac-ft)	Irrigation Discharge Forest Site 1 (Ac-ft)	Irrigation Discharge Forest Site 2 (Ac-ft)	Irrigation Discharge Dikes (Ac-ft)	Final Volume (Ac-ft)	Final Depth (ft)		Irrigation Discharge Forest Site 1 (in/acre)	Irrigation Discharge Forest Site 2 (in/acre)	Irrigation Discharge Dikes (in/acre)
Oct.	30.07	6.00	253833.49	24.15	0.95	3.29	-2.34	-3.92	0.00	0.00	2.95	47.35	7.12		0.00	0.00	3.00
Nov.	47.35	7.12	255011.19	23.48	2.10	1.80	0.30	0.51	0.00	0.00	0.00	71.34	8.65		0.00	0.00	0.00
Dec.	71.34	8.65	258576.80	24.60	2.27	0.00	2.27	3.91	0.00	0.00	0.00	99.86	10.42		0.00	0.00	0.00
Jan.	99.86	10.42	251085.03	23.89	2.24	0.00	2.24	3.94	0.00	0.00	0.00	127.69	12.12		0.00	0.00	0.00
Feb.	127.69	12.12	244023.90	20.97	1.45	0.00	1.45	2.60	0.00	0.00	0.00	151.25	13.51		0.00	0.00	0.00
Mar.	151.25	13.51	256936.59	24.45	1.12	0.00	1.12	2.04	0.00	0.00	0.00	177.74	15.05		0.00	0.00	0.00
Apr.	177.74	15.05	250384.62	23.05	0.79	5.26	-4.47	-8.27	7.38	4.15	2.95	178.05	15.07		1.00	1.00	3.00
May	178.05	15.07	259330.41	24.67	0.78	7.25	-6.47	-11.97	14.75	8.29	2.95	164.77	14.30		2.00	2.00	4.25
June	164.77	14.30	297566.50	27.40	0.61	8.70	-8.09	-14.84	25.81	14.51	4.18	132.82	12.42		3.50	3.50	5.50
July	132.82	12.42	303571.73	28.88	0.38	10.17	-9.79	-17.60	36.88	16.58	5.41	85.24	9.52		5.00	4.00	6.00
Aug.	85.24	9.52	288543.87	27.45	0.41	9.06	-8.65	-15.06	29.50	8.29	5.90	53.94	7.55		4.00	2.00	7.50
Sept.	53.94	7.55	278602.13	25.65	0.40	6.15	-5.75	-9.79	26.55	6.22	7.38	29.66	5.97		3.60	1.50	4.75
Total				298.65	13.5	51.68	-38.18	-68.44	140.9	58.0	31.7				19.1	14.0	34.0
														75% Efficiency	**14.33**	**10.50**	**25.50**

Notes: 1. Depth at deep end. 4.0 foot depth corresponds to 0.0 foot depth at shallow end of pond. The end of season depth is approximately 6 feet in order to keep the surface aerators in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.
2. Application rates in water balance are lower than allowable rates. See Section 6.1 for allowable application rates in each area.

City of Sisters Recycled Water Use Plan

Table II

Water Balance for Aerated Treatment, Holding, and Irrigation (2035 Conditions) - Balance Including Evaporation on Treatment and Holding Ponds

Holding Pond Constants:			**Annual Irrigation:**	Forest Irrigation Site 1	88.5	ac
*Assume 6' Water on 10/01 for Start				Forest Irrigation Site 2	49.75	ac
				Dike Irrigation	11.8	ac
Treatment Pond Constants:				Crop	53.42	ac
Water Surface Area	4.82	ac				
			Irrigation Required:	Dike	25.5	in/acre
				Forest Site 1	14.3	in/acre
				Forest Site 2	14.3	in/acre
				Crop	14.6	in/acre

Mo.	Holding Pond Initial Volume (Ac-ft)	Initial Depth flow (ft) [1]	Influent Flow (gpd)	Monthly Influent Flow (Ac-ft)	Rainfall (in)	Evaporation from Ponds (in)	Net (in)	Net Ponds Evap. (Ac-ft)	Irrigation Discharge Forest Site 1 (Ac-ft)	Irrigation Discharge Forest Site 2 (Ac-ft)	Irrigation Discharge Dikes (Ac-ft)	Irrigation Discharge Crop (Ac-ft)	Final Volume (Ac-ft)	Final Depth (ft)		Irrigation Discharge Forest Site 1 (in/acre)	Irrigation Discharge Forest Site 2 (in/acre)	Irrigation Discharge Dikes (in/acre)	Irrigation Discharge Crop (in/acre) [2]
Oct.	30.07	6.00	348825.48	33.19	0.95	3.29	-2.34	-3.92	9.96	5.60	2.46	11.13	30.20	6.01		1.35	1.35	2.50	2.50
Nov.	30.20	6.01	350443.91	32.27	2.10	1.80	0.30	0.50	0.00	0.00	0.00	0.00	62.97	8.12		0.00	0.00	0.00	0.00
Dec.	62.97	8.12	355343.87	33.81	2.27	0.00	2.27	3.89	0.00	0.00	0.00	0.00	100.67	10.47		0.00	0.00	0.00	0.00
Jan.	100.67	10.47	345048.46	32.83	2.24	0.00	2.24	3.94	0.00	0.00	0.00	0.00	137.44	12.70		0.00	0.00	0.00	0.00
Feb.	137.44	12.70	335344.85	28.82	1.45	0.00	1.45	2.61	0.00	0.00	0.00	0.00	168.87	14.54		0.00	0.00	0.00	0.00
Mar.	168.87	14.54	353089.85	33.59	1.12	0.00	1.12	2.06	0.00	0.00	0.00	0.00	204.53	16.58		0.00	0.00	0.00	0.00
Apr.	204.53	16.58	344085.93	31.68	0.79	5.26	-4.47	-8.40	18.44	10.36	4.43	14.47	180.11	15.19		2.50	2.50	4.50	3.25
May	180.11	15.19	356379.50	33.91	0.78	7.25	-6.47	-11.98	22.13	12.44	4.43	13.36	149.69	13.42		3.00	3.00	5.00	3.00
June	149.69	13.42	408924.67	37.65	0.61	8.70	-8.09	-14.70	29.50	16.58	4.92	11.13	110.51	11.08		4.00	4.00	6.00	2.50
July	110.51	11.08	417177.24	39.69	0.38	10.17	-9.79	-17.34	36.88	20.73	5.90	12.24	57.11	7.75		5.00	5.00	8.00	2.75
Aug.	57.11	7.75	396525.50	37.73	0.41	9.06	-8.65	-14.76	18.44	10.36	7.87	12.24	31.16	6.07		2.50	2.50	6.00	2.75
Sept.	31.16	6.07	382863.27	35.25	0.40	6.15	-5.75	-9.63	5.53	3.11	5.90	12.24	30.00	6.00		0.75	0.75	2.00	2.75
Total				410.41	13.50	51.68	-38.18	-67.73	140.9	79.2	35.9	86.8				19.10	19.10	34.00	19.50
															75% Efficiency	**14.33**	**14.33**	**25.50**	**14.63**

Notes:
1. Depth at deep end. 4.0 foot depth corresponds to 0.0 foot depth at shallow end of pond. The end of season depth is approximately 6 feet in order to keep the surface aerators in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.
2. Application rates in water balance are lower than allowable rates. See Section 6.1 for allowable application rates in each area.

APPENDIX C

Water Pollution Control Facilities (WPCF) Permit No. 101779, Expires December 31, 2025.

WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
475 NE Bellevue Dr. Suite 110, Bend, OR 97701
Telephone: 541-388-6146
(541) 388-6146
Issued pursuant to ORS 468B.050

ISSUED TO:

City of Sisters
P.O. Box 39
Sisters, OR 97759

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Method of Disposal
Domestic Sewage	001	Recycled Water Reuse

SYSTEM TYPE AND LOCATION:

Domestic Sewage Lagoons
912 S. Locust Street
T15S, R10 EWM, S09; TL 1002
Longitude -121.538480;
Latitude 44.280506
Sisters, Oregon

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub-Basin: Upper Deschutes
LLID: 1213357444600-20.47-N
County: Deschutes
Nearest surface stream which would receive waste if it were to discharge: Whychus Creek formally called Squaw Creek

Treatment System Class: I
Collection System Class: II

Issued in response to Application No. 968002 received December 17, 2010.

This permit is issued based on the land use findings in the permit record.

Don Butcher, Water Quality Permit Manager
Eastern Region

January 22, 2016
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

All direct a discharge to surface waters is prohibited.

SCHEDULE A

Waste Disposal Limitations

1. The permittee is authorized to construct, operate, and maintain wastewater collection, treatment and disposal systems to serve the City of Sisters in accordance with the conditions set forth in this permit.

2. The wastewater collections, treatment and land application system must not be hydraulically or organically loaded in excess of their respective, DEQ approved design capacities. At full build-out, however, the annual average daily influent flow must not exceed 0.38 MGD.

3. All wastewater treatment and disposal systems must be operated in compliance with the following conditions:

   a. No discharge to state waters is permitted. All wastewater must be stored and treated for disposal by land application following sound irrigation practices.

   b. Recycled Wastewater
      i. Prior to land application of the recycled water, it must receive at least Class D treatment as defined in OAR 340-055. Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample. Class C recycled water must not exceed a 7 day median of 23 organisms/100 milliliters and no two consecutive samples must exceed 240 organisms/100 milliliters.
      ii. Irrigation must conform to a Recycled Water Use Plan approved by DEQ and meet the required setbacks as defined in OAR 340-055.
      iii. The City of Sisters must restrict public access to the reuse site(s) for the protection of public health.
      iv. Treated effluent may only be irrigated on land between April 1 through October 31 for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices unless otherwise approved in writing by DEQ.
      v. Recycled water equipment must be operated so as to prevent:
         (A) Prolonged ponding of treated recycled water on the ground surface;
         (B) Surface runoff or subsurface drainage through drainage tile;
         (C) The creation of odors, fly and mosquito breeding or other nuisance conditions;
         (D) The overloading of land with nutrients, organics, or other pollutant parameters; and
         (E) Impairment of existing or potential beneficial uses of groundwater.
         (F) Until otherwise approved in writing by the Department via a revised reclaimed water use plan, treated effluent must only be reused on Class D beneficial uses.

4. The storage lagoon must be lowered sufficiently by the end of the irrigation season to ensure maximum practicable storage capacity during the non-irrigation months.

5. The permittee must, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

6. No activities must be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR 340-040).

SCHEDULE B

1. System Monitoring Requirements

The permittee must monitor the operation and efficiency of all treatment and disposal facilities. Sampling and measurements taken as required herein must be representative of the nature of the wastewater, and must be taken under normal operating conditions. Unless otherwise agreed to in writing by the Department of Environmental Quality, data collected, and submitted must include but not necessarily be limited to the following parameters and minimum frequencies:

a. Influent Monitoring and Reporting Requirements

Table B 1: Influent Monitoring

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Required Action	Report
Total Flow (MGD)	Year-round	Daily	Measurement	Daily totals Monthly maximum Monthly minimum Monthly average Monthly total
Flow Meter Verification	Year-round	Annually	Verification	Completed or not completed (Pass, Fail)
BOD_5 and TSS (mg/L)	Year-round	Weekly	Composite	Monthly averages Weekly values
pH (S.U.)	Year-round	3/week	Grab	Monthly maximum Monthly minimum Monthly average

b. Recycled Water Monitoring Requirements:

Table B2: Recycled Water Monitoring

Item or Parameter	Minimum Frequency	Sample Type/Required Action
Total Flow (MGD) or Quantity Irrigated (in/ac)	Daily	Measurement
Flow Meter Calibration	Annually	Verification
Chlorine, Total Residual (mg/L)	Daily	Grab
pH	3/Week	Grab
E. coli Bacteria	1/Week	Grab*
Total Coliform	1/Week	Grab*
Total P and Total N	Annually	Grab
Annual Irigation		

*The permittee is only required to sample for either E. coli or total coliform, but not both for an individual use. If the permittee is irrigating on crops requiring only Class D quality effluent, E. coli must be monitored. If the permittee irrigates/reuses effluent for Class C uses, total coliform must be monitored.

2. Reporting Procedures

a. Monitoring results must be reported on DEQ approved forms. Reports must be submitted to DEQ's Eastern Region – Bend office by the 15th day of the following month.

b. State monitoring reports must identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports must also identify each system classification as found on page one of this permit.

c. Monitoring reports must also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

d. The laboratory used by the permittee to analyze samples must have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results must be included in the report, but not used in calculations required by this permit. When possible, the permittee must re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

e. By no later than January 15 of each year, the permittee must submit to DEQ an annual report describing the effectiveness of the recycle water system to comply with the approved recycle water use plan, the rules of Division 55, and the limitations and conditions of this permit applicable to reuse of recycled water. The review is to provide a summary of land application conducted at each site which is adequate to demonstrate that reuse water was applied agronomically and/or hydraulic loading rates, and that required site management practices were followed.

SCHEDULE C

Compliance Conditions and Schedules

a. Within 180 days the permittee must update their recycled water use plan for DEQ approval. A recycled water use plan must describe how the wastewater treatment system owner will comply with OAR 340-055 (refer to OAR 340-055-0025).

b. The permittee is expected to meet the compliance date that have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director or his authorized representative may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. Prior to constructing or modifying any wastewater control facilities, detailed plans and specifications shall be approved in writing by DEQ. After approval of the plans, all construction shall be in strict conformance with the plans unless otherwise approved in writing by DEQ.

2. Within 6 months of such time as the sewage lagoons require removal of accumulated biosolids, the permittee shall submit a biosolids management plan that complies with the Department's biosolids management regulations as established in OAR 340-50.

3. This permit may be modified to incorporate any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

4. The permittee must, during all times of disposal, provide personnel to ensure the continuous performance of the disposal system within the limitations of this permit. In the event that any condition of this permit or DEQ rules are violated, the permittee must immediately take action to correct the violation and to notify DEQ **within 24 hours** at: DEQ's Eastern Region Water Quality Program Office (541) 388-6146.

   Response: In response to a notification, DEQ may conduct an investigation to evaluate the nature and extent of the problem, and may require additional corrective actions, as necessary. Compliance with this requirement does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

5. All materials and equipment, including but not limited to tanks, pumps, controls, valves, etc. must be installed, operated, and maintained in accordance with manufacturer's minimum specifications.

6. The permittee must immediately notify the DEQ Bend office (phone 388-6146) of any occurrence of surfacing sewage so corrective action can be coordinated between the permittee and DEQ. When the DEQ offices are not open, the permittee must report the incident to the Oregon Emergency Response System (phone 1-800-452-0311).

7. Emergency Response and Public Notification Plan

   a. The permittee must develop, and maintain and implement an Emergency Response and Public Notification Plan (the Plan) per Schedule F, Section B, and Conditions 5 & 6. The permit holder must develop the plan within six months of permit issuance and update the Plan annually to ensure that telephone and email contact information for applicable public agencies are current and accurate. An updated copy of the plan must be kept on file at the wastewater treatment facility for Department review. The latest plan revision date must be listed on the Plan cover along with the reviewer's initials or signature.

8. Recycled Water Use Plan

   a. In order to distribute recycled water for reuse, the permittee must develop, have and maintain and implement a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025. The permittee must submit substantial modifications to an existing plan to DEQ for approval at least 60 days prior to making the proposed changes. Conditions in the Plan are enforceable requirements under this permit.

9. The permittee must meet the requirements for use of recycled water under Division 55, including the following:

   a. All recycled water must be managed in accordance with the approved Recycled Water Use Plan. No substantial changes must be made in the approved plan without written approval by DEQ.

   b. The permittee must notify DEQ within 24 hours if it is determined that the treated effluent is being used in a manner not in compliance with OAR 340-055. When the DEQ offices are not open, the permittee must report the incident of noncompliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

   c. No recycled water must be made available to a person proposing to recycle unless that person certifies in writing that they have read and understand the provisions in Division 55. This written certification must be kept on file by the sewage treatment system owner and be made available to DEQ for inspection.

   e. Treated effluent must not be irrigated on ground that is frozen, snow-covered, or saturated with water. The volume of irrigated effluent and its total nitrogen loading must not exceed that established in a DEQ-approved recycled water use plan.

   f. Unless otherwise approved in writing by DEQ, a vegetative cover must be maintained on the land irrigation area at all times. Vegetation is to be periodically cut and removed to ensure maximum evapotranspiration and nutrient capture.

10. Operator Certification

The permittee must comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and designate a supervisor whose certification corresponds with the classification of the collection and/or treatment system as specified on page 1 of this permit.

   a. Definitions

      i. "Supervise" means to have full and active responsibility for the daily onsite technical operation of a wastewater treatment system or wastewater collection system.
      ii. "Supervisor" or "designated operator", means the operator delegated authority by the permittee for establishing and executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system in accordance with the policies of the owner of the system and any permit requirements.
      iii. "Shift Supervisor" means the operator delegated authority by the permittee for executing the specific practice and procedures for operating the wastewater treatment

system or wastewater collection system when the system is operated on more than one daily shift.

iv. "System" includes both the collection system and the treatment systems.

b. The permittee must have its system supervised by one or more operators who hold a valid certificate for the type of wastewater treatment or wastewater collection system, and at a grade equal to or greater than the wastewater system's classification as specified on page 1 of this permit.

c. The permittee's wastewater system may not be without the designated supervisor for more than 30 days. During this period, there must be another person available to supervisor who is certified at no more than one grade lower than the classification of the wastewater system. The permittee must delegate authority to this operator to supervise the operation of the system.

d. If the wastewater system has more than one daily shift, the permittee must have another properly certified operator available to supervisor operation of the system. Each shift supervisor, if any, must be certified at no more than one grade lower than the system classification.

e. The permittee is not required to have a supervisor on site at all times; however, the supervisor must be available to the permittee and operator at all times.

f. The permittee must notify DEQ in writing of the name of the system supervisor. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of operator in charge. As of this writing, the notice of replacement or re-designation must be sent to Water Quality Division, Operator Certification Program, 2020 SW 4th Avenue, Suite 400, Portland, OR 97201. This address may be updated in writing by DEQ during the term of this permit.

g. When compliance with paragraph (c) of Item 8 in this section is not possible or practicable because the system supervisor is not available or the position is vacated unexpectedly, and another certified operator is not qualified to assume supervisory responsibility, the Director may grant a time extension for compliance with the requirements in response to a written request from the system owner. The Director will not grant an extension longer than 120 days unless the system owner documents the existence of extraordinary circumstances.

11. DEQ may reopen the Schedules in this permit, if necessary, to include new or revised conditions.

12. If warranted, at any time, DEQ may evaluate the need for or require a full assessment of the facilty's impact on groundwater quality.

SCHEDULE F

WPCF GENERAL CONDITIONS – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit

The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and grounds for an enforcement action. Failure to comply is also grounds for the Department to modify, revoke, or deny renewal of a permit.

2. Property Rights and Other Legal Requirements

Issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other rights, or any infringement of federal, tribal, state, or local laws or regulations.

3. Liability

The Department of Environmental Quality or its officers, agents, or employees may not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities or systems because of this permit.

4. Permit Actions

After notice by the Department, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any term or condition of this permit, any applicable rule or statute, or any order of the Commission;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.

5. Transfer of Permit

This permit may not be transferred to a third party without prior written approval from the Department. The Department may approve transfers where the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of this permit and the rules of the Commission. A transfer application and filing fee must be submitted to the Department.

6. Permit Fees

The permittee must pay the fees required by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

At all times the permittee must maintain in good working order and properly operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to comply with the terms and conditions of this permit.

2. Standard Operation and Maintenance

All waste collection, control, treatment, and disposal facilities or systems must be operated in a manner consistent with the following:

a. At all times, all facilities or systems must be operated as efficiently as possible in a manner that will prevent discharges, health hazards, and nuisance conditions.

b. All screenings, grit, and sludge must be disposed of in a manner approved by the Department to prevent any pollutant from the materials from reaching waters of the state, creating a public health hazard, or causing a nuisance condition.

c. Bypassing untreated waste is generally prohibited. Bypassing may not occur without prior written permission from the Department except where unavoidable to prevent loss of life, personal injury, or severe property damage.

3. Noncompliance and Notification Procedures

If the permittee is unable to comply with conditions of this permit because of surfacing sewage; a breakdown of equipment, facilities or systems; an accident caused by human error or negligence; or any other cause such as an act of nature, the permittee must:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department's Regional office so that an investigation can be made to evaluate the impact and the corrective actions taken, and to determine any additional action that must be taken.

c. Within 5 days of the time the permittee becomes aware of the circumstances, the permittee must submit to the Department a detailed written report describing the breakdown, the actual quantity and quality of waste discharged, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or liability for failure to comply.

4. Wastewater System Personnel

The permittee must provide an adequate operating staff that is duly qualified to carry out the operation, maintenance, and monitoring requirements to assure continuous compliance with the conditions of this permit.

5. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B.6. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

6. Emergency Response and Public Notification Plan

The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:

a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

SECTION C. MONITORING AND RECORDS

1. Inspection and Entry

The permittee must at all reasonable times allow authorized representatives of the Department to:

a. Enter upon the permittee's premises where a waste source or disposal system is located or where any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy any records required by this permit;

c. Inspect any treatment or disposal system, practices, operations, monitoring equipment, or monitoring method regulated or required by this permit; or

d. Sample or monitor any substances or permit parameters at any location at reasonable times for the purpose of assuring permit compliance or as otherwise authorized by state law...

2. Averaging of Measurements

Calculations of averages of measurements required for all parameters except bacteria must use an arithmetic mean; bacteria must be averaged as specified in the permit.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures specified in the most recent edition of **Standard Methods for the Examination of Water and Wastewater**, unless other test procedures have been approved in writing by the Department and specified in this permit.

4. Representative Sampling

Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge when discharging or land applying. Monitoring points must not be changed without notification to and the approval of DEQ.

5. Retention of Records

The permittee must retain records of all monitoring and maintenance information, including all calibrations, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. The Department may extend this period at any time.

SECTION D. REPORTING REQUIREMENTS

1. Plan Submittal

Pursuant to Oregon Revised Statute 468B.055, unless specifically exempted by rule, construction, installation, or modification of disposal systems, treatment works, or sewerage systems may not commence until plans and specifications are submitted to and approved in writing by the Department. All construction, installation, or modification shall be in strict conformance with the Department's written approval of the plans.

2. Change in Discharge

Whenever a facility expansion, production increase, or process modification is expected to result in a change in the character of pollutants to be discharged or in a new or increased discharge that will exceed the conditions of this permit, a new application must be submitted together with the necessary reports, plans, and specifications for the proposed changes. A change may not be made until plans have been approved and a new permit or permit modification has been issued.

3. Signatory Requirements

All applications, reports, or information submitted to the Department must be signed and certified by the official applicant of record (owner) or authorized designee.

4. Twenty-Four Hour Reporting

The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.

(1) Oral Reporting within 24 hours.

i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to DEQ.
   a) The location of the overflow;
   b) The receiving water (if there is one);
   c) An estimate of the volume of the overflow;
   d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and
   e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:
   a) The OERS incident number (if applicable) along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:
   a) The OERS incident number (if applicable);
   b) The cause or suspected cause of the overflow;
   c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
   d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
   e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:
   i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
   ii. Any upset that exceeds any effluent limitation in this permit;
   iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
   iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:
   i. A description of the noncompliance and its cause;
   ii. The period of noncompliance, including exact dates and times;
   iii. The estimated time noncompliance is expected to continue if it has not been corrected;
   iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
   v. Public notification steps taken, pursuant to General Condition B.6.

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received
within 24 hours.

SECTION E. DEFINITIONS

1. *BOD_5* means five-day biochemical oxygen demand.
2. *TSS* means total suspended solids.
3. *FC* means fecal coliform bacteria.
4. *NH_3-N* means Ammonia Nitrogen.
5. *NO_3-N* means Nitrate Nitrogen.
6. *NO_2-N* means Nitrite Nitrogen.
7. *TKN* means Total Kjeldahl Nitrogen.
8. *Cl* means Chloride.
9. *TN* means Total Nitrogen.
10. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
11. *Total residual chlorine* means combined chlorine forms plus free residual chlorine.
12. *mg/l* means milligrams per liter.
13. *ug/l* means micrograms per liter.
14. *kg* means kilograms.
15. *GPD* means gallons per day.
16. *MGD* means million gallons per day.
17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
18. *Composite sample* means a combination of samples collected, generally at equal flow or time intervals over a 24-hour period.
19. *Week* means a calendar week of Sunday through Saturday.
20. *Month* means a calendar month.
21. *Quarter* means January through March, April through June, July through September, or October through December.

APPENDIX C
Discharge Monitoring Reports

CITY OF SISTERS, OREGON
WASTEWATER FACILITIES PLAN UPDATE
DISCHARGE MONITORING REPORT SUMMARY

	Influent								Effluent						
Date	Total Monthly Flow (MG)	Maximum Daily Flow (MGD)	Minimum Daily Flow (MGD)	Average Daily Flow (MGD)	Daily Max pH	Daily Min pH	BOD_5 Conc. (mg/L)	TSS Conc. (mg/L)	Dike Quantity Irrigated (in/acre)	Forest Quantity Irrigated (in/acre)	Forest 2 Quantity Irrigated (in/acre)	Average Daily Quantity Chlorine Used (lbs)	*E. Coli* Concentration (CFU/100 ml)	Maximum pH	Minimum pH
Jan-18	6.118	0.220	0.184	0.197	7.34	7.17	268	134							
Feb-18	5.526	0.222	0.187	0.197	7.33	7.05	200	98							
Mar-18	6.124	0.210	0.187	0.197	7.33	6.90	327	136							
Apr-18	5.926	0.213	0.186	0.197	7.36	7.01	357	173	1.37			7.0	1.00	7.40	7.00
May-18	6.634	0.246	0.196	0.214	7.29	7.01	267	147	4.81	2.06		6.0	1.00	7.20	7.10
Jun-18	6.890	0.249	0.213	0.230	7.34	6.71	354	170	6.57	3.22		8.0	1.50	7.30	7.10
Jul-18	7.479	0.264	0.229	0.241	7.25	6.71	354	170	9.33	5.43		9.0	2.86	8.00	7.20
Aug-18	7.331	0.254	0.210	0.236			362	169	6.67	3.77		10.0	2.03	7.82	7.11
Sep-18	6.796	0.250	0.207	0.227	7.59	6.89	366	185	5.37	3.10		9.0	2.52	7.18	7.86
Oct-18	6.500	0.235	0.190	0.211	7.25	7.10	358	195	2.25	1.12		9.0	1.00	7.91	7.21
Nov-18	6.106	0.216	0.187	0.204	7.25	6.85	318	148							
Dec-18	6.521	0.238	0.173	0.210			331	137							
Jan-19	6.504	0.243	0.194	0.209	7.37	7.10	252	153							
Feb-19	5.747	0.235	0.182	0.205	7.42	6.91	311	199							
Mar-19	6.584	0.225	0.191	0.212	7.25	6.94	306	178							
Apr-19	6.477	0.249	0.202	0.216	7.32	7.11	297	174	1.61	0.64		9.9	1.00	7.42	7.29
May-19	6.865	0.243	0.209	0.221	7.41	7.17	308	180	4.93	2.03	0.44		4.63	7.28	7.11
Jun-19	8.421	0.423	0.175	0.280	7.44	7.13	338	172	6.18	3.77			20.80	7.60	7.25
Jul-19	8.126	0.287	0.247	0.262	7.36	7.10	354	153	8.62	5.28		9.0	10.09	7.38	7.11
Aug-19	7.777	0.262	0.240	0.251	7.33	7.13	279	176	10.69	6.73			9.60	7.38	7.23
Sep-19	7.137	0.270	0.221	0.237	7.86	7.11	186	136	9.77	4.88	3.00	12.0	18.60		
Oct-19	6.770	0.244	0.202	0.218	7.39	7.11	372	290	9.49		3.18	9.0	2.60	8.52	7.70
Nov-19	6.568	0.243	0.208	0.219	7.49	6.25	319	111							
Dec-19	6.825	0.249	0.193	0.220	7.31	6.63	397	108							
Jan-20	6.734	0.256	0.196	0.217	7.25	6.75	301	168							
Feb-20	6.352	0.234	0.198	0.219	7.27	7.01	350	160							
Mar-20	6.435	0.227	0.190	0.208	7.25	6.64	323	158							
Apr-20	5.926	0.210	0.186	0.198	7.21	7.12	338	184	1.62			3.5	0.00	7.39	7.01
May-20	6.712	0.241	0.197	0.217	7.31	7.11	296	173	3.83	0.46	0.44	4.7	8.00	7.40	7.00
Jun-20	7.405	0.305	0.225	0.247	7.29	7.11	338	188	3.80	5.27	5.20	7.2	18.10	7.42	7.18
Jul-20	8.059	0.270	0.244	0.260	7.28	7.17	390	177	4.20	3.80	3.80	7.9	7.70	8.40	7.38
Aug-20	6.974	0.283	0.221	0.225	7.49	7.11	319	158	2.22	1.05	1.05	7.8	15.00	8.11	7.50
Sep-20	7.437	0.287	0.226	0.247	7.31	6.62	282	176	5.32	1.20	1.20	15.0	3.70	8.20	7.19
Oct-20	7.586	0.267	0.217	0.244	7.61	7.11	240	179	5.28		3.74	7.0	9.10	7.87	7.10
Nov-20	7.046	0.307	0.216	0.234	7.91	7.00	241	122							
Dec-20															
Maximum	8.421	0.423	0.247	0.280	7.91	7.17	397	290	10.69	6.73	5.20	15.0	20.80	8.52	7.86
Minimum	5.526	0.210	0.173	0.197	7.21	6.62	186	98	1.37	0.46	0.44	3.5	0.00	7.18	7.00
Average	6.812	0.254	0.204	0.224	7.37	6.99	314	164	5.43	3.17	2.45	8.4	6.71	7.66	7.23

BOD = biochemical oxygen demand
CFU = colony forming units
ft = feet
in/acre = inches per acre
lbs = pounds
MG = million gallons
MGD = million gallons per day
mg/L = milligrams per liter
ml = milliliters
TKN = total Kjeldahl nitrogen
TSS = total suspended solids

APPENDIX D
Sewer Rate Resolution and Budget Summary

Sewer Fund

RESPONSIBLE MANAGER: Paul Bertagna, Public Works Director

DESCRIPTION: The Sewer Fund supports the City's wastewater utility which ensures the safe collection and discharge of wastewater effluent under the requirements of the City's National Pollutant Discharge Elimination System (NPDES) permit.

Fund Resources
This fund is an enterprise fund meaning it is self-supporting with expenses paid from its own revenue sources. The main source of revenue is from sewer charges. Other sewer revenue is provided through service fees and sewer connections.

