City of Prineville

Department of Planning & Community Development
Planning Commission Staff Report

PC Hearing Date:	April 3rd, 2018
File No.:	AM-2018-100
Applicant/Owner:	City of Prineville
Location:	Citywide
Notice to DLCD:	March 5th, 2018
Newspaper Notice:	Planning Commission Notice – March 20th, 2018
Staff:	Joshua Smith, Senior Planner
Proposal:	City of Prineville Wastewater Master Plan update.

In meeting with State Wide Planning Goal 11 (Public Facilities and Services), the City has developed an update to its 2010 Wastewater Master Plan.

The Prineville City Council takes seriously the development of a wastewater system for the City.

To this end, the City Council wants to ensure that the investment wastewater infrastructure for households and businesses within Prineville are supported by master planning so as to achieve the goal of having a dependable and efficient City wastewater system that also supports a higher quality of life and business opportunities.

To achieve this the City Council has asked the City Engineer to update the City's Wastewater Master Plan last updated in 2010 (City Wastewater Facility Plan). The City Engineer, Eric Klann has worked with engineering consultants on developing the master plan in conjunction with the recently adopted Water Master Plan.

A number of staff to staff meetings have occurred and there have been several Technical Advisory Committee (TAC) meetings as shown below:

- February 28, 2017 - TAC meeting #1.
- March 28, 2017 - Staff to staff meeting.
- April 25, 2017 - TAC meeting #2.
- May 23, 2017 - TAC meeting #3.

The draft Wastewater master plan attached outlines the City's existing wastewater facilities/resources and updates the 2010 plan. Staff recommends approval of this plan.

CITY OF PRINEVILLE

City of Prineville, Oregon

Wastewater Facilities Plan

2018

DOWL

anderson perry & associates, inc.
engineering · surveying · natural resources

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WASTEWATER FACILITIES PLAN

FOR

CITY OF PRINEVILLE, OREGON

2018

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OREGON
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Job No. 1260-15

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Introduction

This report presents the results of a Wastewater Facilities Plan (WWFP) authorized by agreement between the City of Prineville, Oregon, and Anderson Perry & Associates, Inc., dated August 17, 2016. The City of Prineville completed a WWFP in 2000, a Wastewater Master Plan Update in 2005, and a WWFP Update in 2010 for their wastewater system. Due to recent improvements to the wastewater treatment facility (WWTF), the City of Prineville is updating the WWFP.

Background Information

The original WWTF began operation in 1960. The 1960 treatment system consisted of evaporative lagoons. The WWTF was upgraded in 1993, 2005, and 2016. This included improving system capacity by installing a second partially aerated facultative lagoon system, referred to as Plant 2. Wastewater is collected via a gravity flow collection system and is pumped to the treatment lagoons. Disposal is completed via evaporation and controlled seepage from constructed wetlands for indirect discharge into the Crooked River, with the remainder stored in effluent storage ponds for disposal by irrigation reuse on the Meadow Lakes Golf Course and on City-owned pasture land. Currently, the design and construction of a tertiary treatment plant is being pursued for wastewater reuse as data center cooling and humidification water. See Figure 1-2 in Chapter 1 for an aerial photo of the existing WWTF.

Population

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 combined with future expectations. The City of Prineville's population at the 2010 Census was 9,253. The certified population estimate by the Population Research Center at Portland State University for 2017 was 9,646 with an average annual growth rate of 0.7 percent between the years 2016 and 2035 and 0.1 percent between the years 2035 and 2066.

The historical population plus the projected annual growth rate results in a 20-year (year 2037) population estimate of 10,958. This WWFP uses 10,958 as the 20-year design population inside the city limits.

It is important to note that not all of the existing City population is connected to the wastewater system. In reviewing City records, the connected population was determined to be 9,003. A review of historical wastewater data must be completed using the connected population. Improvements are needed to the collection system to be able to connect the entire population within the city limits. In addition, there are areas of residential development outside the city limits but within the urban growth boundary (UGB). If 20 percent of these areas are annexed into the City, the City population could increase by 744 people to 10,390, without any additional people moving into the area.

To obtain a realistic population that could require service by the wastewater system in the next 20 years, the estimated 2037 City population of 10,958 was added to the 744 population from the UGB for a design population of 11,702 in the year 2037.

Design Criteria

Wastewater design criteria are developed from the amount of historic wastewater produced and are projected for future needs using the population estimates noted above. The criteria used in this WWFP were developed for several design conditions: the estimated 2017 population that is currently connected to the City sewer system; the 2017 population with the assumption everyone within the city limits is connected to the sewer system; the 2017 population with the entire City and 20 percent of the developments in the UGB that could be connected during the planning period; and the latter with the current City population projected to the design year of 2037.

According to the Coordinated Population Forecast Report for Crook County, the estimated number of persons per household is 2.51. This value allows the total population connected to the WWTF to be estimated and flow values to be calculated. Figure 3-4 in Chapter 3 shows the projected 2037 design population, design flows, and expected future influent wastewater strength characteristics.

Existing System Description and Evaluation

Collection System

The majority of the City's wastewater collection system was constructed in 1960. The gravity collection system is composed of pipes ranging in size from 4 inches to 48 inches in diameter with eight lift stations. Sewer pipes are predominately polyvinyl chloride, but much of the older pipe is asbestos cement and concrete. Additionally, sewage forcemain pipes transport wastewater from the lift stations to the gravity sewer main pipelines. Flow then enters the lagoon WWTF. Although diameters of the sewer pipes range from 4 to 48 inches, the majority of the piping is 8 inches in diameter. Infiltration and inflow (I/I) has been identified as a concern for the City.

Figure 5-1 in Chapter 5 shows the results of modeling the existing collection system and 2017 flows. Figure 5-1 assumes the Oregon Youth Authority (OYA) pump station pumps are downsized to match the needs of its service area. The pipelines shown in red are running full. It is suggested that pipelines be designed to run about half full. Figure 5-2 shows the results of modeling the existing collection system with the future 2037 design flows. These figures show the pipelines that need increased capacity now and for the 20-year design. Figure 5-3 shows the recommended improvements to meet the 2037 design criteria. Some of the improvements are identified for areas in the UGB and are subject to annexation. These areas in the UGB may or may not annex in the next 20 years while additional areas not shown for annexation may. The improvements to connect the areas in the UGB should not be pursued until annexation is completed. The estimated cost for these improvements is shown on Figure 5-4.

Figure 5-5 shows the size of the pipelines needed to serve the buildout of the UGB. In the event that areas other than the ones shown are developed first, the collection system improvements identified can be adjusted for the revised service areas. An overall plan for serving the entire UGB has been developed to ensure that some pipelines installed to provide short-term service will still be useful when the area in the UGB is developed. Currently, not all of the pipelines to service the UGB are proposed for installation, as the UGB is not anticipated to be fully developed in the next 20 years.

Lift Station Improvements

The lift stations are generally in good condition, but some minor improvements have been suggested. These improvements are shown on Table ES-1. The cost estimate for the improvements is shown on Figure 5-4.

TABLE ES-1
LIFT STATION IMPROVEMENTS

Lift Station	Improvement
Williamson	Install new enclosure and telemetry system
Saddle Ridge	Improve telemetry system
Western Sky	Install concrete floor in adjacent wetwell
McDougal	Install standby power generator connection
OYA	Replace pumps with smaller ones
Airport	Modify or remove flush valve

Infiltration and Inflow-Related Improvements

As discussed in Chapter 4, the City's existing collection system is currently experiencing I/I of approximately 340,000 gallons per day. This amount of water is approximately one-third of the current average flow entering the WWTF. I/I reduction can be difficult to achieve. For this reason, it is recommended that an annual program for identification and reduction of I/I sources be developed and funded using user fees. A comprehensive evaluation of the collection system is beyond the scope of this planning effort but should be included as part of the annual program. The rationale for the annual program has been developed and is presented as follows:

- The cost to remove I/I from the City's collection system during a one-time improvement project is unknown and could cost millions of dollars.
- A large portion of the City's collection system is old, deteriorated, and in need of replacement and/or repair, regardless of I/I issues.
- Systematic improvements made over time, targeting priority areas, would correct I/I issues, replace old and deteriorated collection system lines, and be affordable.

The collection system should be cleaned and television inspected to define problem areas, a meaningful rating system to prioritize areas needing repairs or replacement should be applied, and the highest priority areas should be corrected on an annual basis as funds permit. This approach should be augmented by adding smoke testing to the television inspection stage of the process. Smoke testing will help identify the sources of inflow into the collection system. Once sources of inflow are identified, these areas can be rated and prioritized along with other problem areas. Improvements can then be made as part of the annual plan. By implementing a repair and replacement program systematically, the entire collection system can be repaired or replaced over a period of time, and I/I can be effectively reduced.

Treatment Plant

The WWTF has been designed for a total capacity of 2.5 MGD. The 20-year average annual design flow for this planning effort is 1.16 MG. The existing facilities are adequately sized for the planning period but improvements to the aerators to prevent ragging are needed, and the accumulated solids need to be removed from Pond 1 in Plant 1.

Disposal System

The disposal system includes the irrigation system for the golf course, the irrigation system for the pasture, and the constructed wetlands. The golf course irrigation ponds need to be dredged and the pumps and sprinklers will need to be replaced in the future. The cost estimated by the City for these improvements is approximately $700,000.

A tertiary treatment plant is currently being designed to use treated effluent as data center cooling water. This facility is not needed to provide additional disposal capacity, but does provide the required treatment for reusing the wastewater for data center cooling.

Summary of Estimated Costs

System Development Charge

Collection System and Lift Station Improvements	$4,210,000

Capital Improvements Plan

I/I Reduction Improvement Plan	$100,000 per year
Lagoon Aerator Improvements	$500,000 (current fiscal year budget)
Lagoon Biosolids Removal	$516,000 to $4,350,000
Golf Course Irrigation Improvements	$700,000

The estimated costs represent 2017 dollars. As project funding is established, costs should be projected to the year of the anticipated expenditure to account for inflation.

Project Financing and Implementation

The project financing is discussed in Chapter 6 and in the rate study prepared by GEL, Inc. A copy of this study is included in Appendix A.

Chapter 1 - Introduction

Introduction

This report presents the results of a Wastewater Facilities Plan (WWFP) authorized by agreement between the City of Prineville, Oregon, and Anderson Perry & Associates, Inc., dated August 17, 2016. The City of Prineville completed a WWFP in 2000, a Wastewater Master Plan Update in 2005, and a WWFP Update in 2010 for their wastewater system. Due to recent improvements and proposed additions to the wastewater treatment facility (WWTF), the City of Prineville is updating the WWFP.

Study Area

The City is located in central Oregon along the Crooked River, a major tributary of the Deschutes River, which flows north into the Columbia River. The valley through which the river flows is bordered on the north by the slopes of the Ochoco Mountains and on the south by the steep escarpments that rise to an extensive lava plateau south of the Prineville area. See Figure 1-1 for location and vicinity maps of the study area. The City of Prineville is the county seat and the only incorporated city in Crook County, with a population of 9,253 at the 2010 Census. The 2017 estimated population for Prineville is 9,646, as estimated by the Population Research Center (PRC) at Portland State University (PSU).

Background Information

The original WWTF began operation in 1960. The 1960 treatment system consisted of evaporative lagoons. The WWTF was upgraded in 1993, 2005, and 2016. This included improving system capacity by installing a second partially aerated facultative lagoon system, referred to as Plant 2. Wastewater is collected via a gravity flow collection system and is pumped to the treatment lagoons. Disposal is completed via evaporation and controlled seepage from constructed wetlands for indirect discharge into the Crooked River, with the remainder stored in effluent storage ponds for disposal by irrigation reuse on the Meadow Lakes Golf Course and on City-owned pasture land. Currently, the design and construction of a tertiary treatment plant is being pursued for wastewater reuse as data center cooling and humidification water. See Figure 1-2 for an aerial photo of the existing WWTF.

The constructed wetlands site used for treated wastewater disposal has been designed to be publically accessible as a wildlife park. The wetlands benefit local wildlife and aquatic organisms and also help provide improved, cooler groundwater flows into the Crooked River to help augment summer flows, all benefiting the river environment for fish and other species. This allows the utilization of wetland characteristics to increase the disposal capacity of the WWTF and improve environmental health. The wetland disposal improvement also eliminates the need to discharge treated wastewater directly to the Crooked River, which is anticipated to help improve water quality in the river. In addition, reuse of treated wastewater for irrigation and data center cooling would reduce the demand on the City's drinking water sources and provide a valuable resource for these uses.

Purpose

The following purposes were identified for this WWFP:

- Provide an overview on the current status of wastewater collection, treatment, and disposal facilities in the City of Prineville.
- Provide population projections developed by the PRC at PSU.
- Develop design criteria for the 20-year planning period.
- Evaluate the capacity of collection, treatment, and disposal facilities for the 20-year planning period.
- Provide an evaluation of improvement alternatives with cost estimates for the 20-year (2037) projected needs.

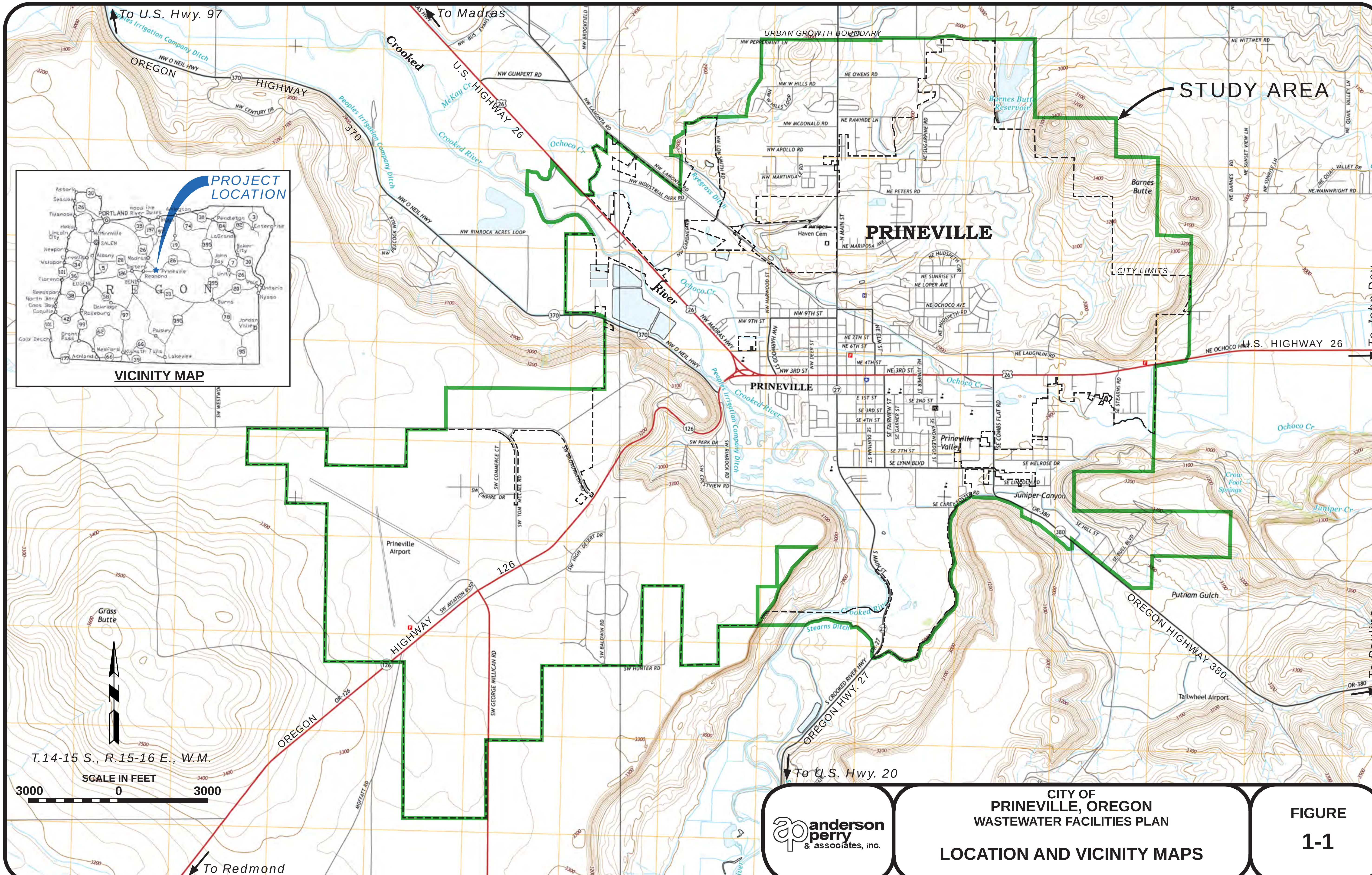
Scope

To meet the intentions and goals of the WWFP, the following scope was identified in the 2016 Agreement for Engineering Services:

- A statement of purpose, background, and need for the WWFP.
- A review and update of the current wastewater flows and loads, as well as the 20-year projection of future population, wastewater flows, and waste loads. Design criteria to be developed based on this information.
- An evaluation and model of the existing collection system.
- A review of the evaluation of the existing wastewater lagoon treatment system and an update of the identified deficiencies based on the review.
- An evaluation of the feasibility of various improvement options and cost effectiveness analysis of the alternatives over a 20-year period. Treatment standards and cost estimates for each alternative to be identified. The evaluation is not to include an infiltration/inflow (I/I) study but is to identify estimated amounts of I/I in the system based on flow data.
- An evaluation and detailed description of a preferred improvements alternative with a capital improvements plan. Treatment and regulatory standards are to be identified and estimated costs are to be outlined.
- An analysis of financing options and review of a possible financing plan for both construction and long-term operation, including projected sewer use charges.
- A preliminary environmental analysis. *Note: This analysis does not include the preparation of environmental reports for design and construction funding applications, biological assessments, wetland delineations, cultural resources evaluations, mitigation plans, or other related environmental documents.*

Presentation of Recommendations

Based on a review with the City, recommended system improvements are identified for the collection system and treatment and disposal systems. Included with these recommendations are a prioritization of needs, cost estimates, and a preliminary environmental analysis of the preferred option.



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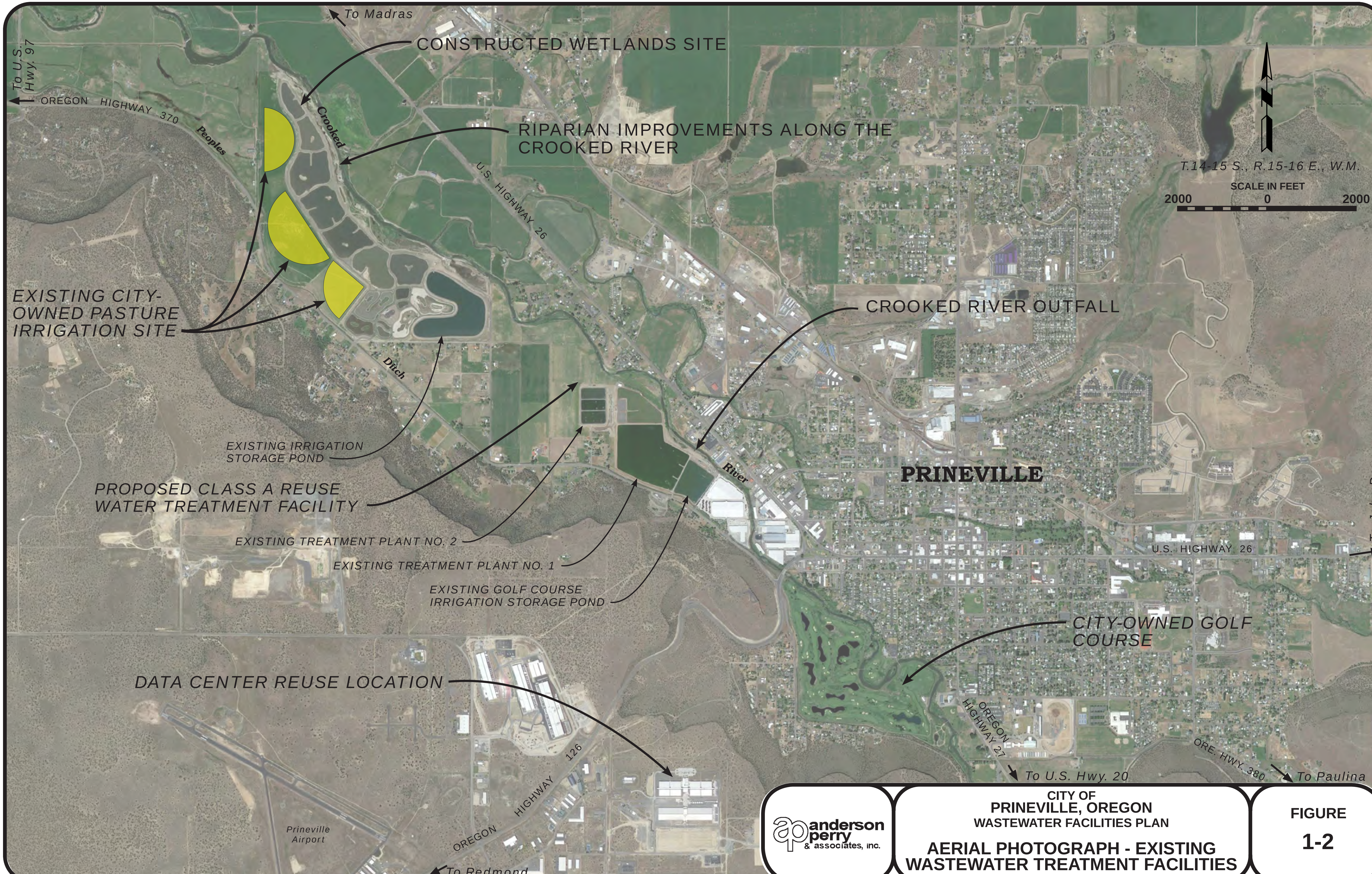
CITY OF PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

LOCATION AND VICINITY MAPS

FIGURE 1-1

Job# 1260-15-021 Nov. 18, 2016 lbauer



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WASTEWATER FACILITIES PLAN

AERIAL PHOTOGRAPH - EXISTING WASTEWATER TREATMENT FACILITIES

FIGURE 1-2

Job# 1260-15-021 Aug. 29, 2017 lbauer

Chapter 2 - Background Information

General

In this chapter, environmental conditions and the social environment in and around the City of Prineville are discussed to provide background information pertinent to completion of the system evaluation and decisions made in this Wastewater Facilities Plan (WWFP). The existing wastewater collection, treatment, and disposal facilities are also described as an introduction to subsequent chapters detailing wastewater system design criteria and capacity and operational deficiencies within the existing wastewater system.

