City of Prineville, Oregon
Water System Master Plan

2023

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

3818 SW 21st Street - Suite 302 Redmond, Oregon 97756
(541) 362-8682
www.andersonperry.com

WATER SYSTEM MASTER PLAN

FOR

CITY OF PRINEVILLE, OREGON

2023

ANDERSON PERRY & ASSOCIATES, INC.

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

 Job No. 1260-36

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Executive Summary

Introduction

This Executive Summary briefly summarizes the results of the Water System Master Plan (WSMP) prepared by Anderson Perry & Associates, Inc., for the City of Prineville, Oregon. The recommendations outlined hereafter have been developed in cooperation with the Prineville City Council and City staff. The focus of this WSMP is on the City's water system components, including the water supply, storage, and distribution systems. This WSMP includes an analysis of the existing systems and their performance, an evaluation of system needs and improvement alternatives, and development of a financial plan and project implementation plan. Included in this Executive Summary is a brief discussion of the population, design criteria, summary of the evaluation and needs of water system components, categories of improvements and summary of costs, and project financing and implementation. For a more detailed discussion of the information presented in this Executive Summary, refer to the individual chapters of this WSMP.

Population

To estimate future water system demands, population projections must be made. Projections are usually made based on an annual percentage increase estimated from past growth rates combined with future expectations. The City of Prineville's population at the 2020 Census was 10,736. The certified population estimate by the Population Research Center (PRC) at Portland State University for 2021 was 11,042, with a predicted average annual growth rate of 1.1 percent between the years 2022 and 2042.

The historical population plus the projected annual growth rate results in a 20-year (year 2042) population estimate of 13,743. This WSMP uses 13,743 as the 20-year design population inside the city limits.

It is important to note that an estimated 812 people within the city limits do not receive City-supplied water, and an estimated 295 people outside the city limits but within the urban growth boundary (UGB) do receive City-supplied water. Therefore, the net 2022 population served by City-supplied water is estimated to be 10,525. A review of historical water data must be completed using the connected population. Improvements to the distribution system are needed 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 UGB. If 20 percent of these areas are annexed into the City in addition to the 812 people not currently connected, the connected population could increase by 1,297 people to 11,822 without any additional people moving into the area.

To obtain a realistic population that could require service from the water system in the next 20 years, a design population of 14,722 in the year 2042 was estimated by utilizing the average annual growth rate values declared by the PRC with the addition of the anticipated future connected population.

Design Criteria

When establishing design standards for a water system, primary consideration must be given to state and federal rules and regulations governing water quality and construction standards for water systems. These regulations are set by both the U.S. Environmental Protection Agency (EPA) and the Oregon

Health Authority - Drinking Water Services (DWS). In addition to these public health and safety requirements, many other factors control the design parameters for municipal water systems. The City must evaluate factors such as financial feasibility, philosophy, and policies of the City Council; past system performance and service; and expectations of the water users. All of these factors are important and can influence the standards by which water system improvements are created.

Chapter 2 presents design criteria for evaluating the existing water system and developing improvements to satisfy present and future needs. Application of these criteria is discussed further in the specific chapters that address the water supply, storage, and distribution system facilities.

Existing Water System

The City of Prineville utilizes water drawn from groundwater wells tapped into the aquifer beneath the valley floor and the Airport Area Aquifer System. Twenty-eight groundwater wells are used, 17 of which pump into a Water Treatment Plant for treatment prior to entering the distribution system. The City uses four aboveground reservoirs in the Valley Floor area and two aboveground reservoirs in the Airport Area for storage. The six combined reservoirs have a capacity of 4.5 million gallons (MG) of storage.

In 2019, the City acquired a Limited License to begin pilot testing for an aquifer storage and recovery (ASR) injection and recovery operation. The ASR program is intended to increase storage during periods of reduced demand and for use during periods of high demand. More detailed information regarding the ASR program is included in this WSMP.

The distribution system began operation in the 1920s and, therefore, is composed of an assortment of pipe sizes and materials. Throughout its history, the City has grown beyond the original system and has upgraded much of the original distribution system to improve flow, pressure, and circulation.

Water Quality Requirements

The City of Prineville's water system comes under the jurisdiction of the DWS. The DWS assumed primary responsibility from the EPA in February 1986 for enforcement of the federal Safe Drinking Water Act. Therefore, the City works primarily with DWS as the regulating agency with regard to their water system. The City has not had any water quality violations but has had 14 cases of late/nonreporting violations, all of which have been returned to compliance.

In summary, many regulations affect the operation of the City of Prineville's water system. The City has good water quality with a well-run system meeting federal and state water quality criteria.