Review of FY 2020/21 Department Work Plan:
Objectives that were accomplished include:

- Developed the Scope and procured a consultant for the Lazy Z master plan and started the mater planning project (*Council Goal)
- Designed the Variable Frequency Drives for the 100 hp effluent pumps to provide energy savings and operational efficiency (*Council Goal)
- Completed the Bio-solids Removal in our primary lagoon (*Council Goal)
- Completed 100% design and developed Bid doc's/specifications for the Locust St. sewer line relocation and procure construction easements (*Council Goal)
- Designed and bid the Rope St. Pump station improvements that includes new and larger capacity pumps and related equipment (*Council Goal)
- Updated Sewer Rate Model and verified adequate fund balance for the 5 yr forecast (*Council Goal)
- Conducted GIS GPS accuracy survey and modified GIS layers as needed

Objectives for FY 2021/22 Department Work Plan:

- Construct the Locust St. sewerline re-locate project (*Council Goal)
- Update the 2016 Wastewater Capital Facilities Plan (*Council Goal)
- Update the 10 yr Capital Improvement Plan (*Council Goal)
- Design/Bid/Construct 75KW Solar Panel installation at the Wastewater Treatment Plant (*Council Goal)
- Complete the procurement and install of the Variable Frequency Drives on the 100 hp effluent pumps to provide energy savings and operational efficiency (*Council Goal)
- Develop a Wildfire Resiliency Plan for the Wastewater Treatment Systems (*Council Goal)
- Procure a portable back-up generator for the City's (3) satellite pumpstations
- Design and construct the generator transfer switches for the Portable power source
- Construct the Rope St. pumpstation improvements

SEWER FUND BUDGET SUMMARY:

RESOURCES	FY 2018/19 ACTUAL	FY 2019/20 ACTUAL	FY 2020/21 BUDGET	FY 2021/22 MANAGER PROPOSED	FY 2021/22 COMMITTEE APPROVED	FY 2021/22 COUNCIL ADOPTED
Revenues:						
Sewer Receipts	$ 952,300	$ 1,078,584	$ 1,090,500	$ 1,160,000	$ 1,160,000	$ 1,160,000
Charges For Services	18,031	17,357	11,900	20,000	20,000	20,000
Licenses And Fees	8,753	10,578	8,000	8,000	8,000	8,000
Intergovernmental	-	-	30,000	154,536	154,536	154,536
Interest/Loan Proceeds	33,348	31,434	16,000	8,000	8,000	8,000
Rental income	10,000	16,000	-	-	-	-
Miscellaneous	29,078	5,337	13,103	12,650	12,650	12,650
Total Revenues	**1,051,510**	**1,159,290**	**1,169,503**	**1,363,186**	**1,363,186**	**1,363,186**
Beginning Fund Balance	1,328,241	1,532,416	1,700,714	1,670,821	1,670,821	1,670,821
TOTAL RESOURCES	**$ 2,379,751**	**$ 2,691,706**	**$ 2,870,217**	**$ 3,034,007**	**$ 3,034,007**	**$ 3,034,007**

REQUIREMENTS	FY 2018/19 ACTUAL	FY 2019/20 ACTUAL	FY 2020/21 BUDGET	FY 2021/22 MANAGER PROPOSED	FY 2021/22 COMMITTEE APPROVED	FY 2021/22 COUNCIL ADOPTED
Expenditures:						
Personnel Services	$ 251,979	$ 286,617	$ 310,184	$ 355,501	$ 355,501	$ 355,501
Materials & Services	250,472	290,202	331,106	321,822	321,822	321,822
Capital Improvements	4,800	24,436	355,850	353,000	353,000	353,000
Debt Service	333,284	334,153	335,917	332,245	332,245	332,245
Total Expenditures	**840,535**	**935,408**	**1,333,057**	**1,362,568**	**1,362,568**	**1,362,568**
Unappropriated Reserves	-	-	-	-	-	-
Operating Contingency	-	-	41,181	112,886	112,886	112,886
Reserves	-	-	1,483,379	1,545,253	1,545,253	1,545,253
Transfers Out	6,800	12,480	12,600	13,300	13,300	13,300
TOTAL REQUIREMENTS	**$ 847,335**	**$ 947,888**	**$ 2,870,217**	**$ 3,034,007**	**$ 3,034,007**	**$ 3,034,007**
NET TOTAL	**$ 1,532,416**	**$ 1,743,818**	**$ -**	**$ -**	**$ -**	**$ -**

		FY 2018/19 ACTUAL	FY 2019/20 ACTUAL	FY 2020/21 BUDGET	FY 2021/22 MANAGER PROPOSED	FY 2021/22 COMMITTEE APPROVED	FY 2021/22 COUNCIL ADOPTED
05 - SEWER FUND							
RESOURCES							
REVENUE							
05-4-00-301	INTEREST EARNED	$ 33,348	$ 31,434	$ 16,000	$ 8,000	$ 8,000	$ 8,000
05-4-00-314	PUBLIC WORKS FEES	8,753	10,578	8,000	8,000	8,000	8,000
05-4-00-327	SEWER RECEIPTS	952,300	1,078,584	1,090,500	1,160,000	1,160,000	1,160,000
05-4-00-337	OVERNIGHT PARK SEWER RECEIPTS	18,031	17,357	11,900	20,000	20,000	20,000
05-4-00-354	PROPERTY RENTAL	10,000	16,000	-	-	-	-
05-4-00-360	MISCELLANEOUS	24,337	1,603	5,000	5,000	5,000	5,000
05-4-00-362	REFUNDS/REIMBURSEMENTS	1,991	1,034	5,903	6,000	6,000	6,000
05-4-00-381	SEWER TAP FEE	2,750	2,700	2,200	1,650	1,650	1,650
05-4-00-389	PLAN CHECK FEES	-	-	-	-	-	-
REVENUE SUBTOTAL		**1,051,510**	**1,159,290**	**1,139,503**	**1,208,650**	**1,208,650**	**1,208,650**
GRANTS & PASS THROUGHS							
05-4-00-640	STATE GRANTS	-	-	30,000	154,536	154,536	154,536
TOTAL GRANTS & PASS THROUGHS		**-**	**-**	**30,000**	**154,536**	**154,536**	**154,536**
TOTAL REVENUES		**1,051,510**	**1,159,290**	**1,169,503**	**1,363,186**	**1,363,186**	**1,363,186**
BEGINNING FUND BALANCE							
05-4-00-400	**BEGINNING FUND BALANCE**	**1,328,241**	**1,532,416**	**1,700,714**	**1,670,821**	**1,670,821**	**1,670,821**
TOTAL BEGINNING FUND BALANCE		**1,328,241**	**1,532,416**	**1,700,714**	**1,670,821**	**1,670,821**	**1,670,821**
TOTAL RESOURCES		**$ 2,379,751**	**$ 2,691,706**	**$ 2,870,217**	**$ 3,034,007**	**$ 3,034,007**	**$ 3,034,007**
REQUIREMENTS							
OPERATING CONTINGENCIES							
05-5-00-400	OPERATING CONTINGENCY	$ -	$ -	$ 41,181	$ 112,886	$ 112,886	$ 112,886
05-5-00-410	RESERVE FOR FUTURE EXPENDITURES	-	-	590,859	518,751	518,751	518,751
TOTAL OPERATING CONTINGENCIES		**-**	**-**	**632,040**	**631,637**	**631,637**	**631,637**
RESERVES							
05-5-00-445	CAPITAL REPLACEMENT RESERVE	-	-	706,920	745,302	745,302	745,302

		FY 2018/19 ACTUAL	FY 2019/20 ACTUAL	FY 2020/21 BUDGET	FY 2021/22 MANAGER PROPOSED	FY 2021/22 COMMITTEE APPROVED	FY 2021/22 COUNCIL ADOPTED
05-5-00-450	CAPITAL IMPROVEMENT RESERVE	-	-	185,600	281,200	281,200	281,200
TOTAL RESERVES		**-**	**-**	**892,520**	**1,026,502**	**1,026,502**	**1,026,502**
TRANSFERS							
05-5-00-602	TRANSFER TO CITY HALL FUND	6,800	12,480	12,600	13,300	13,300	13,300
TOTAL TRANSFERS		**6,800**	**12,480**	**12,600**	**13,300**	**13,300**	**13,300**
EXPENDITURES							
PERSONNEL SERVICES							
SALARIES AND WAGES		155,299	176,631	184,481	212,803	212,803	212,803
PAYROLL TAXES, INSURANCE, AND BENEFITS		96,680	109,986	125,703	142,698	142,698	142,698
TOTAL PERSONNEL SERVICES		**251,979**	**286,617**	**310,184**	**355,501**	**355,501**	**355,501**
MATERIALS & SERVICES							
05-5-00-704	RECRUITMENT	52	-	-	-	-	-
05-5-00-705	ADVERTISING	-	-	-	-	-	-
05-5-00-706	AUDIT FEES	5,173	1,454	5,000	5,000	5,000	5,000
05-5-00-710	COMPUTER SOFTWARE MAINT.	3,303	4,102	4,000	11,500	11,500	11,500
05-5-00-712	CHEMICALS	3,859	3,603	4,500	4,500	4,500	4,500
05-5-00-713	DEVELOPMENT REVIEW	10,162	9,960	8,000	8,000	8,000	8,000
05-5-00-714	OFFICE SUPPLIES	1,019	1,135	1,050	1,050	1,050	1,050
05-5-00-715	POSTAGE	5,906	5,793	5,900	5,900	5,900	5,900
05-5-00-717	OFFICE EQUIPMENT	-	600	500	500	500	500
05-5-00-718	LEASES	-	1,100	-	500	500	500
05-5-00-721	COPIER/PRINTER	1,168	768	800	800	800	800
05-5-00-726	CONTRACTED SERVICES	7,864	28,938	57,000	25,000	25,000	25,000
05-5-00-727	PERMITS & FEES	11,046	10,529	8,500	8,500	8,500	8,500
05-5-00-733	DUES & SUBSCRIPTIONS	310	1,936	400	400	400	400
05-5-00-735	TELEPHONE	2,686	2,835	3,100	3,100	3,100	3,100
05-5-00-736	CELLULAR PHONES	712	910	1,100	1,100	1,100	1,100
05-5-00-740	EDUCATION	624	541	1,500	1,500	1,500	1,500
05-5-00-743	ELECTRICITY	51,702	50,913	55,000	60,000	60,000	60,000
05-5-00-746	SMALL TOOLS & EQUIPMENT	2,581	870	5,000	7,700	7,700	7,700
05-5-00-755	GAS/OIL	5,366	4,342	4,500	6,000	6,000	6,000
05-5-00-765	SEWER SYSTEM IMPROVEMENTS	18,154	10,620	15,000	15,000	15,000	15,000
05-5-00-766	INS: COMP/LIA/UMB	13,490	14,077	15,000	15,000	15,000	15,000

		FY 2018/19 ACTUAL	FY 2019/20 ACTUAL	FY 2020/21 BUDGET	FY 2021/22 MANAGER PROPOSED	FY 2021/22 COMMITTEE APPROVED	FY 2021/22 COUNCIL ADOPTED
05-5-00-768	INTERNAL GEN FUND SERVICES	9,600	9,854	10,071	10,222	10,222	10,222
05-5-00-770	SEWER LOCATE SERVICE	226	276	250	250	250	250
05-5-00-771	MEDICAL TESTING & SERVICES	299	48	200	200	200	200
05-5-00-772	ROW FRANCHISE FEE	66,661	75,501	76,335	81,200	81,200	81,200
05-5-00-775	LABORATORY FEES	2,617	1,403	1,000	1,000	1,000	1,000
05-5-00-777	LEGAL FEES	338	595	1,000	3,500	3,500	3,500
05-5-00-780	CREDIT CARD FEE	7,564	11,943	3,500	3,500	3,500	3,500
05-5-00-782	UNIFORMS	725	612	1,500	1,500	1,500	1,500
05-5-00-787	SEWER SYSTEM REPAIRS	1,489	29,010	25,000	25,000	25,000	25,000
05-5-00-789	MILEAGE/TRAVEL REIMBURSEMT	51	-	200	200	200	200
05-5-00-790	MISCELLANEOUS	121	-	-	-	-	-
05-5-00-793	MEETINGS/WORKSHOPS	118	69	200	200	200	200
05-5-00-795	SUPPLIES	4,462	2,868	6,000	4,000	4,000	4,000
05-5-00-796	VEHICLE MAINTENANCE	11,024	2,997	10,000	10,000	10,000	10,000
05-5-00-799	BAD DEBT EXPENSE	-	-	-	-	-	-
TOTAL MATERIALS & SERVICES		**250,472**	**290,202**	**331,106**	**321,822**	**321,822**	**321,822**
DEBT SERVICE							
05-5-00-817	REFUNDING BONDS PRINCIPAL	157,000	162,000	167,000	171,000	171,000	171,000
05-5-00-818	REFUNDING BONDS INTEREST	175,250	171,250	166,315	161,245	161,245	161,245
05-5-00-820	IFA LOAN PAYMENT - PRINCIPAL	943	839	2,554	-	-	-
05-5-00-821	IFA LOAN PAYMENT - INTEREST	91	64	48	-	-	-
05-5-00-822	LOAN PAYMENT/REFUND	-	-	-	-	-	-
TOTAL DEBT SERVICE		**333,284**	**334,153**	**335,917**	**332,245**	**332,245**	**332,245**
CAPITAL OUTLAY							
05-5-00-906	CAPITAL OUTLAY	4,800	24,436	355,850	183,000	183,000	183,000
05-5-00-926	LOCUST ST. SEWER LINE RELOCATE	-	-	-	170,000	170,000	170,000
TOTAL CAPITAL OUTLAY		**4,800**	**24,436**	**355,850**	**353,000**	**353,000**	**353,000**
TOTAL EXPENDITURES		**840,535**	**935,408**	**1,333,057**	**1,362,568**	**1,362,568**	**1,362,568**
TOTAL REQUIREMENTS		**$ 847,335**	**$ 947,888**	**$ 2,870,217**	**$ 3,034,007**	**$ 3,034,007**	**$ 3,034,007**
05-SEWER FUND NET TOTAL		**$ 1,532,416**	**$ 1,743,818**	**$ -**	**$ -**	**$ -**	**$ -**

RESOLUTION NO. 2017-20

A RESOLUTION ESTABLISHING RATES FOR CITY SEWER SERVICE.

WHEREAS, the City of Sisters ("City") is a provider of sanitary sewer service; and

WHEREAS, Section 13.45.020(2) of the Sisters Municipal Code ("SMC") provides that each user of City sewer shall be assigned an appropriate number of equivalent dwelling units ("EDUs"), a measurement of average waste water use for a single-family residence, to determine a user's sewer use; and

WHEREAS, City presently uses a "winter average" of monthly water use between January and March to determine a commercial user's average water use outside of the irrigation season and thus their EDUs; and

WHEREAS, SMC 13.45.020(3) provides that the Sisters City Council (the "City Council") may establish by resolution the rates to be paid per EDU of sewer usage; and

WHEREAS, FCS Group completed a utility rate study for the City, which identified recommended sewer service rates and proposed to expand the "winter average" evaluation period to October to April; and

WHEREAS, City Council desires to adopt new sewer service rates and expand the "winter average" evaluation period as recommended by FCS Group.

NOW, THEREFORE, BE IT RESOLVED that the City of Sisters resolves as follows:

1. Findings. The above-stated findings contained in this Resolution No. 2017-20 (this "Resolution") are hereby adopted.

2. Assignment of EDUs. Sewer usage shall be determined based on the following assignment of EDUs:

Residential EDU Rate:	***1 per dwelling***
Commercial EDU Rate:	***1 per 501.337 cubic feet of "winter-average" water use***
"Winter Average":	***Effective July 1, 2018, "winter-average" shall be measured as average water use between the preceding November billing period through the April billing period. Effective July 1, 2019, "winter-average" shall be measured as average water use between the preceding October billing period through the April billing period.***

3. Fees. Pursuant to SMC Section 13.45.020(3), the City Council establishes the following rate for sewer service from the City to be effective July 1, 2018:

Per EDU Rate: ***$37.77***

3. Miscellaneous. This Resolution is hereby made part of City's fee resolution, Resolution No. 2017-21 (the "Fee Resolution"). The provisions of the Fee Resolution that are not amended or modified by this Resolution remain unchanged and in full force and effect. The provisions of this Resolution are severable. If any

section, subsection, sentence, clause, and/or portion of this Resolution is for any reason held invalid, unenforceable, and/or unconstitutional, such invalid, unenforceable, and/or unconstitutional section, subsection, sentence, clause, and/or portion will (a) yield to a construction permitting enforcement to the maximum extent permitted by applicable law, and (b) not affect the validity, enforceability, and/or constitutionality of the remaining portion of this Resolution. All pronouns contained in this Resolution and any variations thereof will be deemed to refer to the masculine, feminine, or neutral, singular or plural, as the identity of the parties may require. The singular includes the plural and the plural includes the singular. The word "or" is not exclusive. The words "include," "includes," and "including" are not limiting. This Resolution may be corrected by order of the Council to cure editorial and/or clerical errors.

ADOPTED by the City Council of the City of Sisters and signed by the mayor this 29th day of November, 2017.

Chuck Ryan, Mayor

ATTEST:

Kerry Prosser, City Recorder

City of Sisters

WATER AND SEWER UTILITY RATE STUDY

FINAL REPORT
September 2017

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FCS GROUP
Solutions-Oriented Consulting

TABLE OF CONTENTS

FCS GROUP
Solutions-Oriented Consulting

Section I. EXECUTIVE SUMMARY

The City of Sisters (City) contracted with FCS GROUP in 2017 to conduct a rate study for its water and sewer utilities. The project included the following tasks:

Water Rate Study

The water rate study focused on developing water rates to reflect the cost of providing service. Consistent with industry-approved ratemaking practices, this analysis included determining revenue requirements and developing rate structure alternatives to collect the targeted amount of revenue.

Exhibit ES-1 provides the recommended near-term water rate strategy:

Exhibit ES-1: Summary of Existing & Recommended Water Rates

Monthly Water Rates	Existing 2017	Proposed 2018	Projected 2019	2020	2021	2022
Base Rate:						
5/8" x 3/4" Meter	$20.59	$15.50	*$16.05*	*$16.77*	*$17.36*	*$18.02*
1" or 1-1/2" Meter	$23.09	$17.38	*$18.00*	*$18.80*	*$19.47*	*$20.21*
2" Meter	$25.58	$19.25	*$19.95*	*$20.83*	*$21.57*	*$22.39*
3" or Larger Meter	$62.40	$46.96	*$48.65*	*$50.82*	*$52.62*	*$54.61*
Volume Included in Base Rate	1,000 cf	None	*None*	*None*	*None*	*None*
Volume Rate per 100 cf[1]	$1.00	$1.00	*$1.00*	*$1.00*	*$1.00*	*$1.00*

[1]Applies to usage above the amount included in the base rate.

The rates shown in **Exhibit ES-1** reflect the following findings and proposed changes:

- 2.0% annual rate revenue increases, driven primarily by capital funding requirements that the City has embedded in its water rates. It is worth noting that these increases are also partially attributable to rising operating costs, particularly for employee benefits that the City expects will increase by 25.0% every two years.

- Removal of the 1,000 cubic feet (cf) allowance currently built into the City's base rates. With this change, customers will pay the volume rate on all water usage. The scenario preferred by City staff contemplates reducing the base rates to account for the increased revenue from volume charges, and retaining the existing volume rate for the five-year study period.

Sewer Rate Study

The sewer rate study focused on developing sewer rates to reflect the cost of providing service. Consistent with industry-approved ratemaking practices, this analysis included determining revenue requirements and developing rate structure alternatives to collect the targeted amount of revenue.

Exhibit ES-2 provides the recommended near-term sewer rate strategy:

Exhibit ES-2: Summary of Existing & Recommended Sewer Rates

Monthly Sewer Rates	Existing	Proposed	Projected			
	2017	2018	*2019*	*2020*	*2021*	*2022*
Monthly Rate per EDU	$39.00	$35.96	*$36.65*	*$37.36*	*$38.09*	*$38.83*
Non-Residential "Winter" Period	Jan – Mar	Oct – Apr	Oct – Apr	Oct – Apr	Oct – Apr	Oct – Apr

The rates shown in **Exhibit ES-2** reflect the following findings and proposed changes:

- 2.0% annual rate revenue increases, which the sewer utility needs to cover capital funding requirements that the City has embedded in its sewer rates.

- Adjustment of the "winter" period that the City uses to calculate non-residential equivalent dwelling units (EDUs). The scenario preferred by City staff expands the winter period (currently January – March) to include October, November, December, and April. This change intends to improve equity by recognizing that a number of the City's non-residential customers do not exhibit representative water usage patterns during the January – March billing periods. With this adjustment, the City can decrease the monthly rate per EDU based on the increased number of EDUs assigned to some of its non-residential customers.

Exhibit ES-3 provides a forecast of the combined water/sewer bill that a typical residential customer would pay:

Exhibit ES-3: Combined Residential Bill Forecast

Monthly Residential Bill	Existing	Proposed	Projected			
	2017	2018	*2019*	*2020*	*2021*	*2022*
Water Bill @ 700 cf	$20.59	$22.50	*$23.05*	*$23.77*	*$24.36*	*$25.02*
Sewer Bill	39.00	35.96	*36.65*	*37.36*	*38.09*	*38.83*
Total Bill	$59.59	$58.46	*$59.70*	*$61.13*	*$62.45*	*$63.85*
Change From Prior Year		-$1.13	*+$1.24*	*+$1.43*	*+$1.32*	*+$1.40*
% Change From Prior Year		-1.9%	*+2.1%*	*+2.4%*	*+2.2%*	*+2.2%*

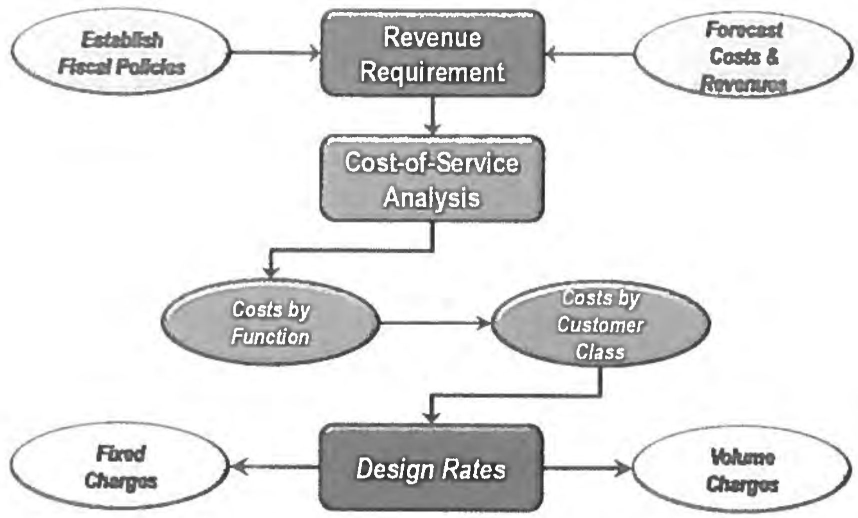
Exhibit ES-3 shows a representative residential bill decreasing by 1.9% under the proposed 2018 rates, due to a decrease in the sewer charge. The subsequent-year increases vary from $1.24 to $1.43, and are generally consistent with the aggregate increases in the utilities' annual costs.

Appendix A and **Appendix B** include printouts of the detailed water rate analysis and sewer rate analysis, respectively.

Section II. INTRODUCTION

The City of Sisters (City) contracted with FCS GROUP in 2017 to conduct a rate study for its water and sewer utilities. **Exhibit 1** shows the ratemaking process commonly used in the utility industry.

Exhibit 1: Ratemaking Methodology



- The first phase defines the amount of revenue that the utility needs to meet its annual financial obligations including operating expenses, capital outlay, debt payments, and other needs attributable to the City's financial policies.

- The second step allocates the revenue requirement to customer classes based on their demands and service characteristics. This phase usually begins with an allocation of the revenue requirement to functions of service, which vary by utility.

- Once the amount of revenue to recover from each customer class is known, the final step involves designing rates that generate the targeted amount of revenue. The City requested the development of alternative rate structures that could potentially improve attainment of the City's policy goals (such as equitable cost recovery and incentives to use water efficiently).

A rate study can include any or all of these phases. The study requested by the City included an evaluation of revenue requirements and development of rate structure alternatives, but not an explicit allocation of costs to customer classes. This study relies on the inter-class cost allocations embedded in the City's existing rates, with potential variations among the rate structure alternatives.

Section III. Policy Framework

III.A. FISCAL POLICIES

The financial plan is based on a framework of fiscal policies that promote the financial integrity and stability of the City's utilities. The ensuing discussion provides a brief summary of the key policies addressed by the City and incorporated into this analysis.

III.B. RESERVES

Like any business, a municipal utility requires certain minimum levels of cash reserves to operate. These reserves address the variability and timing of revenues and expenses as well as occasional disturbances in activities. Given the City's responsibility to provide essential services to its customers at a certain standard, protection against financial disruption is even more important than it would be for private-sector or non-essential counterparts. In addition, a defined reserve structure serves to maintain appropriate segregation of funds and promote the use of resources for their intended purposes. This analysis assumes the following structure of reserves for the City's utilities:

- **Operating Reserves.** Operating reserves provide an unrestricted fund balance to accommodate the short-term cycles of revenues and expenses, addressing unanticipated expenses or revenue shortfalls. This analysis assumes a minimum balance equal to two months (17%) of projected operating expenses, which, based on the operating expense projections in the City's 2017-18 Budget, equates to about $85,000 for the water utility and $92,000 for the sewer utility.

- **Capital Improvement Reserve.** The City sets aside cash funding for capital improvement projects in a reserve embedded within the Water/Sewer Funds. This reserve does not have an explicit minimum balance, but the City sets annual transfers based on an average of annual capital project expenditures. It periodically reviews the accrued balance, recalibrating the annual transfers as needed to attain the targeted funding levels.

- **Capital Replacement Reserve.** Also part of the Water/Sewer Funds, the City maintains a reserve dedicated to the replacement of equipment and vehicles. This reserve does not have an explicit minimum balance, but the City sets annual transfers based on the replacement cost allocated to each utility (amortized over the expected life of the related assets). It periodically reviews the accrued balance, recalibrating the annual transfers as needed to attain the targeted funding levels.

- **SDC Fund.** Consistent with the requirements established in Section 223.307 of the Oregon Revised Statutes (ORS) regarding the expenditure of system development charges (SDCs), the City maintains a separate SDC Fund to ensure that reimbursement fee and improvement fee revenues are spent on eligible capital projects.

III.C. SYSTEM REINVESTMENT

A best-management practice in the utility industry, system reinvestment involves setting aside funds to accumulate cash for immediate and future asset replacements. The policy intent is to promote stable and moderate long-term rates and avoid burdening any single generation of customers with the cost of asset replacement. Absent a formal asset replacement plan, system reinvestment policies most often link the annual funding provision to depreciation as a measure of the annual decline in asset value. The City funds system reinvestment via transfers to the Capital Improvement Reserve and Capital Replacement Reserve. Based on projected capital needs, the City plans to make annual transfers of approximately $149,000 for the water utility and $46,000 – $188,000 for the sewer utility. Note that the sewer utility's transfers include an additional $142,000 in 2018 and $128,000 in 2019 to fund near-term capital improvements – beyond 2019, the sewer utility's transfers remain at $46,000 per year based on anticipated equipment and vehicle replacement needs.

III.D. FINANCIAL PERFORMANCE STANDARDS

This analysis evaluates the sufficiency of each utility's revenues to meet its financial obligations including operation and maintenance (O&M) expenses, debt repayment, rate-funded capital needs, and any other policy-based needs. It determines the amount of revenue needed in a given year to meet that year's expected financial obligations, in the context of two revenue sufficiency tests:

- ***Cash Flow Sufficiency Test.*** The cash flow test determines whether or not each utility's annual revenues are sufficient to cover the known cash requirements for each year of the planning period. These cash requirements typically include O&M expenses, debt service payments, rate-funded capital outlays, and any additions to reserve balances.

- ***Coverage Test.*** The coverage test evaluates the utilities' ability to meet applicable bond coverage requirements, as specified by the City's bond covenants and internal debt policies.

In determining the annual revenue requirement, the test with the greatest deficiency generally drives the rate increase in any given year. It is worth noting that the City can temporarily waive the requirements of the cash flow test as part of a conscious decision to phase in rate increases, as long as its operating reserve balance is sufficient to absorb the resulting cash flow deficit. The coverage test, however, must always be met as failure to do so may result in a downgrading of the City's credit rating. Because the City does not currently have any water or sewer utility debt that requires coverage, the cash flow test defines the utilities' revenue requirements.

Section IV. REVENUE REQUIREMENT ANALYSIS

IV.A. GENERAL METHODOLOGY

The revenue requirement is the amount of revenue that a utility's rates must generate to enable it to meet its various financial obligations. This analysis has two main purposes – it serves as a means of evaluating the utility's fiscal health and adequacy of current rate levels, and it sets the revenue basis for near-term and long-term rate planning. The rate revenue requirement is defined as the net difference between total revenue needs and the revenue generated through non-rate sources. Hence, the revenue requirement analysis involves defining and forecasting both needs and resources.

IV.B. OPERATING FORECAST

Operating costs are initially based on the 2018 Budget, with adjustments for inflation and any anticipated future changes such as changes to programs or staffing levels. The key assumptions and inputs used to develop the operating forecast are described in further detail below:

Operating Revenue

- ***Annual Customer Growth:*** Varies from 2.6 – 2.8% per year, based on estimates from City staff.
- ***Rate Revenue:*** Determined by applying the existing rate structures to projected customer counts and water demand (based on detailed utility billing statistics and expected growth).
- ***Other Operating Revenue:*** Based on the 2018 Budget, assumed to remain constant over the forecast period (no escalation).
- ***Interest Earnings:*** Calculated based on projected reserve balances, assuming an earnings rate of about 0.9% per year (based on the 2016 average Oregon Short-Term Fund interest rate)

Operating Expenses

- ***Operation and Maintenance (O&M) Costs:*** Generally based on the 2018 Budget, with adjustments for inflation at the following rates:

Escalator	Assumed Rate	Applies To
General Cost Inflation	1.8% per year	Most operating expenses
Labor Cost Inflation	2.6% per year	Salaries and wages
PERS Escalation	25.0% every other year	Retirement benefit costs
Medical Cost Escalation	Water: 3.6% per year; Sewer: 13.2% per year	Non-PERS benefit costs

- ***Franchise Fees:*** Set to 7.0% of rate revenue.

Debt Service

- ***Existing Debt:*** The sewer utility currently has one outstanding debt obligation, the 2016 Full Faith and Credit Refunding Bonds (with an annual payment of approximately $333,000). Both utilities also make annual transfers to the City Hall Fund to repay a loan; the water utility's share is around $9,000 per year, and the sewer utility's share is on the order of $12,000 – $13,000 per year. The water utility does not have any other outstanding debt.

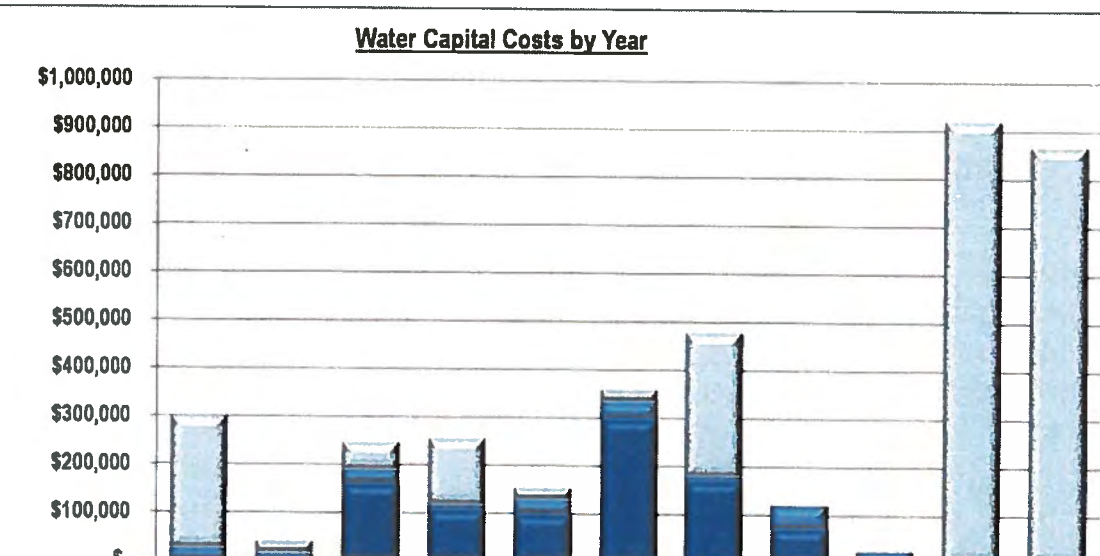
IV.C. CAPITAL FORECAST

The capital forecast involves developing a funding strategy for the annual project expenditures contemplated in the utilities' capital improvement plans (CIPs). Potential funding sources include existing cash balances, incoming rate and SDC revenues, external grants/contributions, and debt (if necessary). Given the magnitude and variability of capital project expenditures, rates most often fund an ongoing contribution for capital projects (system reinvestment) rather than direct expenditures. The ensuing discussion considers each utility's capital forecast separately.

Water Utility

Exhibit 2 summarizes the water utility CIP and anticipated funding strategy.

Exhibit 2: Summary of Water Capital Costs & Funding Strategy



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total	$300,000	$40,000	$246,620	$255,300	$153,500	$358,400	$478,000	$120,500	$25,000	$919,760	$866,300
SDC Fund	$275,000	$25,000	$57,400	$137,590	$25,000	$25,000	$298,720	$-	$-	$914,760	$861,300
Capital Replacement Reserve	$25,000	$15,000	$30,000	$10,800	$30,000	$36,400	$10,000	$48,500	$25,000	$5,000	$5,000
Capital Improvement Reserve	$-	$-	$159,220	$106,910	$98,500	$297,000	$169,280	$72,000	$-	$-	$-

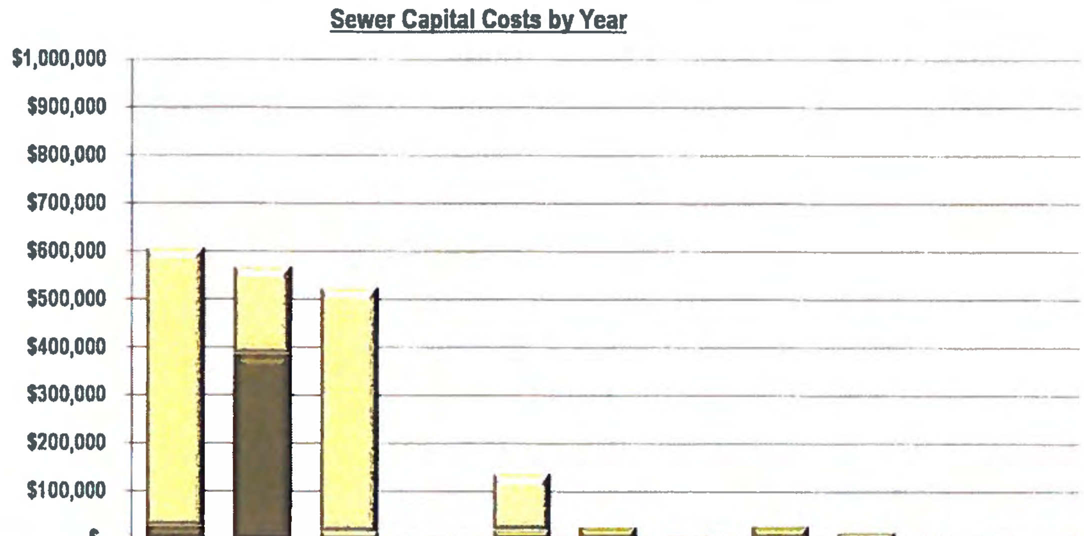
Exhibit 2 indicates that the water utility will spend $995,420 on capital projects that it plans to complete between 2018 and 2022. The full capital program through 2028 includes $3.8 million of anticipated expenditures, with the remaining $2.8 million occurring outside of the five-year planning period. Existing cash balances in the Capital Improvement Reserve, Capital Replacement Reserve,

and SDC Fund appear to be adequate to fund the projected expenditures without any new debt issuance. It is worth noting that this finding relies to an extent on the assumption that water rates fund approximately $149,000 per year in system reinvestment.

Sewer Utility

Exhibit 3 summarizes the sewer utility CIP and anticipated funding strategy.

Exhibit 3: Summary of Sewer Capital Costs & Funding Strategy



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total	$607,000	$568,000	$524,000	$800	$137,000	$26,400	$5,000	$28,500	$15,000	$-	$-
SDC Fund	$580,000	$183,200	$509,000	$-	$117,000	$-	$-	$-	$-	$-	$-
Capital Replacement Reserve	$-	$-	$15,000	$800	$20,000	$26,400	$5,000	$28,500	$15,000	$-	$-
Capital Improvement Reserve	$27,000	$384,800	$-	$-	$-	$-	$-	$-	$-	$-	$-

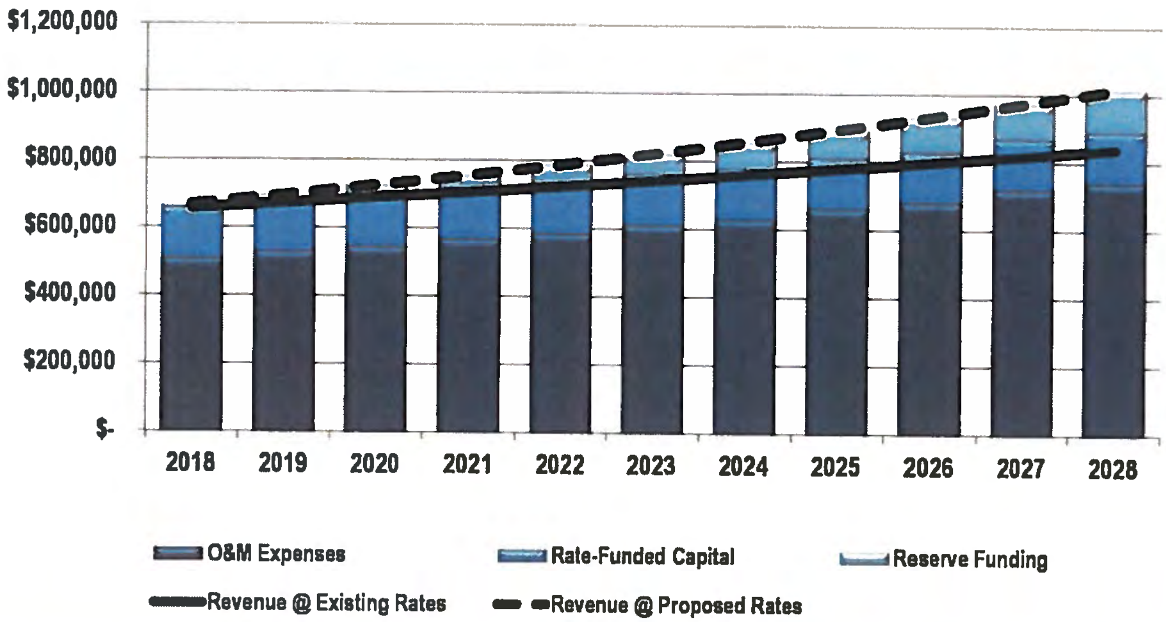
Exhibit 3 indicates that the sewer utility will spend $1,836,800 on capital projects that it plans to complete between 2018 and 2022. The full capital program through 2031 includes $2.7 million of anticipated expenditures, with the remaining $0.9 million occurring outside of the five-year planning period. In addition to these costs, the sewer utility will have to fund 50% of the cost of the West Side Pump Station and Force Main project (total estimated cost of $1.5 million). Since the timing of this project depends on the U.S. Forest Service, **Exhibit 3** does not include this project. Existing cash balances in the Capital Improvement Reserve, Capital Replacement Reserve, and SDC Fund appear to be adequate to fund the projected expenditures without any new debt issuance. It is worth noting that this finding relies to an extent on the assumption that sewer rates fund approximately $46,000 – $188,000 per year in system reinvestment.