Regional Setting

The City of Prineville is located in central Oregon along the Crooked River, a major tributary of the Deschutes River, which flows north into the Columbia River. The valley through which the river flows is bordered on the north by the slopes of the Ochoco Mountains and on the south by the steep escarpments that rise to an extensive lava plateau south of the Prineville area. Location and vicinity maps for the City of Prineville are shown on Figure 1-1 in Chapter 1. The City of Prineville is the county seat and the only incorporated city in Crook County, with a population of 9,253 at the 2010 Census. The 2017 estimated population for Prineville is 9,646, as estimated by the Population Research Center at Portland State University.

The climate in the summer is typically dry with clear days. Winter brings rain, snow, and frozen soils. Temperatures vary from extremes of -30°F in the winter to 120°F in the summer. These extreme temperatures are usually not prolonged. According to the Western Regional Climate Center, the average annual temperature of Prineville is approximately 47°F and the annual average precipitation is approximately 9.9 inches.

Transportation is provided to the City of Prineville by State Highways 26 and 126. Prineville is positioned at the intersection of these two highways and is approximately 16 miles west of U.S. Highway 97, which is a major north-south highway for Oregon.

Soils

The soils throughout the City of Prineville are generally designated silt loams or sandy loams. The major types are Ochoco-Prineville complex, Powder silt loam, Crooked stearns complex, and Metolius ashy sandy loam. These soils are generally nearly level well-drained to moderately well-drained soils with parent materials of volcanic ash over mixed alluvium from volcanic rock.

Land Use

The current zoning in the City is shown on Figure 2-1. Sixteen land use designations have been identified within the city limits. The majority of the City is designated for residential use. Areas along Highway 126 are primarily designated as multipurpose and airport.

Existing Wastewater System

The existing wastewater treatment facility is composed of two partially aerated facultative lagoon treatment plants that produce Class C treated effluent. Site piping allows cross-connection between plants. Influent from the collection system passes through the influent screen on the north side of the river and then into the influent pump station.

Plant 1 is the City's original lagoon system, which was upgraded in 1990 and again in 2005. The plant includes aerated and facultative lagoons, rock filters, disinfection, and a pump station. Effluent from Plant 1 is utilized for irrigation of the Meadow Lakes Golf Course. Plant 2 consists of three treatment lagoons operated in series. Wastewater from an influent pump station travels through an aerated lagoon before passing sequentially through a partially aerated lagoon and then a facultative lagoon. Effluent is then disinfected in a chlorine contact chamber. The chlorinated effluent is stored in the effluent storage pond (kidney pond) before it is utilized as irrigation for City-owned pasture land or discharged to the constructed wetlands. The constructed wetlands provide indirect discharge to the Crooked River. Fifteen lined and unlined wetlands assist in the treatment and discharge of treated effluent. For more detailed information on the existing wastewater system, see Chapter 4.

A wastewater system flow schematic for the existing facilities is shown on Figure 2-2.

Proposed Class A Reuse Water Treatment Facility

This WWFP also describes the proposal of an additional Class A reuse water treatment facility to produce cooling water for data centers. The proposed facility is to be located on City-owned property near the City's existing Plant 2 treatment ponds. Water for this facility would be taken from the effluent storage pond. From the reuse water treatment facility, reuse water would be pumped up the hill to the reuse water storage reservoir. This reservoir would be located on an existing City easement, near the City industrial park. Reuse water would be conveyed from the reuse water storage reservoir to the data center via a booster pump system.

National Pollutant Discharge Elimination System Permit

The City of Prineville's wastewater system is regulated by National Pollutant Discharge Elimination System (NPDES) Permit No. 101433 (see Appendix B). The following outfalls have been identified in the NPDES Permit with their location.

Outfall Number	Location
001	Crooked River Mile 46.8 (Direct Discharge)
002	Golf Course
003	Land Irrigation (Pasture Area)
004	Constructed Wetlands

Each outfall has a different beneficial use and, therefore, different permitted water quality limits. The following summarizes the treatment limits for each outfall. For the complete NPDES Permit requirements, see Appendix B.

1. Treated Effluent Outfall 001 - Direct River Discharge.
    a. May 1 - October 31: No discharge permitted.

b. November 1 - April 30:

i. No discharge when daily average flow in the Crooked River is less than 15 cubic feet per second (cfs).

ii. When discharging, the quality of effluent shall meet the following:

Parameter	Monthly Average (mg/L)	Weekly Average (mg/L)	Monthly Average (lb/day)	Weekly Average (lb/day)	Daily Maximum (pounds)
$CBOD_5$	25	40	230	340	460
TSS	40	60	370	550	730

$CBOD_5$ = five-day carbonaceous biochemical oxygen demand

lb/day = pounds per day

mg/L = milligrams per liter

TSS = total suspended solids

iii. Other parameters (year-round):

Total Coliform Bacteria	Shall not exceed a 7-day median of 23 organisms per 100 milliliters (ml) with no two consecutive samples to exceed 240 organisms per 100 ml.
pH	6.0 to 9.0.
$CBOD_5$ and TSS Removal Efficiency	65 percent for monthly average.
Total Chlorine Residual	Monthly average of 0.10 mg/L and daily maximum of 0.16 mg/L.
Effluent Discharge Rate	Not more than 1/15 of Crooked River flows when river flows are between 15 and 25 cfs.

2. Reclaimed Wastewater Outfall 002 and 003 (Golf Course and Pasture Irrigation)

   a. Biological treatment and disinfection to provide a 7-day median total coliform limit of 23 organisms per 100 ml, with no two consecutive samples exceeding 240 organisms per 100 ml.

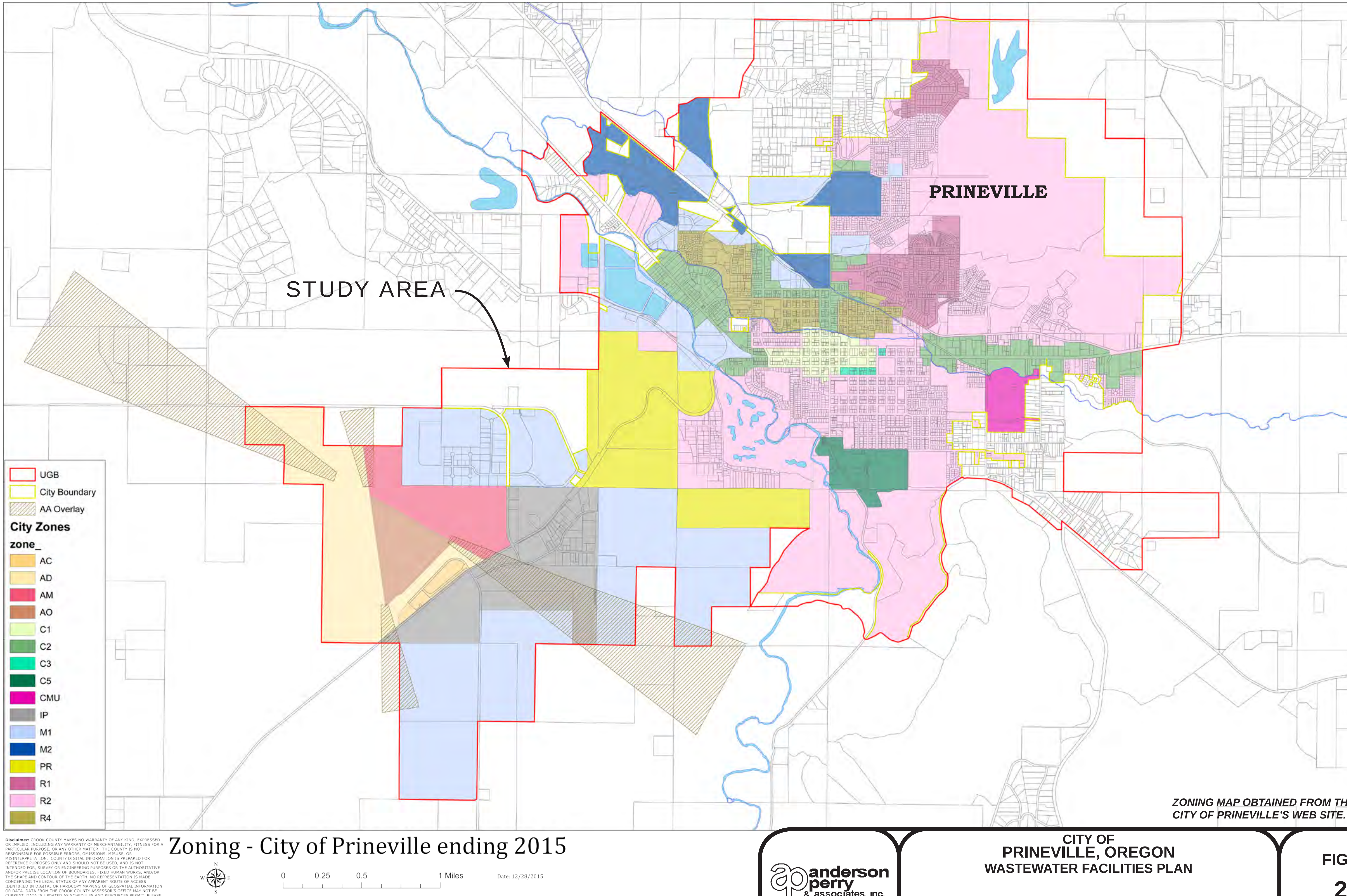
3. Treated Effluent Outfall 004 (Constructed Wetlands)

   a. BOD_5 and TSS

Parameter	Monthly Average (mg/L)	Weekly Average (mg/L)	Month Average (lb/day)	Weekly Average (lb/day)	Daily Maximum (pounds)
BOD_5 (May 1 through October 31)	10	15	100	150	200
TSS (May 1 through October 31)	10	15	100	150	200
BOD_5 (November 1 through April 30)	30	45	280	410	550
TSS (November 1 through April 30)	30	45	300	450	600

i. Other parameters (year-round):

E. coli Bacteria	Shall not exceed a monthly mean of 126 organisms per 100 ml with no single sample to exceeding 406 organisms per 100 ml.
pH	6.5 to 8.5
BOD_5 and TSS Removal Efficiency	85 percent for monthly average.
Total Chlorine Residual	Monthly average of 0.10 mg/L and daily maximum of 0.16 mg/L.



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WASTEWATER FACILITIES PLAN

ZONING MAP

FIGURE
2-1

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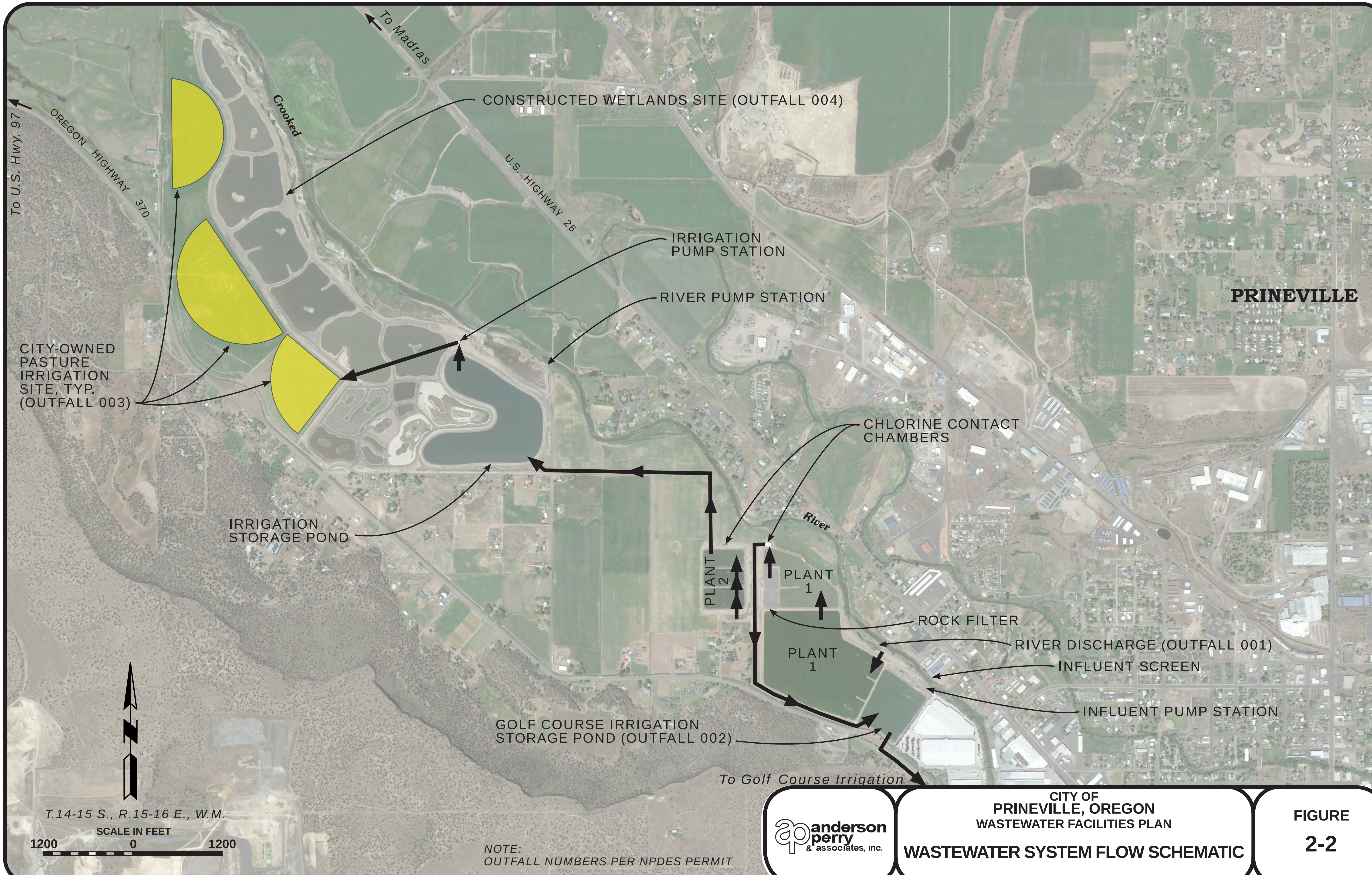

NOTE:
OUTFALL NUMBERS PER NPDES PERMIT

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CITY OF
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WASTEWATER FACILITIES PLAN

WASTEWATER SYSTEM FLOW SCHEMATIC

FIGURE 2-2

Job# 1260-15-021 Aug. 29, 2017 lbauer

Chapter 3 - Basic Planning and Design Data

General

This chapter presents the basic planning and design data necessary to evaluate the City's existing wastewater collection, treatment, and disposal facilities. These data were used to determine the facilities' ability to serve the wastewater system needs of Prineville for the selected planning period and form the basis for evaluating options for required improvements. First, population information and year 2037 population projections for the City of Prineville are presented. This is followed by a section that lists the year 2037 design criteria used for this Wastewater Facilities Plan (WWFP).

Population

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 combined with future expectations. The historical population data shown on Table 3-1 and Chart 3-1 were provided by the Population Research Center (PRC) at Portland State University (PSU). This agency 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 on the basis of an annual percentage increase estimated from past growth rates combined with future expectations. The historical population data shown on Table 3-1 and Chart 3-1 were provided by the PSU Population Forecast Program. In 2013, the Oregon House of Representatives and Senate approved legislation assigning coordinated population forecasting to the PRC at PSU. This allows counties to prepare coordinated population forecasts according to “generally accepted” demographic methods

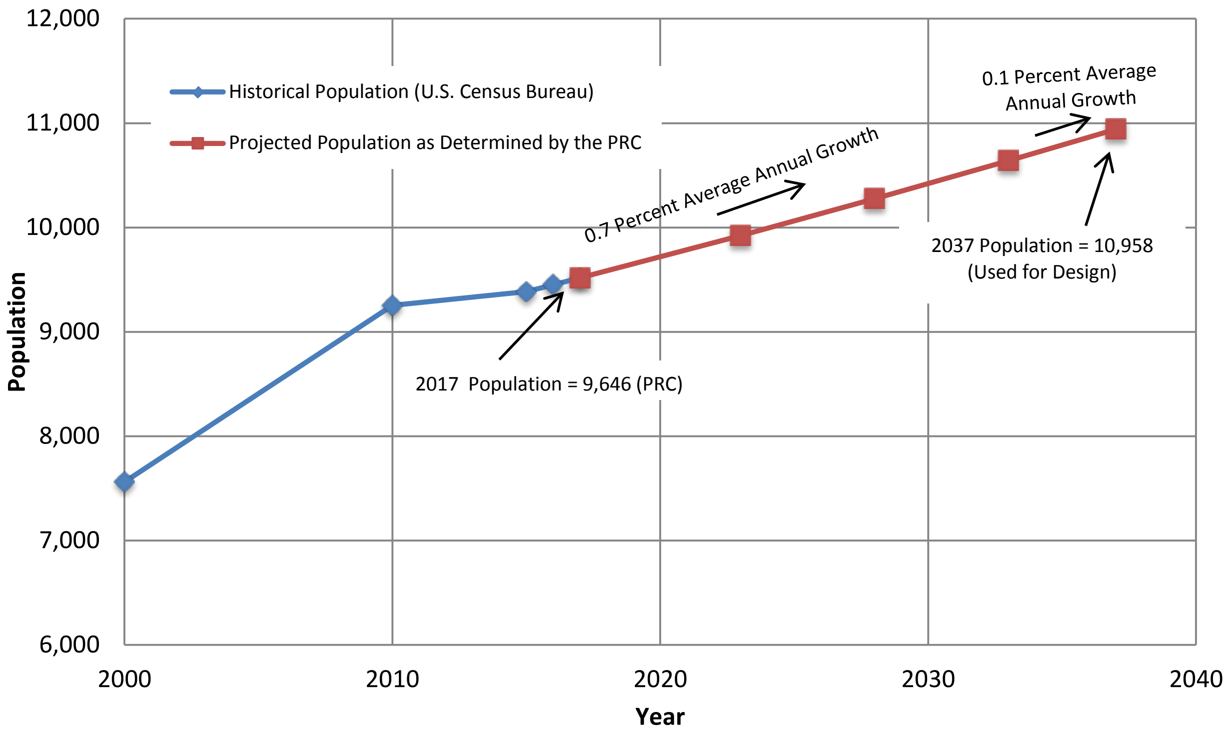
The population projections and average annual growth rates (AAGR) shown appear to be a realistic range based on current data as well as recent historic population increases for Prineville.

TABLE 3-1
HISTORICAL AND FORECASTED POPULATIONS FOR PRINEVILLE, OREGON[1]

Historical		Forecast			
2000	**2010**	**2017**	**2037**	**AAGR (2016 to 2035)**	**AAGR (2035 to 2066)**
7,358	9,253	9,646	10,958	*0.7 percent*	*0.1 percent*

[1]*As provided by the PRC.*

CHART 3-1
HISTORICAL AND PROJECTED POPULATIONS



The City of Prineville's population at the 2010 Census was 9,253. The certified population estimate by the PRC for 2017 was 9,646 with an AAGR of 0.7 percent between the years 2016 and 2035 and 0.1 percent between the years 2035 and 2066.

The historical population plus the projected annual growth rate results in a 20-year (year 2037) population estimate of 10,958. This WWFP uses 10,958 as the 20-year design population inside the city limits.

It is important to note that not all of the existing City population is connected to the wastewater system. In reviewing City records, the connected population was determined to be 9,003. A review of historical wastewater data must be completed using the connected population. Improvements are needed to the collection system to be able to connect the entire population within the city limits. In addition, there are areas of residential development outside the city limits but within the urban growth boundary (UGB). If 20 percent of these areas are annexed into the City, the City population could increase by 744 people to 10,390, without any additional people moving into the area.

To obtain a realistic population that could require service by the wastewater system in the next 20 years, the estimated 2037 City population of 10,958 was added to the 744 population from the UGB for a design population of 11,702 in the year 2037.

Historical Wastewater Data

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

The historical influent flows, including maximum daily flows and average monthly flows for the 5-year period between January 2012 and December 2016, are shown on Figure 3-1. According to the data, the maximum monthly flow of record occurred in December 2016, and was 1,503,000 gallons per day (gpd), which equates to approximately 167 gallons per capita per day (gpcd) utilizing the current year connected population estimate of 9,003. The average annual flow was 967,000 gpd during the time period analyzed, which equates to approximately 107 gpcd.