IV.D. EVALUATION OF REVENUE SUFFICIENCY

Water Utility

Exhibit 4 summarizes the annual revenue requirements for the water utility based on the forecast of revenues, expenses, and fund balances.

Exhibit 4: Water Utility Revenue Requirement Summary

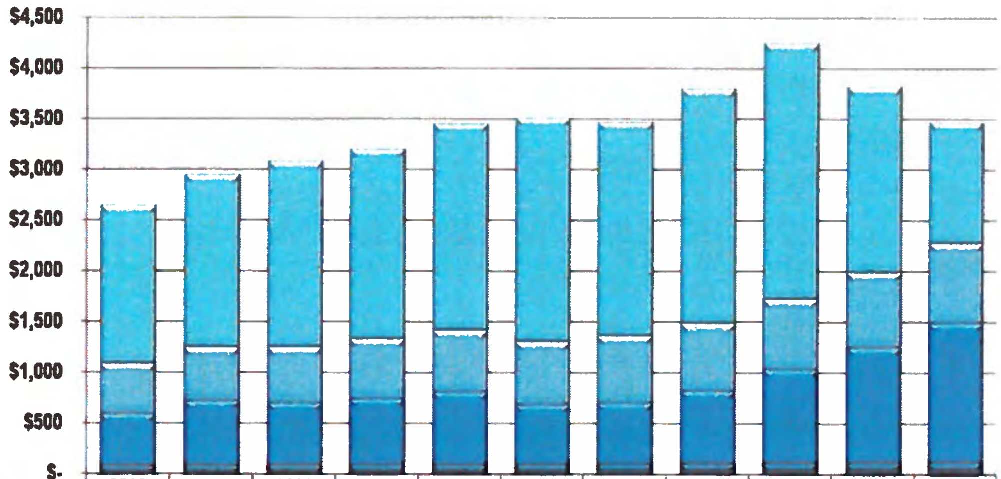


Water Revenue Req. ($000s)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Expenses											
Operating Expenses	$508	$528	$544	$567	$584	$611	$628	$661	$680	$720	$741
System Reinvestment	149	149	149	149	149	149	149	149	149	149	149
Total	**$657**	**$677**	**$693**	**$716**	**$733**	**$760**	**$777**	**$810**	**$829**	**$869**	**$890**
Revenues											
Rate Revenue @ Existing Rates	$595	$611	$628	$644	$662	$680	$698	$717	$737	$757	$778
Other Revenue	61	61	61	61	61	61	61	61	61	61	62
Total	**$656**	**$672**	**$689**	**$705**	**$723**	**$741**	**$759**	**$778**	**$798**	**$818**	**$840**
Net Cash Flow @ Existing Rates	**($1)**	**($5)**	**($4)**	**($11)**	**($10)**	**($19)**	**($18)**	**($32)**	**($31)**	**($51)**	**($50)**
Annual Rate Increase	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**
Rate Revenue After Increases	**$607**	**$636**	**$667**	**$698**	**$731**	**$766**	**$802**	**$841**	**$881**	**$923**	**$968**
Net Cash Flow After Increases	**$11**	**$17**	**$32**	**$38**	**$54**	**$61**	**$79**	**$83**	**$102**	**$104**	**$125**

Exhibit 4 indicates that at existing rates, the water utility is generating enough revenue to cover operating expenses and most of the planned transfers to the Capital Improvement Reserve and Capital Replacement Reserve (system reinvestment). There is a slight cash-flow deficit that appears to grow over time with inflation, especially in employee benefit costs (assumed 25.0% increase every two years). The proposed rate revenue strategy of 2.0% annual increases intends to cover this deficit and generate additional reserve funding for capital needs.

Exhibit 5 summarizes the projected ending balances for the water utility's reserves:

Exhibit 5: Projected Water Utility Ending Fund Balances ($000s)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
SDC Fund	$1,559	$1,703	$1,831	$1,868	$2,032	$2,202	$2,105	$2,311	$2,524	$1,833	$1,195
Capital Replacement Reserve	$496	$531	$550	$589	$610	$624	$664	$667	$693	$739	$786
Capital Improvement Reserve	$512	$634	$614	$652	$714	$584	$600	$715	$924	$1,134	$1,369
Operating Reserve	$85	$88	$91	$94	$97	$102	$105	$110	$113	$120	$123

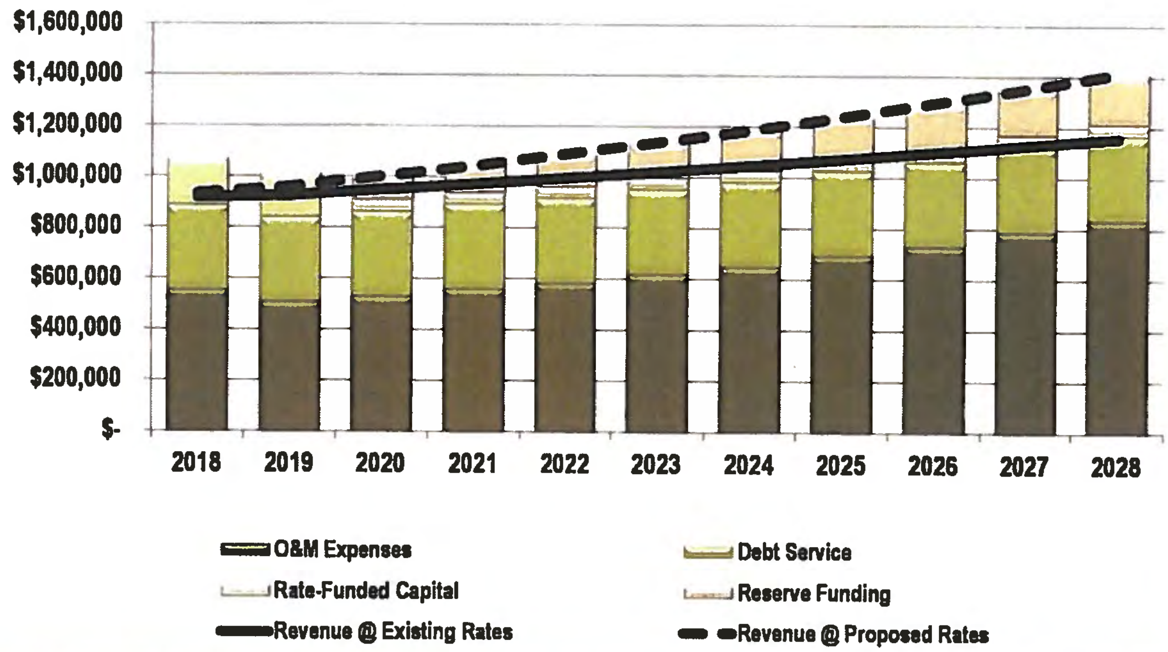
Exhibit 5 generally shows the water utility maintaining a total ending cash balance between $3.0 and $4.0 million, including the following components:

- An Operating Reserve balance increasing from $85,000 to $123,000, based on the policy target of two months (approximately 17%) of operating expenses. This analysis transfers any excess cash flow to the Capital Improvement Reserve to provide additional funding for capital projects.
- A Capital Improvement Reserve balance increasing from $512,000 to $1.4 million. This ending balance reflects $902,910 of capital project spending from 2018 – 2025, and appears to increase beyond 2025 because the City has yet to evaluate its longer-term capital needs.
- A Capital Replacement Reserve balance increasing from $496,000 to $786,000, which reflects an investment of $240,700 in the replacement of vehicles and equipment. As the City's contributions to this reserve are based on an allocation of $1.2 million in replacement costs to the water utility, this balance will decline over time as the City completes its replacement program.
- An SDC Fund balance declining from $1.6 to $1.2 million. **Exhibit 5** shows an increasing balance from 2018 – 2026 as the City collects SDCs, but shows drops in the available balance in 2027 and 2028 as the City invests its SDC revenue in a new transmission main and Well #4.

Sewer Utility

Exhibit 6 summarizes the annual revenue requirements for the sewer utility based on the forecast of revenues, expenses, and fund balances.

Exhibit 6: Sewer Utility Revenue Requirement Summary

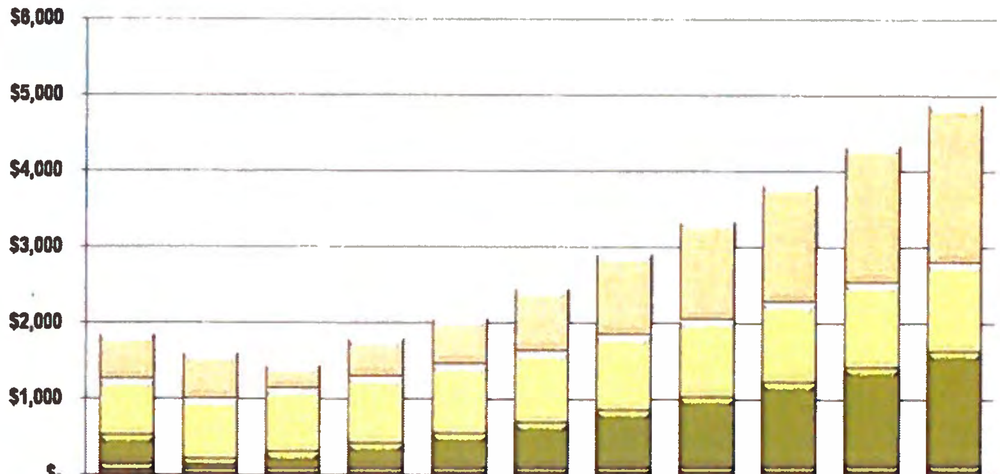


Sewer Revenue Req. ($000s)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Expenses											
Operating Expenses	$551	$507	$528	$557	$582	$618	$647	$693	$728	$787	$832
Debt Service	333	332	333	333	332	332	332	332	332	333	332
System Reinvestment	188	174	46	46	46	46	46	46	46	46	46
Total	**$1,072**	**$1,013**	**$907**	**$936**	**$960**	**$996**	**$1,025**	**$1,071**	**$1,106**	**$1,166**	**$1,210**
Revenues											
Rate Revenue @ Existing Rates	$871	$893	$917	$939	$963	$988	$1,014	$1,040	$1,067	$1,096	$1,125
Other Revenue	45	32	31	32	32	32	32	32	32	32	32
Total	**$916**	**$925**	**$948**	**$971**	**$995**	**$1,020**	**$1,046**	**$1,072**	**$1,099**	**$1,128**	**$1,157**
Net Cash Flow @ Existing Rates	**($156)**	**($88)**	**$41**	**$35**	**$35**	**$24**	**$21**	**$1**	**($7)**	**($38)**	**($53)**
Annual Rate Increase	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**
Rate Revenue After Increases	**$888**	**$929**	**$973**	**$1,016**	**$1,063**	**$1,113**	**$1,165**	**$1,219**	**$1,276**	**$1,336**	**$1,399**
Net Cash Flow After Increases	**($140)**	**($55)**	**$93**	**$106**	**$128**	**$140**	**$161**	**$167**	**$187**	**$185**	**$202**

Exhibit 6 indicates that the sewer utility has a short-term cash flow deficit in 2018 and 2019 due to the planned system reinvestment transfers and other capital outlays. When the system reinvestment transfers drop in 2020 (after the City has funded its near-term improvement projects), the sewer utility's revenue at existing rates appears to be adequate to cover its costs. Longer-term, inflationary cost increases will create a cash flow deficit unless the City imposes comparable increases in its sewer rates. The proposed rate revenue strategy of 2.0% annual increases intends to generate additional reserve funding for capital needs.

Exhibit 7 summarizes the projected ending balances for the sewer utility's reserves:

Exhibit 7: Projected Sewer Utility Ending Fund Balances ($000s)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
SDC Fund	$590	$602	$308	$506	$605	$828	$1,059	$1,299	$1,546	$1,807	$2,078
Capital Replacement Reserve	$738	$791	$828	$881	$914	$942	$991	$1,017	$1,057	$1,112	$1,167
Capital Improvement Reserve	$374	$129	$220	$323	$450	$588	$750	$915	$1,104	$1,289	$1,494
Operating Reserve	$148	$84	$88	$93	$97	$103	$108	$115	$121	$131	$139

Exhibit 7 shows the sewer utility's total ending cash balance increasing from $1.9 million to $4.9 million, including the following components:

- An Operating Reserve balance ending 2018 with $148,000, dropping to $84,000 due to transfers to the Capital Improvement Reserve in 2019, and increasing to $139,000 (based on the policy target of two months of operating expenses).

- A Capital Improvement Reserve balance increasing from $374,000 to $1.5 million. This ending balance reflects $411,800 of capital project spending from 2018 – 2026, and appears to increase in the future because the City has yet to evaluate its longer-term capital needs.

- A Capital Replacement Reserve balance increasing from $738,000 to $1.2 million, which reflects an investment of $110,700 in the replacement of vehicles and equipment. As the City's contributions to this reserve are based on an allocation of $1.3 million in replacement costs to the sewer utility, this balance will decline over time as the City completes its replacement program.

- An SDC Fund balance increasing from $590,000 to $2.1 million. The sewer utility's capital improvement program includes $1.4 million in SDC-eligible project costs from 2018 – 2028, but the City expects to collect $2.5 million in SDC revenue during the same period.

Section V. Rate Structure Analysis

V.A. GENERAL METHODOLOGY

The revenue requirement analysis establishes the amount of rate revenue that the City must collect from each utility through rates, informing across-the-board adjustments to the existing rate structure. The City also requested the development of rate structure alternatives that could improve the alignment of the City's rates with its policy objectives (such as equitable cost recovery).

The rate structure analysis involved the following key steps:

- Review detailed customer billing data (customer counts by meter size, monthly water usage), using the prevailing rate structure and the amount of revenue actually reported by the City to validate the accuracy of the data. This is a critical step, as using accurate billing data to develop rates leads to more accurate projections of future revenue.

- Set fixed and variable charges to generate the targeted amount of revenue. Note that the rate alternatives presented are revenue-neutral to the revenue requirements shown in **Exhibit 4** and **Exhibit 6** (rate revenue after increases).

V.B. WATER RATES

The City's current rate structure consists of a base rate that increases with meter size and volume rate that applies to water usage above 1,000 cubic feet (cf) per month. This rate structure charges all customers for 1,000 cf per month, whether or not they actually use that much water – while this feature promotes revenue stability, it recovers a disproportionate share of costs from low users and provides limited incentive to use water efficiently. To improve equity and conservation incentives, the City requested alternate water rate scenarios that eliminate the 1,000 cf built into the base rate.

Exhibit 8 summarizes the City's current and recommended water rates:

Exhibit 8: Summary of Existing & Recommended Water Rates

Monthly Water Rates	Existing 2017	Proposed 2018	Projected 2019	2020	2021	2022
Base Rate:						
5/8" x 3/4" Meter	$20.59	$15.50	*$16.05*	*$16.77*	*$17.36*	*$18.02*
1" or 1-1/2" Meter	$23.09	$17.38	*$18.00*	*$18.80*	*$19.47*	*$20.21*
2" Meter	$25.58	$19.25	*$19.95*	*$20.83*	*$21.57*	*$22.39*
3" or Larger Meter	$62.40	$46.96	*$48.65*	*$50.82*	*$52.62*	*$54.61*
Volume Included in Base Rate	1,000 cf	None	*None*	*None*	*None*	*None*
Volume Rate per 100 cf[1]	$1.00	$1.00	*$1.00*	*$1.00*	*$1.00*	*$1.00*

[1]Applies to usage above the amount included in the base rate.

The proposed 2018 rates shown in **Exhibit 8** are based on the 2018 revenue requirement after the planned 2.0% revenue increase (approximately $607,000 per **Exhibit 4**). Because extending the volume rate to all usage generates additional revenue relative to the existing rate structure, the proposed 2018 rate structure reflects a reduction to the base rates to remain consistent with the targeted revenue level.

In addition to the proposed rates shown in **Exhibit 8**, this analysis included the development of several other rate structure alternatives:

- Across-the-board adjustment to the existing structure
- Elimination of volume built into the base rate, proportional reduction of base and volume rates
- Elimination of volume built into the base rate, reduction of base rates only, application of future increases to both base and volume rates

The City opted against these alternatives for various reasons. For example, the across-the-board scenario retained the 1,000 cubic feet built into the base rate and failed to address the equity concerns that triggered this analysis. The other alternatives would have improved the equity of the City's rate structure, but did not align as well with the City's policy objectives as the proposed structure.

V.C. SEWER RATES

The City currently charges a monthly sewer rate of $39.00 per equivalent dwelling unit (EDU). For the purpose of imposing this rate, the City defines residential customers as one EDU per dwelling unit and calculates EDUs for non-residential customers based on their winter-average water use. One non-residential EDU equates to 3,750 gallons per day (501 cf per month) of water usage during the months of January – March.

Using winter consumption in sewer rate calculations is standard practice because it does not include irrigation water use and adequately represents the amount of water that enters the sewer system. However, it is important to recognize the nature of the City's customer base and economic cycles. January – March has historically been a slow time of year for economic activity in the City, and as a result there are a number of non-residential customers for which those three months are not representative of "normal" usage patterns.

Exhibit 9 summarizes the City's current and recommended sewer rates:

Exhibit 9: Summary of Existing & Recommended Sewer Rates

Monthly Sewer Rates	Existing	Proposed	Projected			
	2017	2018	*2019*	*2020*	*2021*	*2022*
Monthly Rate per EDU	$39.00	$35.96	*$36.65*	*$37.36*	*$38.09*	*$38.83*
Non-Residential "Winter" Period	Jan – Mar	Oct – Apr	Oct – Apr	Oct – Apr	Oct – Apr	Oct – Apr

The proposed sewer rate structure shown in **Exhibit 9** expands the "winter period" for calculating non-residential EDUs to include the months of October, November, December, and April. This change increases the number of non-residential EDUs by approximately 29%, enabling the City to decrease the monthly rate per EDU and remain revenue-neutral to the amount of revenue targeted for 2018 ($888,000 per **Exhibit 6**).

In addition to the proposed rate shown in **Exhibit 9**, this analysis included the development of several other rate structure alternatives:

- Across-the-board adjustment to the existing structure
- Expansion of non-residential "winter" period to include October, November, and December
- Expansion of non-residential "winter" period to include September, October, November, December, April, and May

The City opted against these alternatives for various reasons. For example, the across-the-board scenario retained the January – March winter averaging period for non-residential customers and failed to address the equity concerns that triggered this analysis. The other alternatives would have improved the equity of the City's rate structure, but would have resulted in a different allocation of costs to non-residential customers relative to the proposed structure.

V.D. COMBINED RESIDENTIAL BILL IMPACTS

Exhibit 10 provides a forecast of the combined water and sewer bill for a single-family residence with a 3/4" water meter and 700 cf of monthly water usage.

Exhibit 10: Combined Residential Bill Forecast

Monthly Residential Bill	Existing	Proposed	Projected			
	2017	2018	2019	2020	2021	2022
Water Bill @ 700 cf	$20.59	$22.50	$23.05	$23.77	$24.36	$25.02
Sewer Bill	39.00	35.96	36.65	37.36	38.09	38.83
Total Bill	$59.59	$58.46	$59.70	$61.13	$62.45	$63.85
Change From Prior Year		-$1.13	+$1.24	+$1.43	+$1.32	+$1.40
% Change From Prior Year		-1.9%	+2.1%	+2.4%	+2.2%	+2.2%

Exhibit 10 shows a representative residential bill decreasing by 1.9% under the proposed 2018 rates, due to a decrease in the sewer charge. The subsequent-year increases vary from $1.24 to $1.43, and are generally consistent with the aggregate increases in the utilities' annual costs.

APPENDIX E
Lazy Z Ranch Master Plan

LAZY Z RANCH MASTER PLAN

AUGUST 2021

Prepared for the
City of Sisters, Oregon

anderson perry

1901 N. Fir Street, La Grande, Oregon
214 E. Birch Street, Walla Walla, Washington
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LAZY Z RANCH MASTER PLAN

FOR

CITY OF SISTERS, OREGON

2021

REGISTERED PROFESSIONAL
ENGINEER
59632PE
OREGON
SEPT. 2, 1998
BRETT MOORE
RENEWS 12-31-22

8-11-21

ANDERSON PERRY & ASSOCIATES, INC.

La Grande, Redmond, and Hermiston, Oregon
Walla Walla, Washington

Job No. 446-06

Table of Contents

TABLES

FIGURES

APPENDICES

Executive Summary

Introduction

The City of Sisters, Oregon, has experienced considerable growth in recent years. Based on current flows, the City's existing irrigation land used for recycled water disposal at the wastewater treatment facility is near or at capacity. Additionally, the City is projected to experience substantial growth over the next 20 years. As such, the City is investigating options for increasing its capacity for recycled water disposal in a manner that complements the open space and view corridors in the City.

Recycled Water Use Options

This Lazy Z Ranch Master Plan investigated multiple beneficial reuse options for disposal of the City's recycled water and the anticipated requirements for each reuse option. Based on this investigation, it is anticipated that the City will be able to continue its production of Class D recycled water under Oregon Administrative Rules 340-055 and still use a combination of the following beneficial reuse options to dispose of its recycled water:

- Forested irrigation
- Pasture irrigation
- Lined wetlands
- Forested ponds and streams

Beneficial Reuse Alternatives

Based on the above beneficial reuse options, two different layout alternatives were developed and presented on Figures 4-1 and 4-3. One of these alternatives uses two irrigation pivots for additional pasture irrigation, while the other alternative replaces the smaller of the two irrigation pivots with larger recycled water wetlands. As discussed in this Lazy Z Ranch Master Plan, it is most cost effective for the City to seek funding for and construct the improvements at one time to take advantage of lower construction costs. However, if the City is unable to find adequate funding before requiring expansion of its beneficial reuse systems, multiple phasing options for each alternative were prepared and are outlined in Chapter 6.

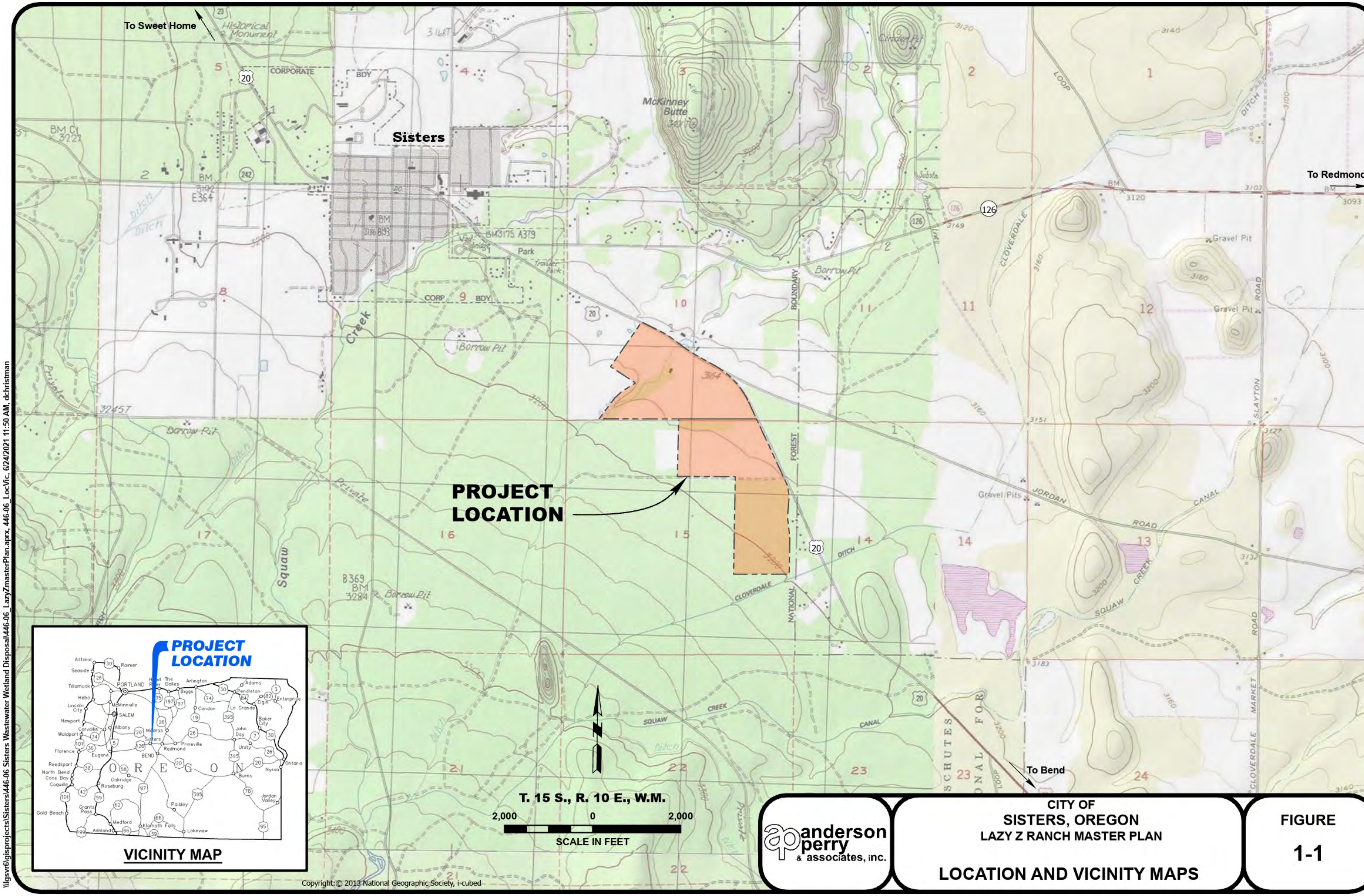
Chapter 1 - Introduction

The City of Sisters, Oregon, has a population of 3,018 and is located near the Three Sisters volcanic peaks. The City's wastewater treatment facility consist of a collection system and an aerated lagoon wastewater treatment plant that produces Class D recycled water beneficially reused for irrigation in and around the Lazy Z Ranch. Location and vicinity maps are included on Figure 1-1.

The region around the City has become a hub for art, recreation, tourism, and more. The area's popularity has brought considerable growth and many opportunities and challenges to City planning. The City's projected growth over the next 20 years will require an increase in the City's ability to dispose of treated wastewater. As such, the City is investigating options for increasing its capacity for treated wastewater disposal while complementing the open space and view corridors in the City.

The purpose of this Lazy Z Ranch Master Plan is to develop and evaluate the City's options for expanding its wastewater disposal to provide direction to City officials, staff, residents, and the City's Public Works Department to implement selected improvements. This Plan will outline the anticipated requirements for the evaluated options based on Oregon Administrative Rules (OAR) Chapter 340 Division 055 (OAR 340-055) as managed by the Oregon Department of Environmental Quality. For reference purposes, a copy of OAR 340-055 is included as Appendix A.

In addition to OAR 340-055, this Plan references the City's 2016 Recycled Water Use Plan as prepared by Becon Civil Engineering and Land Surveying and the Sisters Country Vision. The reader of this Plan is encouraged to refer to these documents.



CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN

LOCATION AND VICINITY MAPS

FIGURE 1-1

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Chapter 2 - Background Information

Site Description

The land where the recycled water is applied is zoned as Exclusive Farm Use (EFU) in Deschutes County, Oregon. The establishment of pasture and forest irrigation is an allowed use for this zoning. Additionally, the creation, restoration, or enhancement of wetlands and the land application of reclaimed water are allowed uses in an EFU zone. These uses will require prior written notification to the Oregon Department of Environmental Quality (DEQ).

A tax lot map showing the City of Sisters, Oregon's existing irrigation sites and the Lazy Z Ranch is presented on Figure 2-1. The existing irrigation sites are located on City-owned property located in Township 15 South, Range 10 East, Section 9, Tax Lot 1002, while the Lazy Z Ranch is located on City-owned property located in Township 15 South, Range 10 East, Sections 10 and 15, Tax Lots 704 and 200.

Site Characterization

The site characterization of the recycled water use site consists of climate, topography, and hydrology, in addition to a description of soils and crops.

Climate, Topography, and Hydrology

The City lies in one of the more arid regions of Oregon, with an average precipitation of approximately 13.5 inches per year. Typically, the months of November through March receive more than 1 inch of monthly precipitation, with no month averaging more than 2.3 inches of precipitation. According to the Western Regional Climate Center, the average annual maximum temperature is 60.7°F, and the average annual minimum temperature is 30.6°F. Average monthly precipitation is presented on Table 2-1.

TABLE 2-1
AVERAGE MONTHLY PRECIPITATION

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation (inches)	2.24	1.45	1.12	0.79	0.78	0.61	0.38	0.41	0.4	0.95	2.1	2.27

The City is located east of the three volcanic peaks for which it is named. Elevations in the city limits range between approximately 3,180 feet and 3,230 feet above mean sea level. The City's wastewater treatment facility (WWTF) is located south of the City.

Soils

According to well logs in the vicinity of the irrigation sites, the static water level ranges substantially across the City's land application sites, up to 200 feet below ground surface. Additionally, multiple wells dug in the same locations have resulted in substantially different static water levels within feet of each other, suggesting that a confining layer exists in the strata of soils at the Lazy Z Ranch. Well logs confirm that layers of basalt and other igneous rocks are prevalent in the area. These igneous rock layers are likely providing the confining layer that is separating shallow groundwater from deep groundwater. The well logs show layers of shallow basalt overburdened by rocks, gravels, sands, and topsoil, with underlying layers of lava rock and other igneous materials.

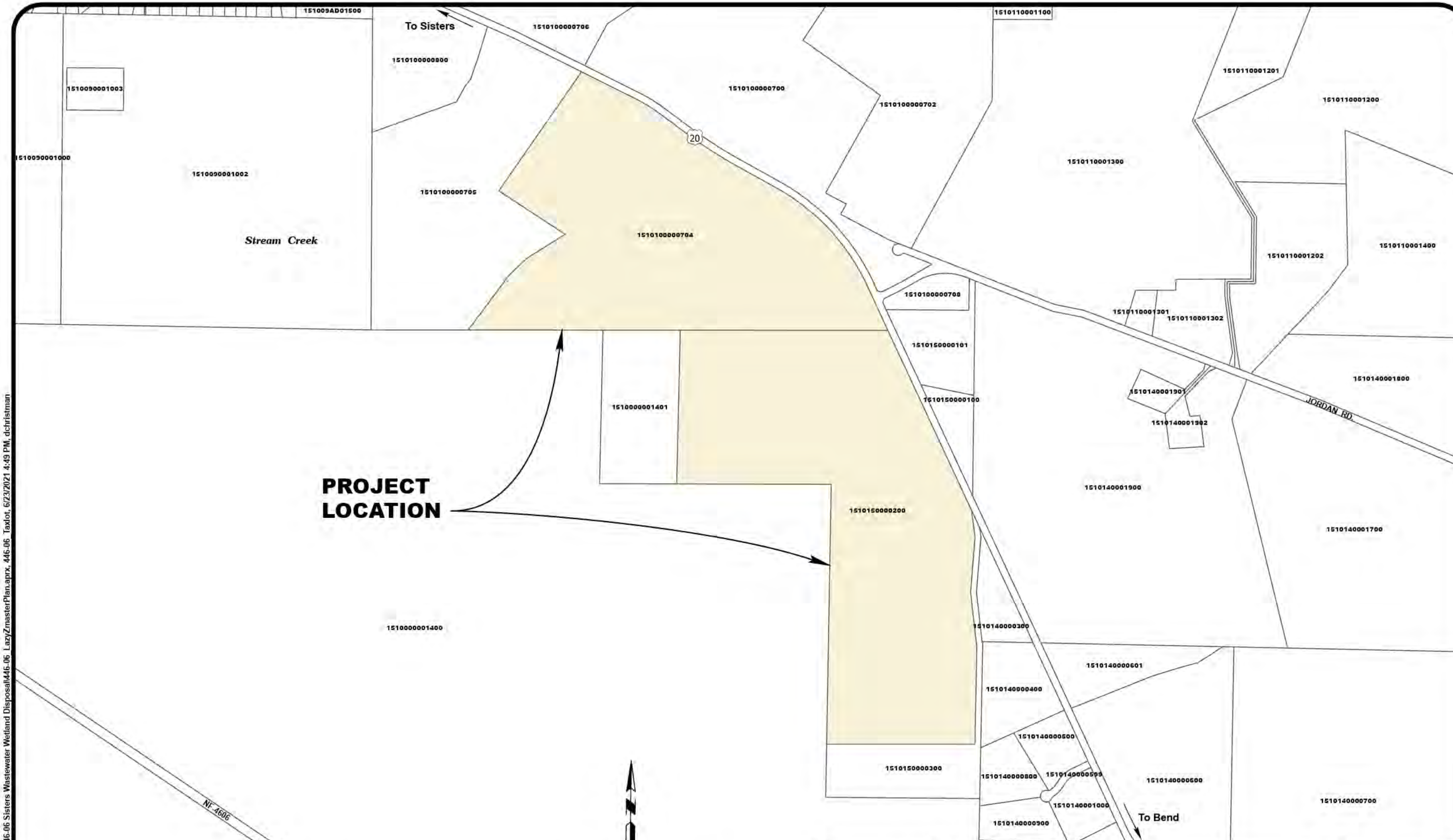
In addition, a Natural Resources Conservation Service Custom Soil Resource Report was developed for the land application sites and their vicinity (see Appendix B). The Custom Soil Resource Report shows high soil transmissivity, with the majority of Ksat values ranging between 1.98 and 5.95 inches per hour. There is one small strip of land in the vicinity of Reed Ditch that has moderately high to high transmissivity, with a Ksat value between 0.57 and 1.98 inches per hour. Most of the site is considered well drained, with a low available water capacity of approximately 3.8 inches. The land in the vicinity of Reed Ditch is somewhat poorly drained, with an available water capacity of approximately 7.0 inches.

Existing Wastewater Treatment Facility Operation

The City's WWTF receives and processes raw sewage from a mix of residential and commercial sources. The City's WWTF consists of an influent lift station that pumps raw sewage through the WWTF influent flowmeter to the headworks. The raw sewage is screened in the headworks to remove inorganic solids before flowing by gravity to the aerated lagoons. The City operates two 2.41-acre aerated lagoons for biological oxidation of the wastewater. Treated wastewater is then stored in an 18-acre treated water storage lagoon during the irrigation off-season. Following the storage lagoon is a chlorine injection vault and chlorine contact pipeline. Treated wastewater is disinfected and then pumped via the City's irrigation pumps to the City's land application sites.

Wastewater received at the City's WWTF is treated to produce Class D recycled water, which is currently applied for beneficial use at various irrigation sites located in the vicinity of the WWTF and at the Lazy Z Ranch, as shown on Figure 2-2. The irrigation sites consist of 88 acres of forested land, 11.8 acres of dikes around the treatment and storage lagoons, and approximately 45 acres of pasture. Of the 88 acres of forested land, approximately 55 acres are currently irrigated. Based on the City's existing irrigation infrastructure, the City's irrigation land at the WWTF is at, or near capacity, for disposal of its recycled water. As such, the City wants to develop additional beneficial reuse options at the Lazy Z Ranch to expand its existing recycled water disposal capacity. The City provides Class D recycled water to each location. In accordance with Oregon Administrative Rules (OAR) 340-055 and the City's Water Pollution Control Facilities Permit, other permitted beneficial uses for Class D recycled water allowed by the OAR may be used in the future. The City is required to notify the DEQ in writing of any changes in beneficial use before they occur.

All irrigation sites are currently owned and operated by the City.



anderson perry & associates, inc.

CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN

TAX LOT MAP

FIGURE
2-1

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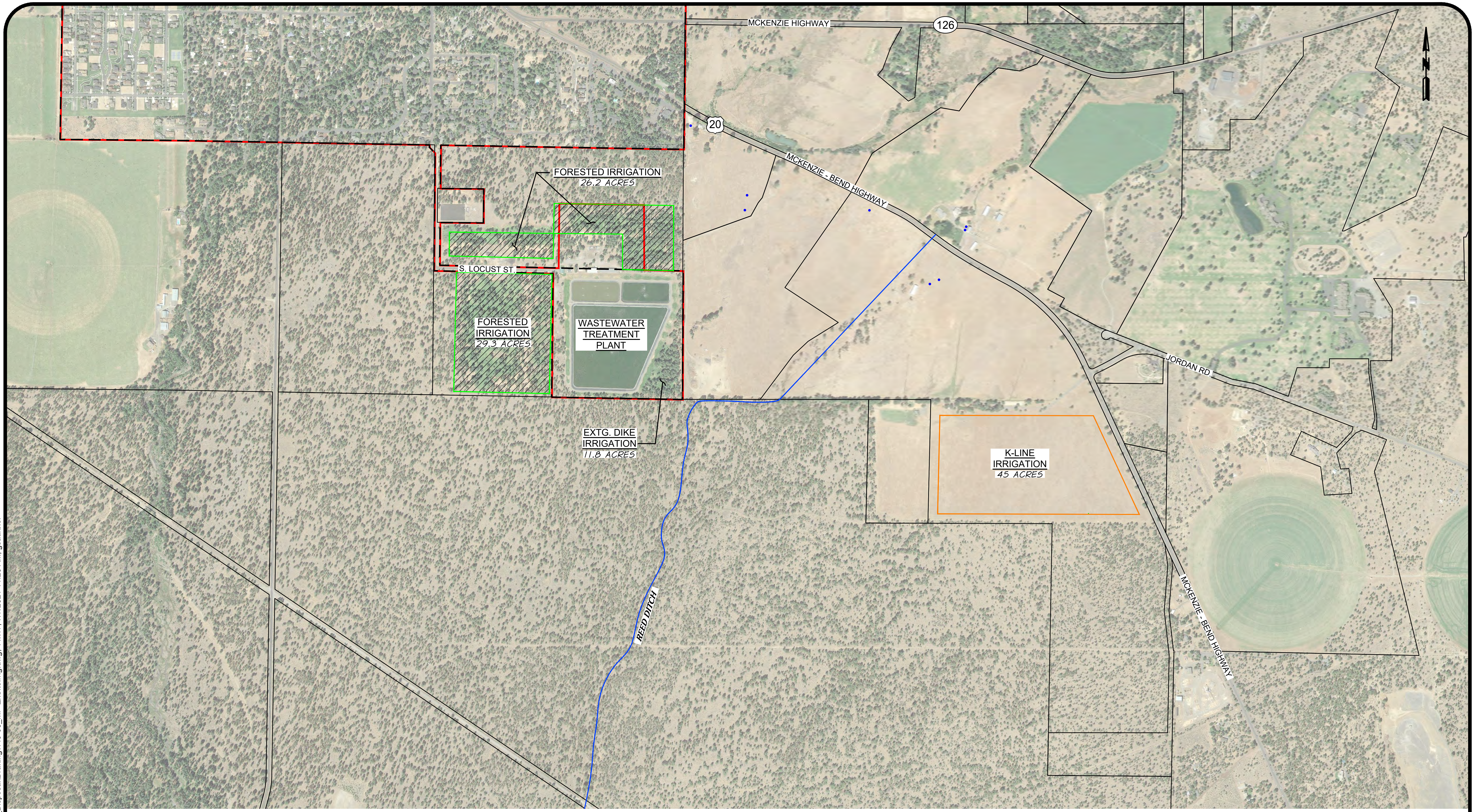

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LEGEND

- PRIVATE TAXLOTS
- CITY LIMITS
- URBAN GROWTH BOUNDARY
- WELL

500 0 500 1000 1500
SCALE IN FEET

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN

EXISTING SITE IRRIGATION

FIGURE
2-2

Chapter 3 - Recycled Water Use Options

This chapter briefly outlines the general requirements for the beneficial reuse of treated wastewater (recycled water) and the options available to the City of Sisters, Oregon, based on the City's existing wastewater treatment facility (WWTF).

Recycled Water Use Requirements

The beneficial use of recycled water is governed by Oregon Administrative Rules (OARs) Chapter 340 Division 055 (OAR 340-055). In OAR 340-055, five qualities (or classes) of recycled water are identified. A summary of these classes of recycled water, their permitted beneficial uses in accordance with OAR 340-055, and their respective treatment and monitoring requirements is included on Figure 3-1. In addition, Anderson Perry & Associates, Inc., prepared the Preliminary Findings Memorandum (PFM) (see Appendix C) to outline the anticipated requirements for the City's potential beneficial reuse options for their recycled water.

As shown on Figure 3-1 and discussed in the PFM, disinfection requirements for each class of recycled water vary substantially. As such, permissible uses for each class of recycled water also vary, as lower disinfection qualities result in increased use restrictions. Additionally, the requirements for restricting access to the recycled water use sites varies by both class and beneficial use. The differences in access restrictions will be summarized during the discussion of the different beneficial use options available to the City.

Recycled Water Quality Options

Aerated lagoon WWTFs are generally capable of producing the following classes of recycled water: nondisinfected recycled water, Class D recycled water, and Class C recycled water. Because the production of Classes B and A recycled water qualities would likely require replacement of the City's existing WWTF to allow reliable production of these higher quality recycled water classes, Classes B and A will not be discussed as options for the City's beneficial reuse. Due to the limited permitted beneficial uses for nondisinfected recycled water and the fact that the City's WWTF has consistently produced Class D recycled water, nondisinfected recycled water will also not be discussed as an option.

Class D Recycled Water

The City's existing WWTF is currently permitted for the production and beneficial reuse of Class D recycled water. The City has been successful in consistently meeting the treatment and monitoring requirements associated with this class of recycled water. Historically, the City has used their recycled water to irrigate grass on the dikes surrounding the treatment and storage lagoons at the WWTF and to irrigate the forested and pasture areas in the WWTF's vicinity. As noted on Figure 3-1, the following are additional beneficial uses permitted for Class D recycled water per OAR 340-055: irrigation for growing seed crops not intended for human ingestion, commercial timber, firewood, sod, ornamental nursery stock, or Christmas trees.

The City has expressed interest in using wetlands and a system of ponds/streams as beneficial reuse options that enhance the aesthetic of the Lazy Z Ranch in a manner consistent with the Sisters

Country Vision Action Plan (see Appendix D). Though this form of beneficial use is not explicitly listed as a beneficial use permitted for Class D recycled water, Class D recycled water may be used for any beneficial purpose authorized in writing by the Oregon Department of Environmental Quality (DEQ). To receive such an authorization, the DEQ may request information or include limitations or conditions on the City's Water Pollution Control Facilities Permit to ensure the protection of public health and environment. Additionally, the DEQ may confer with the Oregon Department of Human Services before giving such an authorization. The City of Prineville, Oregon, encountered a situation like Sisters' and received authorization for the disposal of recycled water via unlined wetlands. To receive this authorization, it is anticipated that the requirements outlined in the PFM must be met (see Appendix C).

City of Prineville Wastewater Treatment Facility

The City of Prineville operates an aerated lagoon wastewater treatment plant similar to that operated by the City of Sisters. Prineville produces a Class D recycled water. Their recycled water leaves Prineville's WWTF and enters a wetland complex. Prineville's wetland complex consists of lined treatment wetlands followed by unlined disposal wetlands. The purpose of the lined treatment wetlands is to provide additional treatment/polishing of the recycled water by reducing the potential pathogen counts of the Class D recycled water before it enters the unlined disposal wetlands.

Based on experience with Prineville's WWTF and wetland disposal complex, the City could continue to produce Class D recycled water that is then reused in wetlands, ponds, and streams, provided that a portion of the wetlands is lined and used for additional treatment of the recycled water. This portion of the wetlands would require fencing or some form of barrier to discourage public contact, along with signage notifying the public of the use of recycled water.

Class C Recycled Water

Currently, the existing WWTF does not produce recycled water that consistently meets the requirements of Class C recycled water. Because the storage lagoon is uncovered and exposed to the elements, wastewater quality can vary with weather and other environmental conditions. During the summer, algae blooms can occur, typically leading to higher total suspended solids (TSS) concentrations in the storage lagoon. During periods of high TSS concentrations, the disinfection effectiveness can be negatively impacted, leading to higher coliform counts in the recycled water. There are generally two approaches that could be taken to address these concerns. These options include either substantially increasing the chlorine dosing rates or modifying the storage lagoon to combat the potential for algae blooms and allow additional settling. Each option and corresponding advantages and disadvantages are outlined below.

Substantial Increase of Chlorine Dosing Rates

Substantially increasing the chlorine dosing rate could allow the WWTF to meet the disinfection requirements of Class C recycled water. However, the variation in effluent TSS can have significant impacts on the required dosing rate. TSS can act as a shield that protects the pathogens and other bacteria/viruses from the chlorine, which would in turn require substantial increases in chlorine dosing rates that would equate to much higher disinfection costs.

Furthermore, TSS is typically composed of natural organic matter in various stages of decomposition. TSS tends to react with chlorine, effectively wasting its disinfection potential, to create disinfection byproducts (DBPs), like chloroform and other trihalomethanes. These DBPs can pose both environmental hazards and health hazards.

Advantages: Low initial capital cost.

Disadvantages: High ongoing operation and maintenance costs, TSS can protect bacteria from disinfection (may not be effective), unpredictable, chlorination byproducts.

Storage Lagoon Modification

A common practice for reducing effluent TSS includes covering a portion of the storage lagoon to prevent algae growth. By covering the lagoon, sunlight is blocked, cause algae to die and allowing it to settle out of the water as it flows through the covered portion of the lagoon and on to later treatment processes. Baffles can also be added in the covered section to promote settling. These improvements could substantially improve the consistency in effluent TSS throughout the year. As a result, chlorine dosing rates would remain relatively consistent and fewer chlorination byproducts would be produced.

Advantages: More consistent effluent quality, easier to provide adequate chlorine dosing, lower chance for chlorination byproducts.

Disadvantages: High capital cost, requires more substantial modification to the existing WWTF.

Of the two water quality options, continued production of Class D recycled water is preferred. This option would not require any modifications to the City's existing WWTF; however, there are more requirements for preventing public access to Class D recycled water. These requirements will be discussed at greater length later in this Plan.

Potential Beneficial Uses

The City has expressed interest in exploring several beneficial reuse options. These options include expanding the City's existing effluent irrigation, wetlands, and forested ponds and streams. The regulatory requirements associated with each beneficial reuse option vary to ensure public health is adequately protected. Each beneficial use option and its associated regulatory requirements is discussed below.

Effluent Irrigation

Multiple options are available for irrigation of the City's recycled water. As previously stated, the City currently uses its recycled water to irrigate pasture at the Lazy Z Ranch. In addition, the City uses its recycled water to irrigate dikes around its treatment and storage lagoons, along with some of the forested areas in the vicinity of the WWTF. Irrigation can be applied in accordance with OAR 340-055.

Methods of Irrigation Application

OAR 340-055 references various acceptable methods for irrigation of recycled water. These methods include applying recycled water directly to the soil and sprinkler irrigation. The City currently uses sprinkler irrigation, and it is recommended to continue this practice. The PFM prepared for the City (Appendix C) outlines the regulatory requirements for sprinkler irrigation.

Potential sprinkler irrigation methods include K-lines, center pivots, wheel lines, solid sets, or hand lines. Hand lines are extremely labor intensive, making them untenable. Solid set irrigation has one of the highest per acre capital costs along with the disadvantage of having multiple risers that can be easily damaged by equipment. As such, the City plans to maintain their existing solid set systems, but no additional solid set systems are recommended for reclaimed water disposal. The primary irrigation methods considered by the City include K-line irrigation, center pivot irrigation, and wheel line irrigation. The advantages and disadvantages of each irrigation method are presented below.

K-Line Irrigation

K-line irrigation offers advantages in its capital cost and flexibility. This form of irrigation consists of impact sprinklers mounted in protective pods made of a durable plastic. The sprinklers are connected to each another via flexible hoses that allow the sprinklers to be oriented in a variety of ways to fit the shape of the irrigation site. This flexibility is one of the key advantages of the K-line systems. Additionally, capital costs for K-line systems are typically low. However, this system requires greater operational attention, as the pods must be manually moved from location to location in the irrigation area to cover the entire area. The typical practice is to move the system after every 24 hours of irrigation. Additionally, the sprinklers used in K-line systems are small and often plastic, making them more susceptible to blockages and increasing maintenance requirements. Due to the operational disadvantages associated with K-line systems, the City has expressed interest in replacing their existing K-lines with a more operationally friendly infrastructure.

Center Pivot Irrigation

Center pivot irrigation offers advantages in its minimal maintenance requirements and automated operation. This form of irrigation uses a movable pipe structure that rotates around a central pivot point. The pipe structure is mounted on drive towers that use electric, motorized wheels to rotate the structure. These systems can be set to automatically run with different run times and rotational speeds. The key advantages of center pivot systems include automation of the system, which minimizes operational requirements, along with the durability resulting in low maintenance requirements. However, this system has a higher capital cost than other systems and is limited to irrigate circular or rectangular areas of land. Additionally, center pivot systems are generally more visible than other systems.

Wheel Line Irrigation

Wheel line irrigation offers a middle-ground option between K-line irrigation and center pivot irrigation. While a wheel line costs more than a K-line system, wheel line capital cost is typically lower than that of center pivot irrigation. Similar to the K-line irrigation system, a wheel line is often moved every 24 hours and requires operator attention to do so. However, the wheel line infrastructure is generally more durable than that of the K-line system and typically requires less maintenance.

Irrigation Uses

A variety of different crops and beneficial land irrigation options are available for the disposal and beneficial use of recycled water. Irrigation uses considered by the City include pasture, crops, forested areas, and the WWTF dikes. Each irrigation use is discussed below.

Pasture Irrigation

The City has already begun some pasture irrigation at the Lazy Z Ranch using a K-line irrigation system. Pasture irrigation provides advantages in reducing operational requirements and eliminating the need for manual harvest of the pasture vegetation, as wildlife and pasture grazing animals automatically and continuously “harvest” the crop. However, because grazing animals usually keep vegetation cut short, pastureland typically has lower water requirements than other crops, resulting in larger areas required to dispose of an equivalent quantity of water compared to crops. Additionally, these animals must be moved during irrigation.

Crop Irrigation

Crop irrigation has frequently been used as a beneficial use in many rural communities. Though the type of crop that can be irrigated with recycled water varies with the quality of recycled water per OAR 340-055 (e.g., Class D recycled water cannot be used to irrigate crops for human consumption), crops tend to use more water and can make better use of the nitrogen found in recycled water. The main disadvantage of irrigating crops with recycled water is the workforce required to harvest and process the crops.

Forested Area Irrigation

Currently, the City irrigates the naturally forested areas around the WWTF using a solid set irrigation system. These areas generally consist of juniper trees with various fir and pine trees mixed in. Though irrigating forested areas consisting of these varieties of trees does not generally require as much water as the irrigation of pasture areas or crops, irrigation of forested areas better allows preservation of the natural beauty of the area. Additionally, the City is recognized as a Tree City, showing the City’s commitment to preserving its forested areas. Because the City has irrigation infrastructure in place, it would be advantageous to maintain the existing infrastructure and continue to irrigate these forested areas.

Dike Irrigation

In addition to irrigating the forested areas around the City’s WWTF, the City also irrigates the dikes and embankments that surround the City’s wastewater treatment lagoons. Though harvesting the grass that grows on the dikes due to this irrigation is difficult, the continued irrigation of this “landscape” area has minimal drawback, as the City already has the irrigation infrastructure in place. The irrigation and maintenance of grass on the dikes helps inhibit weed growth and is more aesthetically appealing than covering the dikes with rock or leaving the earthwork exposed.

Recycled Water Wetlands

Recycled water wetlands can either be lined or unlined to provide additional disposal. However, discussed in the PFM (Appendix C), the soils at the Lazy Z Ranch are highly permeable and not conducive to the development of an unlined wetland, so only a lined wetland will be discussed. Wetlands provide beneficial use of recycled water via disposal of the water (through evaporation and transpiration) and additional treatment/polishing of the water via natural processes that improve its quality. Additionally, wetlands provide habitat for wildlife along with public interaction through trail systems, educational interpretive hubs, and wildlife viewing.

Forested Ponds and Streams

Forested ponds and streams can also be lined or unlined for additional disposal. Due to the highly permeable soils in the area, the ponds and streams would also be lined. Recycled water disposal would primarily occur via evaporation. Advantages of using forested ponds and streams for disposal of recycled water include additional nature trails and hiking areas, enhancing natural habitat for wildlife, and enhancing the natural beauty of the Lazy Z Ranch and surrounding area. The primary disadvantage of using forested ponds and streams is that they are not specifically listed in OAR 340-055 as an approved beneficial use for polished Class D recycled water. As a result, the procedure outlined in the PFM (Appendix C) would need to be followed.

RECYCLED WATER QUALITY STANDARDS AND REQUIREMENTS

Recycled Water Classification	Beneficial Use Description	Monitoring Requirements	Treatment Requirements
Non-disinfected	Irrigation for growing fodder, fiber, seed crops not intended for human ingestion, or commercial timber.	Per the facility owner's Water Polllution Control Facilities or National Pollutant Discharge Elimination System Permit.	Must be oxidized wastewater.
Class D	Any beneficial use defined above or for the irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals.	Monitoring for *E. coli* once per week at a minimum. Recycled water must not exceed a 30-day log mean of 126 *E. coli* organisms per 100 milliliters (mL) and 406 *E. coli* oranisms per 100 mL in any single sample.	Must be an oxidized and disinfected wastewater that meets the monitoring requirements.
Class C	Any beneficial use defined above or for the irrigation of orchards or vineyards (applied directly to the soil), golf courses, cemeteries, highway medians, or industrial or business campuses; industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural fire fighting using aircraft, street sweeping, or sanitary sewer flushing; water supply source for landscape	Monitoring for total coliform organisms once per week at a minimum. Recycled water must not exceed a median of 23 coliform organisms per 100 mL, based on results of the last seven days that analyses have been completed, and 240 total coliform organisms per 100 mL in any two consecutive samples.	Must be oxidized and disinfected wastewater that meets the monitoring requirements.
Class B	Any beneficial use defined above or for stand-alone fire suppression systems in commercial and residential buildings, non-residential toilet or urinal flushing, or floor drain trap priming; water supply source for restricted recreational impoundments,	Monitoring for total coliform organisms three times per week at a minimum. Recycled water must not exceed 2.2 total coliform organisms per 100 mL, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 mL in any single sample.	Must be oxidized and disinfected wastewater that meets the monitoring requirements.
Class A	Any beneficial use defined above or for irrigation for any agricultural or horticultural use; landscape irrigation of parks, playgrounds, school yards, residential landscapes, or other landscapes accessible to the public; commercial car washing or fountains when the water is not intended for human consumption; water supply source for nonrestricted recreational impoundments; artificial groundwater recharge by surface infiltration methods or by subsurface injection in accordance with Oregon Administrative Rule (OAR) Chapter 340, Division 44. Direct injection into an underground source of drinking water is prohibited unless allowed by OAR Chapter 340, Division 44.	Monitoring for total coliform organisms must occur once per day at a minimum. Monitoring for turbidity must occur on an hourly basis at a minimum. Before disinfection, unless otherwise approved in writing by the department, the wastewater must be treated with a filtration process, and the turbidity must not exceed an average of 2 nephelometric turbidity units (NTU) within a 24-hour period, 5 NTU more than five percent of the time within a 24-hour period, and 10 NTU at any time. After disinfection, Class A recycled water must not exceed a median of 2.2 total coliform organisms per 100 mL based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 mL in any single sample.	Must be oxidized, filtered, and disinfected wastewater that meets the monitoring requirements.

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN

RECYCLED WATER QUALITY STANDARDS AND REQUIREMENTS

FIGURE 3-1

Chapter 4 - Beneficial Reuse Alternatives

Based on discussion with the City of Sisters, Oregon, and input from the Public Works Advisory Committee, two different conceptual layouts were developed. Each layout is described below.

Layout Alternative 1

This layout maintains the existing forested irrigation on the property surrounding the City's existing wastewater treatment facility (WWTF) along with the existing wastewater treatment lagoon dike irrigation as shown on Figure 4-1. In addition, this alternative utilizes two irrigation pivots, a wetland area, and an area with forested ponds and streams for the beneficial reuse of the City's recycled water. A summary of the different beneficial reuse options is included on Table 4-1.

TABLE 4-1
LAYOUT 1 BENEFICIAL REUSE

Beneficial Use	Size (acres)	Notes
Forested Irrigation	78.75	Existing
Dike Irrigation	11.80	Existing
Wetland	16.00	Wet acres
Forested Ponds and Streams	4.00	Four wet acres ponds with 2 miles of streams
Wheel Line Irrigation	14.00	None
Irrigation Pivot 1	22.70	Quarter pivot with end gun
Irrigation Pivot 2	47.10	Half pivot with end gun

To enhance the ability for community interaction and provide recreational and educational opportunities, a network of trails and informational markers would wind through the wetland and forested pond areas. An additional trail would meander between the wheel line irrigation area and pivot irrigation area from a viewpoint off U.S. Highway 20 to a future Peterson Ridge Trail connector. Due to public contact concerns, if this area is to be irrigated, it must be irrigated with the City's existing surface water rights for the Lazy Z Ranch.

Based on these areas, a water balance was prepared for the year 2040 planning horizon. This water balance is included on Figure 4-2. As shown on Figure 4-2, approximately 62.5 acre-feet of the City's surface water rights would be required (shown as supplemental freshwater on Figure 4-2) to fully meet the potential water demands of this alternative, which shows that the City has excess land available at the Lazy Z Ranch to meet the anticipated 2040 recycled water disposal demands. Even if the 14-acre wheel line irrigation area was not incorporated, approximately 25 acre-feet of the City's surface water rights would be required to fully meet the potential water demands of this alternative.

Layout Alternative 2

This layout would also maintain the City's existing forested irrigation on the property surrounding the City's existing WWTF along with the existing wastewater treatment lagoon dike irrigation as shown on Figure 4-3. In addition, this alternative would utilize one irrigation pivot, a larger wetland area, and an area with forested ponds and streams for the beneficial reuse of the City's recycled water. A summary of the different beneficial reuse options is included on Table 4-2.

TABLE 4-2
LAYOUT 2 BENEFICIAL REUSE

Beneficial Use	Size (acres)	Notes
Forested Irrigation	78.75	Existing
Dike Irrigation	11.80	Existing
Wetland	47.50	Wet acres
Forested Ponds and Streams	4.00	Four wet acres ponds with 2 miles of streams
Wheel Line Irrigation	14.00	
Irrigation Pivot 2	47.10	Half pivot with end gun

This layout would also incorporate networks of trails and informational markers through the wetland and forested pond areas, along with an additional trail meandering between the wheel line irrigation area and pivot irrigation area from a U.S. Highway 20 viewpoint to a future Peterson Ridge Trail connector. The area around the meandering trail to the future Peterson Ridge Trail connector would also be irrigated and enhanced with the City's existing surface water rights for the Lazy Z Ranch.

Based on these areas, a water balance was prepared for the year 2040 planning horizon. This water balance is included on Figure 4-4. As shown on the figure, approximately 95 acre-feet of the City's surface water rights would be required to fully meet the potential water demands of this alternative, which shows that the City has more capability for beneficial reuse of recycled water under this alternative.

Regulatory Requirements

As outlined in the attached Preliminary Findings Memorandum (see Appendix C), it is anticipated that the City can continue to produce Class D recycled water at their wastewater treatment facility for beneficial reuse under either alternative. Required setback distances vary depending on the beneficial reuse option. A summary of the required setback distances, signage, and other regulatory requirements for each alternative is outlined on Table 4-3.

TABLE 4-3
BENEFICIAL USE REQUIREMENTS

Beneficial Use	Required Setback Distance (feet)	Additional Requirements
Forested irrigation with impact sprinklers	100	Fencing or other barrier restricting public access along with signs notifying of recycled water use.
Dike irrigation with impact sprinklers	100	Fencing or other barrier restricting public access along with signs notifying of recycled water use.
Wetland	10	Simple barrier discouraging public access along with signs notifying of recycled water use.
Forested ponds and streams	10	Signs notifying of recycled water use.
Wheel line irrigation	100	Fencing or other barrier restricting public access along with signs notifying of recycled water use.
Irrigation pivot	100	Fencing or other barrier restricting public access along with signs notifying of recycled water use.

In addition to the requirements summarized above, the implementation of the forested ponds and streams should be completed after the recycled water is polished/further treated via the wetlands. As such, the wetlands must be constructed before the forested ponds and streams can be used for the beneficial reuse/disposal of the City's recycled water.

Furthermore, the City may be required to either develop a new Recycled Water Use Plan (RWUP) or prepare an addendum to the existing RWUP prior to expanding the City's recycled water uses.

Sisters Country Vision Compatibility

Each proposed layout aligns with the Sisters Country Vision and the strategies that have been identified in the 2019 Sisters Country Vision Action Plan (VAC). The proposed improvements would expand the City's ability to dispose of additional effluent and provide public open space and a gateway to the City through enhanced use of the Lazy Z Ranch site. Outlined below is additional discussion on the compatibility of the proposed layouts and the VAC.

Prosperous Sisters

The first strategy identified in the VAC for promoting a "prosperous economy rooted in arts and craft, recreation, entrepreneurship, and innovation" includes the strategic development of tourism. The development of the Lazy Z Ranch as outlined would provide a tourist attraction for the City that would provide both recreational and educational opportunities. Trail systems through the wetlands and ponds would have substantial opportunities for hiking and bird watching. Informational kiosks would help tourists know what different species of wildlife to look for while at the wetlands. The trail and viewpoint north of the pivot irrigation area would allow view of the historic Lazy Z Ranch. Kiosks along this trail and at the viewpoint could educate visitors about the history of the Lazy Z Ranch and its importance to the City of Sisters.

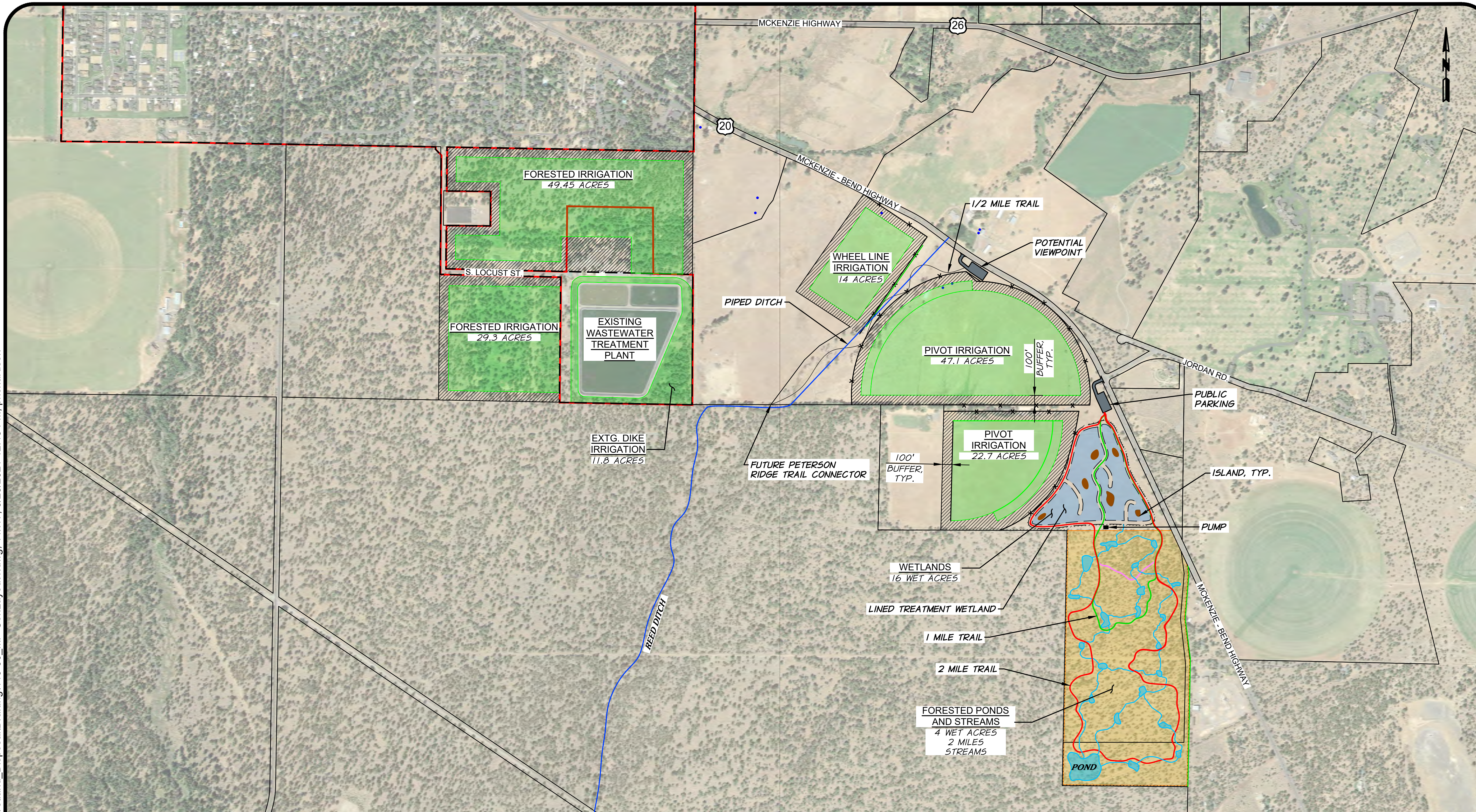
Livable Sisters

Multiple strategies are identified in the VAC for a livable "city and region that remain welcoming even as they grow" that align with both alternatives previously presented. The expansion of the trail systems at the wetlands, forested ponds and streams, and the area north of the irrigation pivots directly correlates with Strategy 4 of the VAC. The trails through the wetlands and forested ponds and streams would provide access to these areas for recreation, while the trail running north of the irrigation pivots could be connected to the Peterson Ridge Trail system. Additionally, the creation of these new public amenities and visitor attractions is a Strategy 5 goal per the VAC.

Resilient Sisters

Under the vision aspect to develop a resilient community, Strategy 3 is to promote an age-friendly community. The varying lengths of trails through the wetlands and forested ponds and streams will allow visitors of a wide variety of age and physical capabilities to enjoy the facilities.

VAC's Strategy 4 includes developing a Sisters Country that is resilient for all residents and discusses the need for drought and fire-resistant landscapes. The water used to fill the wetlands, ponds, and streams and irrigate the Lazy Z Ranch pastures will be the City's reclaimed water. Though there can be seasonal variations in wastewater flows, these variations typically follow consistent trends from year to year. In addition, a certain base flow can typically be expected even during drought conditions, due to the consistent need for sewer service. As such, these consistent flows can help to protect the proposed improvements during drought conditions.