U.S. Environmental Protection Agency (EPA) guidelines for infiltration/inflow (I/I) evaluations state that "no further infiltration/inflow analysis will be required if domestic wastewater plus non-excessive infiltration does not exceed 120 gpcd during periods of high groundwater." The maximum monthly per capita flow was approximately 167 gpcd (2017 population). This is higher than the 120 gpcd allowed by the EPA for domestic wastewater during periods of high water. The flows listed above exceed the minimum EPA criteria for wet weather flows; therefore, based on EPA guidelines, continued I/I evaluation should be pursued. I/I evaluation could be of great benefit to the City, as I/I is a significant contributor to the system. The identification of I/I sources and their removal from the system through manhole and pipeline repair could reduce the total volume of water the City must treat and dispose of. This reduction could provide a long-term cost savings to the City.

Figure 3-2 summarizes historical municipal influent five-day carbonaceous biochemical oxygen demand ($CBOD_5$) concentrations as recorded on the DMRs during the 5-year period between 2012 and 2016. As indicated on Figure 3-2, the maximum, minimum, and average influent $CBOD_5$ were 275 milligrams per liter (mg/L), 49 mg/L, and 128 mg/L, respectively. The WWTF's average $CBOD_5$ mass loading was approximately 1,051 pounds per day (lb/day). The City's secondary WWTF, according to the data, achieved an average $CBOD_5$ removal of 90 percent with an effluent average mass discharge of 33 lb/day.

The historical municipal influent total suspended solids (TSS) concentrations, as reported on the DMRs during the period described previously, are shown on Figure 3-3. As illustrated on Figure 3-3, the maximum, minimum, and average influent TSS were 314 mg/L, 80 mg/L, and 175 mg/L, respectively. The WWTF's average TSS mass loading was approximately 1,082 lb/day. The City's secondary WWTF, according to the data, achieved an average TSS removal of 83 percent with an effluent average mass discharge of 74 lb/day.

Both the $CBOD_5$ and TSS concentrations appear to be increasing. This may be in response to efforts to reduce I/I.

Design Criteria

Figure 3-4 summarizes basic wastewater design criteria used in this WWFP under several design conditions: the estimated 2017 population that is currently connected to the City sewer system; the 2017 population with the assumption everyone within the city limits is connected to the sewer system; the 2017 population with the entire City and 20 percent of the developments in the UGB that could be connected during the planning period; and the latter with the current City population projected to the design year of 2037.

According to the Coordinated Population Forecast Report for Crook County, the estimated number of persons per household is 2.51. This value allows the total population connected to the WWTF to be estimated and flow values to be calculated. Figure 3-4 shows the projected 2037 design population, design flows, and expected future influent wastewater strength characteristics.

Wastewater Flow Projections

Domestic

Wastewater flow projections for the year 2037 were made using the existing base per capita wastewater contributions extrapolated to the end of the 20-year planning period using the year 2037 design population of 11,702 and adding the existing I/I flow contribution. This assumes that I/I will remain constant over the 20-year planning period, because I/I does not generally increase proportionally with population, as new pipelines are generally water-tight.

Industrial

The existing domestic flows and loadings include the small industrial flows that exist within the City. As the City grows in population, similar industrial flow demands on the system will also grow. Any large industrial demands on the system have not been included in the design criteria. If a large industry with large wastewater production is identified for the City, then a separate evaluation would need to be completed to evaluate its impacts. There is potential for the data center, receiving Class A effluent water for cooling, to return approximately 0.01 million gallons per day (MGD) to the treatment plant with possible future flows increasing to 0.08 MGD during the summer. These flows can be considered small industrial flows.

Mass Loadings

Domestic and Commercial

The domestic and commercial design mass loadings ($CBOD_5$ and TSS) to the WWTF were estimated based on the average influent per capita $CBOD_5$ and TSS contributions projected to the end of the 20-year planning period using the year 2037 design population of 11,702 (i.e., mass loading [$CBOD_5$ or TSS] = contribution [$CBOD_5$ or TSS] lb/capita/day x 11,702). Using the design mass loading of 0.11 and 0.16 lb/capita/day for BOD_5 and TSS, respectively, yields a year 2037 domestic mass loading of 1,342 and 1,834 lb/day, respectively.

Industrial

See the industrial flow projections above.

Historical Wastewater Characterization

Chemicals and Materials

The only chemicals currently used at the WWTF are chlorine for final disinfection of effluent prior to discharging to the Crooked River or effluent reuse and calcium nitrate (Bioxide) for odor control. A sulfur dioxide dechlorination system was installed but is not used, as dechlorination is achieved in the effluent storage ponds via natural processes.

Characterization of Waste and Wastewater

Wastewater samples are obtained by the City at the point of discharge to the Crooked River during the time of year when discharge is permitted. As dictated by the City's National Pollutant Discharge

Elimination System (NPDES) Permit, effluent samples are collected regularly (when discharging to the river) for $CBOD_5$, TSS, pH, chlorine residual, ammonia, total Kjeldahl nitrogen (TKN), phosphorus, nitrate, and nitrite. In addition, a total coliform sample is collected as a grab sample and tests are performed bi-weekly. Concentrations are measured from composite samples and mass loading is calculated from concentration and flow data. See Appendix B for a copy of the NPDES Permit.

During the irrigation season, samples are collected from the wastewater before it enters the effluent storage ponds for total coliform bacteria (weekly), chlorine residual (daily), and pH (bi-weekly). All other samples are collected monthly. Nutrients tested for include TKN, nitrate, and nitrite. Sampling began in fall 2016 for discharge to and from the constructed wetlands, so historic data for this discharge point do not exist.

The City has maintained compliance with all NPDES Permit requirements ($CBOD_5$, TSS, pH, chlorine, and coliform) over the last several years. The NPDES Permit requirements are outlined in Chapter 2. According to Summary of DMR Data presented on Figure 3-1, test results for nutrients in the treated effluent showed that TKN ranged from 1.5 to 19.0 mg/L and nitrate-nitrite ranged from 0.1 to 9.4 mg/L.

Characterization of Solids

Solids are accumulated in the lagoons, where they continue to decompose over a period of several years. These solids are referred to as biosolids. The lagoon biosolids are normally removed from the lagoon when they accumulate to an average depth over 2 feet. This usually occurs over a period of 15 to 30 years, depending on wastewater characteristics. When the biosolids are removed, they must be characterized and disposed of in accordance with Oregon Department of Environmental Quality rules and guidelines. This WWFP does not characterize existing biosolids or evaluate requirements for their removal.

Summary

Information for the review of the historical wastewater data for the City of Prineville's WWTF was obtained from the City's DMRs. Historical average influent flows and $CBOD_5$ and TSS concentrations for the period from January 2012 to December 2016 were used during development of the design criteria of this WWFP. It should be noted that the $CBOD_5$ and TSS loadings appear to be significantly lower than typical loadings that would be expected from a similar population. This could be attributed to I/I entering the system.

SUMMARY OF HISTORICAL WASTEWATER DATA

	Influent						Plant Effluent													Contact Basins		
Date	Plant 1 & 2 Influent Average Monthly Flow (MGD)	Total Influent Monthly Flow (MG)	Average Monthly $CBOD_5$ (mg/L)	Average Monthly CBOD5 Loading (lb/day)	Average Monthly TSS (mg/L)	Average Monthly TSS Loading (lb/day)	Effluent Average Monthly Flow (MGD)	001/002 Ave. Total Kjeidahl Nitrogen (mg/L)	003 Ave. Total Kjeidahl Nitrogen (mg/L)	001/002 Ave. No2+No3-N (mg/l)	003 Ave. Ammonia NH_3-N (mg/l)	003 Ave. No2+No3-N (mg/l)	Average Monthly $CBOD_5$ (mg/L)	Average Monthly $CBOD_5$ % Removal	Average Monthly $CBOD_5$ Loading (lb/day)	Average Monthly TSS (mg/L)	Average Monthly TSS % Removal	Average Monthly TSS Loading (lb/day)	001/002 Ave. Monthly pH	001 Avg. Daily Chlorine Residual (mg/L)	001/002 Max Mo. Geo Mean E Coli Conc. (organisms/ 100 ml)	003 Max. Mo. Geo Mean E coli Conc. (organisms/ 100 ml)
Jan-12	0.909	28.18	90.8	688	141.0	1,069	0.362	8.5		1.5	1.4		21.9	75	66	36.5	66	110	8.98			
Feb-12	0.922	26.74	104.1	800	148.6	1,143	0.021						9.77	84	2	40	65	7	8.90			
Mar-12	0.917	28.43	106.4	814	130.0	994	0.191	8.9		1.3	2.3		19.2	79	31	38.167	66	61	8.92	0.1	1.0	
Apr-12	1.081	32.42	99.2	894	129.5	1,167		8.9	9.4	2.0	0.8	9.4									3.1	1.0
May-12	1.071	33.20	72.7	649	148.8	1,329		7.6	12.5	1.0	1.6	0.9									1.0	18.7
Jun-12	1.017	30.50	83.2	705	137.5	1,166		5.4	8.7	0.1		1.3									8.5	8.5
Jul-12	0.930	28.83	62.1	482	90.7	703		3.2	8.7			1.7									7.3	12.2
Aug-12	0.879	27.24	65.9	483	125.3	918		2.1	6.7			0.7									7.3	12.1
Sep-12	0.846	25.37	57.4	404	119.5	843		1.5	4.8			0.7									13.2	2.0
Oct-12	0.939	29.11	69.0	540	130.8	1,024		2.9	4.7	0.5		0.7									8.5	6.3
Nov-12	0.980	29.41	137.0	1,120	205.0	1,676	0.403	4.6		0.5	1.7		5	96	17	11	93	37	7.68			
Dec-12	1.012	31.37	90.0	760	103.0	869	0.521				4.1		6	94	26	16	84	70	7.77		1.0	
Jan-13	1.050	32.57	88.0	771	142.0	1,243	0.513				8.7		7	91	30	20	83	86	7.50			
Feb-13	0.894	27.71	98.0	731	158.0	1,178	0.384				8.6		10	89	32	33	67	106	8.00			
Mar-13	0.926	28.72	99.0	765	140.0	1,081																
Apr-13	0.996	29.89	77.0	640	124.0	1,030			12.0		2.0											
May-13	0.969	30.04	75.0	606	171.0	1,382			12.0		9.0								8.50			
Jun-13	0.897	27.81	49.0	367	80.0	598			10.0													
Jul-13	0.927	28.73	85.0	657	118.0	912			7.0		5.0	1.0										
Aug-13	0.883	27.38	71.0	523	111.0	817			6.0		4.0	1.0										
Sep-13	0.892	26.76	90.0	670	129.0	960			6.0		1.0	2.0										
Oct-13	0.915	28.36	62.0	473	99.0	755																
Nov-13	0.863	26.76	102.0	734	180.0	1,296	0.500	3.0		1.0			7	94	29	10	94	42				
Dec-13	0.954	29.58	75.0	597	119.0	947	0.500						6	91	25	22	79	92	7.80	33.6	1.0	
Jan-14	0.905	28.07	112.0	845	161.0	1,215	0.300						13	88	33	33	81	83	8.00	0.1		
Feb-14	0.951	29.47	80.0	635	163.0	1,293	0.600				.		15	80	75	40	74	200	7.00			
Mar-14	1.010	31.31	94.0	792	118.0	994	0.300						18	77	45	33	71	83	7.70		1.0	3.0
Apr-14	0.934	28.96	83.0	647	128.0	997	0.100	13.0	9.0	1.0	10.0		17	80	14	37	70	31				1.0
May-14	0.962	29.84	94.0	754	176.0	1,412			15.0		8.0	1.0										
Jun-14	0.950	28.51	186.0	1,474	235.0	1,862			12.0		7.0	1.0										
Jul-14	0.930	28.82	83.0	644	153.0	1,187			9.0		3.0	1.0										
Aug-14	0.885	27.45	103.0	760	142.0	1,048			7.0		1.0	2.0										
Sep-14	0.844	26.18	98.0	690	180.0	1,267			6.0		1.0											
Oct-14	0.884	27.40	89.0	656	185.0	1,364			8.0		3.0											
Nov-14	1.036	32.12	127.0	1,097	153.0	1,322																
Dec-14	1.025	31.76	113.0	966	157.0	1,342	0.100						9	95	8	19	91	16	7.00		1.0	
Jan-15	1.071	33.20	112.0	1,000	149.0	1,331	0.300						6	96	15	27	81	68	7.00			
Feb-15	0.937	29.06	123.0	961	303.0	2,368	0.400						14	88	47	55	79	183	7.00			
Mar-15	0.991	30.71	90.0	744	229.0	1,893							13	85		47	78		7.00			
Apr-15	0.964	29.89	100.0	804	218.0	1,753		13.0	16.0	2.0	10.0	1.0	9	94		16	92		7.00	0.1		
May-15	1.009	31.28	109.0	917	314.0	2,642			12.0		8.0	2.0										
Jun-15	0.946	29.32	167.0	1,318	202.0	1,594			12.0		9.0	1.0										
Jul-15	0.896	27.78	177.0	1,323	145.0	1,084			10.0		7.0											
Aug-15	0.923	28.61	144.0	1,108	177.0	1,363			9.0		5.0	1.0										
Sep-15	0.878	27.22	194.0	1,421	277.0	2,028			7.0		1.0	1.0										
Oct-15	0.916	28.39	180.0	1,375	234.0	1,788			7.0		3.0	1.0										
Nov-15	0.924	28.65	187.0	1,441	259.0	1,996							4	98		5	98				2.0	
Dec-15	1.065	33.01	181.0	1,608	223.0	1,981	0.300						5	97	13	5	98	13	7.00			
Jan-16	1.037	32.14	191.0	1,652	292.0	303	0.700						10	95	58	11	96	64	7.00			
Feb-16	0.945	29.30	241.0	1,899	280.0	265	0.400						20	91	67	17	94	57	8.00			
Mar-16	1.103	34.20	217.0	1,996	200.0	221	0.400	19.0				3.0	20	91	67	37	80	123	8.00			
Apr-16	1.091	33.81	175.0	1,592	200.0	218	0.100		11.0		5.0	2.0	13	98	11	56	93	47	9.00			
May-16	1.111	34.44	203.0	1,881	233.0	259			14.0		5.0	1.0										
Jun-16	1.014	31.42	184.0	1,556	212.0	215			12.0		6.0	1.0										
Jul-16	1.037	32.14	191.0	1,652	292.0	303	0.700						10	95	15	11	96	64	7.00			
Aug-16	0.989	30.66	215.0	1,773	155.0	153					2.0	1.0							8.10			
Sep-16	0.924	28.66	249.0	1,919	197.0	182			4.0										8.20			
Oct-16	0.964	29.89	273.0	2,195	158.0	152			3.0		1.0											
Nov-16	0.828	25.68	237.0	1,637	260.0	215	0.500						7	97	29	7	97	29	8.00			
Dec-16	1.503	32.64	275.0	3,447	152	228	0.500						12	97	50	25	87	104	8.00			
Maximum	1.503	34.44	275	3,447	314	2,642	0.700	19.0	16.0	2.0	10.0	9.4	22	98	75	56	98	200	9.00	33.6	13.2	18.7
Minimum	0.828	25.37	49	367	80	152	0.021	1.5	3.0	0.1	0.8	0.7	4	75	2	5	65	7	7.00	0.1	1.0	1.0
Average	0.967	29.62	128	1,051	175	1,082	0.379	7.3	9.1	1.1	4.5	1.6	11	90	33	26	83	74	7.78	8.5	4.3	7.2

BOD_5 = Five-day biochemical oxygen demand
ft = Feet
lb = Pounds
lb/day = Pounds per day
mg/L = Milligrams per liter
MGD = Million gallons per day
ml = Milliliters
TSS = Total suspended solids

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CITY OF
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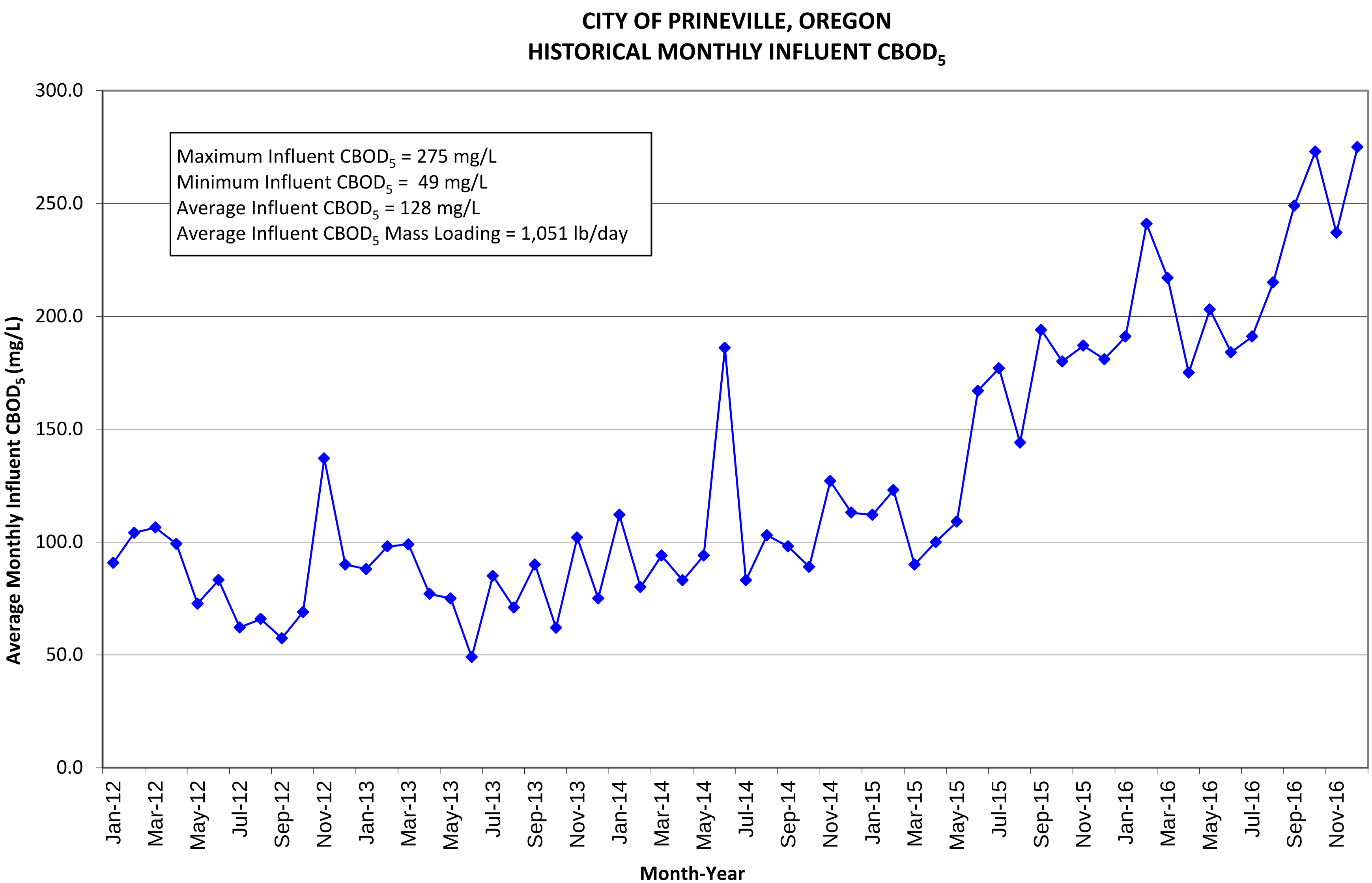
WASTEWATER FACILITIES PLAN

SUMMARY OF DMR DATA

FIGURE 3-1



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CITY OF
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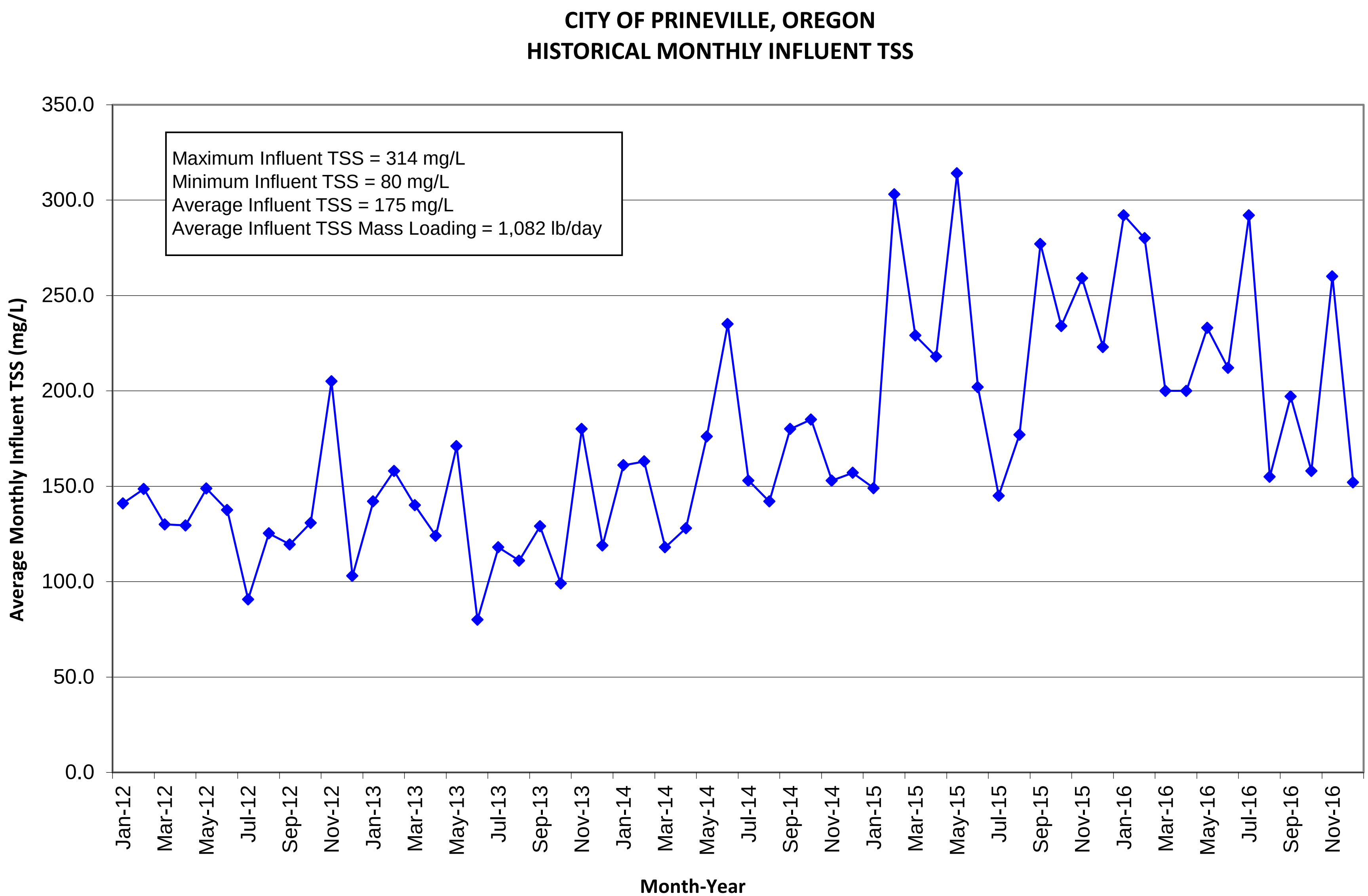
WASTEWATER FACILITIES PLAN
HISTORICAL MONTHLY INFLUENT $CBOD_5$

FIGURE
3-2



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WASTEWATER FACILITIES PLAN
HISTORICAL MONTHLY
INFLUENT TSS

FIGURE
3-3

CITY OF PRINEVILLE, OREGON
DESIGN CRITERIA

	EXISTING CONNECTED POPULATION[1] 2017		EXISTING POPULATION WITH IMPROVEMENTS[2] 2017		EXISTING POPULATION WITH IMPROVEMENTS AND ANTICIPATED URBAN GROWTH BOUNDARY CONNECTIONS[3] 2017		FUTURE POPULATION WITH IMPROVEMENTS AND ANTICIPATED URBAN GROWTH BOUNDARY CONNECTIONS[4] 2037	
	I/I[5]	Total[6]	I/I[7]	Total[8]	I/I[7]	Total[8]	I/I[7]	Total[8]
Population*		9,003		9,897		10,390		11,702
Average Base Flow (ABF), MGD[9]	----	0.691	----	0.759	----	0.797	----	0.898
Per Capita Flow, gpcd	----	77	----	77	----	77	----	77
Average Annual Flow[10] (AAF), MGD	0.309	0.999	0.309	1.068	0.309	1.105	0.309	1.206
Per Capita Flow, gpcd	34	111	31	108	31	106	26	103
Average Dry Weather Flow[10] (ADWF), MGD	0.243	0.933	0.243	1.002	0.243	1.040	0.243	1.140
Per Capita Flow, gpcd	27	104	25	101	25	100	21	97
Average Wet Weather Flow[10] (AWWF), MGD	0.367	1.057	0.367	1.126	0.367	1.163	0.367	1.264
Per Capita Flow, gpcd	41	117	37	114	37	112	31	108
Maximum Month Wet Weather Flow (MMWWF), MGD	0.860	1.551	0.860	1.619	0.860	1.657	0.860	1.758
Per Capita Flow, gpcd	96	172	87	164	87	160	74	150
Maximum Month Dry Weather Flow (MMDWF), MGD	0.516	1.206	0.516	1.275	0.516	1.313	0.516	1.413
Per Capita Flow, gpcd	57	134	52	129	52	126	44	121
Peak Hour Flow (PHF), MGD[11]	----	3.996	----	4.270	----	4.422	----	4.824
Per Capita Flow, gpcd	----	444	----	431	----	426	----	412
Average Influent $CBOD_5$, mg/L	----	109	----	112	----	114	----	118
lb/day	----	911	----	1001	----	1051	----	1,184
lb/capita/day	----	0.10	----	0.10	----	0.10	----	0.10
Average Influent TSS, mg/L	----	159	----	164	----	166	----	171
lb/day	----	1326	----	1457	----	1530	----	1723
lb/capita/day	----	0.15	----	0.15	----	0.15	----	0.15
Average Influent TKN[12], mg/L	----	40	----	40	----	40	----	40
lb/day	----	333	----	356	----	369	----	402
lb/capita/day	----	0.04	----	0.04	----	0.04	----	0.03

1 Existing connected population was found by utilizing City billing reports to find the number of residences not connected to the sewer (356). According to the Population Research Center (PRC) at Portland State University (PSU) the average person per household (PPH) within the City is 2.51. The certified population for 2016 was 9,646 per the PRC. For planning purposes, this population is utilized as the 2017 population. This population also includes the 100 residences that are served outside the city limits. A connected population is estimated utilizing these values.

2 Existing 2017 population with improvements includes all residences within city limtis that could be served.

3 Existing population with improvements and anticipated urban growth connections includes all residences currently being served in addition to all residences within the city limits that could be served and subdivisions directly outside of the city limits that could be served in the future (roughly 20 percent of current tax lots in the urban growth boundary). Population was estimated using a value of 2.51 PPH.

4 The future 2037 population was found by utilizing AAGR values declared by PRC. The growth values were applied to the existing connected population with improvements along with the anticipiated urban growth boundary connections.

5 The average contribution from infiltration and inflow (I/I) for each flow component (AAF, ADWF, AWWF, and MMWWF) was estimated by taking the difference of each of the current total flow values and the current base flow (example: average annual I/I contribution = current AAF - ABF = 0.128 MGD - 0.079 MGD = 0.049 MGD).

6 Existing total flows and mass loads are based on historical plant operating data (i.e., Discharge Monitoring Reports).

7 For projection purposes, it was assumed that the I/I flows currently being experienced in the system will remain constant throughout the planning period.

8 Future total flow is estimated by taking the sum of the future ABF and I/I (example: AAF = 0.095 MGD + 0.049 MGD = 0.144 MGD).

9 ABF is defined as the daily minimum flow recorded for each year averaged over the five years of available data.

10 The AAF, ADWF, and AWWF were determined by taking the average of the corresponding flows from 2010 through July 2016. Wet weather flows were estimated to occur from January through June, and dry weather flows were estimated to occur from July through December.

11 The PHF was determined by multiplying the average annual wastewater flow by a peaking factor of 4.0. The peaking factor is an assumed value as no data exist that allow direct calculation to determine the value.

12 Total Kjeldahl nitrogen (organic nitrogen and ammonia nitrogen). Assumed concentration based on typical domestic wastewater influent values.

$CBOD_5$ = Carbonaceous five-day biochemical oxygen demand
gpcd = Gallons per capita per day
lb/day = Pounds per day
mg/L = Milligrams per liter
MGD = Million gallons per day
TSS = Total suspended solids
TKN = Total Kjeldahl nitrogen

* Population estimate and projections from the PRC at PSU based on a certified population of 9,646 in 2017.

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CITY OF
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WASTEWATER FACILITIES PLAN

DESIGN CRITERIA

FIGURE 3-4

Chapter 4 - Existing Wastewater System Characteristics

Introduction

In this chapter, the existing wastewater collection, treatment, and disposal facilities are described and evaluated. Additionally, a brief history of the construction of the existing system is presented.

Collection System Description and Evaluation

The majority of the City's wastewater collection system was constructed in 1960. The wastewater collection system serving the City of Prineville is shown on Figure 4-1. The gravity collection system is composed of pipes ranging in size from 4 inches to 48 inches in diameter with eight lift stations. Sewer pipes are predominately polyvinyl chloride (PVC), but much of the older pipe is asbestos cement and concrete. Additionally, sewage forcemain pipes transport wastewater from the lift stations to the gravity sewer main pipelines. Flow then enters the lagoon wastewater treatment facility (WWTF). Although diameters of the sewer pipes range from 4 to 48 inches, the majority of the piping is 8 inches in diameter. Infiltration and inflow (I/I) has been identified as a concern for the City.

Collection System Connections

Locations of lift stations, forcemains, and main lines are shown on Figure 4-1. As mentioned in the design criteria presented in Chapter 3, there are approximately 894 residents within the city limits not currently connected to the collection system. Figure 4-2 shows residences not currently connected. Figure 4-3 shows the 100 residences outside the city limits that are served and create a demand on the system. Alternatives for connecting all residences within the city limits are addressed in Chapter 5. As mentioned in Chapter 2, some areas directly outside the city limits but inside the urban growth boundary (UGB) are densely populated and considered for future growth of the collection system. Figure 4-1 illustrates the tax lots and densely populated areas outside the city limits but in the UGB that could be added to the collection system. For the purposes of this Wastewater Facilities Plan, 20 percent of these residences are assumed to be connected to the City collection system by 2037.

Collection System Infiltration and Inflow

I/I is unwanted flows entering the wastewater collection system. I/I in a collection system can occur during different times of the year. During the winter and early spring, the sources of I/I are normally storm events and spring runoff. During the summer, heavy irrigation and the filling of irrigation ditches and canals can raise groundwater levels, which can lead to increased I/I. Poorly lined irrigation canals and ditches can be a source of I/I because leaking irrigation water can elevate groundwater levels in the vicinity of sewer main lines. Specifically, infiltration and inflow are defined as follows:

Infiltration - The 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 - The 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, 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.

Nearly all cities have some amount of I/I into their wastewater collection systems. Based on a review of Discharge Monitoring Reports (DMRs), there appears to be infiltration into the gravity sewer system. The City appears to be experiencing I/I of approximately 340,000 gallons per day. This was determined by analyzing influent data in the DMRs (see Figure 3-5). An improvement plan for I/I removal is presented in Chapter 5.

Collection System Capacity

The capacity of the existing collection system was modeled to determine how full the pipes were anticipated to be during peak hour use. The results of this model are shown in Chapter 5. Generally, the collection system has adequate capacity to serve the anticipated peak hour flows for existing users, but a couple of sections of pipe need some improvement. Improvements are also necessary to serve the 20-year needs as discussed in Chapter 5.

Lift Stations

The City's sewer system includes eight wastewater lift stations. Following is a brief description of each lift station. The locations of these stations are shown on Figure 4-1.

The Williamson Lift Station is located south of the Ochoco Highway at the end of Williamson Drive. The lift station was constructed in 1995 and has a 225-gallon-per-minute (gpm) capacity at 47 feet total dynamic head (TDH) with one pump running. The station contains two Hydronix self-primer pumps with a 3-phase, 480-volt, 7.5 horsepower (Hp) motor. The two pumps and controls are mounted in a reinforced fiberglass pad-mounted enclosure. This enclosure is adjacent to a 12.5-foot deep sump-type wetwell. The wetwell is set up for expansion, and there are no current electrical issues. The City has reported maintenance issues with the supervisory control and data acquisition system, and the cover appears to have some damage. The forcemain is 4-inch PVC pipe to the gravity sewer in the Ochoco Highway.

The Saddle Ridge Lift Station is a 240-volt, 3-phase duplex pump station. The pumps are 2.9 Hp Hydronix submersible with a guide rail system. The lift station is located on Northwest Saddle Ridge Loop on the far north end of the City. The City has reported issues with the telemetry's line of sight.

The Western Sky Lift Station was constructed in 1996 and is located on Northwest Western Sky Road south of Gardner Road. The pump station is constructed in a manhole-like structure and is dual submersible with a guide rail system. The capacity of the station is 140 gpm at 30 feet TDH with one pump running. The motors are 3.0 Hp. The single-phase, 240-volt pump has no standby power. The forcemain is a 4-inch PVC pipe to the gravity sewer along the Madras-Prineville Highway. This lift station has an adjacent wetwell that appears to be abandoned but still collects solids. The purpose of this wetwell is unknown, but it may be able to be modified to eliminate the collection of solids and standing wastewater.

The McDougal Lift Station is a single-phase, 120-volt duplex submersible pump system. It is located in a cul-de-sac off the Madras-Prineville Highway in the northwest part of the City. The 1/3 Hp lift station has no standby power connection. The capacity of the lift station is 100 gpm at 15 feet TDH with one pump running. The pump station was refurbished in August 2014.

The Oregon Youth Authority constructed a lift station in 1997, which is located north of the Ochoco Highway. The submersible design is constructed in a manhole structure. The lift station is 28 feet deep with the pumps mounted on a rail system. The 3-phase, 460-volt lift station now serves the needs of the National Guard. The forcemain is an 8-inch PVC pipe that discharges to the gravity sewer along the Ochoco Highway. This lift station is equipped with a standby power connection and two 40 Hp motors. The pumps are oversized for current needs.

The Airport Lift Station was constructed in 1997 in a manhole structure 15 feet deep with the pumps mounted on a rail system. The single-phase, 240-volt duplex pump station has a capacity of 76 gpm at 38 feet TDH with one pump running. The forcemain is a 3-inch PVC pipe to the gravity sewer along the Ochoco Highway.

The Industrial Park Lift Station and Forest Service Lift Station are currently privately owned and operated.

Wastewater Treatment Facility Description

The City treats its wastewater using a secondary WWTF. The WWTF was originally constructed in 1960 and is composed of two partially aerated facultative lagoon treatment plants operating in parallel. These types of wastewater treatment lagoons are common throughout eastern Oregon. See Figure 1-2 in Chapter 1 for an aerial photo of the WWTF. The process flow schematic is shown on Figure 4-4 and descriptions of the associated WWTF components are provided on Figure 4-5.

Influent Screen

In 2017, the City installed a new influent screen upstream of the influent pump station to remove rags and debris to remediate issues with operation, maintenance, and safety. The Huber Rotamat RoK4 700/6 fine screen has a capacity of 4.5 million gallons per day (MGD) maximum flow. The screen is a perforated basket design with a vertical shaftless screw design. The motor is 3-phase, 5 Hp, and 460-volt.

Influent Pump Station

The influent pump station at the WWTF consists of four submersible influent pumps that receive water from the 48-inch pipe that brings raw sewage from the collection system. The pumps are 25 Hp with a motor speed of 1,800 revolutions per minute. These pumps are currently being updated, with two of the four pumps having recently been replaced with similar pumps. These pumps lift the incoming wastewater into a concrete splitter box that splits flow between Plants 1 and 2 using adjustable weirs. Wastewater is then pumped to Plants 1 and 2 using dedicated submersible feed pumps. Each plant pump station has a total of three feed pumps. Both sets of feed pumps have identical 25 Hp pumps. Influent is pumped to Plant 1 via a 10-inch pipe and to

Plant 2 via a 12-inch pipe. A Panametrics DF868 Strap-on flowmeter is utilized after both feed pumps to measure flows pumped into each plant.

Plant 1

Plant 1 is the original WWTF and has a design influent flow capacity of 1.1 MGD. This plant has a partially aerated primary lagoon with a facultative secondary lagoon. The primary lagoon is partially aerated with floating mechanical aspirating aerators. The floating aerators are experiencing maintenance issues due to rags getting caught in the impellers. Wastewater pumped into Plant 1 is directed through the 37-acre primary lagoon, which has a detention time of 62 days at 1.1 MGD and an operating volume of approximately 68 million gallons (MG). The primary lagoon is aerated with 14 mechanical aerators. Each aerator is 7.5 Hp. The design oxygen transfer rate of the aerators is 1.5 pounds of oxygen per Hp-hour. Plant operators have expressed concern over the condition of this equipment and how to safely operate and maintain it. Alternative equipment that is more reliable and easier to maintain could be pursued. After the primary lagoon, the wastewater enters a 10-acre secondary facultative lagoon with a detention time of 15 days at 1.1 MGD and a volume of approximately 16 MG.

After passing through the two treatment lagoons, wastewater passes through two rock filters, each having an area of 1.2 acres. At the entrance of the rock filters, Bioxide (calcium nitrate) is injected to control odor. Sixteen inches of rock was added to the top of the rock filters in the summer of 2016 to increase the flow capacity. The rock filter has a backwash pump with a capacity of 1,150 gpm at 22 feet TDH. The backwash rate is 1.66 times the loading rate. Finally, the wastewater is disinfected in a two-basin chlorine contact chamber. Each basin has a volume of 26,600 gallons. This produces a contact time of 70 minutes at 1.1 MGD with both basins in operation.

After disinfection, effluent is routed through the intermediate pump station. This pump station has two 15 Hp pumps with a combined capacity of 1,300 gpm at a TDH of 48 feet. The intermediate pump station allows flow to be routed either to the Plant 2 effluent storage pond (commonly referred to as the kidney pond) or the Plant 1 effluent storage pond (golf course irrigation storage pond). The Plant 1 storage lagoon has a volume of approximately 25 MG and a detention time of 23 days. Effluent is treated and disinfected as required by the National Pollutant Discharge Elimination System Permit and is then pumped through the irrigation pump station or discharged into the Crooked River. During the summer, effluent is stored in the golf course irrigation storage pond and utilized for irrigation on the City-owned golf course. During the winter months, effluent can be discharged to the Crooked River. The WWTF is not equipped with a filter system. A filter would normally be recommended for Class C effluent, but the WWTF has been meeting the Class C limits without one.

Before discharging to the Crooked River, water from the effluent storage pond needs to have chlorine residuals below the permitted amount. A sulfur burner is available to add sulfur to the water before discharge. This burner has not been needed for a few years, as dechlorination has been achieved naturally in the effluent storage pond. When the effluent is discharged into the Crooked River, an 18-inch diameter pipe with a three-port diffuser is utilized. The discharge rate is 11.5 feet per second at 1.1 MGD. It is unlikely this form of discharge will be utilized in the future due to the presence of the constructed wetlands; however, the outfall is maintained for the purpose of allowing discharge during unprecedented high flows.

Plant 2

Plant 2 has a design flow capacity of 1.2 MGD. Before wastewater reaches Plant 2, it is run through a diversion box constructed to allow expansion of the lagoons. At this time, the diversion box routes flow to the primary lagoon in Plant 2. The plant consists of three treatment lagoons operated in series. The lagoons are lined with a high-density polyethylene liner. The first lagoon is an aerated lagoon, which is followed by a partially aerated facultative lagoon, and finally an unaerated facultative lagoon. The primary lagoon is an aerated basin 3.49 acres in size with a 10-foot operating depth and a volume of 11.4 MG. Aeration in the primary lagoon is performed by nine floating aspirating aerators. Each aerator is 7.5 Hp and has an aeration capacity of 1.5 pounds of oxygen per HP-hour. The second lagoon is also equipped with four 10 Hp aerators. The second and third lagoons are both 2.91 acres in size with an operating depth of 6 feet and a combined volume of approximately 11.4 MG.

After the three treatment lagoons, wastewater is disinfected in a 42-inch chlorine contact pipe that leads into a 21,500-gallon chlorine contact basin. The 12-inch PVC pipe from the transfer pumps to the effluent storage pond provides additional contact time for disinfection to total 60 minutes of contact time at 1.2 MGD. Effluent is subsequently stored in the Plant 2 effluent storage pond (kidney pond) after being pumped through the effluent transfer pump station. The effluent transfer pump station has a total of two vertical turbine pumps (VTP) with a capacity of 1,200 gpm and a TDH of 44 feet. These pumps were recently upgraded during the wastewater improvement efforts in 2016. Each VTP is 20 Hp. The 29-acre kidney pond has a volume of 118 MG and a maximum detention time of 98 days. Effluent from Plant 2 either is pumped through the effluent irrigation pump station and utilized for irrigation on City-owned pasture lands in summer or is processed through the constructed wetland complex and indirectly discharged into the Crooked River through controlled seepage. Additional water for irrigation of pasture lands is pumped from the Crooked River using a variable speed VTP with a capacity of 2,400 gpm.

Effluent Disposal

The treated and disinfected effluent is irrigated from the effluent storage ponds at the treatment plant to either the golf course or the pasturelands. The golf course is irrigated using an underground sprinkler system, while the pasture is irrigated using pivots. The golf course irrigation system consists of storage, pumps, and underground sprinklers. The effluent storage ponds have accumulated solids that need to be cleaned, and the pumps and sprinklers are approaching the end of their useful life, so future replacement should be planned.

A portion of the treated effluent is disposed of by indirect discharge into the Crooked River through controlled seepage via the newly constructed wetlands. Composed of 160 acres, the wetlands are constructed with the treated effluent first passing through a lined treatment wetland and then into one of the several unlined wetlands varying in size from 15 to 30 acres. The system consists of 15 separate wetlands. There are eight lined wetlands used for further treatment of the wastewater and seven disposal wetlands. The primary purpose of the wetlands is to reduce the nutrients in the water leaving the WWTF. The lined wetlands are split into two treatment trains, while disposal wetlands are controlled individually.

The first lined wetland treatment train consists of Lined Wetlands 1, 2, 3, and 4. The second treatment train consists of Lined Wetlands 5, 6, 7, and 8. The treatment trains are configured so water flows through a shallow aerobic wetland (Lined Wetland 1 or 5), then flow is split between one or two deep anoxic wetlands (Lined Wetlands 2 and 3 or 6 and 7). Flow from the two deep anoxic wetlands combines and travels through another shallow aerobic wetland (Lined Wetland 4 or 8). The wetlands are designed to help reduce the total nitrogen concentration in the wastewater. Once through the second shallow aerobic wetland, the flow from each treatment train combines and can be sent to any of the seven disposal wetlands. A schematic of the wetlands is provided on Figure 4-6.