LEGEND

- PRIVATE TAXLOTS
- CITY LIMITS
- URBAN GROWTH BOUNDARY
- WELL
- FOREST, POND, AND STREAMS
- WETLAND
- IRRIGATION
- REQUIRED SETBACK

500 0 500 1000 1500
SCALE IN FEET

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN

CONCEPTUAL LAYOUT 1

FIGURE
4-1

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
CONCEPTUAL LAYOUT 1
WATER BALANCE

Month	Holding Pond Initial Volume (ac-ft)	Influent Flow[1] (gpd)	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation[2] (in)	Net (in)	Net WWTP Evaporation (ac-ft)	Net Forested Ponds Evaporation (ac-ft)[3]	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Pasture Irrigation Requirements (in)[4]	Pasture Irrigation (in)[5]	Forest Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Fresh Water (ac-ft)	Final Volume (ac-ft)[6]
October	30.00	369,882.51	35.19	0.95	1.00	-0.05	-0.10	-0.02	0.00	-0.07	0.00	0.44	0.52	3.40	0.98	2.03	0.51	0.60	0.00	57.49
November	57.49	371,598.64	34.21	2.10	1.00	1.10	2.09	0.42	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.68
December	95.68	376,794.40	35.85	2.27	1.00	1.27	2.42	0.49	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	136.12
January	136.12	365,877.50	34.81	2.24	1.00	1.24	2.36	0.48	0.00	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	175.42
February	175.42	355,588.12	30.56	1.45	1.00	0.45	0.86	0.17	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	207.60
March	207.60	374,404.31	35.62	1.12	1.00	0.12	0.23	0.05	0.00	0.16	0.00	0.88	1.04	6.79	1.97	4.05	1.02	1.21	0.00	228.61
April	228.61	364,856.87	33.59	0.79	4.25	-3.46	-6.58	-1.33	0.00	-4.61	0.00	2.81	3.31	21.69	6.28	12.95	3.25	3.86	0.00	201.65
May	201.65	377,892.55	35.95	0.78	6.14	-5.36	-10.19	-2.05	0.00	-7.15	0.00	3.51	4.13	27.10	7.85	16.17	4.06	4.82	0.00	158.21
June	158.21	433,609.63	39.92	0.61	6.69	-6.08	-11.56	-2.33	0.00	-8.11	0.00	3.81	4.48	29.42	8.52	17.56	4.41	5.23	0.00	111.01
July	111.01	442,360.36	42.08	0.38	8.66	-8.28	-15.75	-3.17	0.00	-11.04	0.00	4.64	5.46	35.82	10.37	21.38	5.37	6.37	33.50	77.32
August	77.32	420,461.98	40.00	0.41	7.91	-7.50	-14.26	-2.88	0.00	-10.00	0.00	3.92	4.61	30.26	8.76	18.06	4.53	5.38	29.00	52.18
September	52.18	405,975.02	37.38	0.40	5.42	-5.02	-9.55	-1.92	0.00	-6.69	0.00	2.42	2.85	18.68	5.41	11.15	2.80	3.32	0.00	30.02
		Total	**435.15**	**13.50**	**45.07**	**-31.57**	**-60.04**	**-12.10**	**0.00**	**-42.09**	**0.00**	**22.43**	**26.39**	**173.17**	**50.14**	**103.35**	**25.95**	**30.79**	**62.50**	

Notes:
[1] Based on Portland State University's forecasted 2040 population of 4,867 people.
[2] From the Western Regional Climate Center for the Bend 7 N.E. Evaporation Station.
[3] Assumes 2 miles of streams with 4-foot wide water surface on average and 3.5 acres of ponds.
[4] From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.
[5] From the Reclamation's AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.
[6] Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators could be kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac = acre
ac-ft = acre-feet
evap. = evaporation
ft = feet
gpd = gallons per day
in = inch
WWTP = wastewater treatment plant

Treatment Lagoons Wet Area (ac):	**4.82**
Storage Pond Wet Area (ac):	**18.00**
Total WWTP Wet Area (ac):	**22.82**
Storage Pond Capacity (ac-ft):	**213.00**

	Area (ac)	Storage Depth (ft)	Additional Storage (ac-ft)	
Wetland	16.00	1.50	24.00	
Forested Ponds	4.60	0.00	0.00	
Pivot 1	22.80	-	-	
Pivot 2	47.00	-	-	
Lagoon Dike Irrigation	11.80	-	-	
Forested Irrigation	78.75	-	-	
Wheel Line Irrigation	14.00	-	-	
		Total	**24.00**	**ac-ft**
		Total Storage	**237.00**	**ac-ft**

Recycled Water Disposal Option	Disposal Capacity (ac-ft)
Wetland/Ponds	54.20
Pasture Irrigation	153.49
Wheel Line	30.79
Existing Irrigation	259.16
Total	497.63

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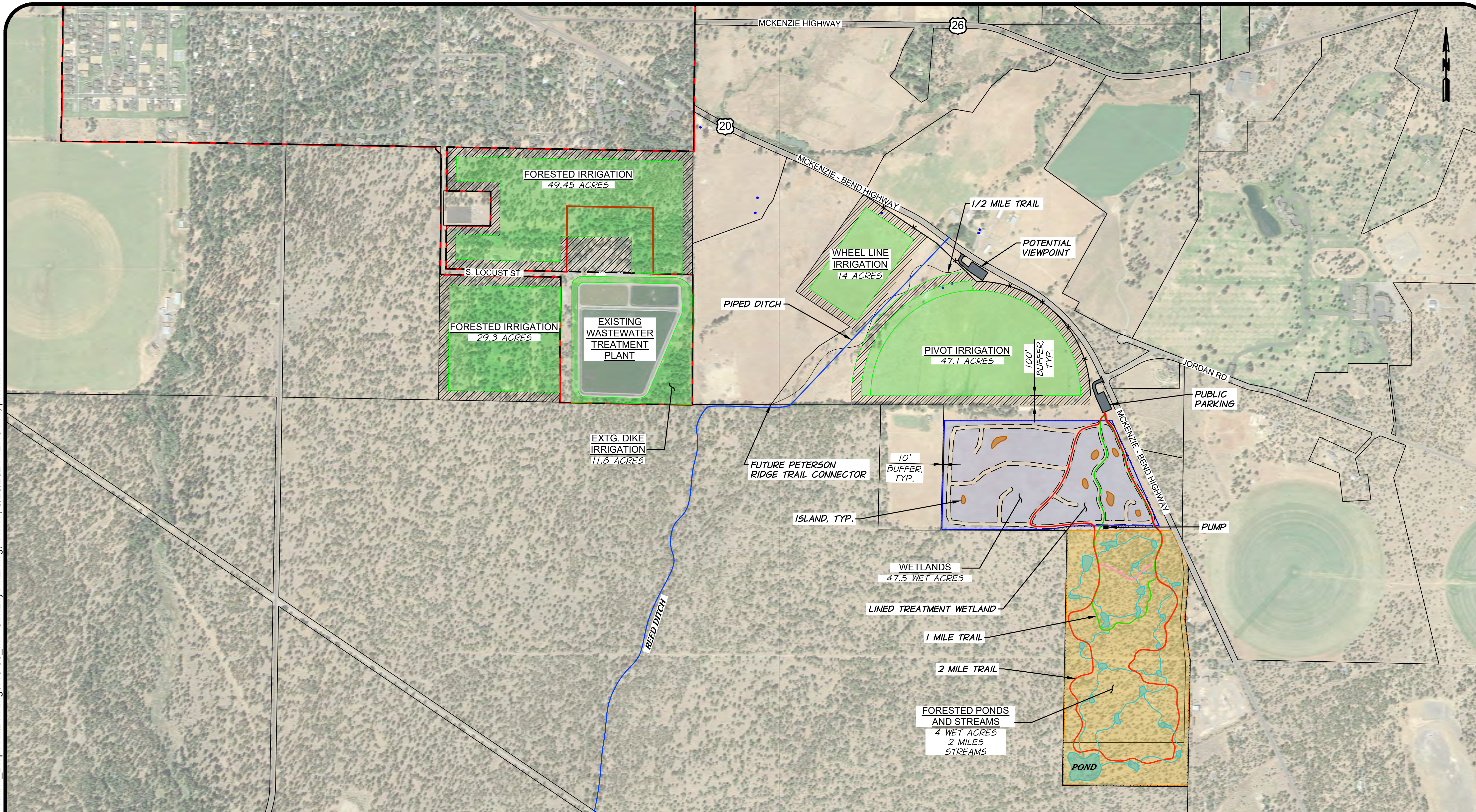
CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
CONCEPTUAL LAYOUT 1
WATER BALANCE

FIGURE
4-2



LEGEND

- PRIVATE TAXLOTS
- CITY LIMITS
- URBAN GROWTH BOUNDARY
- WELL
- FOREST, POND, AND STREAMS
- WETLAND
- IRRIGATION
- REQUIRED SETBACK

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN

CONCEPTUAL LAYOUT 2

FIGURE
4-3

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
CONCEPTUAL LAYOUT 2
WATER BALANCE

Month	Holding Pond Initial Volume (ac-ft)	Influent Flow[1] (gpd)	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation[2] (in)	Net (in)	Net WWTP Evaporation (ac-ft)	Net Forested Ponds Evaporation (ac-ft)[3]	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Pasture Irrigation Requirements (in)[4]	Pasture Irrigation (in)[5]	Forest Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Fresh Water (ac-ft)	Final Volume (ac-ft)[6]
October	30.00	369,882.51	35.19	0.95	1.00	-0.05	-0.10	-0.02	0.00	-0.20	0.00	0.44	0.52	3.40	0.00	2.03	0.51	0.60	0.00	58.34
November	58.34	371,598.64	34.21	2.10	1.00	1.10	2.09	0.42	0.00	4.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.42
December	99.42	376,794.40	35.85	2.27	1.00	1.27	2.42	0.49	0.00	5.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	143.19
January	143.19	365,877.50	34.81	2.24	1.00	1.24	2.36	0.48	0.00	4.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	185.74
February	185.74	355,588.12	30.56	1.45	1.00	0.45	0.86	0.17	0.00	1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	219.11
March	219.11	374,404.31	35.62	1.12	1.00	0.12	0.23	0.05	0.00	0.48	0.00	0.88	1.04	6.79	0.00	4.05	1.02	1.21	0.00	242.40
April	242.40	364,856.87	33.59	0.79	4.25	-3.46	-6.58	-1.33	0.00	-13.70	0.00	2.81	3.31	21.69	0.00	12.95	3.25	3.86	0.00	212.64
May	212.64	377,892.55	35.95	0.78	6.14	-5.36	-10.19	-2.05	0.00	-21.22	0.00	3.51	4.13	27.10	0.00	16.17	4.06	4.82	0.00	162.98
June	162.98	433,609.63	39.92	0.61	6.69	-6.08	-11.56	-2.33	0.00	-24.07	0.00	3.81	4.48	29.42	0.00	17.56	4.41	5.23	0.00	108.33
July	108.33	442,360.36	42.08	0.38	8.66	-8.28	-15.75	-3.17	0.00	-32.78	0.00	4.64	5.46	35.82	0.00	21.38	5.37	6.37	60.00	89.78
August	89.78	420,461.98	40.00	0.41	7.91	-7.50	-14.26	-2.88	0.00	-29.69	0.00	3.92	4.61	30.26	0.00	18.06	4.53	5.38	35.25	59.96
September	59.96	405,975.02	37.38	0.40	5.42	-5.02	-9.55	-1.92	0.00	-19.87	0.00	2.42	2.85	18.68	0.00	11.15	2.80	3.32	0.00	30.04
		Total	**435.15**	**13.50**	**45.07**	**-31.57**	**-60.04**	**-12.10**	**0.00**	**-124.96**	**0.00**	**22.43**	**26.39**	**173.17**	**0.00**	**103.35**	**25.95**	**30.79**	**95.25**	

Notes:
1 Based on Portland State University's forecasted 2040 population of 4,867 people.
2 From the Western Regional Climate Center for the Bend 7 N.E. Evaporation Station.
3 Assumes 2 miles of streams with 4-foot wide water surface on average and 3.5 acres of ponds.
4 From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.
5 From the Reclamation's AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon, Station divided by 0.85 for irrigation efficiency.
6 Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators could be kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac = acre
ac-ft = acre-feet
ft = feet
gpd = gallons per day
in = inch
WWTP = Wastewater Treatment Plant

Treatment Lagoons Wet Area (ac):	**4.82**
Storage Pond Wet Area (ac):	**18.00**
Total WWTP Wet Area (ac):	**22.82**
Storage Pond Capacity (ac-ft):	**213.00**

	Area (ac)	Storage Depth (ft)	Additional Storage (ac-ft)	
Wetland	47.50	1.50	71.25	
Forested Ponds	4.60	0.00	0.00	
Pivot 2	47.00			
Lagoon Dike	11.80			
Forested Irrigation	78.75			
Wheel Line Irrigation	14.00			
		Total	**71.25**	**ac-ft**
		Total Storage	**284.25**	**ac-ft**

Recycled Water Disposal Option	Disposal Capacity (ac-ft)
Wetland/Ponds	137.07
Pasture Irrigation	103.35
Wheel Line	30.79
Existing Irrigation	259.16
Total	530.36

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
CONCEPTUAL LAYOUT 2
WATER BALANCE

FIGURE
4-4

Chapter 5 - Alternatives Cost Estimates

This chapter outlines preliminary cost estimates for each alternative previously metioned. Understanding the anticipated costs of each layout alternative may impact which alternative is eventually pursued by the City of Sisters, Oregon, and will help guide the City in its pursuit for funding. Discussion about the development of each cost estimate is included below. These cost estimates are provided for budgetary purposes.

Alternative 1

A preliminary construction cost estimate for Alternative 1 was developed based on the beneficial uses presented for this alternative in Chapter 4. This cost estimate is summarized by each beneficial use and is included on Table 5-1.

TABLE 5-1
ALTERNATIVE 1 PRELIMINARY COST ESTIMATE

Beneficial Use	Cost
Wetland	$1,200,000
Forested Ponds and Streams	$1,300,000
Pivot 1	$300,000
Pivot 2	$250,000
General	$480,000
Future Wheel Line	$130,000
Subtotal	**$3,400,000**
Contingency, Engineering, and Administration (35%)	$1,190,000
Total	**$4,590,000**

The cost for the wetland includes all earthwork for the impoundments and dikes, a 1-inch bentonite liner, 12 inches of soil placed over the bentonite liner, all required plantings, and wetland fencing. In addition, the costs for wetland piping, control structures, and the effluent lift station were included in the development of this cost estimate.

The forested ponds and streams cost estimate includes all earthwork, plantings, pathways, and bridges to develop the area as discussed in Chapter 4 and as shown on Figure 4-1. All pathways are assumed to be gravel paths; paved pathways would cost more. This cost also includes anticipated piping costs to convey the water from the wetlands to the primary pond.

Both pivot cost estimates include pivot infrastructure, end gun, booster pumps, an irrigation pump station, electrical work, piping, and fencing to construct the pivots as shown on Figure 4-1.

The “General” line item was included to cover improvements that did not fall under a specific beneficial reuse category. Included in this item are the wetlands parking area, the Lazy Z Ranch viewpoint shown just north of the pivots on Figure 4-1, and the Peterson Ridge Trail connector. In addition, a cost to replace and extend, as necessary, the effluent piping to the beneficial reuse sites on the Lazy Z Ranch was included.

The cost for the future wheel line included all piping, wheel line infrastructure, and fencing associated with this beneficial reuse item.

Alternative 2

A preliminary construction cost estimate for Alternative 2 was developed based on the beneficial uses presented for this alternative in Chapter 4. This cost estimate is summarized by each beneficial use and is included on Table 5-2.

TABLE 5-2
ALTERNATIVE 2 PRELIMINARY COST ESTIMATE

Beneficial Use	Cost
Wetland	$3,580,000
Forested Ponds and Streams	$1,300,000
Pivot 2	$325,000
General	$480,000
Future Wheel Line	$130,000
Subtotal	**$4,770,000**
Contingency, Engineering, and Administration (35%)	$1,670,000
Total	**$6,440,000**

The costs for each beneficial use line item included on Table 5-2 include the same components as those discussed previously for Alternative 1. As shown on Table 5-2, the costs for the forested ponds and streams, future wheel line, and general are the same as those for Alternative 1. The cost for Pivot 2 is higher under Alternative 2 than under Alternative 1 because Alternative 1 was able to divide some of the costs for the electrical work between the two pivot options, as there is not a substantial cost difference between the controls work or utility service work required for one pivot or two pivots.

The greatest cost difference between the two alternatives is the wetland cost. As discussed in Chapter 4, this alternative would incorporate approximately an additional 31 acres of wetland in lieu of Pivot 1. Based on the earthwork, liner, and plantings costs associated with the construction of these wetlands, the cost per acre to construct the wetlands is higher than that to construct an irrigation pivot.

Cost Considerations

As discussed, the capital cost to construct Alternative 1 is substantially lower than that to construct Alternative 2; however, potential funding opportunities should be considered that may help offset some of the cost disparity. Due to environmental benefits associated with wetlands, additional funding opportunities are available for the construction of these wetlands. The Oregon Parks and Recreation Department (OPRD) and the Oregon Department of Fish and Wildlife (ODFW) have grants available that could assist with these construction costs. OPRD awards more than $13 million in grants each year to support recreation on public lands, while ODFW provides grant funding for projects that conserve, enhance, or provide wildlife habitat or develop water in arid regions.

In addition, as shown on Figures 4-2 and 4-4, wetlands provide greater potential for beneficial reuse and disposal of recycled water per acre than pivots. As such, the increased wetland size would provide a more efficient use of the Lazy Z Ranch property from a disposal standpoint and, therefore, provide greater recycled water use capacity than the construction of an irrigation pivot.

Chapter 6 - Beneficial Use Phasing

As discussed in Chapter 4, each proposed alternative provides excess capability for the reuse and disposal of the City of Sisters, Oregon's recycled water when compared to the anticipated 2040 demands. From an overall cost standpoint, it is most advantageous for the City to acquire funding for the entire project and construct it all at once. However, due to the excess capacity provided by either alternative presented in Chapter 4, the City will not need to construct all the proposed improvements at once to meet its disposal needs. The purpose of this chapter is to outline different options for phasing the beneficial uses to assist the City with its planning efforts.

Alternative 1 Phasing

The City's Discharge Monitoring Reports (DMRs) for the years 2018 through 2020 are summarized on Figure 6-1. Based on the highest continuous year of flows from these data, water balances representative of the City's current demands were prepared. Each water balance represents a different option for phasing for this alternative. These options are outlined further below.

Option 1

The first option involves the initial replacement of the City's K-line irrigation system with two irrigation pivots. Based on current flows from the City's DMRs, a water balance for this phase was prepared and is included on Figure 6-2. As shown, this phasing offers approximately 107 acre-feet of capacity to allow for population growth. Based on past Portland State University (PSU) population projections, this additional disposal capacity is anticipated to provide the City with adequate beneficial reuse capacity for the next 8 to 12 years.

Option 2

The second option incorporates the initial implementation of the wetland and forested ponds and streams, along with the maintenance of the existing K-line irrigation system. Based on current flows from the City's DMRs, a water balance for this phase was prepared and is included on Figure 6-3. As shown, this initial phase is anticipated to provide 80.5 acre-feet of additional disposal capacity. Based on past PSU population projections, this additional disposal capacity is anticipated to provide the City with adequate beneficial reuse capacity for the next five to nine years.

Alternative 2 Phasing

Two phasing options were explored for this alternative. The highest continuous year of flows from the City's 2018 to 2020 DMR data was used to prepare water balances representative of the City's current recycled water demands for each phasing option. These options are outlined further below.

Option 1

The first option initially replaces the existing K-line irrigation system with the wetlands and the forested ponds and streams. Based on current flows from the City's DMRs, a water balance for this phase was prepared and is included on Figure 6-4. As shown, this phasing option offers approximately 90 acre-feet of additional recycled water disposal capacity. Based on past PSU population projections, this additional disposal capacity is anticipated to provide the City with adequate beneficial reuse capacity for the next six to ten years.

Option 2

The second option involves the initial installation of a half-circle pivot. Based on current flows from the City's DMRs, a water balance for this phase was prepared and is included on Figure 6-5. This option is anticipated to provide approximately 56.5 acre-feet of additional recycled water disposal capacity. Based on past PSU population projections, this disposal capacity is anticipated to provide the City with adequate beneficial reuse capacity for the next two to six years. To further increase the short-term disposal capacity under this option, the City could maintain its existing K-line irrigation system. Doing so would provide approximately 44 additional acre-feet of disposal capacity, which is anticipated to provide adequate beneficial reuse capacity for the next 7 to 11 years.

Phasing Advantages and Disadvantages

Generally, each alternative phasing option falls under one of the following categories: construct the wetlands and forested ponds and streams first, or construct the irrigation pivot(s) first. Discussion is included below regarding the advantages and disadvantages of these general categories.

Wetlands Phased First

The primary advantage of constructing the wetlands and forested ponds and streams first comes primarily from the parks and recreational benefits. The earlier the City invests in this improvement, the earlier the community could begin to benefit. Additionally, wildlife would benefit from the development of habitat.

The primary disadvantage of constructing the wetlands first is the initial capital cost. The wetlands and forested ponds and streams are anticipated to cost more than the irrigation pivots. However, construction costs increase each year. As such, postponing construction will result in escalated prices in the future.

The advantages and disadvantages of constructing the wetlands and forested ponds and streams first are summarized as follows:

- **Advantages**
  - Parks and recreational benefits
  - Development of natural habitat for wildlife
- **Disadvantages**
  - Cost

Irrigation Pivot(s) Phased First

There are multiple advantages from constructing the irrigation pivot(s) before the wetlands and forested ponds and streams. First, the irrigation pivot(s) are relatively inexpensive to construct. The City could construct the irrigation pivot(s) first to gain short-term disposal capacity. This time could be used to build the sewer fund, apply for funding, and increase sewer rates as needed to help lower potential costs due to interest if the City receives any loans for the construction of improvements. In addition, the time of construction for irrigation pivots is relatively low.

The primary disadvantage of constructing the irrigation pivot(s) first is the initial lack of parks and recreational benefits.

The advantages and disadvantages of constructing the irrigation pivot(s) first are summarized as follows:

- **Advantages**
  - Cost
  - Allows additional time for funding acquisition
  - Short construction time
- **Disadvantages**
  - No public open space or recreational benefits

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
DISCHARGE MONITORING REPORT SUMMARY

	Influent								Effluent						
Date	Total Monthly Flow (MG)	Maximum Daily Flow (MGD)	Minimum Daily Flow (MGD)	Average Daily Flow (MGD)	Daily Max pH	Daily Min pH	BOD_5 Conc. (mg/L)	TSS Conc. (mg/L)	Dike Quantity Irrigated (in/acre)	Forest Quantity Irrigated (in/acre)	Forest 2 Quantity Irrigated (in/acre)	Average Daily Quantity Chlorine Used (lbs)	*E. Coli* Concentration (CFU/100 ml)	Maximum pH	Minimum pH
Jan-18	6.118	0.220	0.184	0.197	7.34	7.17	268	134							
Feb-18	5.526	0.222	0.187	0.197	7.33	7.05	200	98							
Mar-18	6.124	0.210	0.187	0.197	7.33	6.90	327	136							
Apr-18	5.926	0.213	0.186	0.197	7.36	7.01	357	173	1.37			7.0	1.00	7.40	7.00
May-18	6.634	0.246	0.196	0.214	7.29	7.01	267	147	4.81	2.06		6.0	1.00	7.20	7.10
Jun-18	6.890	0.249	0.213	0.230	7.34	6.71	354	170	6.57	3.22		8.0	1.50	7.30	7.10
Jul-18	7.479	0.264	0.229	0.241	7.25	6.71	354	170	9.33	5.43		9.0	2.86	8.00	7.20
Aug-18	7.331	0.254	0.210	0.236			362	169	6.67	3.77		10.0	2.03	7.82	7.11
Sep-18	6.796	0.250	0.207	0.227	7.59	6.89	366	185	5.37	3.10		9.0	2.52	7.18	7.86
Oct-18	6.500	0.235	0.190	0.211	7.25	7.10	358	195	2.25	1.12		9.0	1.00	7.91	7.21
Nov-18	6.106	0.216	0.187	0.204	7.25	6.85	318	148							
Dec-18	6.521	0.238	0.173	0.210			331	137							
Jan-19	6.504	0.243	0.194	0.209	7.37	7.10	252	153							
Feb-19	5.747	0.235	0.182	0.205	7.42	6.91	311	199							
Mar-19	6.584	0.225	0.191	0.212	7.25	6.94	306	178							
Apr-19	6.477	0.249	0.202	0.216	7.32	7.11	297	174	1.61	0.64		9.9	1.00	7.42	7.29
May-19	6.865	0.243	0.209	0.221	7.41	7.17	308	180	4.93	2.03	0.44		4.63	7.28	7.11
Jun-19	8.421	0.423	0.175	0.280	7.44	7.13	338	172	6.18	3.77			20.80	7.60	7.25
Jul-19	8.126	0.287	0.247	0.262	7.36	7.10	354	153	8.62	5.28		9.0	10.09	7.38	7.11
Aug-19	7.777	0.262	0.240	0.251	7.33	7.13	279	176	10.69	6.73			9.60	7.38	7.23
Sep-19	7.137	0.270	0.221	0.237	7.86	7.11	186	136	9.77	4.88	3.00	12.0	18.60		
Oct-19	6.770	0.244	0.202	0.218	7.39	7.11	372	290	9.49		3.18	9.0	2.60	8.52	7.70
Nov-19	6.568	0.243	0.208	0.219	7.49	6.25	319	111							
Dec-19	6.825	0.249	0.193	0.220	7.31	6.63	397	108							
Jan-20	6.734	0.256	0.196	0.217	7.25	6.75	301	168							
Feb-20	6.352	0.234	0.198	0.219	7.27	7.01	350	160							
Mar-20	6.435	0.227	0.190	0.208	7.25	6.64	323	158							
Apr-20	5.926	0.210	0.186	0.198	7.21	7.12	338	184	1.62			3.5	0.00	7.39	7.01
May-20	6.712	0.241	0.197	0.217	7.31	7.11	296	173	3.83	0.46	0.44	4.7	8.00	7.40	7.00
Jun-20	7.405	0.305	0.225	0.247	7.29	7.11	338	188	3.80	5.27	5.20	7.2	18.10	7.42	7.18
Jul-20	8.059	0.270	0.244	0.260	7.28	7.17	390	177	4.20	3.80	3.80	7.9	7.70	8.40	7.38
Aug-20	6.974	0.283	0.221	0.225	7.49	7.11	319	158	2.22	1.05	1.05	7.8	15.00	8.11	7.50
Sep-20	7.437	0.287	0.226	0.247	7.31	6.62	282	176	5.32	1.20	1.20	15.0	3.70	8.20	7.19
Oct-20	7.586	0.267	0.217	0.244	7.61	7.11	240	179	5.28		3.74	7.0	9.10	7.87	7.10
Nov-20	7.046	0.307	0.216	0.234	7.91	7.00	241	122							
Dec-20															
Maximum	8.421	0.423	0.247	0.280	7.91	7.17	397	290	10.69	6.73	5.20	15.0	20.80	8.52	7.86
Minimum	5.526	0.210	0.173	0.197	7.21	6.62	186	98	1.37	0.46	0.44	3.5	0.00	7.18	7.00
Average	6.812	0.254	0.204	0.224	7.37	6.99	314	164	5.43	3.17	2.45	8.4	6.71	7.66	7.23

BOD = biochemical oxygen demand
CFU = colony forming units
ft = Feet
in/acre = inches per acre
lbs = pounds
MG = million gallons
MGD = million gallons per day
mg/L = milligrams per liter
ml = milliliters
TKN = total Kjeldahl nitrogen
TSS = total suspended solids

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
DISCHARGE MONITORING
REPORT SUMMARY

FIGURE
6-1

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 1 - PHASING OPTION 1
WATER BALANCE

Month	Holding Pond Initial Volume (ac-ft)	Influent Flow[1] (gpd)	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation[2] (in)	Net (in)	Net Evap. (ac-ft)	Net Forested Ponds Evaporation (ac-ft)[3]	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Pasture Irrigation Requirements (in)[4]	Pasture Irrigation (in)[5]	Forest Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Freshwater (ac-ft)	Final Volume (ac-ft)[6]
October	30	211,000.00	20.07	0.95	1.00	-0.05	-0.10	0.00	0.00	0.00	0.00	0.44	0.52	2.37	0.98	2.03	0.51	0.00	0.00	44.09
November	44.09	204,000.00	18.78	2.10	1.00	1.10	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.96
December	64.96	210,000.00	19.98	2.27	1.00	1.27	2.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	87.36
January	87.36	209,000.00	19.88	2.24	1.00	1.24	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	109.60
February	109.60	205,000.00	17.62	1.45	1.00	0.45	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	128.07
March	128.07	212,000.00	20.17	1.12	1.00	0.12	0.23	0.00	0.00	0.00	0.00	0.88	1.04	4.75	1.96	4.05	1.02	0.00	0.00	136.69
April	136.69	216,000.00	19.89	0.79	4.25	-3.46	-6.58	0.00	0.00	0.00	0.00	2.81	3.31	15.15	6.25	12.95	3.25	0.00	0.00	112.39
May	112.39	221,000.00	21.02	0.78	6.14	-5.36	-10.19	0.00	0.00	0.00	0.00	3.51	4.13	18.93	7.81	16.17	4.06	0.00	0.00	76.25
June	76.25	280,000.00	25.78	0.61	6.69	-6.08	-11.56	0.00	0.00	0.00	0.00	3.81	4.48	20.54	8.48	17.56	4.41	0.00	56.50	95.98
July	95.98	262,000.00	24.93	0.38	8.66	-8.28	-15.75	0.00	0.00	0.00	0.00	4.64	5.46	25.02	10.33	21.38	5.37	0.00	50.00	93.07
August	93.07	251,000.00	23.88	0.41	7.91	-7.50	-14.26	0.00	0.00	0.00	0.00	3.92	4.61	21.14	8.72	18.06	4.53	0.00	0.00	50.23
September	50.23	237,000.00	21.82	0.40	5.42	-5.02	-9.55	0.00	0.00	0.00	0.00	2.42	2.85	13.05	5.39	11.15	2.80	0.00	0.00	30.11
Total		**226,500.00**	**253.82**	**13.50**	**45.07**	**-31.57**	**-60.04**	**0.00**	**0.00**	**0.00**	**0.00**	**22.43**	**26.39**	**120.95**	**49.92**	**103.35**	**25.95**	**0.00**	**106.50**	

Notes:

1 Based on the highest continuous year of flows from the City's 2018 to 2020 DMR data.

2 From the Western Regional Climate Center for the Bend 7 NE Evaporation Station.

3 Assumes 2 miles of streams with 4-foot wide water surface on average and 3.5 acres of ponds.

4 From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.

5 From the Reclamation AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.

6 Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators could be kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac = acre
ac-ft = acre-feet
DMR = Discharge Monitoring Report
evap. = evaporation
ft = feet
gpd = gallons per day
in = inches
WWTP = wastewater treatment plant

Treatment Lagoons Wet Area (ac):	**4.82**
Storage Pond Wet Area (ac):	**18.00**
Total WWTP Wet Area (ac):	**22.82**
Storage Pond Capacity (ac-ft):	**213.00**

	Area (ac)	Storage Depth (ft)	Additional Storage (ac-ft)	
Wetland	16.00	1.50	24.00	
Forested Ponds	4.60	0.00	0.00	
Pivot 1	22.70	-	-	
Pivot 2	47.00	-	-	
Lagoon Dike Irrigation	11.80	-	-	
Forested Irrigation	55.00	-	-	
Wheel Line Irrigation	0.00	-	-	
		Total	**24.00**	**ac-ft**
		Total Storage	**237.00**	**ac-ft**

Recycled Water Disposal Option	Disposal Capacity (ac-ft)
Wetland/Ponds	0.00
Pasture Irrigation	153.27
Wheel Line	0.00
Existing Irrigation	206.93
Total	360.20

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CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 1 - PHASING OPTION 1
WATER BALANCE

FIGURE
6-2

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 1 - PHASING OPTION 2
WATER BALANCE

Month	Holding Pond Initial Volume (ac-ft)	Influent Flow[1] (gpd)	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation[2] (in)	Net (in)	Net Evap. (ac-ft)	Net Forested Ponds Evaporation (ac-ft)[3]	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Pasture Irrigation Requirements (in)[4]	Pasture Irrigation (in)[5]	Forest Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Freshwater (ac-ft)	Final Volume (ac-ft)[6]
October	30	211,000.00	20.07	0.95	1.00	-0.05	-0.10	0.38	0.00	1.33	0.00	0.44	0.52	2.37	0.98	0.00	0.51	0.00	0.00	44.40
November	44.40	204,000.00	18.78	2.10	1.00	1.10	2.09	0.38	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.56
December	63.56	210,000.00	19.98	2.27	1.00	1.27	2.42	0.38	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.23
January	84.23	209,000.00	19.88	2.24	1.00	1.24	2.36	0.38	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	104.76
February	104.76	205,000.00	17.62	1.45	1.00	0.45	0.86	0.38	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.51
March	121.51	212,000.00	20.17	1.12	1.00	0.12	0.23	0.38	0.00	1.33	0.00	0.88	1.04	4.75	1.96	0.00	1.02	0.00	0.00	132.47
April	132.47	216,000.00	19.89	0.79	4.25	-3.46	-6.58	1.63	0.00	5.67	0.00	2.81	3.31	15.15	6.25	0.00	3.25	0.00	0.00	113.83
May	113.83	221,000.00	21.02	0.78	6.14	-5.36	-10.19	2.35	0.00	8.19	0.00	3.51	4.13	18.93	7.81	0.00	4.06	0.00	0.00	83.32
June	83.32	280,000.00	25.78	0.61	6.69	-6.08	-11.56	2.56	0.00	8.92	0.00	3.81	4.48	20.54	8.48	0.00	4.41	0.00	30.50	83.12
July	83.12	262,000.00	24.93	0.38	8.66	-8.28	-15.75	3.32	0.00	11.55	0.00	4.64	5.46	25.02	10.33	0.00	5.37	0.00	50.00	86.72
August	86.72	251,000.00	23.88	0.41	7.91	-7.50	-14.26	3.03	0.00	10.55	0.00	3.92	4.61	21.14	8.72	0.00	4.53	0.00	0.00	48.36
September	48.36	237,000.00	21.82	0.40	5.42	-5.02	-9.55	2.08	0.00	7.23	0.00	2.42	2.85	13.05	5.39	0.00	2.80	0.00	0.00	30.10
Total		**226,500.00**	**253.82**	**13.50**	**45.07**	**-31.57**	**-60.04**	**17.28**	**0.00**	**60.09**	**0.00**	**22.43**	**26.39**	**120.95**	**49.92**	**0.00**	**25.95**	**0.00**	**80.50**	

[1] Based on highest continuous year of flows from the City's 2018 to 2020 DMR data.
[2] From the Western Regional Climate Center for the Bend 7 NE Evaporation Station.
[3] Assumes 2 miles of streams with 4-foot wide water surface on average and 3.5 acres of ponds.
[4] From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.
[5] From the Reclamation AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.
[6] Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators could be kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac = acre
ac-ft = acre-feet
DMR = Discharge Monitoring Report
evap. = evaporation
ft = feet
gpd = gallons per day
in = inches
WWTP = wastewater treatment plant

Treatment Lagoons Wet Area (ac):	**4.82**
Storage Pond Wet Area (ac):	**18.00**
Total WWTP Wet Area (ac):	**22.82**
Storage Pond Capacity (ac-ft):	**213.00**

	Area (ac)	Storage Depth (ft)	Additional Storage (ac-ft)	
Wetland	16.00	1.50	24.000	
Forested Ponds	4.60	0.00	0.00	
Pivot 1	22.70	-	-	
Pivot 2	0.00	-	-	
Lagoon Dike Irrigation	11.80	-	-	
Forested Irrigation	55.00	-	-	
Wheel Line Irrigation	0.00	-	-	
		Total	**24.00**	**ac-ft**
		Total Storage	**237.00**	**ac-ft**

Recycled Water Disposal Option	**Disposal Capacity (ac-ft)**
Wetland/Ponds	77.37
Pasture Irrigation	49.92
Wheel Line	0.00
Existing Irrigation	206.93
Total	334.22

anderson perry & associates, inc.

CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 1 - PHASING OPTION 2
WATER BALANCE

FIGURE
6-3

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 2 - PHASING OPTION 1
WATER BALANCE

Month	Holding Pond Initial Volume (ac-ft)	Influent Flow[1] (gpd)	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation[2] (in)	Net (in)	Net WWTP Evap. (ac-ft)	Net Forested Ponds Evaporation (ac-ft)[3]	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Pasture Irrigation Requirements (in)[4]	Pasture Irrigation (in)[5]	Forest Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Freshwater (ac-ft)	Final Volume (ac-ft)[6]
October	30	211,000.00	20.07	0.95	1.00	-0.05	-0.10	-0.02	0.00	-0.20	0.00	0.44	0.52	2.37	0.00	0.00	0.51	0.00	0.00	46.88
November	46.88	204,000.00	18.78	2.10	1.00	1.10	2.09	0.42	0.00	4.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.53
December	72.53	210,000.00	19.98	2.27	1.00	1.27	2.42	0.49	0.00	5.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.44
January	100.44	209,000.00	19.88	2.24	1.00	1.24	2.36	0.48	0.00	4.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	128.06
February	128.06	205,000.00	17.62	1.45	1.00	0.45	0.86	0.17	0.00	1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	148.49
March	148.49	212,000.00	20.17	1.12	1.00	0.12	0.23	0.05	0.00	0.48	0.00	0.88	1.04	4.75	0.00	0.00	1.02	0.00	0.00	163.64
April	163.64	216,000.00	19.89	0.79	4.25	-3.46	-6.58	-1.33	0.00	-13.70	0.00	2.81	3.31	15.15	0.00	0.00	3.25	0.00	0.00	143.52
May	143.52	221,000.00	21.02	0.78	6.14	-5.36	-10.19	-2.05	0.00	-21.22	0.00	3.51	4.13	18.93	0.00	0.00	4.06	0.00	0.00	108.10
June	108.10	280,000.00	25.78	0.61	6.69	-6.08	-11.56	-2.33	0.00	-24.07	0.00	3.81	4.48	20.54	0.00	0.00	4.41	0.00	60.00	130.96
July	130.96	262,000.00	24.93	0.38	8.66	-8.28	-15.75	-3.17	0.00	-32.78	0.00	4.64	5.46	25.02	0.00	0.00	5.37	0.00	30.00	103.81
August	103.81	251,000.00	23.88	0.41	7.91	-7.50	-14.26	-2.88	0.00	-29.69	0.00	3.92	4.61	21.14	0.00	0.00	4.53	0.00	0.00	55.19
September	55.19	237,000.00	21.82	0.40	5.42	-5.02	-9.55	-1.92	0.00	-19.87	0.00	2.42	2.85	13.05	0.00	0.00	2.80	0.00	0.00	29.82
		Total	**253.82**	**13.50**	**45.07**	**-31.57**	**-60.04**	**-12.10**	**0.00**	**-124.96**	**0.00**	**22.43**	**26.39**	**120.95**	**0.00**	**0.00**	**25.95**	**0.00**	**90.00**	

[1] Based on highest continuous year of flows from the City's 2018 to 2020 DMR data.
[2] From the Western Regional Climate Center for the Bend 7 NE Evaporation Station.
[3] Assumes 2 miles of streams with 4-foot wide water surface on average and 3.5 acres of ponds.
[4] From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.
[5] From the Reclamation AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.
[6] Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators could be kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac = acre
ac-ft = acre-feet
DMR = Discharge Monitoring Report
evap. = evaporation
ft = feet
gpd = gallons per day
in = inches
WWTP = wastewater treatment plant

Treatment Lagoons Wet Area (ac):	**4.82**
Storage Pond Wet Area (ac):	**18.00**
Total WWTP Wet Area (ac):	**22.82**
Storage Pond Capacity (ac-ft):	**213.00**

	Area (ac)	Storage Depth (ft)	Additional Storage (ac-ft)	
Wetland	47.50	1.50	71.25	
Forested Ponds	4.60	0.00	0.00	
Pivot 2	0.00			
Lagoon Dike	11.80			
Forested Irrigation	55.00			
Wheel Line Irrigation	0.00			
		Total	**71.25**	**ac-ft**
		Total Storage	**284.25**	**ac-ft**

Recycled Water Disposal Option	Disposal Capacity (ac-ft)
Wetland/Ponds	137.07
Pasture Irrigation	0.00
Wheel Line	0.00
Existing Irrigation	206.93
Total	344.00

anderson perry & associates, inc.

CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 2 - PHASING OPTION 1
WATER BALANCE

FIGURE
6-4

CITY OF SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 2 - PHASING OPTION 2
WATER BALANCE

Month	Holding Pond Initial Volume (ac-ft)	Influent Flow[1] (gpd)	Monthly Influent Flow (ac-ft)	Rainfall (in)	Evaporation[2] (in)	Net (in)	Net WWTP Evap. (ac-ft)	Net Forested Ponds Evaporation (ac-ft)[3]	Forested Ponds Seepage (ac-ft)	Net Wetland Evaporation (ac-ft)	Unlined Wetland Seepage (ac-ft)	Crop Irrigation Requirements (in)[4]	Crop Irrigation (in)[5]	Forest Irrigation (ac-ft)	Pivot 1 Irrigation (ac-ft)	Pivot 2 Irrigation (ac-ft)	Lagoon Dike Irrigation (ac-ft)	Future Wheel Line Irrigation (ac-ft)	Supplemental Freshwater (ac-ft)	Final Volume (ac-ft)[6]
October	30	211,000.00	20.07	0.95	1.00	-0.05	-0.10	0.00	0.00	0.00	0.00	0.44	0.52	2.37	0.00	2.03	0.51	0.00	0.00	45.07
November	45.07	204,000.00	18.78	2.10	1.00	1.10	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.94
December	65.94	210,000.00	19.98	2.27	1.00	1.27	2.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	88.34
January	88.34	209,000.00	19.88	2.24	1.00	1.24	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	110.58
February	110.58	205,000.00	17.62	1.45	1.00	0.45	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	129.05
March	129.05	212,000.00	20.17	1.12	1.00	0.12	0.23	0.00	0.00	0.00	0.00	0.88	1.04	4.75	0.00	4.05	1.02	0.00	0.00	139.63
April	139.63	216,000.00	19.89	0.79	4.25	-3.46	-6.58	0.00	0.00	0.00	0.00	2.81	3.31	15.15	0.00	12.95	3.25	0.00	0.00	121.58
May	121.58	221,000.00	21.02	0.78	6.14	-5.36	-10.19	0.00	0.00	0.00	0.00	3.51	4.13	18.93	0.00	16.17	4.06	0.00	0.00	93.26
June	93.26	280,000.00	25.78	0.61	6.69	-6.08	-11.56	0.00	0.00	0.00	0.00	3.81	4.48	20.54	0.00	17.56	4.41	0.00	0.00	64.96
July	64.96	262,000.00	24.93	0.38	8.66	-8.28	-15.75	0.00	0.00	0.00	0.00	4.64	5.46	25.02	0.00	21.38	5.37	0.00	56.50	78.88
August	78.88	251,000.00	23.88	0.41	7.91	-7.50	-14.26	0.00	0.00	0.00	0.00	3.92	4.61	21.14	0.00	18.06	4.53	0.00	0.00	44.76
September	44.76	237,000.00	21.82	0.40	5.42	-5.02	-9.55	0.00	0.00	0.00	0.00	2.42	2.85	13.05	0.00	11.15	2.80	0.00	0.00	30.03
		Total	**253.82**	**13.50**	**45.07**	**-31.57**	**-60.04**	**0.00**	**0.00**	**0.00**	**0.00**	**22.43**	**26.39**	**120.95**	**0.00**	**103.35**	**25.95**	**0.00**	**56.50**	

[1] Based on highest continuous year of flows from the City's 2018 to 2020 DMR data.
[2] From the Western Regional Climate Center for the Bend 7 NE Evaporation Station.
[3] Assumes 2 miles of streams with 4-foot wide water surface on average and 3.5 acres of ponds.
[4] From the U.S. Bureau of Reclamation (Reclamation) AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station.
[5] From the Reclamation AgriMet Crop Consumptive Use Crop Chart for the Bend, Oregon Station, divided by 0.85 for irrigation efficiency.
[6] Final volume was maintained above or approximately equal to 30 ac-ft to ensure surface aerators could be kept in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

ac = acre
ac-ft = acre-feet
DMR = Discharge Monitoring Report
evap. = evaporation
ft = feet
gpd = gallons per day
in = inches
WWTP = wastewater treatment plant

Treatment Lagoons Wet Area (ac):	**4.82**
Storage Pond Wet Area (ac):	**18.00**
Total WWTP Wet Area (ac):	**22.82**
Storage Pond Capacity (ac-ft):	**213.00**

	Area (ac)	Storage Depth (ft)	Additional Storage (ac-ft)	
Wetland	47.50	1.50	71.25	
Forested Ponds	4.60	0.00	0.00	
Pivot 2	47.00			
Lagoon Dike	11.80			
Forested Irrigation	55.00			
Wheel Line Irrigation	14.00			
		Total	71.25	ac-ft
		Total Storage	**284.25**	**ac-ft**

Recycled Water Disposal Option	Disposal Capacity (ac-ft)
Wetland/Ponds	0.00
Pasture Irrigation	103.35
Wheel Line	0.00
Existing Irrigation	206.93
Total	310.28

anderson perry & associates, inc.

CITY OF
SISTERS, OREGON
LAZY Z RANCH MASTER PLAN
ALTERNATIVE 2 - PHASING OPTION 2
WATER BALANCE

FIGURE
6-5

APPENDIX A
Oregon Administrative Rules 340-055

Department of Environmental Quality

Chapter 340

Division 55
RECYCLED WATER USE

340-055-0005
Purpose

These rules (OAR 340-055-0005 to 340-055-0030) prescribe requirements for the use of recycled water for beneficial purposes. The purpose of this division is to protect the environment and public health in the State of Oregon.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.015 & 468B.020
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0007
Policy

It is the policy of the Environmental Quality Commission to encourage the use of recycled water for domestic, agricultural, industrial, recreational, and other beneficial purposes in a manner which protects public health and the environment of the state. The use of recycled water for beneficial purposes will improve water quality by reducing discharge of treated effluent to surface waters, reduce the demand on drinking water sources for uses not requiring potable water, and may conserve stream flows by reducing withdrawal for out-of-stream use.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.015
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0010
Definitions

The following definitions apply to this division of rules:

(1) “Artificial Groundwater Recharge” means the intentional addition of water diverted from another source to a groundwater reservoir.

(2) "Beneficial Purpose" means a purpose where recycled water is utilized for a resource value, such as nutrient content or moisture, to increase productivity or to conserve other sources of water.

(3) “Department” means the Oregon Department of Environmental Quality.

(4) "Disinfected Wastewater" means wastewater that has been treated by a chemical, physical or biological process and meets the criteria if applicable to its classification for use as recycled water.

(5) “Filtered Wastewater” means an oxidized wastewater that meets the criteria defined in OAR 340-055-0012(7)(c).

(6) “Human Consumption” means water used for drinking, personal or oral hygiene, bathing, showering, cooking, or dishwashing.

(7) "Landscape Impoundment" means a body of water used for aesthetic purposes or other function that does not include public contact through activities such as boating, fishing, or body-contact recreation. Landscape impoundments include, but are not limited to, golf course water ponds or non-residential landscape ponds.

(8) "Nonrestricted Recreational Impoundment" means a constructed body of water for which there are no limitations on body-contact water recreation activities. Nonrestricted recreational impoundments include, but are not limited to, recreational lakes, water features accessible to the public, and public fishing ponds.

(9) "NPDES Permit" means a National Pollutant Discharge Elimination System permit as defined in OAR chapter 340, division 45.

(10) "Oxidized Wastewater" means a treated wastewater in which the organic matter is stabilized and nonputrescible, and which contains dissolved oxygen.

(11) "Person" means the United States and agencies thereof, any state, any individual, public or private corporation, political subdivision, governmental agency, municipality, copartnership, association, firm, trust estate, or any other legal entity.

(12) “Processed Food Crops” means those crops that undergo thermoprocessing sufficient to kill spores of Clostridium botulinum.

(13) “Recycled Water” means treated effluent from a wastewater treatment system which as a result of treatment is suitable for a direct beneficial purpose. Recycled water includes reclaimed water as defined in ORS 537.131.

(14) "Restricted Recreational Impoundment" means a constructed body of water that is limited to fishing, boating, and other non-body contact water recreation activities.

(15) “Sprinkler Irrigation” means the act of applying water by means of perforated pipes or nozzles operated under pressure so as to form a spray pattern.

(16) “Wastewater” or "Sewage" means the water-carried human or animal waste from residences, buildings, industrial establishments or other places, together with such groundwater infiltration and surface water as may be present. The admixture with sewage of wastes or industrial wastes shall also be considered “wastewater” within the meaning of this division.

(17) “Wastewater Treatment System” or "Sewage Treatment System" means an approved facility or equipment used to alter the quality of wastewater by physical, chemical or biological means or a combination thereof that reduces the tendency of the wastewater to degrade water quality or other environmental conditions.

(18) “Waters of the State” means lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the

State of Oregon, and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters) that are located wholly or partially within or bordering the state or within its jurisdiction.

(19) "WPCF Permit" means a Water Pollution Control Facilities permit as defined in OAR chapter 340, division 45.

(20) “Wetlands” means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.005, 468B.030 & 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0012
Recycled Water Quality Standards and Requirements

(1) Any person having control over the treatment or distribution or both of recycled water may distribute recycled water only for the beneficial purposes described in this rule, and must take all reasonable steps to ensure that the recycled water is used only in accordance with the standards and requirements of the rules of this division.

(2) Any person who uses recycled water may use recycled water only for the beneficial purposes described in this rule, and must comply with the standards and requirements of this rule and the rules of this division.

(3) The following requirements apply to nondisinfected recycled water.

(a) Beneficial Purposes. Nondisinfected recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Irrigation for growing fodder, fiber, seed crops not intended for human ingestion, or commercial timber; and

(B) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Nondisinfected recycled water must be an oxidized wastewater.

(c) Criteria. There are no disinfection criteria for nondisinfected recycled water.

(d) Monitoring. Monitoring must be in accordance with the wastewater treatment system owner’s NPDES or WPCF permit.

(e) Setback Distances. There must be a minimum of 150 feet from the edge of the irrigation site to a water supply source used for human consumption. Other site specific setback distances for irrigation necessary to protect public health and the environment must be established in the recycled water use plan and must be met when irrigating.

(f) Access and Exposure. Public access to the irrigation site must be prevented.

(g) Site Management.

(A) Irrigation with recycled water is prohibited for 30 days before harvesting.

(B) Sprinkler irrigation is prohibited unless authorized in advance and in writing by the department based on demonstration that public health and the environment will be adequately protected from aerosols.

(4) The following requirements apply to Class D recycled water.

(a) Beneficial Purposes. Class D recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (3)(a) of this rule;

(B) Irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals; and

(C) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class D recycled water must be an oxidized and disinfected wastewater that meets the numeric criteria in subsection (c) of this section.

(c) Criteria. Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample.

(d) Monitoring. Monitoring for E. coli organisms must occur once per week at a minimum.

(e) Setback Distances.

(A) Where an irrigation method is used to apply recycled water directly to the soil, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(B) Where sprinkler irrigation is used, there must be a minimum of 100 feet from the edge of the site used for irrigation and the site property line.

(C) There must be a minimum of 100 feet from the edge of an irrigation site to a water supply source used for human consumption.

(D) Where sprinkler irrigation is used, recycled water must not be sprayed within 70 feet of an area where food is prepared or served, or where a drinking fountain is located.

(f) Access and Exposure.

(A) Animals used for production of milk must be restricted from direct contact with the recycled water.

(B) When using recycled water for irrigation of sod, ornamental nursery stock, or Christmas trees, the personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management.

(A) When irrigating, signs must be posted around the perimeter of the irrigation site stating recycled water is used and is not safe for drinking.

(B) Irrigation of fodder, fiber, seed crops not intended for human ingestion, sod, commercial timber, firewood, ornamental nursery stock, or Christmas trees is prohibited for three days before harvesting.

(5) The following requirements apply to Class C recycled water.

(a) Beneficial Purposes. Class C recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (4)(a) of this rule;

(B) Irrigation of processed food crops;

(C) Irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil;

(D) Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses;

(E) Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural fire fighting using aircraft, street sweeping, or sanitary sewer flushing;

(F) Water supply source for landscape impoundments; and

(G) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class C recycled water must be an oxidized and disinfected wastewater that meets the numeric criteria in subsection (c) of this section.

(c) Criteria. Class C recycled water must not exceed a median of 23 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 240 total coliform organisms per 100 milliliters in any two consecutive samples.

(d) Monitoring. Monitoring for total coliform organisms must occur once per week at a minimum.

(e) Setback Distances.

(A) Where an irrigation method is used to apply recycled water directly to the soil, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(B) Where sprinkler irrigation is used, there must be a minimum of 70 feet from the edge of the site used for irrigation and the site property line.

(C) There must be a minimum of 100 feet from the edge of an irrigation site to a water supply source used for human consumption.

(D) Where sprinkler irrigation is used, recycled water must not be sprayed within 70 feet of an area where food is being prepared or served, or where a drinking fountain is located.

(f) Access and Exposure.

(A) When irrigating for a beneficial purpose defined in subsection (4)(a) of this rule, the access and exposure requirements defined in subsection (4)(f) of this rule must be met.

(B) During irrigation of a golf course, a cemetery, a highway median, or an industrial or business campus, the public must be restricted from direct contact with the recycled water.

(C) If aerosols are generated when using recycled water for an industrial, commercial, or construction purpose, the aerosols must not create a public health hazard.

(D) When using recycled water for an agricultural or horticultural purpose where sprinkler irrigation is used, or an industrial, commercial, or construction purpose, the public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management.

(A) When irrigating for a beneficial purpose defined in subsection (4)(a) of this rule, the site management requirements defined in subsection (4)(g) of this rule must be met.

(B) When using recycled water for a landscape impoundment or for irrigating a golf course, cemetery, highway median, or industrial or business campus, signs must be posted at the use area and be visible to the public. The signs must state that recycled water is used and is not safe for drinking.

(C) Irrigation of processed food crops is prohibited for three days before harvesting.

(D) When irrigating an orchard or vineyard, the edible portion of the crop must not contact the ground, and fruit or nuts may not be harvested off the ground.

(E) When using recycled water for a landscape impoundment, aerators or decorative fixtures that may generate aerosols are allowed only if authorized in writing by the department.

(6) The following requirements apply to Class B recycled water.

(a) Beneficial Purposes. Class B recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (5)(a) of this rule;

(B) Stand-alone fire suppression systems in commercial and residential buildings, non-residential toilet or urinal flushing, or floor drain trap priming;

(C) Water supply source for restricted recreational impoundments; and

(D) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class B recycled water must be an oxidized and disinfected wastewater that meets the numeric criteria in subsection (c) of this section.

(c) Criteria. Class B recycled water must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample.

(d) Monitoring. Monitoring for total coliform organisms must occur three times per week at a minimum.

(e) Setback Distances.

(A) Where an irrigation method is used to apply recycled water directly to the soil, there are no setback requirements.

(B) Where sprinkler irrigation is used, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(C) There must be a minimum of 50 feet from the edge of the irrigation site to a water supply source used for human consumption.

(D) Where sprinkler irrigation is used, recycled water must not be sprayed within 10 feet of an area where food is being prepared or served, or where a drinking fountain is located.

(f) Access and Exposure.

(A) During irrigation of a golf course, the public must be restricted from direct contact with the recycled water.

(B) If aerosols are generated when using recycled water for an industrial, commercial, or construction purpose, the aerosols must not create a public health hazard.

(C) When using recycled water for an agricultural or horticultural purpose where sprinkler irrigation is used, or an industrial, commercial, or construction purpose, the public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management.

(A) When irrigating for a beneficial purpose defined in subsection (4)(a) of this rule, the site management requirements defined in subsection (4)(g) of this rule must be met.

(B) When using recycled water for a landscape impoundment or for irrigating a golf course, cemetery, highway median, or industrial or business campus, signs must be posted at the use area and be visible to the public. The signs must state recycled water is used and is not safe for drinking.

(C) Irrigation of processed food crops is prohibited for three days before harvesting.

(D) When irrigating an orchard or vineyard, the edible portion of the crop must not contact the ground, and fruit or nuts may not be harvested off the ground.

(7) The following requirements apply to Class A recycled water.

(a) Beneficial Purposes. Class A recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (6)(a) of this rule;

(B) Irrigation for any agricultural or horticultural use;

(C) Landscape irrigation of parks, playgrounds, school yards, residential landscapes, or other landscapes accessible to the public;

(D) Commercial car washing or fountains when the water is not intended for human consumption;

(E) Water supply source for nonrestricted recreational impoundments;

(F) Artificial groundwater recharge by surface infiltration methods or by subsurface injection in accordance with OAR chapter 340, division 44. Direct injection into an underground source of drinking water is prohibited unless allowed by OAR chapter 340, division 44; and

(G) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class A recycled water must be an oxidized, filtered and disinfected wastewater that meets the numeric criteria in subsection (c) of this section are met.

(c) Criteria. Class A recycled water must not exceed the following criteria:

(A) Before disinfection, unless otherwise approved in writing by the department, the wastewater must be treated with a filtration process, and the turbidity must not exceed an average of 2 nephelometric turbidity units (NTU) within a 24-hour period, 5 NTU more than five percent of the time within a 24-hour period, and 10 NTU at any time, and

(B) After disinfection, Class A recycled water must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample.

(d) Monitoring.

(A) Monitoring for total coliform organisms must occur once per day at a minimum.

(B) Monitoring for turbidity must occur on an hourly basis at a minimum.

(e) Setback Distances. Where sprinkler irrigation is used, recycled water must not be sprayed onto an area where food is being prepared or served, or onto a drinking fountain.

(f) Access and Exposure. When using recycled water for an agricultural or horticultural purpose where spray irrigation is used, or an industrial, commercial, or construction purpose, the public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management. When using recycled water for a landscape impoundment, restricted recreational impoundment, nonrestricted recreational impoundment, or for irrigating a golf course, cemetery, highway median, industrial or business campus, park, playground, school yard, residential landscape, or other landscapes accessible to the public, signs must be posted at the use area or notification must be made to the public at the use area indicating recycled water is used and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0013
Exempted Use of Recycled Water

Recycled water used by a wastewater treatment system owner for landscape irrigation or for in plant processes at a wastewater treatment system is exempt from the rules of this division if:

(1) The recycled water is an oxidized and disinfected wastewater;

(2) The recycled water is used at the wastewater treatment system site where it is generated or at an auxiliary wastewater or sludge treatment facility that is subject to the same NPDES or WPCF permit as the wastewater treatment system. Contiguous property to the parcel of land upon which the treatment system is located is considered the wastewater treatment system site if under the same ownership;

(3) Spray or drift or both from the use does not occur off the site; and

(4) Public access to the site is restricted.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0016
General Requirements for Permitting the Use of Recycled Water

(1) NPDES or WPCF permit. A wastewater treatment system owner may not provide any recycled water for use unless authorized by a NPDES or WPCF permit issued by the department pursuant to OAR chapter 340, division 045.

(2) Recycled water use plan.

(a) Except for use of recycled water authorized by a NPDES or WPCF permit, a wastewater treatment system owner may not provide any recycled water for distribution or use or both until a recycled water use plan meeting the requirements of OAR 340-055-0025 has been approved in writing by the department. Upon approval of the plan, the permittee must comply with the conditions of the plan.

(b) Before approving or modifying any plan for the use of Class C, Class D, or nondisinfected recycled water, the department will submit the proposed plan to the Oregon Department of Human Services for comment.

(c) For use of recycled water previously authorized under a NPDES or WPCF permit but without a department approved recycled water use plan, the wastewater treatment system owner must submit a recycled water use plan to the department within one year of the effective date of these rules.

(3) Land application on land zoned exclusive farm use. A recycled water use plan will not be approved for the land application of recycled water on land zoned exclusive farm use until the requirements of ORS 215.213(1)(bb) and 215.283(1)(y) for recycled water are met.

(4) Compliance with this division. When the rules of this division require a limitation or a condition or both that conflicts with a limitation or a condition or both in an existing permit, the existing permit controls until the permit is modified or renewed by the department. When the existing permit is modified or renewed, the permittee will be given a reasonable compliance schedule to achieve new requirements if necessary.

(5) Additional permit limitations and conditions. The department may include additional permit limitations or conditions or both if it determines or has reason to believe additional requirements for the use of recycled water are necessary to protect public health or the environment or both.

(6) Authorization of other recycled water uses. The department may authorize through a NPDES or WPCF permit a use of recycled water for a beneficial purpose not specified in this division. When the department considers the authorization, it may request information and include permit limitations or conditions or both necessary to assure protection of public health and the environment. The department will confer with the Oregon Department of Human Services before authorizing other uses of Class C, Class D, or nondisinfected recycled water under this section.

(7) Setback distances. The department may consider and approve, on a case-by-case basis, a setback distance other than what is required in this division. For a reduced setback distance, it must be demonstrated to the department that public health and the environment will be adequately protected. The recycled water use plan must include any approved alternative setback distance.

(8) Public outreach and sign posting. When the rules of this division require the posting of signs at a use area, the department may, on a case-by-case basis, approve an alternative method for public outreach where it considers the method will assure an equivalent degree of public protection.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0017
Treatment and Use of Recycled Water

(1) Alternative treatment process. The department may approve in writing an alternative wastewater treatment process not specified in the rules of this division if it is demonstrated that the treatment is equivalent to and can achieve the recycled water criteria required for a specific beneficial purpose.

(2) Additional treatment. A person using recycled water from a wastewater treatment system may provide additional treatment for a different class of recycled water that is identified in this division. The wastewater treatment system owner providing the additional treatment is subject to the rules of this division and must have a NPDES or WPCF permit issued by the department.

(3) Blending recycled water. The department may approve on a case-by-case basis blending recycled water with other water if proposed by a wastewater treatment system owner. Before blending recycled water, the owner must obtain written authorization from the department. In obtaining authorization, the wastewater treatment system owner must submit to the department, at a minimum the following:

(a) An operations plan,

(b) A description of any additional treatment process,

(c) A description of blending volumes, and

(d) A range of final recycled water quality at the compliance point identified in the NPDES or WPCF permit.

(4) Water right. The rules of this division do not create a water right under ORS chapters 536, 537, 539 or 540. A person must contact the Oregon Water Resources Department to determine water right requirements for the use of recycled water.

(5) Prohibited use for human consumption. The use of recycled water for direct human consumption, regardless of the treatment class, is prohibited unless approved in writing by the Oregon Department of Human Services, and after public hearing, and it is so authorized by the Environmental Quality Commission.

(6) Prohibited use for a public pool. The use of recycled water as a source of supply for a public pool, spa, or bathhouse is prohibited unless authorized in writing by the department and with written approval from the Oregon Department of Human Services. Public pools are subject to the requirements of ORS 448 and the Oregon Department of Human Services administrative rules.

(7) Transporting recycled water. A vehicle used to transport or distribute recycled water must not be used to transport water for human consumption, unless authorized in writing by the department. The vehicle must be clearly identified with the words “nonpotable water” written in letters at least six inches high and displayed on each side and rear of the vehicle unless otherwise authorized by the department.

(8) Impoundments. Constructed landscape, and restricted and nonrestricted recreational impoundments approved for use under the rules of this division are not considered waters of the state for water quality purposes. Impoundments used for wastewater treatment are subject to ORS 215.213 and 215.283.

(9) Wetlands.

(a) The term “waters of the state” as provided in OAR 340-055-0012(18) includes, but is not limited to, the following wetlands and discharge to any of these wetlands requires a NPDES permit issued by the Department pursuant to OAR chapter 340, division 45:

(A) Enhanced or restored wetlands;

(B) Existing natural wetlands; and

(C) Wetlands created as mitigation for loss of wetlands under the Clean Water Act, Section 404.

(b) Wetlands constructed on non-wetland sites and managed for wastewater treatment are exempt from the rules of this division and are not considered waters of the state for water quality purposes.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0020
Groundwater Quality Protection

Recycled water will not be authorized for use unless all groundwater quality protection requirements in OAR chapter 340, division 40 are met. The requirements in OAR chapter 340, division 40 are considered to be met if the wastewater treatment system owner demonstrates recycled water will be used or land applied in a manner and at a rate that minimizes the movement of contaminants to groundwater and does not adversely impact groundwater quality. If the use of recycled water occurs within a designated groundwater management area, the department may require additional conditions to be met.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.150 - 468B.190
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0022
Monitoring and Reporting

(1) The department will include in a NPDES or WPCF permit authorizing the use of recycled water, at a minimum, the monitoring requirements in OAR 340-055-0012.

(2) When chlorine or a chlorine compound is used as a disinfecting agent, the department may specify in the NPDES or WPCF permit a minimum chlorine residual concentration. When other disinfecting agents are used, the department may require additional monitoring requirements to assure adequate disinfection.

(3) The department will include in a NPDES or WPCF permit authorizing the use of recycled water, a requirement that the wastewater treatment system owner submit an annual report to the department describing the effectiveness of the system to comply with the approved recycled water use plan, the rules of this division, and the permit limits and conditions for recycled water.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0025
Recycled Water Use Plan

(1) A recycled water use plan must describe how the wastewater treatment system owner will comply with the rules of this division and must include, but is not limited to, the following:

(a) A description of the wastewater treatment system, including treatment efficiency capability;

(b) A detailed description of the treatment methods that will be used to achieve a specific class of recycled water and for what beneficial purpose;

(c) The estimated quantity of recycled water to be provided by the wastewater treatment system owner to the user, and at what frequency and for what beneficial purpose;

(d) A description of contingency procedures that ensure the requirements of this division are met when recycled water is provided for use;

(e) Monitoring and sampling procedures;

(f) A maintenance plan that describes how the wastewater treatment system equipment and facility processes will be maintained and serviced;

(g) If notification is required by the rules of this division, a description of how the public and personnel at the use area will be notified; and

(h) A description of any measuring and reporting requirements identified by the Oregon Water Resources Department after consultation with that agency.

(2) If Class B, C, or D, or nondisinfected recycled water is to be used for irrigation, a recycled water use plan must also include, but is not limited to, the following:

(a) A description and identification of the land application site, including the zoned land use of the irrigation site and surrounding area, a site map with setbacks, and distances of nearest developed property from all boundaries of the irrigation site;

(b) A description of the irrigation system, including storage, distribution methods, application methods and rates, and shut off procedures;

(c) A description of the soils and crops or vegetation grown at the land application site;

(d) A description of site management practices including, but not limited to, the timing of application, methods used to mitigate potential aerosol drift, and if required by this division, posting of signs or public outreach; and

(e) If public access control or notification is required by this division, descriptions of public access control and how the public and personnel will be notified.

(3) If Class A recycled water is to be used for the beneficial purpose of artificial groundwater recharge, a recycled water use plan must also include, but is not limited to, the following:

(a) A groundwater monitoring plan in accordance with OAR 340-040-0030(2);

(b) A determination if the recharge will be to a drinking water protection area;

(c) A description of the soils and characteristics;

(d) The distance from the recharge area to the nearest point of withdrawal and the retention time in the aquifer until the time of withdrawal; and

(e) Verification from Oregon Water Resources Department that a request for authorization for this use has been initiated.

(4) Conditions contained in a department approved recycled water use plan are NPDES or WPCF permit requirements.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0030
Operational Requirements for the Treatment and Distribution of Recycled Water

(1) Bypassing. The intentional diversion of wastewater from any unit process in the wastewater treatment system for a beneficial purpose is not allowed, unless with the unit process out of service the recycled

water meets the criteria of this division for a specific class and beneficial purpose described in the recycled water use plan.

(2) Alarm devices. Alarm devices are required to provide warning of power loss and failure of process equipment essential to the proper operation of the wastewater treatment system and compliance with this division.

(3) Standby power. Unless otherwise approved in writing by the department, a wastewater treatment system providing recycled water for use must have sufficient standby power to fully operate all essential treatment processes. The department may grant an exception to this section only if the wastewater treatment system owner demonstrates that power failure will not result in inadequately treated water being provided for use and will not result in any violation of an NPDES or WPCF permit limit or condition or Oregon Administrative Rule.

(4) Redundancy. A wastewater treatment system that provides recycled water for use must have a sufficient level of redundant treatment facilities and monitoring equipment to prevent inadequately treated recycled water from being used or discharged to public waters.

(5) Distribution system requirements. Unless otherwise approved in writing by the department, all piping, valves, and other portions of the recycled water use system that is outside a building must be constructed and marked in a manner to prevent cross-connection with a potable water system. Unless otherwise approved in writing by the department or as required by the rules of this division, construction and marking must be consistent with sections (2), (3), (4), and (5) of the 1992 "Guidelines for the Distribution of Nonpotable Water" of the California-Nevada Section of the American Water Works Association.

(6) Cross-connection control. Connection between a potable water supply system and a recycled water distribution system is not authorized unless the connection is through an air gap separation approved by the department. A reduced pressure principle backflow prevention device may be used only when approved in writing by the department and the potable water system owner.

[Publications: Publications referenced are available from the agency.]

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

APPENDIX B
Natural Resources Conservation Service Custom Soil Resource Report

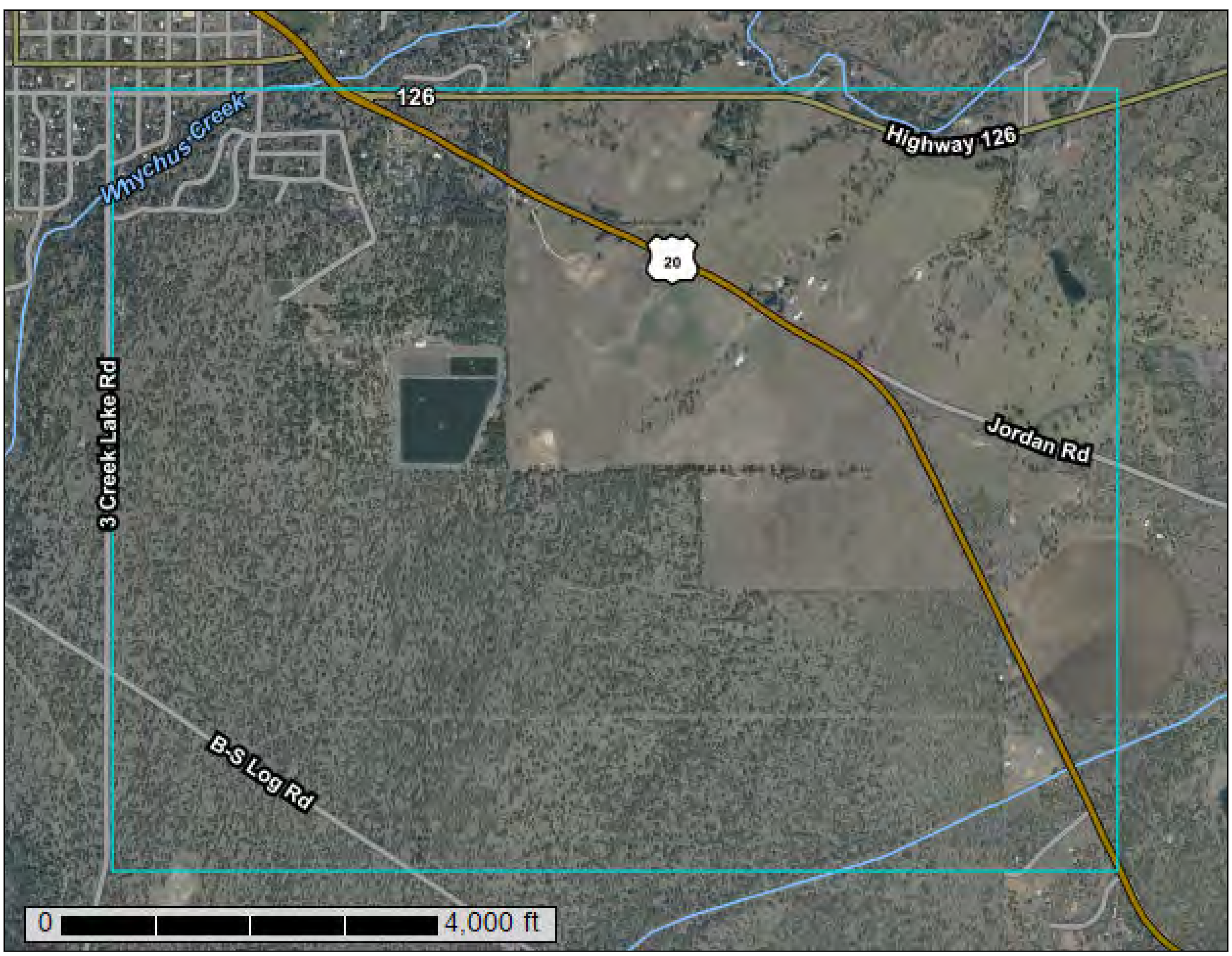
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Deschutes National Forest, Oregon; and Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties