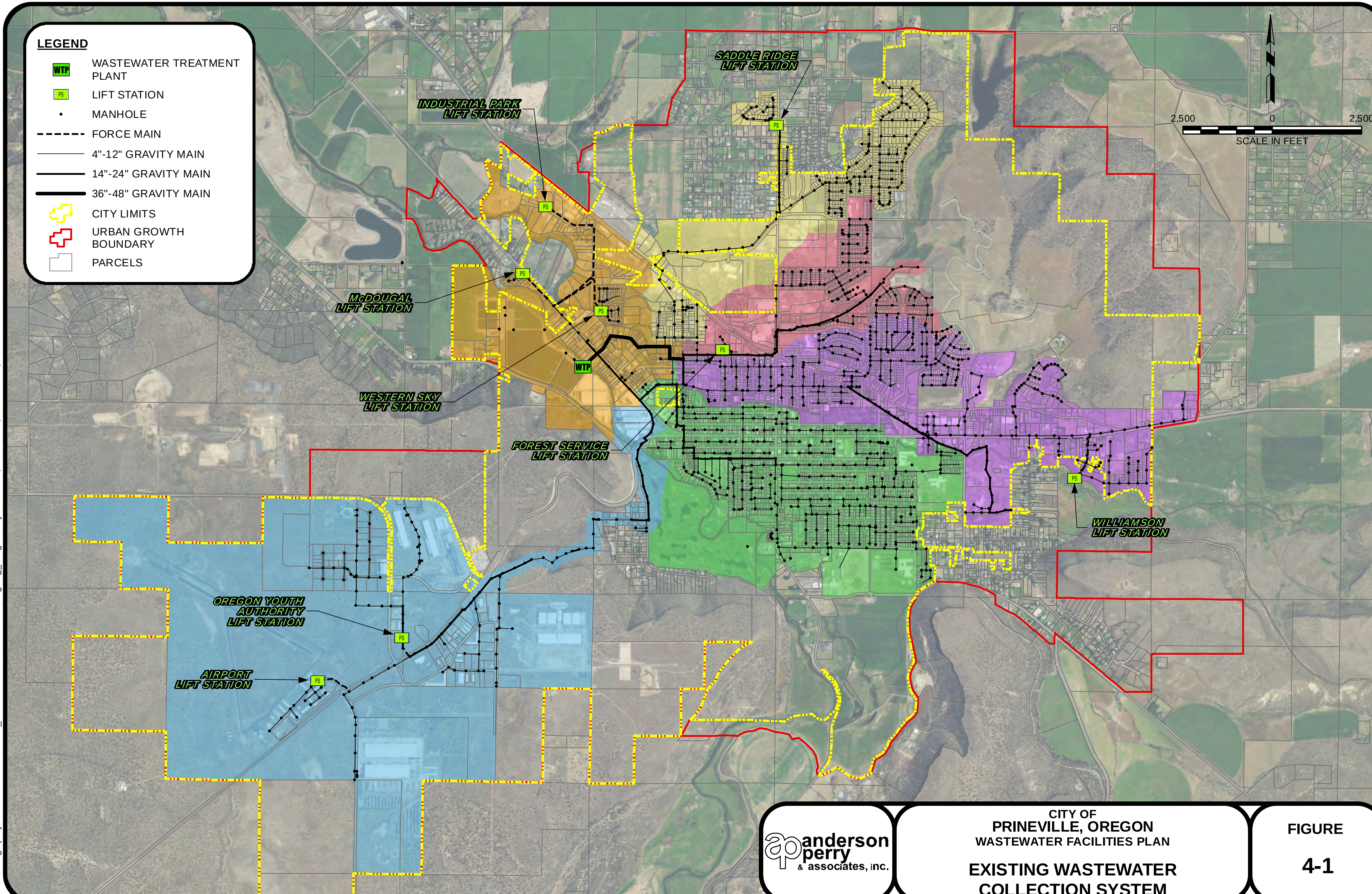
There is no required minimum detention time for the wetlands. However, the design detention time of the lined wetlands is about three days and is monitored to adjust wetland treatment. The wetland detention time varies in each wetland based on the wetland depth and flow through the wetland. The depths of the lined wetlands are controlled by the gate in the control structures directly downstream of each wetland. During operation, the disposal wetlands are monitored periodically to confirm that adequate draining of the wetlands is occurring. A tertiary treatment plant is currently being designed to use treated effluent as data center cooling water. This facility is anticipated to be operational in a couple of years.

Solids Disposal

The City of Prineville has never removed solids from the lagoon system. A significant accumulation of solids has occurred in Pond 1 of Plant 1. These solids equate to approximately 86,000 cubic yards. Anderson Perry & Associates, Inc., and the City performed a sludge survey on March 15, 2017 (see Figures 4-7A and 4-7B for sludge depths). Sludge in Pond 1 in Plant 1 needs to be removed, as it will cause operational issues, reduce the treatment capacity, and contribute to odors.

Summary

The existing collection system has some areas that need improvement. An ongoing effort to reduce I/I would reduce flows to the WWTF and extend the capacity of the treatment and disposal facilities. The WWTF has been designed for a total capacity of 2.5 MGD. The 20-year average annual design flow for this planning effort is 1.16 MG. The existing facilities are adequately sized for the planning period but improvements to the aerators to prevent ragging are needed, and the accumulated solids need to be removed from Pond 1 in Plant 1.



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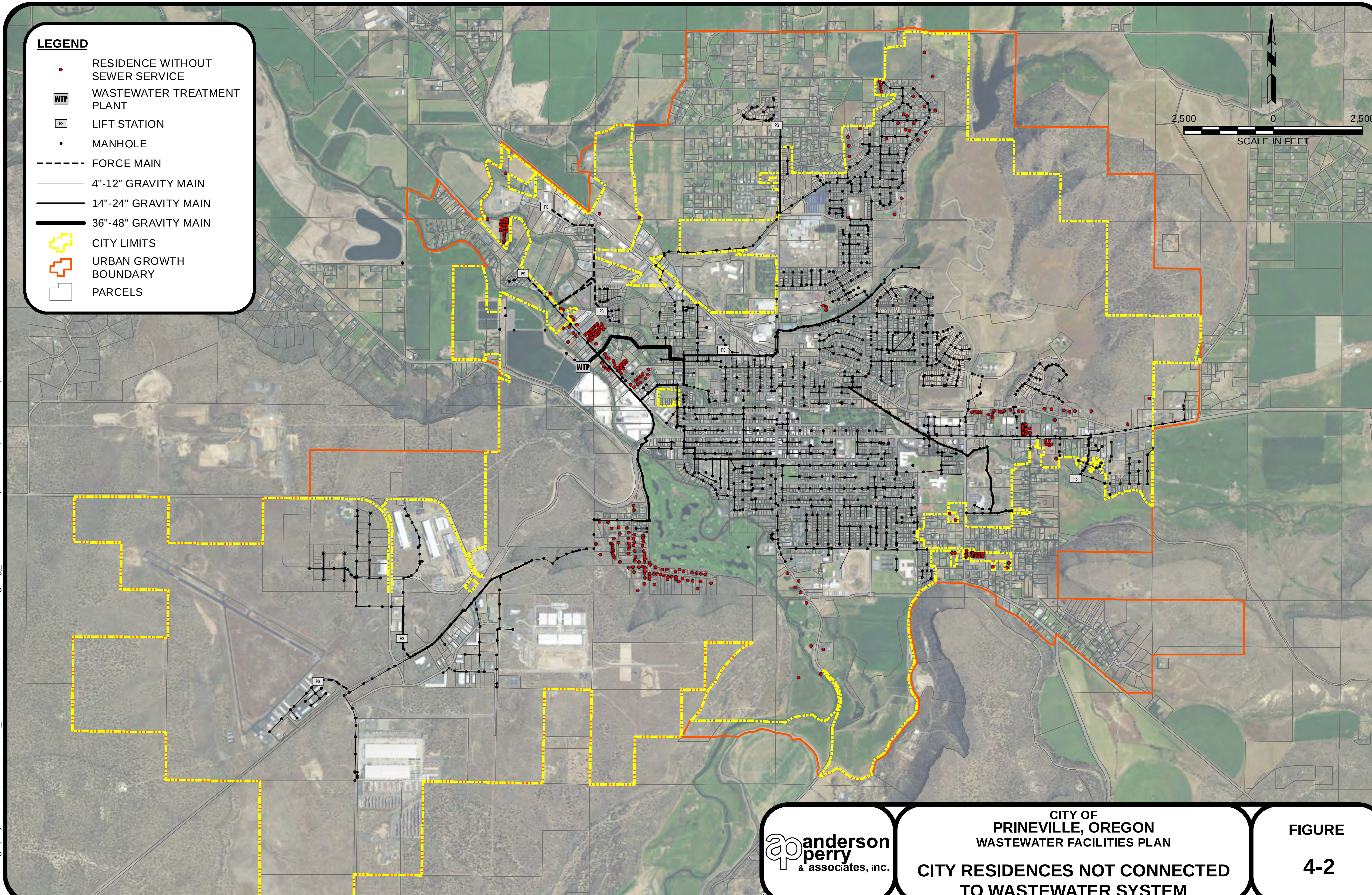
CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

EXISTING WASTEWATER COLLECTION SYSTEM

FIGURE 4-1



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CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

CITY RESIDENCES NOT CONNECTED TO WASTEWATER SYSTEM

FIGURE 4-2

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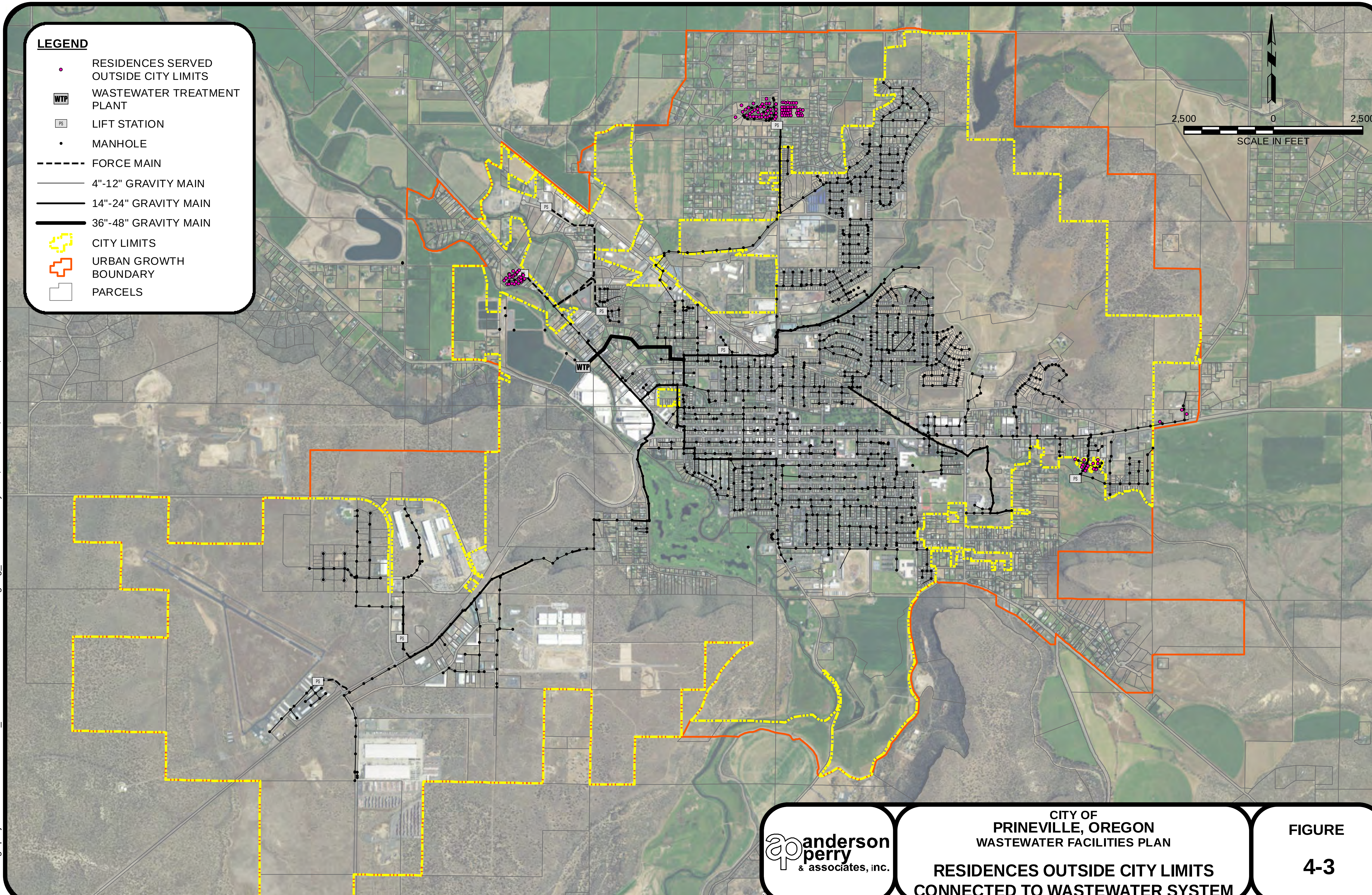

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CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

RESIDENCES OUTSIDE CITY LIMITS CONNECTED TO WASTEWATER SYSTEM

FIGURE 4-3

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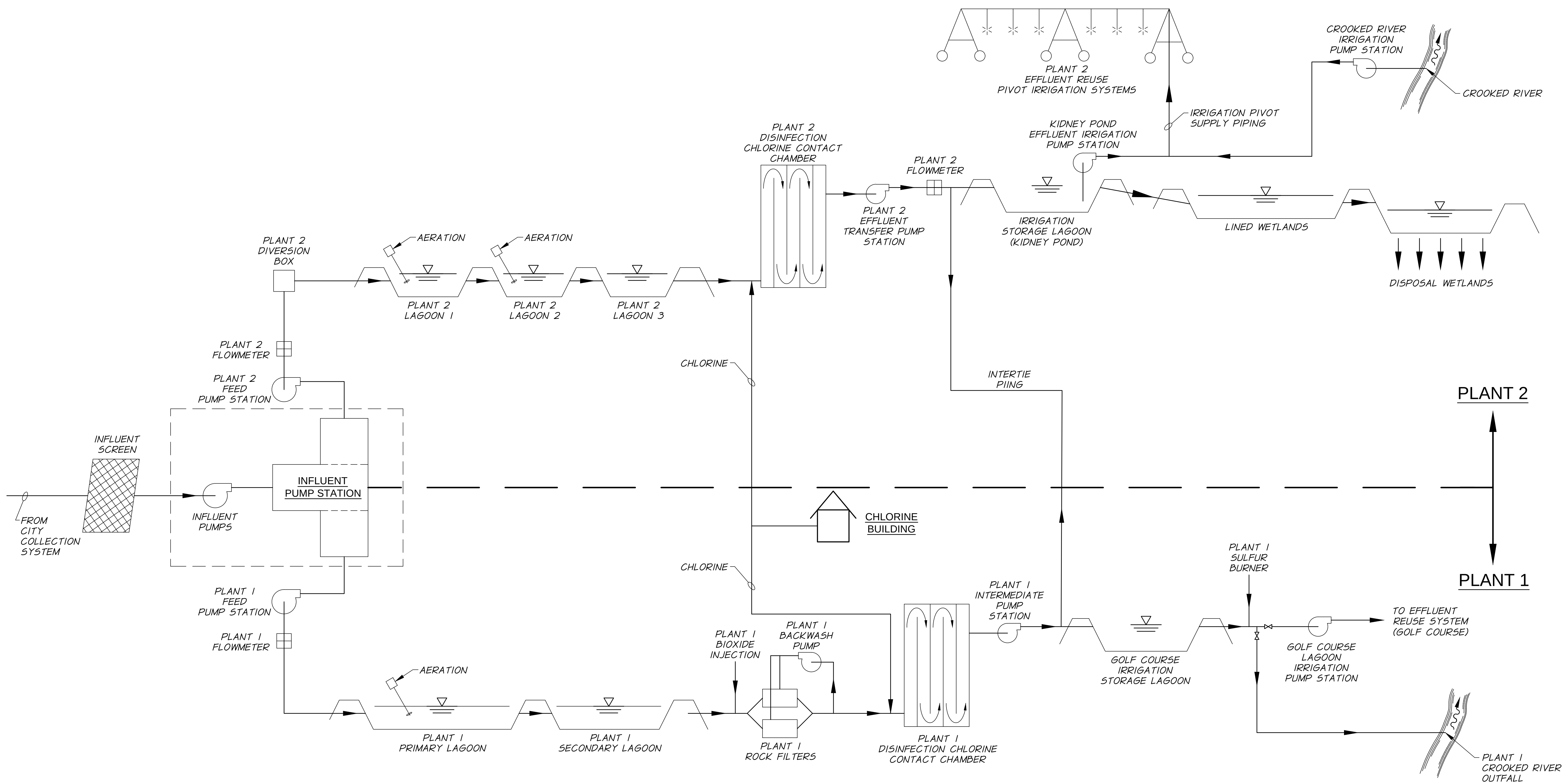

NOTE:
INTERCONNECTION EXIST BETWEEN PLANTS.

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CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

TREATMENT PROCESS FLOW SCHEMATIC

FIGURE
4-4

Influent Screen

Date Constructed	2017
Capacity	4.5 MGD Max Flow
Type	Huber Rotamat RoK4 700/6 Fine Screen
Motor	230/460 VAC, 3 phase
Horse Power	5

Influent Pump Station

Date Constructed	2005
Pipe to Influent Pump Station	48" RCP San. Sewer
Quantity of Submersible Pumps	4
Model No.	KRT K150 315 310 1160
Discharge Connection	6"
First Operating Point	1650gpm @ 38.5 feet
Second Operating Point	1750 @ 35.5 feet
Third Operating Point	1760 @ 35.2 feet
Shutoff Head	73.0 feet
Motor Speed	1800 rpm
Horsepower (each)	25

Plant 1 Feed Pump Station

Quantity of Submersible Pumps	3
Capacity	1760 gpm @ 35.2 feet
Horsepower (each)	25
Piping to Plant 1	10" diameter

Plant 1 Flowmeter

Panametrics DF868 Strap-on flowmeter

Plant 1 Partially Aerated Primary Lagoon

Area	37 acres
Operating Volume	68.7 MG
Max Operating Depth	5.7 feet
Max Weir	2854.9 feet
Min Weir	2853.4 feet
Bottom Elevation	2849.2 feet
Detention Time at 1.1 MGD	62 days
Number of Mechanical Aerators	15
HP of Aerators (each)	7.5
Oxygen Transfer (lbs/Hp*hr)	1.5

Plant 1 Facultative Secondary Lagoon

Area	10 acres
Depth	5 feet
Bottom Elevation	2844.5 feet
Operating Volume	16 MG
Detention time at 1.1 MGD	15 days

Plant 1 Rock Filters

Filter Area (each)	1.2 acres
Quantity	2
Loading Rate	1.7 gpd/cf
Backwash Rate	1.66 times loading rate
Backwash Pump Capcity	1150 gpm @ 22 feet

Plant 1 Disinfection

Number of Basins	2
Basin L:W ratio	50:1
Basin Volume	26,600 gallons per basin
Chlorine Dosage at Contact Basin	0-100 lb per day

Plant 1 Intermediate Pump Station

Number of Pumps	2
Combined Rated Capacity	1300 gpm @ 48 feet
Horsepower (each)	15

Golf Course Irrigation Storage Lagoon

Area	10.5 acres
Storage Capacity	25 MG
Holding Capacity at 1.1 MGD	23 days

Golf Course Lagoon Irrigation Pump Station

Number of Pumps	3
Combined Rated Capacity	3000 gpm @ 324 feet
Horsepower (each)	100

Crooked River Outfall

Diffuser Nozzel Discharge	11.5 ft/sec @ 1.1 mgd
Number of Nozzles	3
Outfall Pipe Diameter	18 inches

Plant 2 Feed Pump Station

Quantity of Submersible Pumps	3
Capacity	1760 gpm @ 35.2 feet
Horsepower (each)	25
Piping to Plant 2	12" diameter

Plant 2 Flowmeter

Panametrics DF868 Strap-on flowmeter

Plant 2 Aerated Lagoon 1

Area	3.49 Acres
Operating Depth	10 feet
Volume	11.4 MG
Detention Time at 1.2 MGD	9.5 days
Quantity of Aspirating Aerators	9
Horsepower of Aerators (each)	7.5
Oxygen Transfer (lbs/Hp*hr)	1.5

Plant 2 Aerated Lagoon 2

Area	2.91 Acres
Operating Depth	6 feet
Volume	5.7 MG
Detention Time at 1.2 MGD	4.7 days
Quantity of Aspirating Aerators	4
Horsepower of Aerators (each)	10
Oxygen Transfer (lbs/Hp*hr)	2

Plant 2 Facultative Lagoon 3

Area	2.91 Acres
Operating Depth	6 feet
Volume	5.7 MG
Detention Time	4.7 days

Plant 2 Disinfection

Type	Chlorine Gas
Capacity	0-100 lbs chlorine per hour
Number of Basins	1
Basin Volume (gal)	21,500
42" Contact Pipe Volume (gal)	10,800
12" PVC Pipe Volume (gal)	20,000
Total Detention Time at 1.2 MGD	60 minutes

Plant 2 Effluent Transfer Pump Station

Number of Pumps	2 Verticle Turbine
Capacity	1200 gpm at 44 ft (TDH)
Horsepower (each)	20