January 15, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

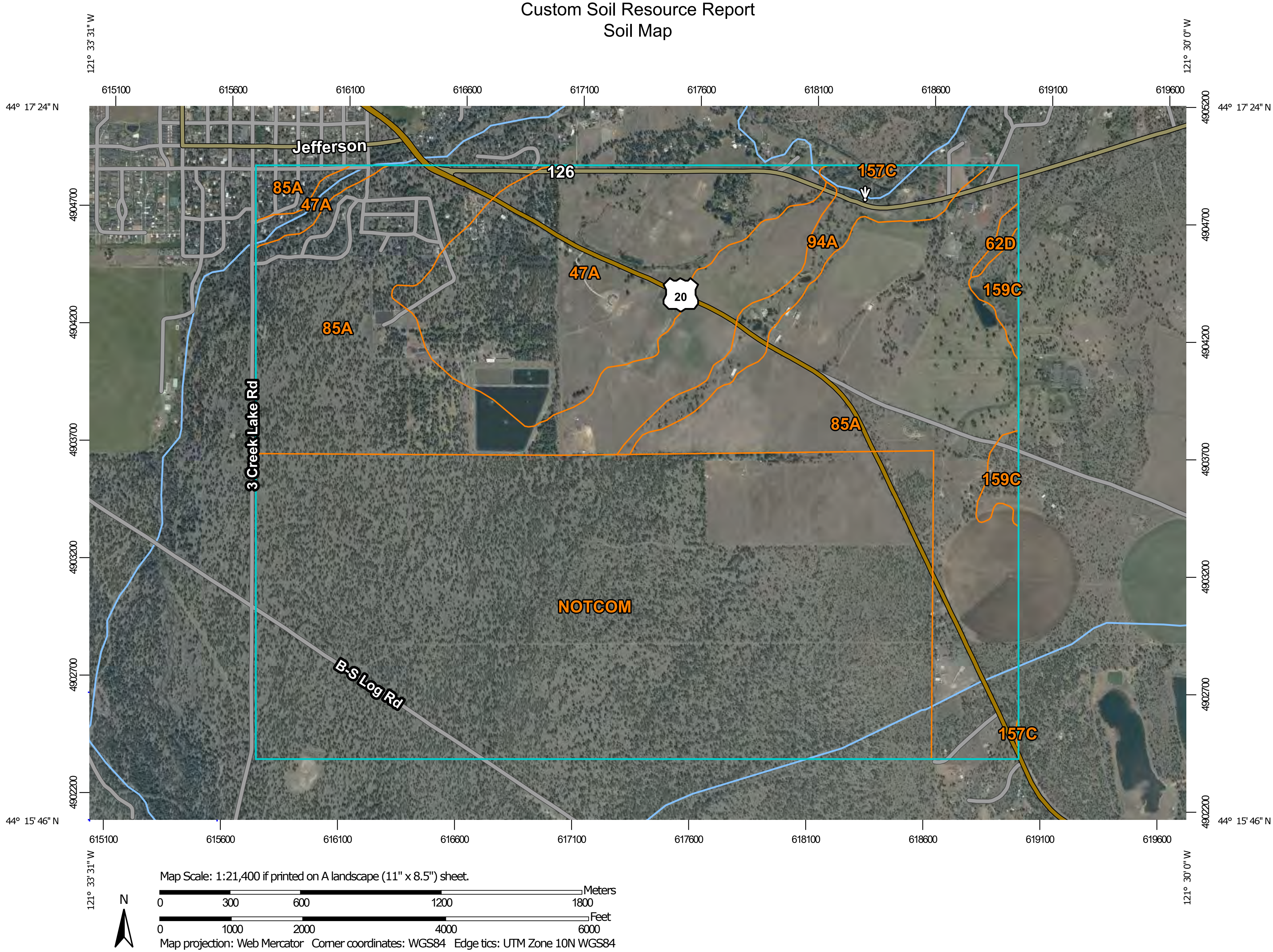
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


121° 33' 31" W
121° 30' 0" W
44° 17' 24" N
44° 15' 46" N
615100
615600
616100
616600
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618100
618600
619100
619600
4905200
4904700
4904200
4903700
4903200
4902700
4902200
Jefferson
126
20
85A
47A
157C
94A
62D
159C
NOTCOM
3 Creek Lake Rd
B-S Log Rd
Map Scale: 1:21,400 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0
300
600
1200
1800
Feet
0
1000
2000
4000
6000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Deschutes National Forest, Oregon
Survey Area Data: Version 3, Sep 17, 2019

Soil Survey Area: Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties
Survey Area Data: Version 17, Sep 14, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 7, 2020—Jun 2, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
NOTCOM	No Digital Data Available	932.4	45.6%
Subtotals for Soil Survey Area		**932.4**	**45.6%**
Totals for Area of Interest		**2,042.8**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
47A	Ermabell loamy fine sand, 0 to 3 percent slopes	289.0	14.1%
62D	Henkle-Lava flows-Fryrear complex, 15 to 50 percent slopes	4.4	0.2%
85A	Lundgren sandy loam, 0 to 3 percent slopes	726.5	35.6%
94A	Omahaling fine sandy loam, 0 to 5 percent slopes	64.4	3.2%
157C	Wanoga-Fremkle-Rock outcrop complex, 0 to 15 percent slopes	1.5	0.1%
159C	Wilt sandy loam, 0 to 15 percent slopes	24.6	1.2%
Subtotals for Soil Survey Area		**1,110.4**	**54.4%**
Totals for Area of Interest		**2,042.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Deschutes National Forest, Oregon

NOTCOM—No Digital Data Available

Map Unit Composition

Notcom: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Notcom

Properties and qualities

Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties

47A—Ermabell loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 24b4
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 60 to 90 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ermabell and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ermabell

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash over glacial outwash

Typical profile

H1 - 0 to 8 inches: loamy fine sand
H2 - 8 to 31 inches: loamy fine sand
H3 - 31 to 41 inches: fine sand
H4 - 41 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 40 to 60 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water capacity: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: A
Ecological site: F006XY708OR - Frigid Xeric Foothills 12 - 20 PZ
Hydric soil rating: No

Minor Components

Aquands, poorly drained

Percent of map unit: 3 percent
Landform: Flood plains
Hydric soil rating: Yes

62D—Henkle-Lava flows-Fryrear complex, 15 to 50 percent slopes

Map Unit Setting

National map unit symbol: 24f6
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 60 to 90 days
Farmland classification: Not prime farmland

Map Unit Composition

Henkle and similar soils: 35 percent
Lava flows: 30 percent
Fryrear and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Henkle

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and colluvium over volcanic rock

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 3 inches: very cobbly sandy loam
H2 - 3 to 18 inches: very cobbly sandy loam
H3 - 18 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R006XB002OR - Frigid Xeric Lava Plains 12 - 16 PZ
Hydric soil rating: No

Description of Lava Flows

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Fryrear

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and colluvium over basalt

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 4 inches: stony sandy loam
H2 - 4 to 19 inches: very stony sandy loam
H3 - 19 to 28 inches: very stony sandy loam
H4 - 28 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R006XB002OR - Frigid Xeric Lava Plains 12 - 16 PZ
Hydric soil rating: No

85A—Lundgren sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 24gn
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 60 to 90 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lundgren and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lundgren

Setting

Landform: Outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash over glacial outwash

Typical profile

H1 - 0 to 14 inches: sandy loam
H2 - 14 to 23 inches: gravelly sandy loam
H3 - 23 to 38 inches: very gravelly loam
H4 - 38 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F006XY708OR - Frigid Xeric Foothills 12 - 20 PZ
Hydric soil rating: No

94A—Omahaling fine sandy loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 24hq
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 60 to 90 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Omahaling and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Omahaling

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash over old alluvium

Typical profile

H1 - 0 to 19 inches: fine sandy loam
H2 - 19 to 23 inches: silt loam
H3 - 23 to 29 inches: gravelly sand
H4 - 29 to 48 inches: silt loam
H5 - 48 to 60 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R006XB100OR - WET MEADOW
Hydric soil rating: No

Minor Components

Aquolls, poorly drained

Percent of map unit: 4 percent
Landform: Flood plains
Hydric soil rating: Yes

157C—Wanoga-Fremkle-Rock outcrop complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 242b
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 60 to 90 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wanoga and similar soils: 35 percent
Fremkle and similar soils: 30 percent
Rock outcrop: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wanoga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash over tuff or basalt

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 13 inches: sandy loam
H2 - 13 to 25 inches: sandy loam
H3 - 25 to 35 inches: weathered bedrock
H4 - 35 to 45 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock; 30 to 50 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water capacity: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: F006XY708OR - Frigid Xeric Foothills 12 - 20 PZ
Hydric soil rating: No

Description of Fremkle

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash over tuff or basalt

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 4 inches: sandy loam
H2 - 4 to 15 inches: sandy loam
H3 - 15 to 25 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R006XB002OR - Frigid Xeric Lava Plains 12 - 16 PZ
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

159C—Wilt sandy loam, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 242d
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 60 to 90 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wilt and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wilt

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash over residuum weathered from andesite

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 26 inches: cobbly loam
H3 - 26 to 33 inches: very cobbly clay loam
H4 - 33 to 43 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F006XY708OR - Frigid Xeric Foothills 12 - 20 PZ
Hydric soil rating: No

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APPENDIX C
Preliminary Findings Memo

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MEMO

To:	Paul Bertagna, Public Works Director, City of Sisters
From:	Treyton Moore, E.I.
Subject:	**Lazy Z Ranch Master Plan** **Preliminary Findings Memo**
Date:	March 15, 2021
Job/File No.	446-06-02 (w/encl.)
cc:	Troy Rayburn, Project Coordinator, City of Sisters Brett Moore, P.E., Anderson Perry & Associates, Inc. (AP) Josh Robertson, P.E., AP

Introduction

The region around the City of Sisters has become a hub for art, recreation, tourism, and more. The area's popularity has brought considerable growth and many opportunities and challenges to City planning. The City's projected growth over the next 20 years will require the City to increase its ability to dispose of treated wastewater (recycled water). The purpose of this memo is to outline the different recycled water use options considered for the City's effluent disposal and the associated requirements for these beneficial reuse options pursuant to Oregon Administrative Rules (OAR) 340-055.

General Site Conditions

The City's approximately 231-acre recycled water use site is located southeast of the City at the Lazy Z Ranch. The general soils at the site are classified as sandy loams and loamy sands with high permeability rates. General depth to groundwater in the area is more than 80 inches.

Beneficial Reuse Options

The City has expressed interest in exploring several beneficial reuse options. The requirements for each option based on the quality of recycled water vary and are discussed hereafter. The quality of recycled water for use with these options is recommended based on this discussion.

- Lined wetlands
- Unlined wetlands
- Lined ponds and streams
- Pasture irrigation
- Forested irrigation

Beneficial Reuse Requirements

The City of Sisters currently produces Class D recycled water. Under OAR 340-055, five recycled water qualities, or classes, are discussed. A summary of these classes of recycled water is included on Table 1.

Table 1
Recycled Water Qualities

Class	Treatment Criteria*
Nondisinfected	No Criteria
D	126 *E. coli* organisms per 100 ml (30-day log mean) 406 *E. coli* organisms per 100 ml (any single sample)
C	23 total coliform organisms per 100 ml (seven-day median) 240 total coliform organisms per 100 ml (any consecutive two samples)
B	2.2 total coliform organisms per 100 ml (seven-day median) 23 total coliform organisms per 100 ml (single sample)
A	2.2 total coliform organisms per 100 ml (seven-day median) 23 total coliform organisms per 100 ml (single sample) Less than 2 NTU (24-hour average) Less than 5 NTU (up to 72 minutes over a 24-hour period) Less than 10 NTU (at any time)

*All classes of recycled water must be oxidized in addition to these criteria.
ml = milliliters
NTU = nephelometric turbidity unit

As shown on Table 1, disinfection requirements for the different classes of recycled water vary substantially. As such, permissible uses for each class of recycled water vary, as lower disinfection qualities result in more restrictions for use of that recycled water. Additionally, the requirements for restricting access to the recycled water use sites vary by class and by beneficial use. The following is additional information about each considered beneficial reuse option and the associated requirements.

Lined Wetlands/Lined Ponds and Streams

Both lined wetlands and lined ponds and streams are similar recycled water uses. Aside from the aesthetic contribution provided by the lined wetlands and lined ponds and streams, these beneficial purposes would allow recycled water disposal via evaporation and plant matter transpiration. Both the lined wetlands and the lined ponds and streams would likely be subject to the same requirements. These requirements are outlined below and organized by class of recycled water.

Nondisinfected Recycled Water

Lined wetlands/lined ponds and streams are not identified as beneficial purposes for nondisinfected recycled water under OAR 340-055. For this reason, this beneficial purpose would require authorization in writing from the Oregon Department of Environmental Quality (DEQ). Additionally, public access to the site would have to be prevented, and a 150-foot buffer between the wetlands, ponds, and streams sites and any water supply sources used for human consumption would have to be maintained. For example, if any potable wells are located at or in the vicinity of the Lazy Z Ranch, the lined wetlands, ponds, and streams cannot be located within 150 feet of these wells. AP is unaware of any applications where nondisinfected recycled water is used for lined wetlands or lined ponds and streams. AP does not recommend attempting to use nondisinfected recycled water for this beneficial purpose.

Class D Recycled Water

Lined wetlands/lined ponds and streams are not identified as beneficial purpose for Class D recycled water under OAR 340-055. For this reason, this beneficial purpose would require authorization in writing from the DEQ. Although this purpose is not explicitly authorized by the DEQ, it has been allowed in some applications, such as for the City of Prineville's wastewater treatment facility (WWTF).

The City of Prineville currently produces Class D recycled water using aerated lagoons and a chlorine disinfection system, then uses lined wetlands followed by unlined wetlands to treat and dispose of the Class D recycled water. The purpose of the lined wetlands is to provide additional treatment/polishing of the recycled water. This process further reduces potential pathogens, improving the quality of the recycled water. The unlined wetlands provide additional treatment and disposal of the recycled water. At Prineville's WWTF, recycled water percolates through the unlined wetlands and flows through the soil to Crooked River.

Public access is allowed at the City of Prineville wetland site. Through coordination with the DEQ, it was determined that a simple cable delineator could be used around the lined treatment wetlands, while no barrier is provided between walking paths and the unlined disposal wetlands. For both types of wetlands, the City of Prineville maintains a minimum 10-foot setback distance between the wetlands and any public walking paths, along with signage to alert the public of the use of recycled water in the wetland system.

Based on the similarities between Prineville's WWTF and Sisters' WWTF, this beneficial purpose appears to be a viable option for disposing of Class D recycled water.

Class C Recycled Water

Class C recycled water is allowed for use as a water supply source for landscape impoundments such as wetlands or ponds under OAR 340-055. When used for this method, signs must be posted at the use area that are visible to the public and state that recycled water is used and is not safe for drinking. Additionally, a minimum 10-foot setback distance must be maintained between the impoundment and the property boundary. Furthermore, a 100-foot setback distance must be maintained between the impoundment and a water supply source used for human consumption.

Classes B and A Recycled Water

Both Classes B and A may be used as a water supply source for landscape impoundments such as wetlands or ponds under OAR 340-055. When used for this purpose, the same requirements regarding signage as those required for Class C recycled water apply. Additionally, no setback distances are required between the impoundment and the property boundary. Class B recycled water use requires a 50-foot setback distance between the impoundment and any water supply source used for human consumption.

Unlined Wetlands

Unlined wetlands must meet the same requirements as those outlined above for lined wetlands plus additional groundwater quality requirements. Unlined wetlands allow recycled water to percolate through the soil and into the groundwater, so these systems must also follow OAR 340-040, which outlines the groundwater quality requirements. The summarized requirements, as presented in OAR 340-040-0030, are included on the tables found in Attachment A. Based on past experience AP has with systems such as the City of Prineville's, use of an unlined wetland or other water feature would likely require implementation of monitoring wells. These wells monitor the groundwater for water surface elevation, pH, nitrate nitrogen, total nitrite/nitrate nitrogen, and conductivity. Reporting on groundwater monitoring is done on a quarterly basis.

As stated previously, the soils at the Lazy Z Ranch are anticipated to have relatively high permeabilities. For this reason, the acreage of unlined wetlands would have to be limited; unlined wetlands would likely tend to dry out if they were too large due to these anticipated high soil permeabilities.

Pasture Irrigation/Forested Irrigation

Both the pasture irrigation and forested irrigation options are similar and generally governed by the same restrictions. Additionally, OAR 340-055 states that nondisinfected wastewater may be used to irrigate fodder, fiber, and seed crops not intended for human ingestion, or for commercial timber. All other classes of recycled water (A through D) are held to higher treatment standards. Therefore, each class of recycled water may be used to irrigate pasture or forest, as long as the proper setback distances and guidelines related to the respective class of recycled water are met. These requirements are outlined on Table 2 below for sprinkler irrigation.

Table 2
Guidelines for Irrigating Recycled Water by Class

Class	Distance to Water Supply for Human Consumption	Distance to Food Preparation or Drinking Fountain	Public Access Requirements	Additional Restrictions	Property Line Setback Distance
Nondisinfected	150 feet	As required to protect public health and environment	Prevent all public access	Cease irrigation 30 days before harvest	As required to protect public health and environment

Class	Distance to Water Supply for Human Consumption	Distance to Food Preparation or Drinking Fountain	Public Access Requirements	Additional Restrictions	Property Line Setback Distance
D	100 feet	70 feet	Signage warning of recycled water use	Cease irrigation three days before harvest	100 feet
C	70 feet	70 feet	Signage warning of recycled water use	Cease irrigation three days before harvest	70 feet
B	50 feet	10 feet	Signage warning of recycled water use	Notify personnel of recycled water use	50 feet
A	No direct contact	No direct contact	Signage warning of recycled water use	Notify personnel of recycled water use	No direct contact

Recommendations

The City of Sisters currently produces Class D recycled water at its WWTF using aerated treatment lagoons and liquid chlorine disinfection. The City then disposes of its Class D recycled water via forested and pasture irrigation at multiple sites that include the following:

- Forested irrigation around the wastewater treatment lagoons
- Pasture irrigation at Lazy Z Ranch

As previously discussed, the restrictions for each recycled water beneficial purpose can vary substantially based on the class of the recycled water in question. The requirements for beneficial purpose generally become less strict as the quality of the recycled water increases; however, the difference in operational requirements necessary to advance from one class to the next often increases considerably. For these reasons, AP recommends that the City of Sisters continue to produce Class D recycled water for the proposed beneficial uses, as this would minimize impact to the operation of the City's existing WWTF.

To permit the use of Class D recycled water, any recycled water used in lined ponds/streams would first go through lined wetlands. The first section of wetlands would be used for additional treatment of the recycled water effluent to further reduce the number of pathogens in the water. A six-day detention time with a 12-inch wetland water depth is recommended. These treatment wetlands would have a simple barrier in addition to the signage and setback distances to discourage contact. The anticipated requirements for each beneficial reuse option are summarized on Table 3.

Table 3
Anticipated Regulatory Requirements for Recommended Beneficial Uses

Beneficial Use	Anticipated Requirements for Class D Recycled Water
Lined Wetland	Maintain a minimum 10-foot setback distance between wetlands and walking paths. Visibly post signage alerting the public of the use of recycled water in the wetlands. Provide simple fencing or a natural barrier around the treatment wetlands to discourage dog contact.
Lined Ponds/Streams	Maintain a minimum 10-foot setback distance between water surfaces and walking paths. Visibly post signage alerting the public of the use of recycled water in ponds/streams.
Unlined Wetland	Maintain a minimum 10-foot setback distance between wetlands and walking paths. Visibly post signage alerting the public to the use of recycled water in wetlands. Provide monitor wells and monitor regularly for nitrates and nitrites, along with any other DEQ-required water quality parameters, which are likely to include pH, conductivity, and groundwater elevation.
Pasture/Forested Irrigation	Maintain a 100-foot setback distance to any water supply for human consumption and property boundary. Maintain a 70-foot setback distance to any drinking fountain or food preparation area. Visibly post signage alerting the public to the use of recycled water for irrigation. Cease irrigation at least three days prior to harvest of any crops.

It is important to note that the anticipated requirements for the wetland and ponds options, both lined and unlined, are based on experience with similar applications in the City of Prineville and would be subject to DEQ review and approval. If the DEQ does not approve these uses for Class D recycled water, or if any additional requirements established by the DEQ have the potential to negatively impact the City's vision for the Lazy Z Ranch, then the City can modify its disinfection operations to produce Class C wastewater to use wetlands and ponds/streams for disposal of the City's recycled water.

TM/sg

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ATTACHMENT A
Oregon Department of Environmental Quality
Groundwater Quality Tables

State of Oregon Department of Environmental Quality

OAR 340-040-0020
Numerical Groundwater Quality Reference Levels
11/14/97

Table 1 – Inorganic Contaminants Numerical Groundwater Quality Reference Level[1]	
Contaminants	**Reference Level (mg/L)**
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Fluoride	4.0
Lead	0.05
Mercury	0.002
Nitrate-N	10.0
Selenium	0.01
Silver	0.05

[1]All reference levels are for total (unfiltered) concentrations unless otherwise specified by the Department.

Table 2 – Organic Contaminants Numerical Groundwater Quality Reference Level[1]	
Contaminants	**Reference Level (mg/L)**
Benzene	0.005
Carbon Tetrachloride	0.005
p-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.200
Trichloroethylene	0.005
Total Trihalomethanes (the sum of concentrations bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform))	0.100
Vinyl Chloride	0.002
2,4-D	0.100
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.100
Toxaphene	0.005
2,4,5-TP Silvex	0.010

[1]All reference levels are for total (unfiltered) concentrations unless otherwise specified by the Department.

Table 3 – Miscellaneous Contaminants Numerical Groundwater Quality Guidance Levels[1]	
Contaminants	**Guidance Level (mg/L)[2]**
Chloride	250
Color	15 Color Units
Copper	1.0
Foaming agents	0.5
Iron	0.3
Manganese	0.05
Odor	3 Threshold odor number
pH	6.5 – 8.5
Sulfate	250
Total dissolved solids	500
Zinc	5.0

[1] All guidance levels except total dissolved solids are for total (unfiltered) concentrations unless the Department specifies otherwise.
[2] Unless otherwise specified, except pH.

APPENDIX D
Sisters Country Vision Action Plan

VISION ACTION PLAN

FINAL

Sisters Country Vision
City of Sisters, Oregon
June 2019

(Last Updated: 06.20.19)

Prepared by
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CONTENTS

INTRODUCTION & OVERVIEW

The **Vision Action Plan** presented in this report is the final outcome of the **Sisters Country Horizons** community visioning project of the **City of Sisters**, Oregon conducted in 2018. (Note: As of June 2019, the project has been rebranded as the **Sisters Country Vision** with a new logo and tagline: "Our Community • Our Future".)

The City sponsored this effort to engage the community in a comprehensive conversation about the future of Sisters Country, to renew and update the community's existing vision for the future, and to develop a community-based action plan to engage the City and its key partners in achieving that vision over time, focusing on the next five years.

Deschutes County and **Central Oregon Intergovernmental Council**, along with PSU's **Oregon's Kitchen Table** project and **Citizens4Community**, partnered with the City in this effort.

As its name implies, the Horizons project focused on the **Sisters Country** area of Deschutes County – loosely defined as the Sisters School District 006 and Camp Sherman, including the city of Sisters proper, along with outlying residential developments and unincorporated areas, ranches and farms. The project actively reached out to residents throughout Sisters Country to engage them in the conversation.

To accomplish this goal, the project incorporated an exhaustive outreach and engagement effort. Key activities included: **stakeholder interviews** with 81 community leaders; 13 local **community meetings** conducted across the area; additional **"kitchen table" meetings** run by residents themselves; two major **online surveys** along with additional web-based opportunities for public comment; four **community forums** focused on the vision's four respective focus areas; and a culminating **Vision Summit**.

Special outreach was also conducted for local service clubs, senior citizens, high school students, veterans, the Latino community, Millennials, and others.

All of these activities were promoted by a **project website** and **social media**, along with **press releases** for local and regional media. As a result, a number of articles were published by *The Nugget*, *Bend Bulletin* and *Bend Magazine*. The project also developed a bespoke brand identity, logo and tagline, designed to be useful beyond the visioning process itself.

By the end of the process, nearly 2,000 participants had been engaged in the conversation, accounting for tens of thousands of individual comments and suggestions. This input eventually culminated in an overarching long-range vision statement presented at the Summit in September and 20 top priority **Strategies** recommended by the public for implementation over time.

Following these activities, a 31-member **Vision Action Team (VAT)** was formed and charged with reviewing and refining the strategies, and developing a vision action plan to promote their implementation.

The VAT met six times in the fall of 2018 to develop this plan, totaling nearly 500 hours of citizen time. Five strategies were fully developed for each of four focus areas: **Prosperous Sisters**,

Livable Sisters, **Resilient Sisters** and **Connected Sisters**, along with detailed action steps, suggested lead partners for their implementation, timelines and milestones. The City of Sisters, the major plan partner, commenced an effort to secure the commitments of other partners.

The final **Vision Action Plan** is intended to be a "living plan" and a guide to future action by the Lead Partners who sign on to help implement it. At the same time, it is not a legally binding document, but rather a catalogue of ideas and possibilities with the ambition of making it happen to the best of the City and its partners' abilities. Sisters City Council, as well as the boards of other Lead Partner organizations, is anticipated to adopt the plan.

Some actions in the plan may take up to five years (or beyond) to fully implement, and not every action called out in the plan may be achieved. It is also expected that the final list of Lead Partners may change or evolve over time, as may the actions themselves that they commit to undertake.

That said, based on the thousands of comments received from residents across Sisters Country, it is clearly the community's expressed desire that most of what is called out in the Vision Action Plan will, in fact, be achieved. And the results will mean a more prosperous, livable, resilient and connected Sisters Country – better prepared for whatever the future may bring.

NXT Consulting Group, consultant to the Sisters Country Horizons project, would like to thank the many **elected officials, citizens, community members and volunteers** who helped make this visioning process an exceptional community effort.

This long list includes: the Mayor of Sisters, President of Sisters City Council, and Sisters City Councilors; City of Sisters City Manager, City staff and the Community Development Department; Project Partners Deschutes County, Central Oregon Intergovernmental Council, Oregon's Kitchen Table and Citizens4Community; the Horizons Project Management Team; the Horizons Vision Action Team (VAT); numerous planners at Deschutes County who assisted with community meetings and VAT planning sessions; community leaders who volunteered to be interviewed by the Horizons project; volunteers who were trained and helped facilitate community meetings and/or kitchen table sessions; volunteers who assisted with special outreach to youth, seniors, veterans and the Latino community; and the many contributors who created the Sisters Horizons Community Quilt, itself a catalogue of ideas and possibilities.

During the course of this project, it has been said many times that if there is one person smarter than any of us, it's all of us. The residents of Sisters Country have demonstrated many times over that they possess the intelligence, vision and courage to ensure a bright future for their community and all its residents – and a legacy for generations to come.

SISTERS COUNTRY – PROFILE OF A CHANGING COMMUNITY

Situated at the eastern base of Cascade Range, "Sisters Country" is the widely used name for a much loved, stunningly beautiful part of Deschutes County, Oregon. The majestic Three Sisters peaks – just miles from the city of Sisters and visible from almost every part of the region – lend the region its name and help define its lifestyles, identity and brand.

As the heart of Sisters Country, the city of Sisters lies where the Santiam and McKenzie highways converge at the west end of town to form Cascade Avenue and separate again on their way to Bend and Redmond to the east. Most Sisters Country residents frequent the city as part of their daily lives, for school and work, business and shopping, and government, professional and medical services – traveling to Bend or Redmond for those needs that cannot be met locally.

Population Growth and Change

During the latter half of the 20th century, the city of Sisters' population grew (and declined) in direct relation to its economic fortunes. In 1950 the population was 723 and 50 years later in the year 2000 it was still only 959. However, with the 21st century came a sustained period of growth as more people discovered Sisters. Despite the disruption of the Great Recession in 2008-09, the city's population in 2016 was estimated to be 2,537 – and growing.

The population of the city of Sisters is largely white (estimated at 94% in 2016), although there is a small but growing Latino population. The population is slightly older and more affluent than the state as a whole, while the median value of the city's housing is higher than that of the state.

Demographic information for the larger Sisters Country area is not easy to quantify, as most available data is not collected or aggregated by its informal boundaries. The best approximation can be found in examining combined data for Black Butte and Sisters school districts (which includes the city of Sisters). In 2016, the combined Census-estimated population of this area was 7,796, or a little more than three times that of the city of Sisters proper. This would indicate that two-thirds of the Sisters Country population lives outside the city – or roughly twice as many people as live within it.

The statistical differences with the rest of the state appear to be more pronounced for the part of Sisters Country that lies outside the city. Anecdotally, this area is considered older and more affluent. Population in the wider region has also grown during the last two decades.

History and a Changing Economy

Sisters Country has a rich and colorful history, shaped by its geographic location and spectacular geology, pre-history and native peoples, early pioneers and settlers, development of the town of Sisters (first incorporated in 1946), and the area's legacy economy, including logging, lumber and wood products, ranching and farming.

In latter decades of the 20th century, the economic profile of the area began to shift significantly, with the decline of logging and closure of the town's sawmills – and rise of destination resorts, tourism, arts and cultural amenities, and outdoor recreation. Catalyzed by the development of Black Butte Ranch resort, the downtown Sisters' 1880's building façades and Western-themed visitor attractions grew from the 1970s onward, launching a new chapter in the community's economic development.

Today, the "Sisters County" brand is promoted by the Sisters Area Chamber of Commerce and bolstered by iconic Western events, including the Sisters Rodeo, Sisters Outdoor Quilt Show and Sisters Folk Festival. These, in turn, have fostered the spin-off of newer arts and craft, performance and visitor-related events and attractions.

While government (including the U.S. Forest Service), administration, education, accommodations and food, and professional/technical services are relatively large sectors of the Sisters compared to the state as a whole, the number of innovative new companies, telecommuting workers (i.e., "lone eagles"), and independent entrepreneurs has begun to grow, drawn by its location, amenities, and quality of life. An influx of retirees also has also brought a steady stream of former professionals, not to mention retirement incomes and accumulated wealth.

Middle- and lower-income families in Sisters Country have not fared so well in Sisters Country of late, as living wage jobs are not easy to find and rising housing costs have made it more difficult for Millennials, young families and minority residents to sink roots. There is also a small but significant population of homeless families living in the area, some of whom have encamped in nearby forests.

The lack of affordable housing and family wage jobs has also challenged local schools, which have faced declining enrollments in recent years. Sisters' schools are considered the heart of the community by many, with a history of strong financial support, community-based initiatives, and academic excellence. The School District offers innovative programming reflecting the area's evolving economy, including the Americana, arts and luthier programs, and the Interdisciplinary Environmental Expedition.

As to its future economy, Sisters Country recognizes that tourism and the arts and recreational economies will continue to be a major source of its future prosperity. Rural Sisters Country, which continues to support ranching and agricultural operations, also hosts other visitor amenities and attractions.

At the same time, clean, light industry and smaller specialty companies compatible with the local culture are seen as critical to a more sustainable and equitable economy that can support working families. Currently, existing and potential relocating traded-sector employers (i.e., companies that produce goods and services sold outside the region) estimate 450 new year-round non-seasonal jobs, which will significantly impact the local and regional economy. Not only would this represent a significant number of new jobs, but also a shift in the economic base toward greater diversification.

Economic Development for Central Oregon's (EDCO) Sisters staff is working with the City, other government agencies, Sisters Area Chamber of Commerce, local businesses, investors and developers, and the community-at-large to strategically assist in diversifying the future economy of Sisters.

Planning for Future Growth and Development

The City of Sisters, Deschutes County and Central Oregon Intergovernmental Council (COIC) are actively involved in planning for the future growth and development of Sisters and Sisters Country. The City of Sisters has purview over plans, policies and ordinances affecting the city proper, while

Deschutes County provides traditional county services for the entire area, administers building codes for the City of Sisters, and oversees planning and policy for all unincorporated areas outside the City. COIC offers a range of regional planning and governmental services that includes Sisters Country, focusing on community economic development, education and training, transportation and more.

The City of Sisters has active public works, planning and community development departments, and a full slate of plans and policies guiding the town's growth and development. These include the Sisters Comprehensive Plan (last updated in 2014), Transportation System Plan Refinement (June 2018), Natural Hazards Mitigation Plan (prepared in collaboration with Deschutes County) (2015), Greater Sisters Country Community Wildfire Protection Plan (2014), Sisters Housing Plan (2010), and Downtown Urban Renewal Plan (2003).

Among the City's active planning projects in 2018 were the Community Planning Assistance for Wildfire project (CPAW), Whychus Creek Riparian Restoration and Fish Passage Project, and the Sisters Country Horizons visioning project. A complete update of the City's Comprehensive Plan is expected to be undertaken in the next couple years.

Sisters Country Horizons Visioning Project

The Sisters Country Horizons project is intended to provide a larger context for more detailed plans and initiatives of the City, County and COIC, and to do so in a way that engages the diverse perspectives and input of the wider public across the region.

The Sisters City Council has expressed a desire for the project to develop a better understanding and what local residents, both inside and outside city limits, aspire to for the future of their community – and what types of projects they are willing to support. The visioning project also has been seen by some as part of a response to a recent difficult period in community relations – and the expressed desire for more inclusive, civil conversations about the area's future.

Not surprisingly, the Horizons project is not the first time Sisters Country has set its sights on the future. The most recent vision plan for Sisters Country was undertaken more than a decade ago. Sponsored by the Community Action Team of Sisters, COIC and Rural Development Initiatives, Inc., this effort resulted in the *Community Vision and Strategic Plan* (2007). The plan included seven focus areas, a long list of action projects, and identified project "champions." Many of the recommended projects were achieved over time, although the Great Recession put a damper on local initiatives and the plan was never formally updated.

The Horizons project is built in part on the foundation of the 2007 plan. At the same time, it has involved local governments as project sponsors, reframed the vision's focus areas into a shorter list, and addressed a number of trends that have accelerated since 2007 (see below). It has also been designed to encourage ongoing involvement of the City of Sisters, its partner agencies and the wider community to help ensure the implementation of its vision action plan over time. (See "Implementing the Vision Action Plan," page 24.)

Emerging State and Local Trends & Strategic Issues

While the Sisters Country Horizons project was launched during a relatively stable and prosperous time in the state and local economies, the future could be seen as more challenging. Below are some of the trends projected to have major impacts Oregon's local communities going forward, including observations on how they may affect Deschutes County and Sisters Country. This information was gathered from a variety of government, educational and independent research organizations, and online data sources.

- Oregon's population is growing. Oregon's statewide population is forecast to increase by nearly a million people, from 3.97 million in 2014 to 4.8 million in 2030, with most population growth occurring in urban centers. This is due in part to increased levels of in-migration from others states; over the last decade, Oregon has had one of the highest levels of in-migration from other states in the entire nation. **Deschutes County** is one of the fastest growing counties in Oregon; current forecasts show County population increasing from nearly 188,000 in 2018 to 244,000 in 2040. Similarly, the **City of Sisters** population is forecast to nearly double from 2,691 in 2018 to 5,169 in 2043. Forecasts for future growth in *rural* parts of Deschutes County while significant are somewhat lower than its urbanized areas.

- Oregon's population is aging. Oregon's percentage of citizens over 65 is growing faster than the nation as a whole (an 18% increase from 2010 to 2014 compared to 14% for the nation as a whole). This increase is happening across the state and in every county, and is due to the aging Baby Boomers as well as an influx of retirees from other places. **Sisters Country** has become a significant destination for more affluent retirees.

- Oregon's population continues to diversify. Oregon will continue to become more racially and culturally diverse, especially with a burgeoning Hispanic population dominating younger cohorts. Oregon's Hispanic population grew five times faster than the rest of the population between 2000 and 2014, increasing by 65%. **Sisters Country** has attracted a small but growing number of Latinos; Hispanics accounted for an estimated 4% of the area's population in 2016.

- Oregon's economy is restructuring and diversifying. Oregon's economy has largely recovered from the Great Recession, and continues its long-term trend away from resource-based and extractive industries to a more diversified economy. Rural areas of Oregon continue to lag behind its larger cities economically, but the State of Oregon is working to link natural resources with innovation to create new jobs in rural areas. With its quality of life, natural amenities, and arts and tourism industries, the **city of Sisters** could be considered a prime example of the economic potential of Oregon's smaller communities.

- Oregonians continue to earn less than the nation with a few exceptions. In 2014 median household income in Oregon was slightly above $51,000, or more than $2,500 less than the nation as a whole. At the same time, Oregon currently has one of the higher minimum wages in the nation. Oregon's highest household incomes are in the Portland metro area and Deschutes County, and yet there are significant numbers of households in the county that struggle with the area's high living costs, especially housing. This problem is very evident in **Sisters Country** and a focus of local government and community-based organizations.