Irrigation Storage Lagoon (Kidney Pond)

Area	29 acres
Volume	118 MG
Minimum Depth	1 foot
Maximum Depth	12.5 feet
Maximum Detention @1.2 MGD	98 days

Kidney Pond Effluent Irrigation Pump Station

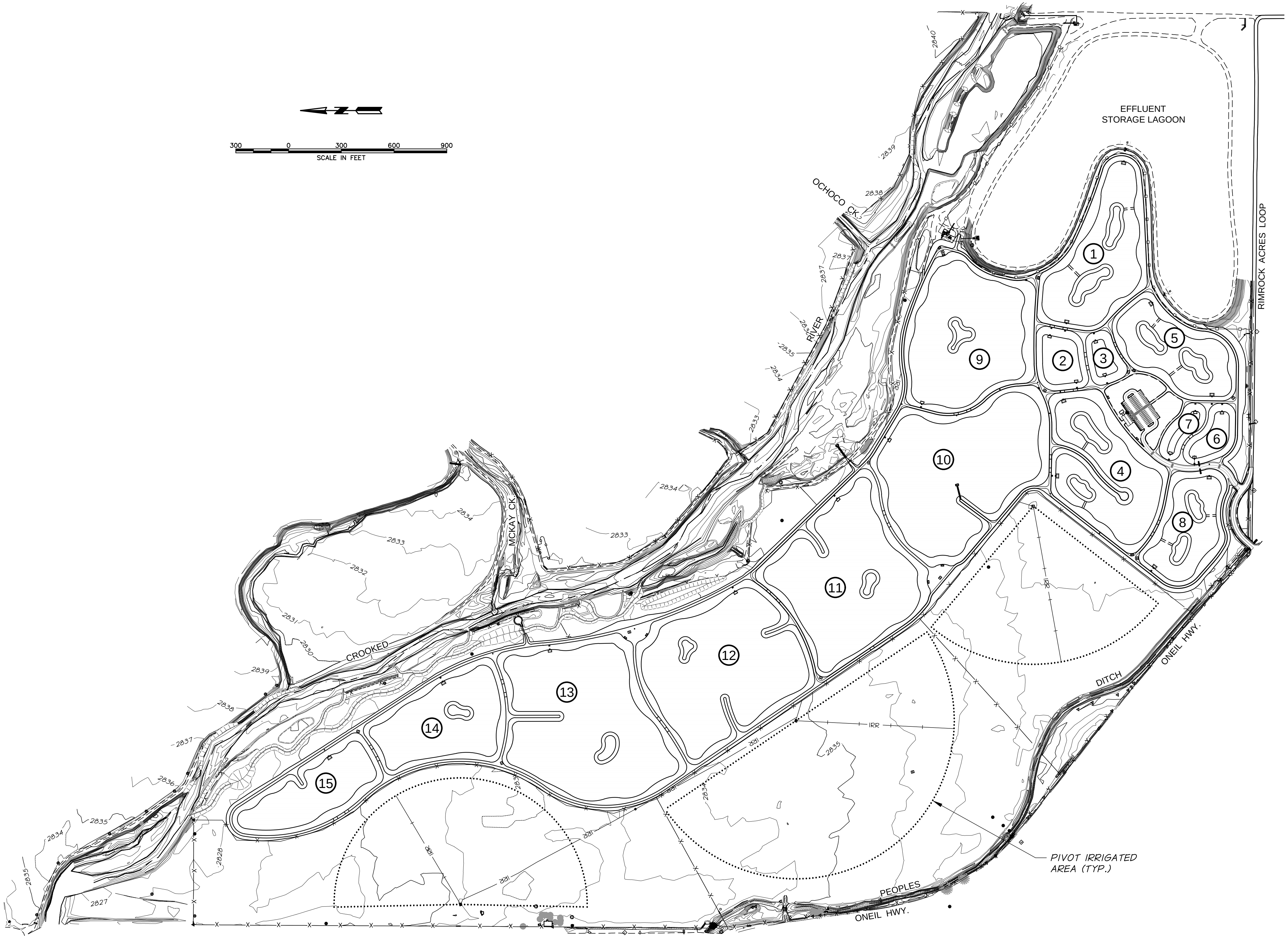
Number of pumps	3
Capacity	775 gpm @ 215 feet
Horsepower (each)	75

Effluent Reuse Pivot Irrigation Systems

Number of Pivots	3
Acreage Irrigated	120

Crooked River Irrigation Pump Station

Number of pumps	1
Capacity	2400 gpm
Horsepower	20
Variable Speed Drive	



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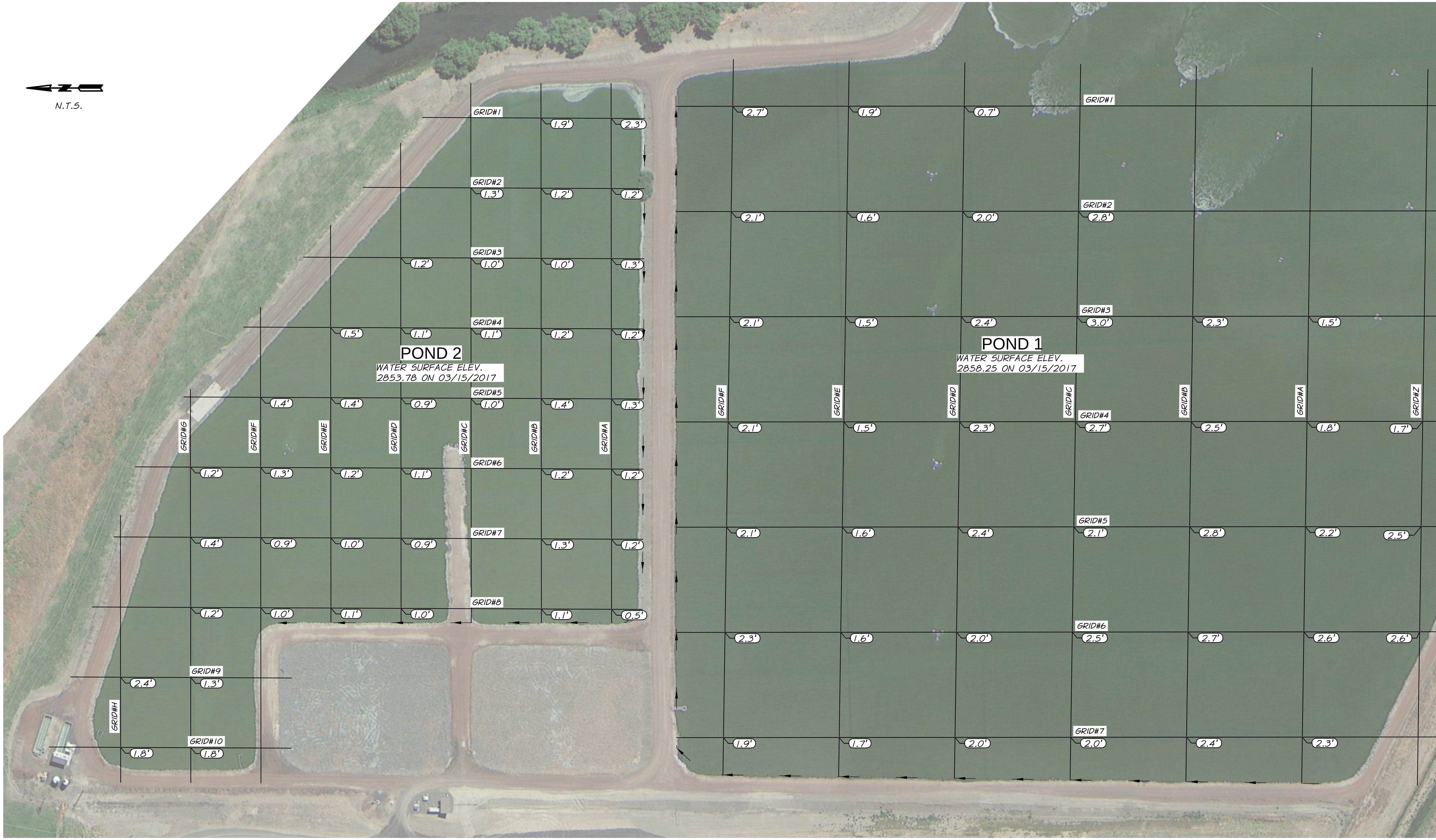
CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

LINED AND DISPOSAL
WETLANDS SITE PLAN

FIGURE
4-6



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CITY OF PRINEVILLE
WASTEWATER FACILITIES PLAN

PLANT 1 - SLUDGE DEPTHS

FIGURE 4-7A

N.T.S.

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CITY OF PRINEVILLE
WASTEWATER FACILITIES PLAN

PLANT 2 - SLUDGE DEPTHS

FIGURE
4-7B

R:\PRINEVILLE\1260-15 WW Fac Pln\DRAFTING\1260-15-021F-102SEL.dwg, PLANT2, 8/17/2017 4:16:45 PM, AutoCAD PDF (General Documentation).pc3, DMC

Chapter 5 - System Improvements

General

This chapter develops and evaluates options to improve the City of Prineville's wastewater collection, treatment, and effluent disposal facilities to address the needs identified in Chapter 4. The System Development Charge (SDC), Capital Improvements Plan (CIP), and Local Improvement District (LID) improvements categories are identified and discussed. Chronologically, priorities for improvements under the SDC and CIP categories are outlined, and estimated costs to complete the improvements are presented.

Categories of Improvements

The City of Prineville, Oregon, is proposing to complete wastewater system improvements utilizing two different funding categories. These categories are:

- SDC - Improvements identified under the SDC category have been developed to address those needs in the system to specifically support growth and associated increased system demands.
- CIP - Improvements identified under the CIP category include capital improvements projects that need to be completed to address existing system deficiencies irrespective of growth.

A third category to fund improvements is potentially available. This category is the formation of LIDs. Oregon Revised Statutes (ORS), Chapter 223-001 provides the statutory definition of an LID. An LID is an area a city council determines should be benefited by public improvement, and the improvement is financed by the City and repaid by owners of benefited properties.

Wastewater Collection System Improvements

Figure 5-1 shows the results of modeling the existing collection system and 2017 flows. Figure 5-1 assumes the Oregon Youth Authority (OYA) pump station pumps are downsized to match the needs of its service area. The pipelines shown in red are running full. It is suggested that pipelines be designed to run approximately half full. Figure 5-2 shows the results of modeling the existing collection system with the future 2037 design flows assuming the 24-inch railroad grade pipeline has been installed. These figures show the pipelines that need increased capacity now and for the 20-year design. Figure 5-3 shows the recommended improvements to meet the 2037 design criteria. Some of the improvements are identified for areas in the urban growth boundary (UGB) and are subject to annexation. As described in Chapter 2, an estimated 20 percent of the residential development outside the city limits but within the urban growth boundaries is assumed to be annexed into the City sewer service. Figure 5-3 shows the improvements needed for this 20 percent estimation. Locations of future extensions are schematic in nature and may be constructed in locations not shown on the figure. The sewer line extension running from the Airport Industrial Park to the wastewater treatment facility (WWTF) is anticipated to accommodate future industrial growth. Improvements to the existing system shown on Figure 5-3, however, will occur in the exact locations as shown on the map. Figure 5-3 also includes those residential developed areas that can be served by formation of LIDs, shaded in green. Estimated costs for assumed LIDs have not been developed as part of this WWFP as that is beyond the scope of work identified. The estimated cost for these improvements is shown on Figure 5-4.

Figure 5-5 shows the size of the pipelines needed to serve the buildout of the UGB. In the event that areas other than the ones shown are developed first, the collection system improvements identified can be adjusted for the revised service areas. An overall plan for serving the entire UGB has been developed to ensure that some pipelines installed to provide short-term service will still be useful when the area in the UGB is developed. Currently, not all of the pipelines to service the UGB are proposed for installation, as the UGB is not anticipated to be fully developed in the next 20 years.

Lift Station Improvements

The lift stations are generally in good condition but some minor improvements have been suggested. These improvements are shown on Table 5-1. The cost estimate for the improvements is shown on Figure 5-4.

TABLE 5-1
LIFT STATION IMPROVEMENTS

Lift Station	Improvement
Williamson	Install new enclosure and telemetry system
Saddle Ridge	Improve telemetry system
Western Sky	Install concrete floor in adjacent wetwell
McDougal	Install standby power generator connection
OYA	Replace pumps with smaller ones
Airport	Modify or remove flush valve

Infiltration and Inflow-Related Improvements

As discussed in Chapter 4, the City's existing collection system is currently experiencing infiltration and inflow (I/I) of approximately 340,000 gallons per day. This amount of water is approximately one-third of the current average flow entering the WWTF. I/I reduction can be difficult to achieve. For this reason, it is recommended that an annual program for identification and reduction of I/I sources be developed and funded using user fees. A comprehensive evaluation of the collection system is beyond the scope of this planning effort but should be included as part of the annual program. The rationale for the annual program has been developed and is presented as follows:

- The cost to remove I/I from the City's collection system during a one-time improvement project is unknown and could cost millions of dollars.
- A large portion of the City's collection system is old, deteriorated, and in need of replacement and/or repair, regardless of I/I issues.
- Systematic improvements made over time, targeting priority areas, would correct I/I issues, replace old and deteriorated collection system lines, and be affordable.

The collection system should be cleaned and television inspected to define problem areas, a meaningful rating system to prioritize areas needing repairs or replacement should be applied, and the highest priority areas should be corrected on an annual basis as funds permit. This approach should be augmented by adding smoke testing to the television inspection stage of the process. Smoke testing will help identify the sources of inflow into the collection system. Once sources of inflow are identified, these areas can be rated and prioritized along with other problem areas.

Improvements can then be made as part of the annual plan. By implementing a repair and replacement program systematically, the entire collection system can be repaired or replaced over a period of time, and I/I can be effectively reduced.

Infiltration and Inflow Reduction Improvement Plan

General

The improvement plan includes collection system evaluation, cleaning and television inspection, smoke testing, I/I analysis, evaluation of structural and physical conditions, and repair and replacement cost scenarios. By implementing the procedures discussed in this section, the City can have a modified, systematic annual approach to removing I/I from its collection system piping and, at the same time, rehabilitate its aging collection system through replacement and/or repair.

Two sources of information regarding I/I reduction programs are as follows. Some important points from these references are summarized in this section.

1. Sewer System Infrastructure Analysis and Rehabilitation, U.S. Environmental Protection Agency, EPA/625/6-91/030, October 1991.
2. Existing Sewer Evaluation and Rehabilitation, Water Environment Federation Manual of Practice, FD-6, American Society of Civil Engineers Manual and Report on Engineering Practice, No. 62, 1994.

One of the first steps of establishing a collection system evaluation plan is developing a data gathering network. Obtaining relevant data greatly aids the decision process for repair and/or replacement of collection system main lines. Data that can be gathered for each collection system basin include the following:

- Depth of sewer main lines and service lines.
- Depth to shallow groundwater, including seasonal high and low groundwater levels.
- Typical time of year for high and low shallow groundwater levels.
- Typical time of year for highest I/I flow in each basin.
- Average age of collection system main lines and service lines.
- Soil data (high or low permeability).
- Description of manhole, depth, pipe connections, and condition.
- Description of pipe, size, type, and condition.
- Description of pipe laterals, connection locations, types, and sizes.
- Flow data and related precipitation data for inflow analysis.

Once these data have been gathered for each basin, night flow observations should be completed during the season of high I/I. Night flow observations are the systematic visual and sometimes metered observation of the flows in the system during the period when most people are asleep and not using the sewer system. This is when basins and areas contributing I/I can be most effectively identified and quantified. After night flow observations are completed, several assumptions can be made to prioritize City-wide rehabilitation efforts and focus efforts in each basin. A database, when developed with at least the above parameters, will allow the City to make educated decisions concerning prioritizing television inspections, repair, and replacement efforts.

Cleaning and Television Inspection

When the high priority areas have been identified, the collection system should be cleaned and television inspected to identify structural and grade defects, sources of I/I, etc.

The need to complete collection system television inspection activities at the optimum time of year (to identify I/I sources) cannot be stressed enough. If television inspection is completed when I/I flows are low, most sources of I/I will not be identified. Therefore, television inspection of a collection system should be completed during the highest flow period of the year to identify the most I/I sources possible. However, high flows in the collection system piping often limit visibility in the pipe and can limit the inspection of the lower portion of the collection system piping that is out of view (under the flow). In this case, television inspection primarily focuses on evaluating sources of I/I flow. Depending on the City's television inspection needs (I/I or structural inspection, etc.), each situation will need to be evaluated on a case-by-case basis to best determine when internal inspection should be made.

Structural Condition

A key component of collection system television inspection activities is performing a structural evaluation of the pipes and manholes. The goal of this field evaluation is to locate structural deficiencies and determine their cause so proper corrective action can be taken. There are a number of reasons for structural defects in wastewater collection system piping and manholes. In older piping with grouted joints, the grout often deteriorates and wears away over time. Eventually, groundwater may leak into the pipe through these joints. Where improper bedding of the pipe has occurred, the pipeline may begin to sag. Some joints may have been improperly grouted or gasketed. In some cases where pipe deflection has occurred, the joints may be out of round, permitting root intrusion, cracking, or infiltration. This represents just a sampling of some of the possible structural defects.

Physical Condition

When performing a collection system evaluation, it is important to have a clear understanding of the physical condition of collection system piping. Key items for the physical condition of a collection system are as follows.

1. Operation and Maintenance Problems. A record-keeping system to track collection system operation and maintenance problems should be in place. Common problems range from overflowing manholes to sewer backups and pavement settling around manholes. All reported problems should be recorded so a detailed history can be developed.
2. Collection System Mapping and Updating. A current, up-to-date computer-based collection system map should be available to properly plan investigative and rehabilitation activities. Corrections and changes to this map should be monitored at a centralized location. Various map sizes would also be useful (i.e., maps that show the overall collection system and

smaller maps that show individual basins or other areas). This mapping may be most efficient to maintain in a GIS format.

Smoke Testing

Smoke testing is often used to locate sources of I/I, particularly inflow sources. Smoke is blown into collection system piping using smoke bombs or canisters. Smoke escapes through structural defects or undesirable connections to the wastewater collection system. Smoke testing is useful in detecting inflow sources such as storm sewer connections, roof drain connections, and foundation drain connections.

Replacement/Repair

Once data have been gathered and needed improvements identified and prioritized, system repair/replacement can then be pursued using annually budgeted funds. With this type of program, funds are allocated annually to perform collection system investigative and/or rehabilitative work. It is anticipated that I/I would be reduced at a rate that would offset some demands on the system due to growth in the City.

The annual dollar amount set aside will need to be sufficient to complete the following activities:

- Investigative Work - This would include the preparation (cleaning) and television inspection of collection system lines. It is assumed this work would be performed by City crews utilizing a closed circuit television inspection system. If City crews are not available to complete work in the required time frame (because of other commitments), the City should contract the inspection work. Contracting the work may be slightly higher in cost, but this would allow the work to be completed in the relatively short window of opportunity each year. Additionally, smoke testing and visual inspections would be completed during this effort.
- Rehabilitation Work - This work may include such items as pipeline slip lining, placement of repair clamps, grouting of manholes or joints, replacement of short sections of pipe for structural repair, raising of manholes to grade, etc.
- Replacement Work - This work may include replacing defective pipelines and/or manholes.
- Project Administration - This would include gathering and analyzing flow data to help prioritize rehabilitation work, bidding and contracting of rehabilitation work, monitoring the annual collection system rehabilitation program, record keeping, etc.

Summary

There is significant I/I in the collection system, and the City needs to develop a plan to appropriately identify and reduce the I/I sources. It is suggested the City set aside approximately $100,000 per year toward collection system improvements targeted to remove I/I and/or address structurally defective pipe. In developing a plan and appropriately funding improvements to the collection system, the City would also be making a wise investment by extending the useful life of the pipelines and WWTF.

Wastewater Treatment Facility Improvements and Effluent Disposal Improvements

The WWTF is adequately sized for the design flows identified, so capacity improvements to the treatment system are not needed at this time, based on the current permit requirements. However, a few improvements to individual system components could be considered.

Lagoon Improvements

The lagoons consist of both Plant 1 and Plant 2 ponds with their associated floating surface aerators. The lagoons and lagoon aerators are adequately sized to handle the flows and loadings. However, a significant number of rags has been deposited in the lagoons that bind in the aerator impellers, causing ongoing maintenance issues. Also, maintaining the floating surface aerators is difficult. It is recommended the City either clean all the rags out of the lagoons and prevent rags from entering in the future or install an alternative aeration system. The estimated cost for an alternative aeration system is approximately $500,000.

The lagoons also accumulate biosolids over time. A recent survey of the solids in the lagoons was completed. Solids in Pond 1 of Plant 1 are approximately 2-1/2 feet deep in the 5-foot deep lagoon. These solids need to be removed as soon as financially feasible. The solids could be removed by dredging at an estimated cost of approximately $4,350,000. If Plant 1 can be bypassed so Pond 1 can be dewatered and the solids dried to approximately 30 percent solids, then the solids could be removed for approximately $516,000. The solids could either be landfilled or land-applied for beneficial use on farmland. Solids removal will also remove the rags from Pond 1.

Disinfection System Improvements

The chlorine contact chambers and chlorination system are adequately sized to handle the flows and loadings, so no improvements are recommended.

Disposal System Improvements

The disposal system includes the irrigation system for the golf course, the irrigation system for the pasture, and the constructed wetlands. The golf course irrigation ponds need to be dredged and the pumps and sprinklers will need to be replaced in the future. The cost estimated by the City for these improvements is approximately $700,000.