- Oregon’s cities have relatively stronger controls over new development. As Oregon grows, the State’s comprehensive land-use planning system will provide Oregon cities a relatively greater degree of control over new development than other states – and potentially higher levels of community livability. The **city of Sisters** continues to grow, but faces long-term constraints on land for both housing and industrial development due to adjacent public lands and exclusive farm use lands. Vacant and buildable land within City limits is highly constrained. The City projects a need for 922 new housing units by 2038 – but not enough land to accommodate 20 years of residential growth. The largest and most significant parcel of potentially developable land in the city is the 81-acre Forest Service property.

- Homelessness is becoming a bigger issue in Oregon. For the foreseeable future the number of people affected by homelessness in Oregon is projected to grow, placing increased stresses on schools and local social services, housing, drug treatment and mental health providers, and the criminal justice system. With known encampments in its vast expanse of adjacent public lands, the homeless situation in **Sisters Country** is not as visible as other Deschutes County communities, but significant nonetheless. The community and schools have responded to this challenge with a number of programs and initiatives.

- Oregonians are stepping up preparations for climate change and natural disasters. Oregon faces the threats of climate change in the form of increasing average temperatures, ongoing serious droughts, and the threat of large-scale wildfires, as well as the predicted Cascadia Subduction Zone earthquake. At the same time, "climate refugees" are also expected to increase in their numbers in Oregon, including migrants from more severely climate-impacted areas of California, the Southwest and beyond.

  Sisters Country faces the possibility of larger, catastrophic wildfires and affiliated impacts in the future. Research shows that the largest fires in Deschutes Country over the last century have occurred since the year 2000, and that most of them have occurred in the vicinity of Sisters Country. The Milli Fire of 2017 burned 24,000 acres in the Deschutes National Forest and Three Sisters Wilderness, came within several miles of the City of Sisters, and caused the cancellation of key summer activities and the Sisters Folk Festival. In 2018, the City of Sisters was a participant in the Community Planning Assistance for Wildfire project.

  There is a predicted 37% chance of a Cascadia earthquake occurring between now and 2065. Impacts will be severe on the Oregon coast and serious in the western valleys, while more moderate in Central Oregon. However, after the quake **Central Oregon** will become the center for Federal emergency response (FEMA), possibly the temporary seat of state government, and the state’s transportation and distribution hub for two years or more. Large population migrations to Central Oregon from Western valleys in the short term are anticipated with major impacts on housing, traffic, cost of living and day-to-day life.

  State and local governments are increasingly focused on building greater resiliency in local communities in Oregon. The State of Oregon has a State Resiliency Plan and localities are working to increase public awareness and readiness. In addition to wildfires and earthquakes, Central Oregon and Sisters Country face a number of other potential natural hazards. **Deschutes County** and the **City of Sisters** are working aggressively to anticipate and prepare for a range of potential natural disasters, including fire and volcanic events.

- Use of public lands, parks and recreational amenities continues to increase in Oregon. With its exceptional natural attractions and large amount of public lands, Oregon will continue to focus on both economic utilization and public enjoyment of its natural amenities. More and more people will be using national, state, regional and local parks and recreational facilities, bringing more potential visitors, tourists and new residents to **Sisters Country**. While offering potential large economic benefits to the region, these activities may have associated impacts such as traffic congestion, demand for vacation rentals, and potential overuse of local parks and other recreational facilities.

Community Perceptions on Change

Beyond the data and forecasts, local community residents often have very accurate insights into the impact of change on their communities, informed by their daily experiences and personal observations. Such insights were on full display during the Horizons visioning process. (See "Sisters Country Horizons – A Comprehensive Community Conversation," page 12.) In the first of two online community surveys, hundreds of respondents voiced their opinions on the biggest challenges facing the future of the region.

Among the top challenges cited by respondents:
- **Planning for and managing future growth**
- **Meeting the need for more affordable housing**
- **Ensuring sufficient living wage jobs**
- **Addressing traffic congestion**
- **Undertaking key transportation improvements**

Also mentioned were a number of distinctly more social challenges, including:
- **Maintaining the small-town character of Sisters Country**
- **Building greater community trust**
- **Meeting the needs of the region's young adults and families**

Finally, respondents cited **adapting and responding to change itself** as among the greatest of challenges facing the future of Sisters Country. These challenges directly informed the Sisters Country Horizons visioning process and its resulting Vision and Action Plan. (See "Sisters Country Horizons Strategies & Actions," page 18.)

SISTERS COUNTRY HORIZONS – A COMPREHENSIVE COMMUNITY CONVERSATION

From the beginning, the **Sisters Country Horizons** visioning project was intended to be a conversation as broad and comprehensive as the landscape of the Central Oregon Cascades.

The project's overarching goal was a 'whole of community' vision, reflecting the breadth, depth and diversity of the Sisters Country region. For this reason, the visioning process was inclusive of many voices as possible – rural and urban, young and old, newcomers and old-timers – reflecting their shared values, perceived challenges, and aspirations for the future of the area.

For the better part of a year, community leader interviews, on-line surveys, meetings and forums offered multiple opportunities for citizens of all backgrounds and perspectives to contribute their ideas and feedback. Toward the end of the process, guided by a task force of 31 community leaders, the focus shifted to developing a concrete plan of action to achieve the vision.

As a result, the resulting vision and plan feel both 'right-sized' yet full of the possibility and promise of the wider Sisters Country community. Here's how we got there...

Project Organization & Structure

Sponsored by the **City of Sisters**, the Sisters Country Horizons visioning process was undertaken in partnership with **Deschutes County** and the **Central Oregon Intergovernmental Council** (COIC). **Oregon's Kitchen Table**, a program of Portland State University affiliated with COIC and **Citizens4 Community** also partnered with the project. These groups formed a **Project Management Team** that met 20 times over the course of the project. **NXT Consulting Group** of Bend and Portland led the planning process.

The area of study for the project – **Sisters Country** – was defined as the part of Deschutes County served by the Sisters School District 006, including the city of Sisters itself, surrounding unincorporated communities and residential areas, local ranches and farms, as well as a small area outside the District. Even though it lies within Jefferson County, Camp Sherman is typically considered part of Sisters Country and was a part of this assessment.

As a comprehensive community visioning process, the Horizons project was based on a planning approach known as the **Oregon Model**. This approach, employed by scores of communities across the state, is driven by a series of questions, tapping into the inherent wisdom of the community about its future. The process was delivered over the span of 2018, with framing of the process in the late winter, setting the context in the early spring, conducting visioning activities late spring through early fall, and developing the plan in the fall and early winter.

The content of all Horizons project conversations was organized around four **focus areas** providing the structure of the vision and action plan – **Prosperous Sisters**, **Livable Sisters**, **Resilient Sisters**, and **Connected Sisters**. These themes became the "mantra" of project organizers, facilitators and participants alike – organizing and adding specificity to the higher-level discussions.

Stakeholder Interviews (February-April 2018)

As the first step of engagement for its visioning process, Sisters Country Horizons conducted a series of stakeholder interviews between February and April 2018.

Interviewees were identified as community leaders and opinion shapers for the Sisters Country community. Building on an initial list recommended by the City, the number of interviews grew significantly. Additional referrals were added to reflect the broader diversity of the community, with attention paid to emerging business and cultural leaders, Millennials, and representatives of underserved or under-represented residents, including rural areas. Fully 81 individuals participated in the interviews – an exceptional number for a community of this size.

Conducted by Ruth Williamson of NXT Consulting Group, most interviews lasted over an hour and were organized by five major questions:

- **Values:** What do you most value about living in Sisters Country?
- **Challenges:** What is the biggest challenge facing the future of Sisters Country?
- **Vision:** What is your vision for the future of Sisters Country?
- **Action:** What actions would help achieve your vision?
- **Results:** How would you know your vision has been achieved?

Capturing major themes that surfaced during these conversations, a 76-page interview report was produced, concealing the identity of individual interviewees. The full report, along with a shorter executive summary, was released in May 2018 and can be found at the project website: ***www.sistershorizons.com/learn-more/***

General Community Input (March-May 2018)

The project applied these same themes to the general public through two major on-line community surveys and printed questionnaires, a series of small town hall-style community meetings facilitated by Oregon's Kitchen Table, Deschutes County planners and community volunteers, and DIY 'Kitchen Table' conversations hosted by community members themselves.

These activities were supplemented by presentations to various local groups, including C4C's Age-Friendly Community Event, Sisters High School Leadership class, local service clubs, and others, using the print or online survey to gather additional input.

<u>On-Line Community Survey I</u>. Findings from the first online community survey, in particular, served as the foundational research in developing a long-range vision and action plan for Sisters Country and its residents. The total number of online and print survey respondents –

approaching 500 people in a community with a population of some 8,000 residents – added validity to these findings.
Four core questions were worded exactly the same in both the on-line and print versions of the survey, and corresponded to the same questions asked during the community leader interviews. With the on-line survey, several more questions were added to mine community perceptions on the future more deeply, get a better sense of who was taking the survey, and to test differences in attitudes between different communities within Sisters Country, such urban and rural residents. While a few significant differences were noted, more significant was the high degree of alignment.

By far, the on-line survey proved to be the most effective method in reaching community members. The short print survey featured key questions used in the online version and provided a more traditional form of input for individuals not inclined to go online.

<u>Community Meetings</u>. A series of 13 community meetings, augmented by Kitchen Table conversations, were held at various locations in Sisters Country, both inside the city and in several rural locations. During these group discussions, meeting facilitators, drawn from the community-at-large and the Deschutes County Community Development Department, took notes of what residents said, including what they value most about the community, what they see as its biggest challenges, and finally what vision ideas they have for the future of the community. Again, these topics closely mirrored three of the main questions asked in Online Community Survey I. These notes were added to the online database and separated from the survey results.

<u>C4C's Values and Visioning Quilt.</u> Adding an artistic (and highly local) touch to the visioning process, the Citizens4Community organization collected ideas of residents and visitors about what they value about Sisters Country and their aspirations for its future. These aspirations were literally quilted into an "interactive piece of community art" known as the Sisters Horizons Community Quilt. These short but inspiring sentiments were added to the Sisters Country Horizons online database and separated from the results of the two surveys and from the results of the community meetings.

Factoring in the stakeholder interviews, presentations to Citizens4Community's (C4C) Age-Friendly Community event, and Sisters High School's Leadership Class, and creative forms of input including C4C's Values and Visioning Quilt, the total number of data points from all sources climbed to nearly 1,000 submissions by the end of May.

Working with all of these sources, the Sisters Country Horizons project utilized "qualitative data analysis" (QDA) software to analyze all compiled community input, identifying major themes and enabling the generation of graphical "word clouds" to capture the community's core values, perceived challenges, and high-level aspirations.

All of these methods of community input reflected Sisters Country Horizons' strong commitment to engaging as many people as possible in order to firmly and clearly articulate their aspirations for the future of Sisters Country. Based upon this input, the Community Input Report was released in report was released in June 2018 and can be found at the project website:
www.sistershorizons.com/learn-more/

Community Forums (June 2018)

With clear themes emerging from the Stakeholder Interviews and Community Input Report, the project began to drill down from high-level aspirations to more specific strategies for the future of Sisters Country. Four community forums were staged, each forum dedicated to one of the four Horizons focus areas: Prosperous Sisters, Livable Sisters, Resilient Sisters, and Connected Sisters. At each forum, local and regional experts presented base line data and trends for that focus area. Forum participants, working with ideas gleaned from the general public, developed a draft list of strategies. Slide presentations for each of the four forums can be found at the project website: ***www.sistershorizons.com/learn-more/***

Online Community Survey II (July-August 2018)

Working with the results of the four community forums, a second online community survey tested 54 potential strategies with the general public between late July and late August. Between 13 and 14 strategies were presented for each focus area, and respondents were asked to select their top five ideas for each area. Based on total numbers of votes, a short list of the top five strategies for each area was determined.

A total of 565 participants took the second survey. Their top overall strategies were: **Oregon's Artisanal Capital** (Prosperous Sisters), **Walkable Downtown** (Livable Sisters), **Urgent Care Facility** (Resilient Sisters), and **Small Town Atmosphere** (Connected Sisters).

These top scoring strategies were presented at the Vision Summit in September, and handed over to the project's Vision Action Team for further refinement. The Community Survey Report II was released in September and can be found at the project website: ***www.sistershorizons.com/learn-more/***

Vision Summit (October 2018)

After a late summer hiatus, the Sisters Country Horizons visioning process was reintroduced to the community in early October with a Vision Summit hosted at Five Pines Lodge Conference Center.

Close to 100 citizens gathered for an initial reading of the draft Sisters Country Horizons Vision Statement, shaped from the data collected through the aforementioned engagements earlier in the vision process, and the revealing of the top-scoring vision strategies. Both the vision and strategies were simultaneously posted to the Horizons website for general public comment.

The Summit also set the stage for the final phase of the project – planning the actions that would help make the vision for Sisters Country a reality. The newly formed Vision Action Team was introduced to the community at this time.

Finally, the Summit was highlighted with storytelling from community leaders from across Sisters Country, describing their diverse experiences of the 'Sisters Way,' a cultural standard often referred to in interviews and community meetings during the project.

Vision Action Team (September-November 2018)

The Sisters Country Horizons Vision Action Team – or "VAT" – was appointed and oriented in early September and went to work immediately following the Vision Summit. The VAT was comprised of 31 community members representing leaders from across Sisters Country. Their mission was to develop a Vision Action Plan to guide achievement of the Sisters Country Horizons vision with implementable action steps over the next 3-5 years.

During the months of October and November the Vision Action Team met four times to

- **finalize top priority strategies;**
- **brainstorm actions for each strategy;**
- **finalize actions and identify Lead Partner contacts; and**
- **affirm suggested Lead Partners and finalize the draft Vision Action Plan.**

The VAT worked in small teams organized by the four vision focus areas and guided by Team Leaders from the City of Sisters, Deschutes Country, COIC and EDCO. The open-ended dialogue in small group format coalesced the VAT membership and created a collective sense of ownership of the community vision, establishing a robust foundation for implementation of the adopted strategies and actions pending approval by the Sisters City Council.

Early in the week of Thanksgiving, the VAT elected to meet one more time to review and finalize the draft action plan, preparing it for posting to the Horizons website for public comment and presentation to Sisters City Council. The draft plan was previewed with Sisters City Council on November 28. A final draft was planned for Council consideration on January 9, 2019 with formal adoption of the final plan scheduled for February 13, 2019.

A summary version of the plan is presented in this report (See "Sisters Country Horizons Strategies & Actions," page 18) and the Vision Action Plan Implementation Guide presented in the Appendix.

OUR VISION FOR SISTERS COUNTRY – A LEGACY FOR GENERATIONS TO COME

Our Vision for Sisters Country – first revealed at the Vision Summit in October 2018 – is the overarching vision statement developed by the Sisters Country Horizons visioning process. The result of input from participants across Sisters Country, including community interviews, meetings, online surveys and forums, it reflects the ideas and words of Sisters Country residents themselves – and their aspirations for a more prosperous, livable, resilient and connected community.

SISTERS COUNTRY proudly stands at a pivotal moment in its history – with a past we choose to honor, a present we seek to improve, and a future we aspire to create that is uniquely and positively our own.

WE HONOR AND STRIVE TO MAINTAIN our spectacular natural environment, our small town feel, the experience of caring and belonging, our outstanding schools, and our Western identity.

WE ACTIVELY SEEK TO IMPROVE our community's quality of life, economic opportunity and affordability for all residents, and the facilities, programs and services that enrich and sustain our lives.

WE ASPIRE TO CREATE a prosperous economy rooted in arts and craft, recreation, entrepreneurship and innovation, a livable city and region that remain welcoming even as we grow, resilient people better prepared for a challenging world, and a connected community that works together for the common good.

OUR VISION is to seize this moment, choose our preferred future, and create an enduring legacy for generations to come.

SISTERS COUNTRY HORIZONS STRATEGIES & ACTIONS

The following **Strategies and Actions** – summarized here from the **Sisters Country Horizons Vision Action Plan** – are intended to help achieve the community's vision over time. (A complete version of the Vision Action Plan Implementation Guide can be found in the Appendix of this document.)

The **Strategies** are the result of an extensive community conversation, including stakeholder interviews, community meetings, community forums, and two online community surveys. Through this process hundreds of potential ideas were whittled down to a list of 54 draft strategies, tested again with the public, and then reduced to a list of 20 top priority strategies. From there, the project's 31-member **Vision Action Team** further refined the list and developed a series of recommended actions to implement each strategy over the next five years.

The resulting strategies and actions are organized into four "focus areas," each area representing a key aspect of the future of Sisters Country: **Prosperous Sisters**, **Livable Sisters**, **Resilient Sisters**, and **Connected Sisters**.

Each action includes one or more **Suggested Lead Partners**, who are being asked to lead its implementation. The plan also identifies **Potential Supporting Partners**, **Milestones**, and **Timelines** for each action.

As a community-based initiative, the actions in the **Vision Action Plan** will involve multiple partners from the public, private and nonprofit sectors in its implementation. While a good deal of the actions will be led by the City of Sisters, other Lead Partners are anticipated to include **Deschutes County**, **Central Oregon Intergovernmental Council** (COIC), **Sisters Ranger District/U.S. Forest Service**, **Sisters-Camp Sherman Fire District**, **Sisters School District**, **Sisters Park & Recreation District**, **Economic Development for Central Oregon** (EDCO), **Sisters Chamber of Commerce**, **Sisters Arts Association**, **Sisters Trail Alliance**, **Citizens4Community**, and others.

PROSPEROUS SISTERS

Our Vision: a prosperous economy rooted in arts and craft, recreation, entrepreneurship and innovation.

This focus area is about creating a Sisters Country that is prosperous for all its residents. It covers such topics as jobs, small business, economic development, and entrepreneurial activities that generate income for Sisters: tourism, arts and craft, recreation, and more. More detailed information can be found in the Vision Action Plan Implementation Guide in the Appendix.

Strategy 1: Four-Season Tourism & Visitor Destination. Strategically develop Sisters Country's tourism and destination economy, increasing the number of shoulder season and winter events and attractions, such as performances, festivals, retreats, educational speaker series, trainings, and outdoors sports tournaments.

Actions:

1.1 Sisters Event Committee & Coordinator
1.2 Permanent Multi-Use Events Center
1.3 Four-Season Competitive Tournaments
1.4 Sisters Country Winter Festival
1.5 Regional Events Partnerships
1.6 Ice Rink & Fly-Fishing Pond

Strategy 2: Oregon's Artisanal Capital. Develop and promote Sisters Country as the "Artisanal Capital of Oregon," building on its strategic location and spectacular environment, expanding the artisanal economy including visual artists, trades and crafts people, musicians, performance artists, writers, brewers, distillers, and farm-to-table chefs.

Actions:

2.1 Public Art Installations
2.2 Artisanal Capital Marketing Plan & Programming
2.3 'Made in Sisters' Annual Festival

Strategy 3: Sisters Makers District. Develop and promote a Sisters Makers District, where wood, metal, and glass crafts, woven crafts, pottery, and arts studios mix with local food and craft beverages, creating a pedestrian friendly zone that compliments, diversifies, and expands the local economy and supports entrepreneurialism and innovation.

Actions:

3.1 Sisters Makers District Designation
3.2 Makers District Marketing Plan
3.3 Sisters Makers Event
3.4 Makers District Pedestrian Zone

Strategy 4: Vibrant & Diverse Local Economy. Facilitate local entrepreneurial infrastructure and the development of Sisters-compatible light Industrial land and building inventory, as well as support vocational education and workforce development.

Actions:

4.1 Local Entrepreneur & Start-Up Infrastructure
4.2 Light Industrial Space & Lands

4.3 Emerging Workforce Development
4.4 Baseline Economic Data

Strategy 5: Forest Service Property Development. Facilitate the development of a masterplan on the U.S. Forest Service property that is compatible with the community's character and identity, combining mixed-used commercial, residential and recreational facilities that anchor and define the community, create new jobs, and provide housing options.

Actions:
5.1 Interested Parties Meeting
5.2 USFS Property City Advisory Committee
5.3 Data Collection & Feasibility Analysis
5.4 Design Competition & Symposium

LIVABLE SISTERS

Our Vision: a livable city and region that remain welcoming even as they grow.

This focus area is about creating a Sisters Country that is livable for all its residents. It covers such topics as growth and planning, housing, transportation, parks and recreation, environmental quality, biking and walking, and other factors that combine to make Sisters Country such a great place to live. More detailed information can be found in the Vision Action Plan Implementation Guide in the Appendix.

Strategy 1: Walkable Downtown. Expand pedestrian-friendly amenities in Downtown Sisters, encouraging residents and visitors to get out of their cars and walk, including during the evening hours.

Actions:
1.1 Pedestrian Flag Program
1.2 'Hey, Let's Walk There!' Initiative
1.3 Improved Downtown Lighting

Strategy 2: Affordable Housing. Increase the availability of affordable housing in Sisters Country, including a comprehensive review of the 2010 Sisters Housing Plan, promotion of a diverse mix of housing types, and support for private and volunteer programs that address the issue of housing affordability.

Actions:
2.1 Sisters Housing Plan Update
2.2 Workforce Housing
2.3 Long-Term Rental Housing

Strategy 3: Integrated Transportation System. Implement the updated Sisters Transportation System Plan that addresses changes in local and regional growth and new state transportation policies. Determine a preferred alternative to address congestion on Highway 20 in Downtown Sisters, exploring alternate routes and roadway designs, traffic management strategies, bicycle and pedestrian options, signage, and centralized public parking.

Actions:

3.1 Intra-Sisters Country Transit
3.2 Activity Bus Route
3.3 Grant Funding for Transportation
3.4 Washington Avenue Bike Boulevard
3.5 Alternative Regional Transportation Options

Strategy 4: Expanded Trail System. Support Sisters Trails Alliance and the U.S. Forest Service in expanding and integrating equestrian, bicycle and hiking trails throughout Sisters Country and beyond, connecting unincorporated rural communities with Downtown, linking Sisters to Redmond and Bend, and facilitating appropriate access to recreational areas.

Actions:

4.1 Trail Expansion Outreach
4.2 Trail Expansion Funding
4.3 Regional Trails System
4.4 Separated Bike and Equestrian Trails on Sisters Tie Trail

Strategy 5: Parks, Recreation & Greenspace. Identify potential new parks, greenspaces and recreation sites and facilities in Sisters Country to meet the needs of a growing resident population and create new public amenities and visitor attractions. Recognize and honor the City of Sisters' status as a Tree City, and develop Dark Skies program.

Actions:

5.1 Greenspace and View Corridor Assets Inventory
5.2 Greenspace and View Corridor Standards
5.3 New City Park on East Portal Property
5.4 Tree-Planting/Replanting
5.5 New Community Recreational Facilities

RESILIENT SISTERS

Our Vision: resilient people better prepared for a challenging world.

This focus area is about creating a Sisters Country that is resilient for all its residents. It covers such topics as public safety, health and wellness, social services, fire safety and disaster preparedness, and other initiatives that will help our community to be prepared for unanticipated events or a less certain future. More detailed information can be found in the Vision Action Plan Implementation Guide in the Appendix.

Strategy 1: Urgent Care Facility. Pursue establishment of a comprehensive urgent care facility in Sisters, providing walk-in and related ambulatory care and medical services for a rapidly growing population and increasing numbers of tourists.

Actions:

1.1 Needs Analysis
1.2 Gaps/Barriers Analysis
1.3 Close Gaps and Eliminate Barriers

Strategy 2: Communications Connectivity. Improve communications connectivity and infrastructure (telecommunications, broadband, mobile and Internet services) in Sisters Country with special attention paid to underserved areas.

Actions:
2.1 **FirstNet Communications Tower**
2.2 **Underserved Areas**
2.3 **Remediation in Underserved Areas**

Strategy 3: Age-Friendly Community. Support an 'age-friendly' community in Sisters Country, encouraging key organizations to share resources and to advocate for issues relevant to all ages and abilities.

Actions:
3.1 **Inventory of Age Specific Facilities and Programs**
3.2 **Community Calendar**
3.3 **Access to Healthy Outdoor Activities – On Unincorporated Lands**
3.4 **Access to Healthy Outdoor Activities – Within City Limits**

Strategy 4: Fire/Drought Resistant Building & Development Codes. Review and update City of Sisters and Deschutes County building and development codes to improve and enhance the fire and drought resistance of homes, communities and landscapes in Sisters Country.

Actions:
4.1 **State Regulatory Framework**
4.2 **Sisters-Specific Regulatory Framework**
4.3 **Retrofits to Critical Infrastructure, Other Structures and Landscaping**

Strategy 5: Disaster Preparedness & Response. Promote enhanced coordination of disaster preparedness and response efforts in Sisters Country within the statewide network. Improve and enhance natural disaster preparedness and socioeconomic resilience training and education programs.

Actions:
5.1 **Active Forest Management**
5.2 **Models for Active Forest Management**
5.3 **Economic Uses of Forest Management By-Products**
5.4 **Community Outreach Activities**
5.5 **Comprehensive Natural Hazards Planning and Preparation**

CONNECTED SISTERS

Our Vision: a connected community working together for the common good.

This focus area is about creating a Sisters Country that is more connected, making all its residents feel welcome and involved. It covers such topics as governance and leadership, education and learning, civic engagement and dialogue, volunteerism, and other things that bind us together as a community. More detailed information can be found in the Vision Action Plan Implementation Guide in the Appendix.

Strategy 1: Small Town Atmosphere. Promote the small-town atmosphere and friendly vibe of Sisters Country as the city and region grow, increasing outreach and opportunities for face-to-face contacts, neighbor-to-neighbor cooperation, and visitors-to-locals connections and commerce.

Actions:

1.1 Values-Based Marketing Campaign
1.2 Strengthened Business Community Connections
1.3 New Celebrations
1.4 Community Hub Activities

Strategy 2: Innovation & Distinctive Programming in Schools. Support the innovative curriculum, distinctive programming, community-based initiatives, and year-round use of existing Sisters School District facilities, bolstering the district as the "hub of the community" and connecting its students to the community and beyond.

Actions:

2.1 Schools Marketing Campaign
2.2 New Schools Partners and Leaders
2.3 Community HR Database
2.4 Annual School Pitch Event
2.5 Crowdfunding for New Programs

Strategy 3: Multi-Purpose Community Center. Plan, finance and develop a multi-purpose community center in Sisters, featuring year-round programming and opportunities for community members of all ages and abilities to gather and connect, take part in healthy recreation and exercise, and participate in classes, arts, lectures, and community events.

Actions:

3.1 Existing Elementary School Conversion
3.2 Community Center Task Force
3.3 New Funding for Sisters Park & Recreation District

Strategy 4: Diversity & Inclusion. Bring Sisters Country's less frequently heard voices into a more diverse, welcoming and inclusive community conversation, fostering greater tolerance in the community helping newcomers as well as long-time residents to feel valued and supported.

Actions:

4.1 Community Demographics Assessment
4.2 Barriers to Diversity
4.3 Mental Health Support Systems

Strategy 5: Leadership Training & Development Emphasizing Youth. Develop a deeper pool of leadership through mentorship, education and training, opportunities for civic participation, and community involvement across the generational spectrum with a particular emphasis on youth and young adults.

Actions:

5.1 Community-wide Leadership Training Model
5.2 Existing Leadership Barriers
5.3 Mentorship Program
5.4 Key Community Leadership Partners

5.5 Sisters Foundation

IMPLEMENTING THE VISION ACTION PLAN

The **Sisters Country Horizons Vision Action Plan** has been designed and developed to help Sisters Country achieve its vision for the future. Each of its 20 strategies includes a number of action steps intended to be implemented over the next five years, suggested "Lead Partner" organizations who are being asked to take on those activities, and timelines and milestones for their achievement. (A complete version of the Vision Action Plan Implementation Guide with supporting information can be found in the Appendix of this document.)

For many communities that have developed vision action plans, seeing their plans through to completion can be more daunting than creating them in the first place. It involves commitment, resolve and persistence. However, those communities that have succeeded in implementing their plans have achieved significant, even impressive results.

The **City of Sisters** has been called upon to implement a number of the actions in the Vision Action Plan, but as primary sponsor and "owner" of the visioning process it is also identified to lead another important charge: to ensure that the overall plan is effectively implemented over time, as well as renewed and updated at an appropriate point in the future.

As Sisters Country looks forward to achieving its plan for the future, **NXT Consulting Group**, consultant to the Sisters Country Horizons visioning process, offers the follow **implementation recommendations** to the help the City and its partners achieve the most successful outcomes:

- <u>Formal Commitment</u>. Signal the City's formal commitment to implementation through plan adoption. Support Deschutes Country and other government agencies and organizations in signaling their commitment to the plan as well. Use the action plan to guide annual Council goal setting sessions and link the plan to the City's own internal strategic planning efforts. Refer back to the public input compiled through the visioning process interviews, meetings, surveys and forums to help inform new City plans and policies on a continuing basis.

- <u>Dedicated Staff Time</u>. Dedicate a portion of City staff time to promote implementation of City-led actions and track overall plan implementation. For a variety of reasons, it makes good sense to lead such activities from the City Manager's desk.

- <u>Vision Implementation Team (VIT)</u>. Form a City advisory team to monitor, track and support plan implementation. A Vision Implementation Team (VIT) reflecting key Lead Partners in the plan should meet periodically to support plan partners in implementing the plan and to monitor and report on implementation progress back to the City and community.

- <u>Easy Wins and Game Changers</u>. Immediately implement some plan actions in order to get "easy wins" on the board and communicate the success of these achievements to the public. These small successes will help demonstrate the power of the plan to affect change and build motivation and resolve to take on the bigger, bolder actions – such as developing a masterplan for development of the USFS property or a multi-purpose community center.

- <u>Horizons Brand</u>. Use the brand, logo, website that have been developed for the visioning process to sell the vision and plan to the community and beyond. Publish a polished, graphical version of the vision statement and strategies, that can be used by the City, Chamber, Schools and other organizations to develop support for their own activities, promote the community, and attract grants and other investments in the community.

- Ongoing Engagement. Continue to engage the wider community in the achievement of the Vision Action Plan over time. Along with the VIT, an annual Vision Town Hall meeting is a good way to keep people engaged, report on progress and accomplishments, honor citizens and organizations who have done the most to promote the vision, and generate new ideas that keep the plan alive.

- Measuring Progress. Develop a set of community "indicators" and corresponding metrics to measure the community's general progress in the direction of its vision over time. Having measurable indicators of the plan's general effectiveness is a critical part of ensuring the long-term success and relevance of a community's vision. The Sisters Vision Action Plan has been designed and structured to promote this additional activity.

Next Steps for Plan Implementation

The process to successfully implement each of the Vision Acton Plan strategies going forward will entail highly coordinated and committed efforts among several organizations and committees. Given the above recommendations, below is a suggested path forward for the City and its partners.

Lead Partner Engagement. First and foremost, the City must engage the suggested Lead Partner for each strategy, respecting the fact that each partner must confirm their readiness and capacity to implement specific actions. These leads are critical to the success of the plan and have been chosen based on their expertise in that particular strategy. Fortunately, most of the major partners were involved with the Vision Action Team and have had a hand in developing specific strategies and actions.

The effort to engage Lead Partners is already underway and being led by the City Manager with assistance as needed from the Mayor. Once all Lead Partners have been engaged, it will be their responsibility to begin the process of implementing identified actions necessary for successful strategy implementation. In some cases partners may suggest refinements to specific actions or timelines to better fit their ability to implement them.

For some actions, this also means engaging several supporting partners and/or possibly forming separate committees to supplement the lead partner’s activities. It will be necessary for the Lead Partner to work with their key players to communicate and coordinate progress; update milestones and responsible parties; and monitor remaining action item plans.

Vision Implementation Team (VIT) Formation. Another key step in plan implementation will be forming the Vision Implementation Team (VIT). This team should be established over the next few months and will serve as an overall advisory board to the City (Staff and Council) and to the general public. Ideally, the VIT will include members of the Vision Action Team (VAT), a number of whom have already indicated their interest in continuing with the process.

The VIT role will be to monitor and track accomplishment progress across all strategies, using tools such as key performance indicators (KPI's). This team will also need to meet regularly to keep an active pulse on progress and to identify "gaps" where we may need to increase focus and attention. Selected City Staff should be active members of the VIT and regular reporting including the KPI's will be necessary.

Council & Board Engagement. Another key step will be to engage Sisters City Council and the Deschutes County Board of Commissioners in this process on an ongoing basis. The Council and Board can help by potentially identifying liaison members to some of the key lead partner organizations and/or the VIT. This will be particularly valuable when an action may potentially need some type of future decision by the Council or the Board (e.g.: funding mechanisms; policy resolutions; etc.).

It will be necessary to have regular workshop agenda items on the Council calendar focused on updates to the Visioning process including reviewing VIT KPI's, etc. Finally, the Council and Board will make the Visioning project part of their annual goal setting sessions so there is greater coordination and momentum between the two areas.

Another potential is to engage the various existing City and County Committees (e.g.: planning; parks; HPAB; etc.) in the process by potentially identifying member(s) to serve on either lead partner committees or the VIT.

It goes without saying that adequate resources, overall engagement and commitment, and communication will be critical for overall success of the Horizons Vision Action Plan. That said, potential selected consulting support and/or incremental staff assistance may be necessary for successful implementation. These decisions will be led by the City Manager and will be part of the upcoming annual budgeting process.

Finally, ongoing engagement of the entire community will be necessary to keep communication lines open on progress and feedback including an annual Vision town meeting. At the end of the day, the community's continued engagement will ensure the success of this plan for the future of Sisters Country.

APPENDIX
VISION ACTION PLAN
Implementation Guide

Sisters Country Vision

City of Sisters, Oregon
February 2019

(Last Updated: 06.20.19)

Prepared by
Sisters Country Horizons Vision Action Team

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INTRODUCTION & OVERVIEW

The **Vision Action Plan** presented in this document is the final outcome of the **Sisters Country Horizons** community visioning project of the **City of Sisters**, Oregon conducted in 2018. (Note: As of June 2019, the project has been rebranded as the **Sisters Country Vision** with a new logo and tagline: "Our Community • Our Future".)

The preceding report contains a *summary* version of the plan including focus area visions, strategies and corresponding actions.

The following ("Implementation Guide") is the *full* version of the plan, containing all supplementary information developed by the Sisters County Horizons Vision Action Team (VAT), 31 appointed community and agency leaders who articulated the actions recommended herein.

Following public input via the Horizons website in December 2018, a few subsequent minor revisions and one new action (Prosperous 4.4, "Baseline Economic Data") were approved by the Horizons Project Management Team, advised by the VAT's Focus Area Team Leaders.

In addition to **Strategies** and corresponding **Actions**, for each action this version of the plan includes the following information:

- **Suggested Lead Partners**, the government agencies or nonprofit organizations who have been recommended for implementing respective actions;
- **Potential Supporting Partners,** other government agencies or nonprofit organizations that may be able to assist in or support the implementation of those actions;
- **Suggested Milestones** for measuring progress in implementation of actions;
- **Suggested Timeline** for action implementation.

It should be noted that not all Suggested Lead Partners may have been confirmed as of publication of this final Vision Action Plan. The City of Sisters will continue to work on those confirmations with the respective agencies or organizations, as necessary.

It is quite possible that agencies or organizations recommended by the VAT as "Suggested Lead Partners" for specific actions may change at the request of those entities, and may not necessarily be the entities that end up implementing those actions.

Finally, this plan represents a well-informed road map forward. It is not intended, however, to be a prescriptive document. Adoption assumes further development and refinement of the plan's recommended actions by their respective Suggested Lead Partners.

APPENDIX F
Oregon Department of Environmental Quality Approval *(Forthcoming)*