Improvements Included in the System Development Charge Funding Category

This section summarizes and describes those identified improvements included in the SDC funding category. The estimated costs of the various improvements are also presented.

System Development Charge Fee Categories

ORS 223.297 to 223.314 require SDCs be divided into two fee categories, as follows:

- Reimbursement Fee - This fee establishes the value of the unused capacity of the existing system infrastructure. The value of the unused capacity can be assessed to future connections until the excess capacity is exhausted. This fee is levied on new developments to contribute a proportionate share of the cost of constructing existing facilities with the capacity to serve new developments. The Reimbursement Fee is based on original construction costs and the remaining capacity of the system component.

- Capital Improvements Fee - This fee establishes the cost of planned capital improvements to be constructed within the planning period. This cost is levied on new developments to provide funding for planned capital improvements projects, increase system capacity, and provide the needed service.

The Reimbursement and Capital Improvements Fees are combined to result in the total SDC Fee.

Establishment of System Development Charges

Oregon SDC statutes require the City develop a methodology for establishing an SDC Fee schedule. These fees can be assessed to new developments requiring City sewer services. Additional detailed discussion of the SDC methodologies and comprehensive SDC analysis are presented in an SDC study prepared by GEL Oregon, Inc., as part of the overall wastewater system planning effort.

Identified Improvements and Estimated Costs

As previously mentioned, improvements for the 20-year planning period have been identified that will be necessary, assuming wastewater system expansion will be needed to support future development and growth. The SDC costs include collection system and lift station improvements. The estimated costs for identified improvements categorized under the SDC funding category are presented on Figure 5-4. The reference numbers shown on the figures have been arbitrarily assigned and are not in order of priority. It is not possible to assign priorities to the improvements identified under the SDC funding category as they are development driven, and it is unknown which areas of the City will develop first or how quickly development within the City will occur.

Capital Improvements Plan

Introduction

A CIP provides a framework to prioritize and implement the City's facility and infrastructure asset improvement process over a specified time period. A CIP is a financing and construction plan for projects that require significant capital investment and are essential to safeguarding the financial health of the City, while providing continued delivery of utility and other services to citizens and businesses.

As part of this WWFP, the City is developing a CIP based on identified deficiencies and improvements required to address the wastewater system needs of the City for the next 20 years. The CIP will need to be reviewed and updated periodically (at least every five years) to accommodate changing community needs, additional improvements that may be identified through time, and changes in financial resources. The CIP will list the City's capital improvements projects, place the projects in a priority order (subject to periodic review), and schedule the projects for funding and construction.

The CIP is a tool to be used in the development of responsible and progressive financial planning. The program complies with the City's financial policies. City policies and the CIP form the basis for making annual capital budget decisions and supporting the City's continued commitment to sound, long-term financial planning and direction.

Capital wastewater system improvements projects will be coordinated with the annual budget process to maintain full utilization of available resources. For each capital improvements project, the CIP provides a variety of information, including a project description and the service need to be addressed, a proposed timetable, and proposed funding levels. Capital wastewater system improvements projects will be prioritized with the most urgent projects first. Ongoing operating costs are not included in the CIP's estimated project costs.

Development of a CIP is a collaborative effort between the City manager and engineer, City Council members, department heads, and the City's engineering and financial consultants. City staff participates in CIP development via specific master plans and other planning tools. Major capital improvements projects require City Council interaction during project development and where funding allocations are made.

Identified Improvements and Estimated Costs

This section summarizes and describes those identified improvements that have been included in the CIP funding category. The chronological listing of priorities is outlined and the estimated costs of the various CIP improvements are presented. The CIP improvements outlined are intended to correct deficiencies identified in the existing system and will provide the means to connect a portion of those residences located in the City not currently connected to the municipal wastewater collection system.

Proposed Improvements to be Completed within 10 Years

- **CIP 1** - Lagoon Biosolids Removal. CIP 1 involves removing accumulated solids from Pond 1 in Plant 1 to recapture Plant 1 treatment capacity. Currently, the pond is approximately half full of biosolids, so the actual treatment capacity of this plant is much less than design. It is recommended the City take Pond 1 offline to dry the solids for mechanical removal at a cost of approximately $516,000. If the pond is wet dredged, the removal cost is estimated to be $4,350,000.
- **CIP 2** - Infiltration and Inflow Reduction Improvement Plan. CIP 2 has been designated as a top priority to be completed by the City. These improvements would include collection system evaluation, cleaning and television inspection, smoke testing, I/I analysis, evaluation of structural and physical conditions, and repair and replacement cost scenarios. By implementing the procedures discussed in this section, the City would have a modified, systematic annual approach to removing I/I from its collection system piping and, at the same time, rehabilitate its aging collection system through replacement and/or repair.
- **CIP 3** - Lagoon Aerator Improvements. It is recommended the City either clean all the rags out of the lagoons and prevent rags from entering in the future or install an alternative aeration system. The estimated cost for an alternative aeration system is approximately $500,000.
- **CIP 4** - Golf Course Irrigation Improvements. The disposal system includes the irrigation system for the golf course, the irrigation system for the pasture, and the constructed wetlands. The golf course irrigation ponds need to be dredged, and the pumps and sprinklers need to be replaced in the future. The cost estimated by the City for these improvements is approximately $700,000.

The estimated costs of the identified improvements categorized under the CIP funding category are presented on Figure 5-6. The reference numbers shown on the figure were assigned based on City-established priorities (1 - highest and 4 - lowest).

Further detailed evaluation of the proposed CIP improvements impact on sewer rates is presented in a Wastewater Rate Study prepared by GEL Oregon, Inc., and Anderson Perry & Associates, Inc., as part of the overall planning efforts related to this WWFP. Project financing and implementation is discussed in Chapter 7.

Summary of Estimated Costs

System Development Charge (See Figure 5-4)

Collection System and Lift Station Improvements	$4,210,000

Capital Improvements Plan (See Figure 5-6)

I/I Reduction Improvement Plan	$100,000 per year
Lagoon Aerator Improvements	$500,000 (current fiscal year budget)
Lagoon Biosolids Removal	$516,000
Golf Course Irrigation Improvements	$700,000

The estimated costs represent 2017 dollars. As project funding is established, costs should be projected to the year of the anticipated expenditure to account for inflation.

Preliminary Environmental Review of the Selected Wastewater System Improvements for the City of Prineville, Oregon - Wastewater Facilities Plan 2017

Introduction

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

Affected Environment/Environmental Consequences

Land Use

The City of Prineville is located in northwestern Crook County in central Oregon. The Population Research Center at Portland State University approximated the population of Prineville at 9,253 in 2010, based on the 2010 Census. The majority of land in the vicinity is privately owned and is either residential or used for livestock grazing or irrigated crop farming. Located at an elevation of 2,877 feet above mean sea level, the Prineville area is situated in the high desert area east of the Cascade Mountains and west of the Ochoco National Forest. The City occupies 6.65 square miles. The main access to Prineville is via the Madras Highway (OR 26) or the Ochoco Highway (OR 126). The City of Prineville adopted an updated Comprehensive Plan in April 2007.

The proposed collection system improvements are within the City limits and the UGB. These improvements are not anticipated to require a conditional use permit.

Important Farmland

The soils in the Prineville area are generally considered good for farming and agriculture. The primary soil types in the Prineville vicinity are summarized on Table 5-2. In general, the soils are classified in variations of loam.

TABLE 5-2
FARMLAND CLASSIFICATION, SUMMARY BY MAP UNIT,
CROOK COUNTY, OREGON

Map Unit Symbol	Map Unit Name	Rating
013	Dryck loam, 0 to 2 percent slopes	Prime Farmland if Irrigated
014	Powder silt loam, 0 to 2 percent slopes	Prime Farmland if Irrigated
015	Metolius ashy sandy loam, 0 to 2 percent slopes	Prime Farmland if Irrigated
016	Crooked-Stearns complex, 0 to 2 percent slopes	Farmland of Statewide Importance
020	Boyce silt loam, 0 to 2 percent slopes	Prime Farmland if Irrigated and Drained

One of the proposed collection system improvements is located on Lamonta Road, which is adjacent to an Exclusive Farm Use (EFU) zone. All of other the proposed collection system improvements are within the UGB and are not located on EFU land. None of the collection system improvements are anticipated to affect prime farmland; if farmland could be impacted by the project (particularly the Lamonta Road segment), consultation under the Farmland Protection Program would be necessary.

Formally Classified Lands

Formally classified lands are lands designated by federal, state, and local governments for special purposes. These include parks, monuments, landmarks, historic trails, wild and scenic areas, wilderness areas, Native American-owned lands, etc.

A number of City parks are in the vicinity of the proposed project, including Gary A. Ward Park, Davidson Park, and Ochoco Creek Park. No impacts to formally classified lands are anticipated.

Floodplains

The Deschutes subbasin is located in central Oregon in the high desert. The Crooked River watershed, within the Deschutes subbasin, is the largest eastside tributary to the Deschutes River. The South Fork Crooked River and Beaver Creek join the North Fork Crooked River east of Prineville. The Crooked River flows immediately south of Prineville and reaches its confluence with the Deschutes River northwest of Prineville and southwest of Madras. The Deschutes River is a tributary of the Columbia River. In total, the Crooked River extends nearly 125 miles east to west from its source to the Deschutes River.

According to the Federal Emergency Management Agency (FEMA) Map Service Center, FEMA Flood Insurance Rate Map Panel Numbers 41013C0385C, 41013C0403C, 41013C0412C, 41013C0411C, 41013C0384C, 41013C0415C, and 41013C0416C (dated February 2, 2012) have been assigned to the project area.

Small lengths of the proposed collection system improvements appear to be located within FEMA Zone AE, an area located within the 100-year flood zone, and other flood areas. Construction activities will consist of burying main lines and restoring the sites to preconstruction conditions. No permanent impacts to the 100-year flood zone are anticipated. Any activity within floodplains will be required to comply with applicable local floodplain development standards.

Wetlands

The National Wetlands Inventory Map identified several Freshwater Emergent Wetlands within the project vicinity. A wetland determination/delineation should be completed prior to construction. Wetlands will be avoided if possible. If avoidance is impracticable or unfeasible, permits will be obtained and appropriate environmental documents will be prepared prior to construction.

Cultural/Historic Resources

A search of the National Register of Historic Places was conducted. Five historic buildings are listed within the City of Prineville. The majority of the collection system main line improvements will be located on 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 Oregon Administrative Rules 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 survey, testing, and/or permitting may be required to comply with state laws.

Biological Resources

Important fish and wildlife habitat in the proposed project area includes the Crooked River, Ochoco 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.

One of the proposed collection system improvements appears to cross an irrigation ditch. This project is not anticipated to have impacts to waterbodies. Potential crossings are anticipated to be accomplished in the least environmentally damaging way possible (e.g., boring, crossing on established roadways, etc.). 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

The Crooked River, Ochoco Creek, Ryegrass Ditch, and several distribution canals are the primary surface waters located in the vicinity of Prineville. Some of the proposed collection system improvements would occur in the vicinity of waterbodies, 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 the Deschutes Groundwater Mitigation Area regulations do not apply. No impacts to groundwater are anticipated.

Socioeconomic/Environmental Justice

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

Completion of the proposed collection system improvements project is necessary to provide adequate wastewater 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 Prineville's ordinances. According to Josh Smith, City Planner, the dust ordinance simply states that activity cannot create a "nuisance." Smith noted that this is complaint-based and can usually be addressed by spraying water on the affected areas to reduce dust.

The project has the potential to temporarily affect air quality. Short-term impacts would 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 proposed project. It is unlikely that the Oregon Department of Environmental Quality (DEQ) would require air quality permits for the proposed project.

Noise

The proposed collection system 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.

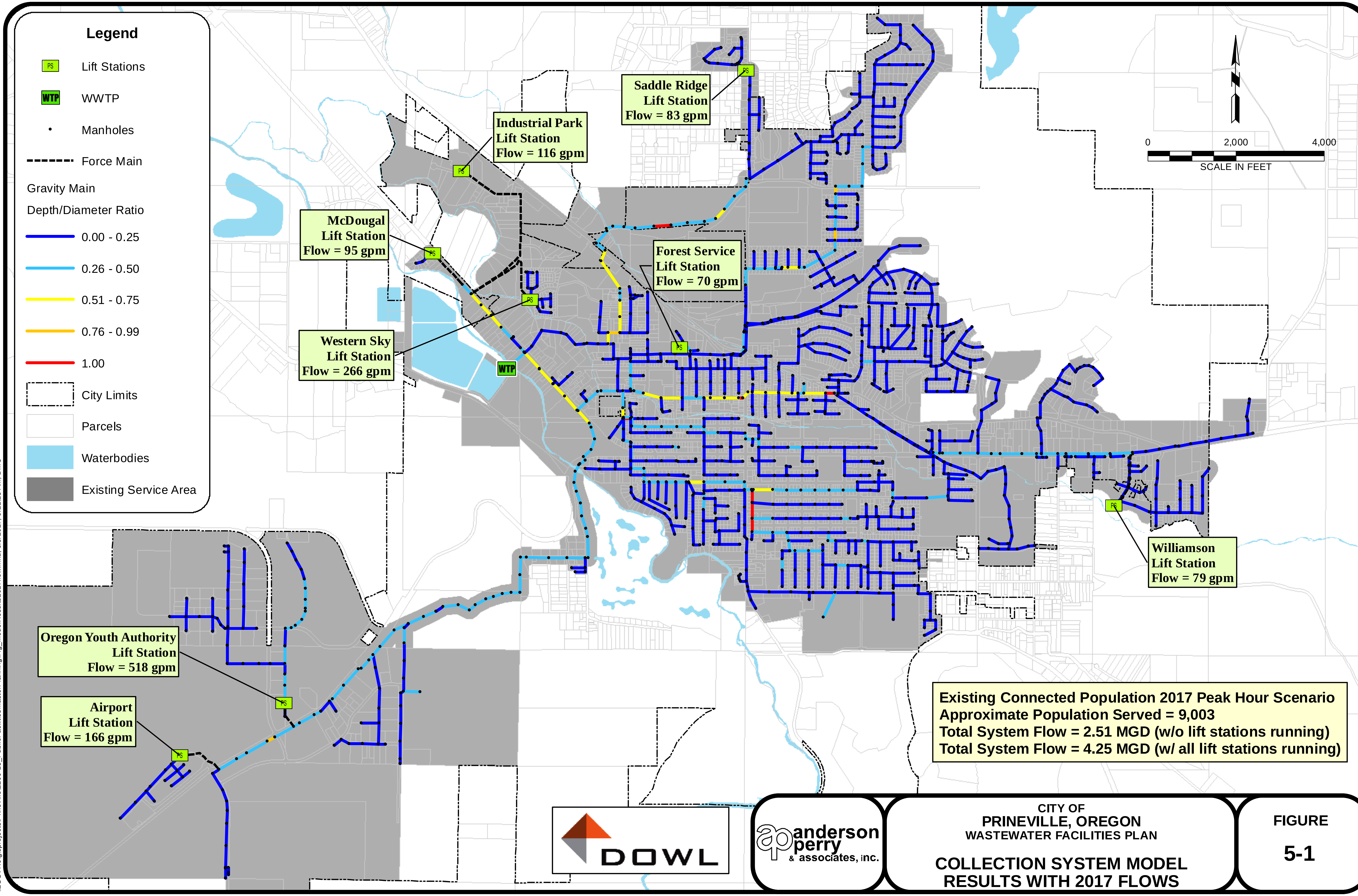
Traffic

During construction there may be temporary increases in traffic due to construction vehicles. No permanent or long-term impacts to transportation are anticipated as a result of the proposed project.

Hazardous Material

According to the DEQ, there is potential for buried asbestos cement (AC) pipe in the work areas. The City of Prineville installed AC pipe for their water and sewer systems from 1960 through the latter part of the 1970s. The proposed collection system main lines will potentially cross existing AC lines.

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, 61 cleanup sites are located in the vicinity of the City of Prineville; however, none appear to be adjacent to the collection system improvements area. No environmental records were found adjacent to the project corridor. Additional hazardous materials analysis may be required during the project design phase.



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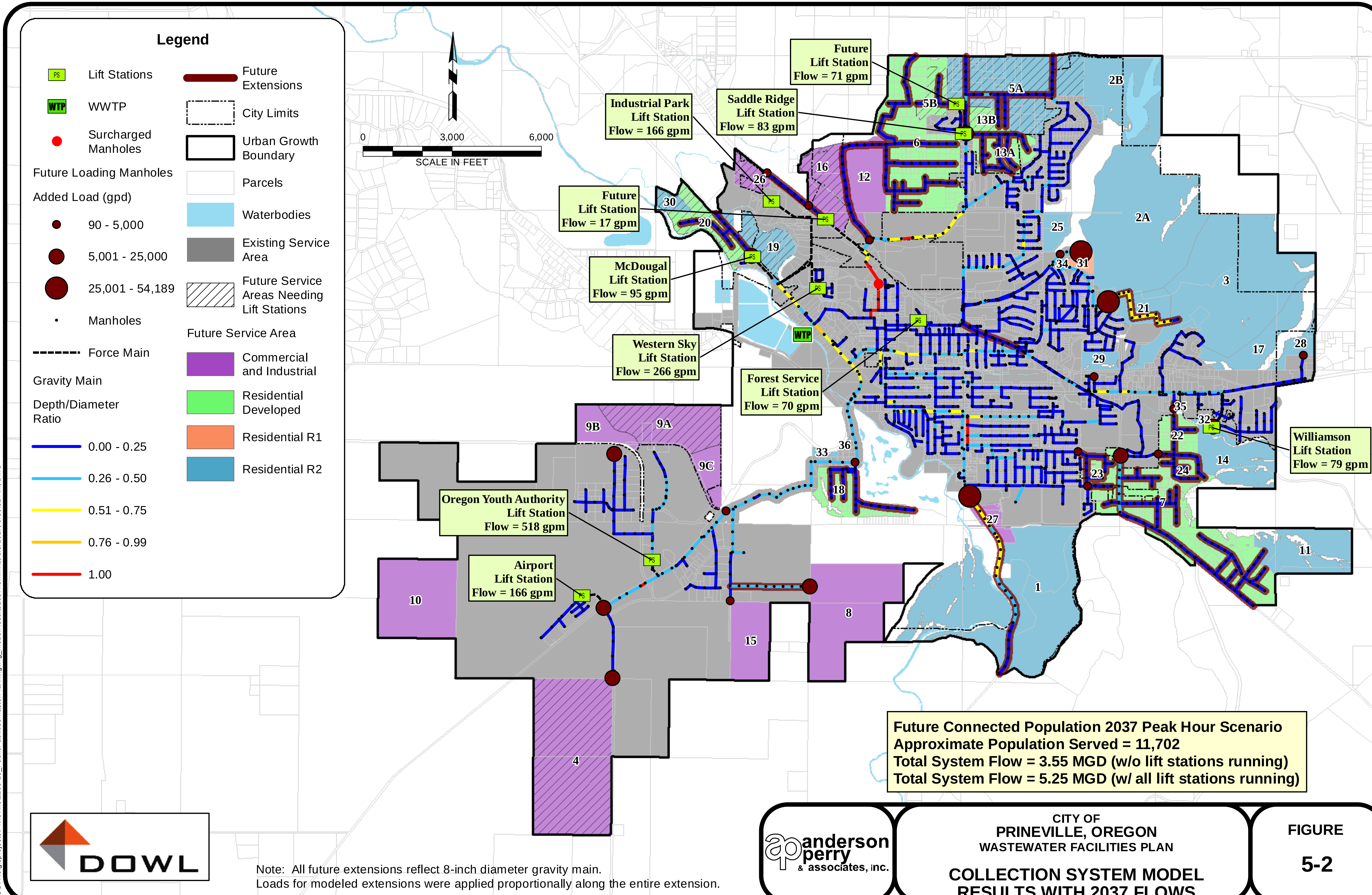

Legend
Lift Stations
WWTP
Surcharged Manholes
Future Loading Manholes
Added Load (gpd)
90 - 5,000
5,001 - 25,000
25,001 - 54,189
Manholes
Force Main
Gravity Main
Depth/Diameter Ratio
0.00 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 0.99
1.00
Future Extensions
City Limits
Urban Growth Boundary
Parcels
Waterbodies
Existing Service Area
Future Service Areas Needing Lift Stations
Future Service Area
Commercial and Industrial
Residential Developed
Residential R1
Residential R2
0 3,000 6,000
SCALE IN FEET
Future Lift Station Flow = 71 gpm
Industrial Park Lift Station Flow = 166 gpm
Saddle Ridge Lift Station Flow = 83 gpm
Future Lift Station Flow = 17 gpm
McDougal Lift Station Flow = 95 gpm
Western Sky Lift Station Flow = 266 gpm
Forest Service Lift Station Flow = 70 gpm
Williamson Lift Station Flow = 79 gpm
Oregon Youth Authority Lift Station Flow = 518 gpm
Airport Lift Station Flow = 166 gpm
WTP
Future Connected Population 2037 Peak Hour Scenario
Approximate Population Served = 11,702
Total System Flow = 3.55 MGD (w/o lift stations running)
Total System Flow = 5.25 MGD (w/ all lift stations running)
Note: All future extensions reflect 8-inch diameter gravity main.
Loads for modeled extensions were applied proportionally along the entire extension.
DOWL
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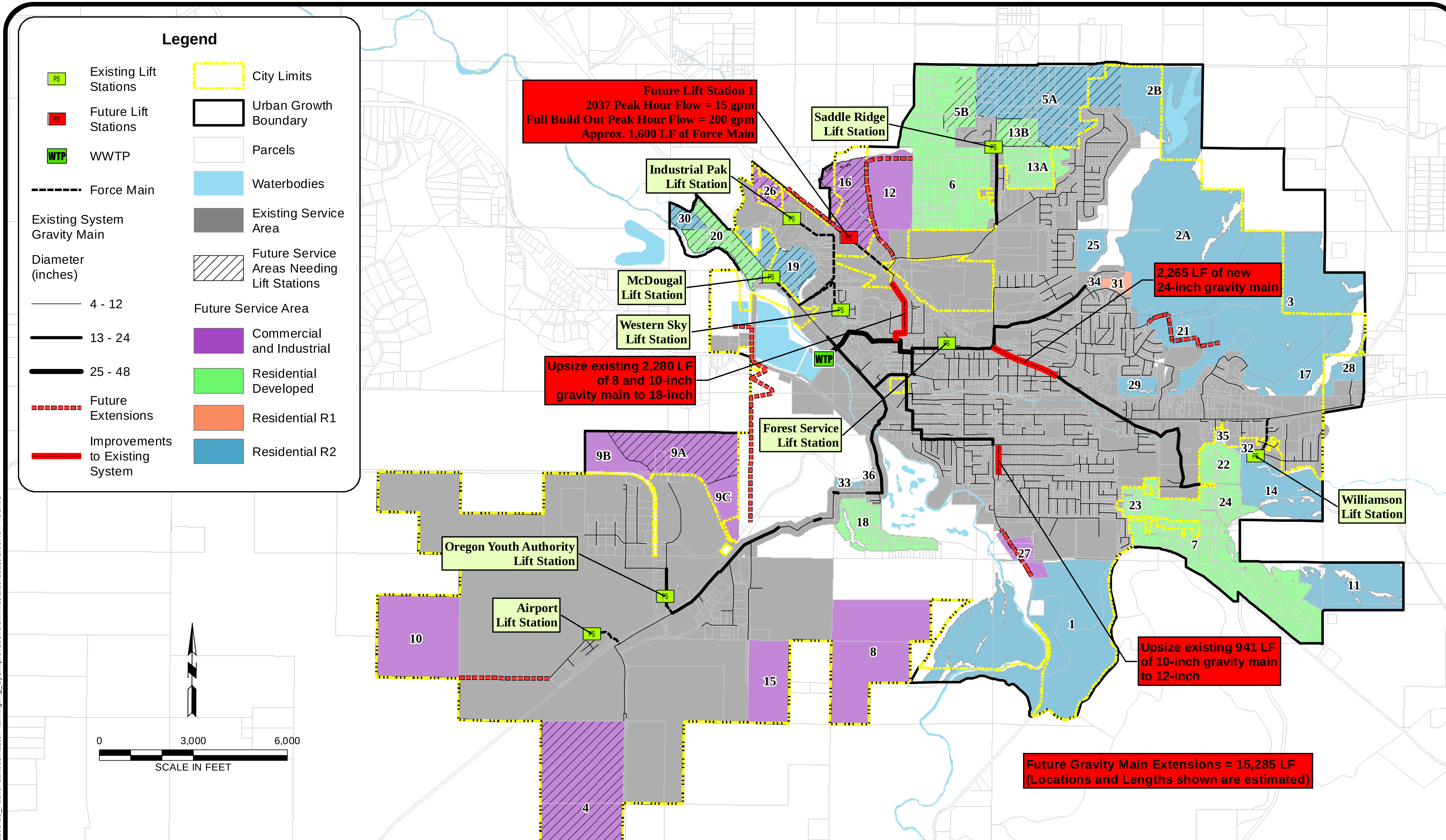
CITY OF PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN
COLLECTION SYSTEM MODEL RESULTS WITH 2037 FLOWS
FIGURE 5-2



DOWL

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CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN
COLLECTION SYSTEM IMPROVEMENTS FOR 2037 DESIGN CRITERIA

FIGURE
5-3

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CITY OF PRINEVILLE, OREGON
PROPOSED SYSTEM DEVELOPMENT CHARGE-FUNDED IMPROVEMENTS
COLLECTION SYSTEM IMPROVEMENTS
ESTIMATED PROJECT COST
June 2017

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization, Bonding, and Insurance	L.S.	$ 142,000	All Req'd	$ 142,000
2	Temporary Protection and Direction of Traffic/Project Safety and Quality Control	L.S.	20,000	All Req'd	20,000
3	8-inch PVC Gravity Sewer Line[1]	L.F.	30	15,285	458,550
4	12-inch PVC Gravity Sewer Line[1]	L.F.	45	8,941	402,345
5	18-inch PVC Gravity Sewer Line[1]	L.F.	60	2,280	136,800
6	24-inch PVC Gravity Sewer Line[1]	L.F.	65	2,265	147,225
7	Precast Manhole (48-inch)	Each	4,000	300	1,200,000
8	Precast Manhole (60-inch)	Each	5,000	25	125,000
9	Remove Existing Manhole	Each	1,200	6	7,200
10	Connection to Existing Main Line	Each	1,000	12	12,000
11	Sewer Service Connection	Each	500	50	25,000
12	Asphalt Surface Restoration	L.F.	30	5,486	164,580
13	4-inch Forcemain	L.F.	25	1,600	40,000
14	Lift Station	L.S.	250,000	All Req'd	250,000
				Subtotal	**$ 3,130,700**
				Existing Lift Station Improvements	81,000
				Administration, Legal, Engineering, and Contingencies @ 35%	1,095,745
				TOTAL ESTIMATED PROJECT COST (2017)	**$ 4,307,445**

[1] Cost estimates for gravity sewer mains include excavation and backfill.

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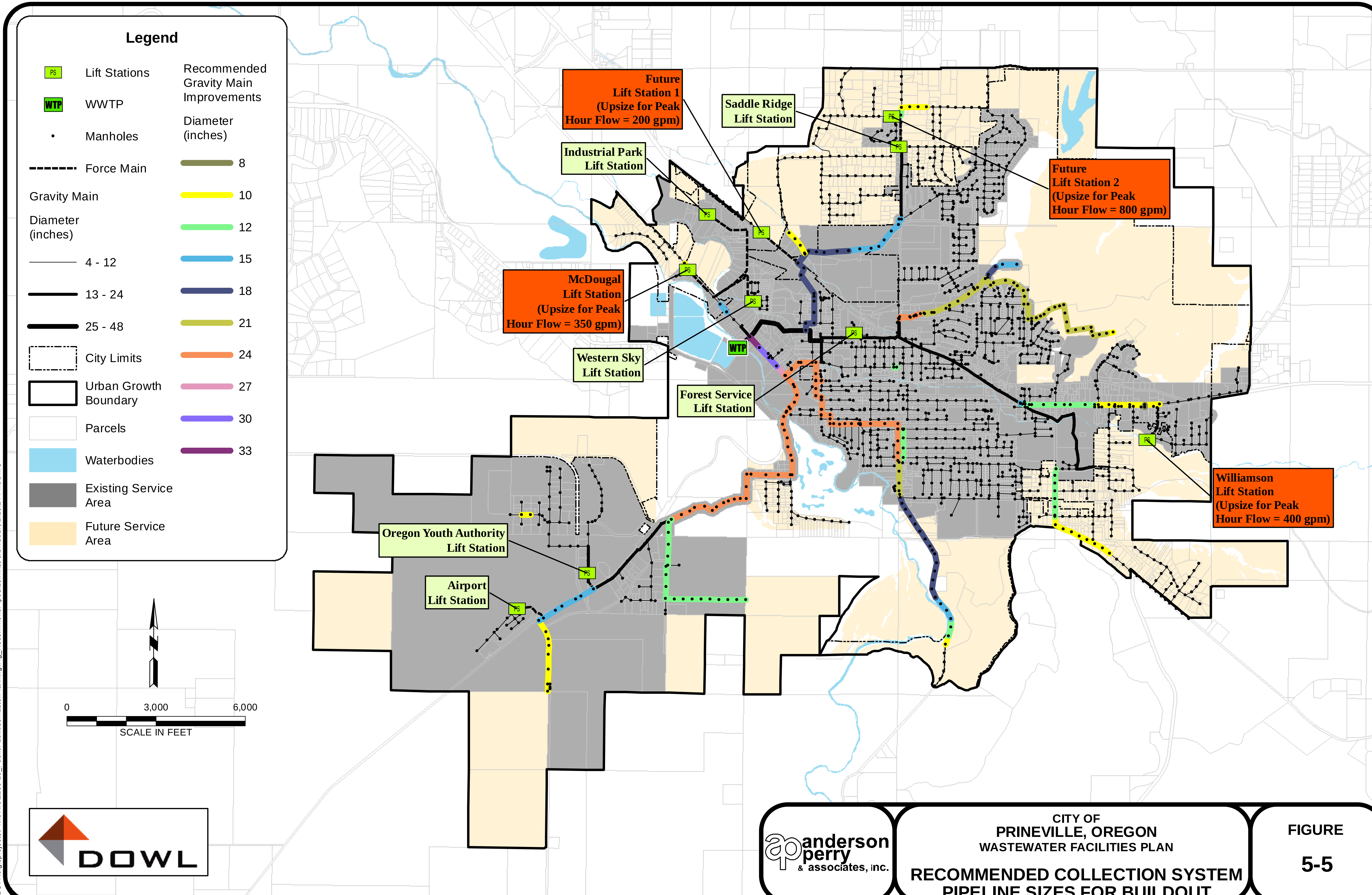
CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

COLLECTION SYSTEM IMPROVEMENTS
PRELIMINARY COST ESTIMATE

FIGURE
5-4



CITY OF PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

RECOMMENDED COLLECTION SYSTEM PIPELINE SIZES FOR BUILDOUT

FIGURE 5-5

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CITY OF PRINEVILLE, OREGON
PROPOSED CAPITAL IMPROVEMENTS PLAN-FUNDED IMPROVEMENTS
ESTIMATED PROJECT COSTS
(YEAR 2017 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE		ESTIMATED QUANTITY	TOTAL PRICE	
CIP 1: Plant 1 Pond 1 Biosolids Removal							
1	Mobilization/Demobilization	LS	$	21,000	All Req'd	$	21,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS		5,000	All Req'd	$	5,000
3	Biosolids Removal (30 Percent Solids)	CY		17,000	25	$	425,000
					Subtotal	**$**	**451,000**
					Construction Contingency Cost (10%)		50,000
					Total Estimated Construction Cost	**$**	**501,000**
					Biosolids Management Plan		15,000
					TOTAL ESTIMATED IMPROVEMENT COST (2017 DOLLARS)	**$**	**516,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE		ESTIMATED QUANTITY	TOTAL PRICE	
CIP 2: Collection System Improvements - Annual Infiltration and Inflow Reduction Improvement Plan							
1	Mobilization/Demobilization	LS	$	5,000	All Req'd	$	5,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS		10,000	All Req'd		10,000
3	Collection System Evaluation, Cleaning, Smoke Testing, and Television Inspection	EA		15,000	All Req'd		15,000
4	Collection System Replacement/Repair	EA		60,000	All Req'd		60,000
					Subtotal		**$90,000**
					Construction Contingency Cost (11%)		10,000
					TOTAL ESTIMATED IMPROVEMENT COST (2017 DOLLARS)		**$100,000**

Note: These improvements are occuring annually and are based on a future annual allotment of $100,000.
Cost for line items may change depending on the improvements being completed in any given year.

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CITY OF
PRINEVILLE, OREGON
WASTEWATER FACILITIES PLAN

ESTIMATED PROJECT COSTS

FIGURE
5-6

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 3: Wastewater Treatment Facility Improvements - Lagoon Aerator Improvements					
1	Mobilization/Demobilization	LS	$ 17,000	All Req'd	$ 17,000
2	Project Safety	LS	5,000	All Req'd	5,000
3	New Aeration System Including Valves and All Associated Appurtenances	LS	348,000	All Req'd	348,000
				Estimated Construction Cost	**$ 370,000**
				Construction Contingency Cost (15%)	55,000
				Total Estimated Construction Cost	**$ 425,000**
				Preliminary, Design, and Construction Engineering (20%)	75,000
				TOTAL ESTIMATED IMPROVEMENT COST (2017 DOLLARS)	**$ 500,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 4: Wastewater Treatment Facility Effluent Disposal Improvements - Golf Course Irrigation Improvements					
1	Mobilization/Demobilization	LS	$ 25,000	All Req'd	$ 25,000
2	Project Safety	LS	5,000	All Req'd	5,000
3	Polyvinyl Chloride Lateral Lines Including Valves	LS	125,000	All Req'd	125,000
4	Main Line, Pumps, and Associated Appurtenances	LS	150,000	All Req'd	150,000
5	Pond Improvements Including Sludge Removal and Replacing Liners	LS	200,000	All Req'd	200,000
				Subtotal	**$ 505,000**
				Construction Contingency Cost (15%)	75,000
				Total Estimated Construction Cost	**$ 580,000**
				Preliminary, Design, and Construction Engineering (20%)	115,000
				Environmental Report, Cultural Resources Investigation, Permitting, Plan Reviews (5%)	5,000
				TOTAL ESTIMATED IMPROVEMENT COST (2017 DOLLARS)	**$ 700,000**

Chapter 6 - Project Financing and Implementation

General

This chapter briefly outlines alternatives for financing the City of Prineville's wastewater system improvements. A summary of federal and state funding programs is presented, including a review of funding options potentially available to the City for the wastewater system improvements. To construct some or all of the proposed improvements, a financing plan acceptable to the City of Prineville must be developed to complete the improvements.

A detailed analysis of the City's current wastewater rate structure was completed as part of the City's master planning process. Refer to the Wastewater Rate Study prepared by GEL Oregon, Inc., and Anderson Perry & Associates, Inc., for a comprehensive evaluation of wastewater rate options to fund the selected wastewater system improvements while maintaining adequate revenue to support operation and maintenance (O&M) and other system expenditures.

The City is currently planning to complete the identified improvements as funds are developed from user rates and the System Development Charge (SDC) fees. If improvements are needed before sufficient funds are developed, then an alternative funding source is needed.

Federal and State Grant and Loan Programs

Financing public improvements projects is a complex issue that must be resolved before a project can move beyond the planning stage. The cost of providing local financing for wastewater system improvements often exceeds the financial capability of local businesses and residents. Federal and state financing programs are in place that may allow the City of Prineville to access low interest loans and, possibly, grants. Federal and state programs are designed to keep monthly user rates affordable, simultaneously making the improvements project possible.

A number of federal and state grant and loan programs can provide assistance to Oregon cities for municipal improvement projects. These programs offer various levels of funding aimed at different types of projects. These include programs administered by the U.S. Department of Agriculture Rural Development (RD), the U.S. Economic Development Administration (EDA), Business Oregon (BO), the Oregon Department of Environmental Quality (DEQ), and others. These agencies can provide low interest loan funding, and possibly grant funding, to assist rural communities with public works projects. Most of these agencies will require sewer rates that equal or exceed the City of Prineville's Affordability Index of approximately $32 per month to support a loan for wastewater system improvements, both as a condition of receiving monies and prior to being considered for grant funds.

The following section briefly summarizes the primary funding programs available to assist the City of Prineville with a wastewater system improvements project. It should be noted that the monthly user rates discussed in this section can represent a combination of monthly usage fees and taxes.

Summary of Federal Grant and Loan Programs

U.S. Department of Agriculture Rural Development

RD can provide financial assistance to communities with a population less than 10,000 through both loans and direct grants. The interest rate for these bonds is dependent on the median household income (MHI) of the community and other factors, and varies from year to year based on other economic factors nationally. The fixed interest rate is generally in the 2 to 3 percent range, with a repayment period of up to 40 years. For the City of Prineville, the reported MHI for 2015 is $30,291, which will likely qualify the City for low interest rates with a repayment period of up to 40 years through this program. Applying for this type of funding is a fairly lengthy process involving development of an Environmental Report and a detailed funding application.

The agency generally requires communities to establish average residential user costs in the range of similar systems with similar demographics before the community qualifies for grant funds. Typical monthly cost requirements are in the $45 to $50 per month range. Loans without grant funds may be acquired from RD that may not require rates to reach this level, depending on the results of an RD funding analysis. The user costs must provide sufficient revenue to pay for all system O&M costs and pay for the local debt service incurred as a result of the project. All project costs above this level may be paid for by grant funds, up to given limits, which are usually not more than 45 percent of the total project cost. 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 pay.

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 if such a reserve does not already exist. 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 information later in 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 and possibly grant funds from RD are likely options for the City of Prineville to implement wastewater system improvements and are evaluated later in this chapter.

U.S. Economic Development Administration

The EDA grant and loan 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 has invested a great deal of money in Oregon to fund public works improvements projects in areas where new industries are locating or planning 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 wastewater system improvements can be linked directly to industrial expansion or job retention, the City is not likely to be in a competitive position to receive funding from the EDA.

Hardship grants may also be available through this program for rural communities that have:

1. Fewer than 3,000 residents with no access to a centralized wastewater treatment/collection system or need improvements to on-site systems.

2. A community per capita income of less than 80 percent of the national average.
3. An unemployment rate exceeding the national average by one percentage point or more.

Prineville may meet some these criteria, so a hardship grant through the EDA may be available.

Summary of State Funding Programs

Business Oregon Finance Programs

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 infrastructure and other facilities that support economic and community development. Loans and grants are available to municipalities for planning, designing, purchasing, improving, and constructing municipally owned facilities, replacing owned essential community facilities, and emergency projects as a result of a disaster.

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 is able to 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. Grants are limited to projects associated with job creation/retention. 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. Unless the City of Prineville can tie the needed improvements to job creation, the SPWF is not a likely funding source for wastewater system improvements.

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 this is primarily a loan program, grants are available for municipalities that meet eligibility criteria. The 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). The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10 million per project, 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.

The maximum grant is $750,000 per project based on a financial analysis. An applicant is not eligible for grant funds if the applicant's annual MHI is equal to or greater than 100 percent of the state average MHI for the same year. The State of Oregon's annual MHI in 2014 was $50,521. The City of Prineville's annual MHI in 2015 was $30,291, which is 59.1 percent of the statewide MHI. The Water/Wastewater program is a potential funding source for the proposed Prineville Wastewater System Improvements project.

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 federally funded grant program. The state receives an annual allocation from Housing and Urban Development for the CDBG program. Grant funding is subject to the 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 equal to or greater than 51 percent. The State of Oregon's 2015 MHI was $51,243. The City of Prineville's percentage of low to moderate income is 44.40 percent, based on the BO's 2015 Low/Moderate Income Summary Data used by the CDBG program, so funding from the CDBG program does not appear to be available to the City of Prineville. It is important to note these data are updated annually and should be monitored to see if the City becomes eligible for CDBG program funds in future years.

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.

Oregon Department of Environmental Quality

Clean Water State Revolving Fund Program

This program, administered by the DEQ, provides low interest rate loans to public agencies for the planning, design, and construction of various projects that prevent or mitigate water pollution (e.g., wastewater treatment facilities), as well as for some publicly owned estuary management and non-point source control projects. Priority in the agency's ranking process is always given to projects addressing documented water quality problems and health hazards.

Under the Clean Water State Revolving Fund (CWSRF) program rules, interest rates on all standard design and/or construction loans are set at 65 percent of the municipal bond rate as of the quarter preceding signing of the loan agreement. These percentages vary from 25 to 55 percent of the bond rate depending on the length of the repayment period. In 2016, loans for design and construction for small communities had an interest rate that varied from 1.14 to

1.30 percent, with repayment of 15 years or up to 30 years, depending on the MHI and other factors. In addition, fees were assessed to cover program administration costs by the DEQ. A servicing fee of 0.5 percent of the outstanding balance is collected annually, and a loan reserve equal to 50 percent of the annual debt service is also to be set aside in a separate fund. This program has also implemented measures for principal forgiveness or hardship grants to be allocated to cities in combination with loans. The DEQ CWSRF program is an attractive low interest loan and potential grant source for the City of Prineville, although priority in the agency's ranking process would need to be sought by the City.

Funding Program Summary

It appears that more than one funding source is available to the City, potentially including the BO's Water/Wastewater program and the DEQ's CWSRF program. These programs appear to be sources that can provide the funds needed to potentially make the proposed improvements financially feasible for the City, if immediate implementation is needed, or desired.

It is important for the City to consult with funding agencies early in the project development stages to ascertain which funding programs the City would be eligible to receive funding for their proposed improvements and understand which funding programs would provide the best funding package for the proposed improvements. This consultation with funding agencies may be done at a "One Stop" meeting.

Local Financing Options

Regardless of the ultimate project scope and agency from which loan and grant funds are obtained, the City 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 authorization to incur debt.

There are generally two options a city may use for its bonding authority (authorization to incur debt): 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 City Council action authorizing the sale of revenue bonds, if the City Charter allows. If more than 5 percent of the registered voters 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 typically required for the BO and CWSRF programs. Due to current tax measure limitations in Oregon, careful consultation with experienced, licensed bonding attorneys needs to be made if the City of Prineville begins the process of obtaining bonding authority for the proposed wastewater system improvements. It would be wise for the City to consult its City Charter and City attorney to see if debt for the wastewater system can be assumed.

Implementation Steps

The key to implementing part or all of the City of Prineville's wastewater system improvements is the City's ability to finance them. The City will have to work closely with its citizens to inform them of the system needs and the necessity for increased sewer user costs. It is also possible for the City to complete the identified improvements by seeking funding assistance from both state and federal funding sources.

The wastewater system improvements outlined herein are anticipated to provide the City with a higher quality wastewater system with significantly improved reliability. The funding sources outlined in this chapter are potential sources of loans and grants for the City to consider if an improvements project is pursued.

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