Summary of Supply, Storage, and Distribution Systems' Evaluation and Needs

Supply

At this time the City has enough source capacity to meet current and future demands. It is desirable to design a system with enough source capacity to provide for peak daily demands without requiring the well pumps to operate 24 hours per day. The 2042 peak daily flow requirement is estimated to be 5,220 gallons per minute (gpm). The current capacity from the City's 11 wells and Crooked River Wellfield is approximately 6,436 gpm based on current water rights withdrawal rate limits. As a preliminary step the City should explore water right improvements for existing sources to allow higher withdrawal rates to further maximize existing source production. With additional water rights, the City could begin developing additional wells in the Deschutes Regional Aquifer within the Airport Area or by constructing additional wells in the Valley Floor area. Both options are currently being explored, and additional source capacity has recently been constructed in the Valley Floor area. The City and its partners continue to evaluate water sources and the necessary water rights in order to acquire additional capacity for future growth. Once the study is completed, the information needed to compare alternatives will be available, and the City will have the required data and documentation to make the best long-term decision to meet supply capacity needs.

Storage

The City currently has six operating storage reservoirs with a total volume of 4.5 MG. With the exception of the Ochoco Heights reservoirs, the existing condition of the reservoirs is generally good to very good. The recommended storage needed for the 20-year planning period is 5.9 MG, so the City should add another 1.4 MG of storage within the planning period. Additionally, maintenance and rehabilitation improvements are recommended for the Ochoco Heights reservoirs as discussed below.

Anticipated future growth in east Prineville will require expansion of two existing water system pressure zones, Williamson and Barnes Butte. The expansion of these two pressure zones will allow additional water to move into the Valley Floor Pressure Zone through the use of pressure reducing valves (PRVs). A new 1.0 MG reservoir is recommended to be constructed in connection with the growth in this area to provide adequate system pressures and fire protection. The lower of the two pressure zones would be served by gravity flows from the new reservoir. A booster pump station would be necessary to provide adequate pressures to fill the new reservoir. While this improvement will not directly impact the Barnes Butte Pressure Zone, it is anticipated that the additional pressure downstream of the Williamson, Wilco, and Combs Flat PRVs will help to maintain pressure and stored water volume in the Barnes Butte Pressure Zone.

As discussed in Chapter 4, a new larger reservoir (1.5 MG) is recommended to be constructed at the existing Ochoco Heights reservoirs site. This would enable the existing reservoirs to continue to serve the system as the new reservoir is constructed. Once the new reservoir is constructed and in operation, one of the existing 0.5 MG reservoirs can be taken out of service to complete renovations and repairs. Once the rehabilitation work is complete, the renovated and repaired reservoir would work in conjunction with the new reservoir, providing a total of 2.0 MG storage at the site. The second existing 0.5 MG reservoir would be demolished.

Distribution

As detailed in Chapter 5, the City's distribution system is generally well looped and provides adequate system-wide pressures under normal operating conditions. Fire flow availability is limited in some areas of the system due to several undersized main lines and areas of higher elevation. The undersized main lines in the system result in both fire flow capacity limitations and water circulation issues. Some of these lines, where improved fire flow capacities are needed, are recommended for upgrading. It is recommended the City complete improvements to the distribution system to eliminate as many deteriorating and undersized main lines as possible and provide improved system fire flow capacities in areas lacking adequate fire flows. Key water distribution system improvements have been identified to meet the following objectives:

- Improve water quality and circulation by replacing old, undersized, deteriorating pipe. Increase flow capacity to the existing system to provide adequate fire flows to residential, commercial, and industrial areas.
- Replace existing small diameter or wood stave water pipes. Upsize water pipes in key locations to increase fire flow.
- Connect existing homes in the Fairview, Crestview, and Seehale areas to City water.
- Improve the system to serve future growth.
- Construct a new transmission main, booster pump station, and reservoir to serve growth in the east portion of the City. This improvement will also eliminate some of the low-pressure problems currently experienced in the system at higher elevation areas by reducing the amount of water released through PRVs.
- Construct a new reservoir and booster pump station at Ochoco Heights. Refurbish one existing 0.5 MG reservoir and demolish the other 0.5 MG reservoir.
- Construct future mains and booster pump stations to serve growth within the UGB.

To meet these objectives, address identified deficiencies and support growth and development, the recommended water system improvements have been identified and are shown on Figure ES-1.

Categories of Improvements and Summary of Costs

The City of Prineville's intent is to complete water system improvements utilizing the following funding categories:

System Development Charge (SDC)

Improvements identified under the SDC category were developed to address those needs in the system to specifically support growth and associated increased system demands.

Capital Improvements Plan (CIP)

Improvements identified under the CIP category include capital improvements projects that need to be completed to address existing system deficiencies irrespective of growth.

Proposed water system improvements under the SDC funding category are shown on Figure ES-1. A summary of the identified improvements and estimated costs categorized under the SDC funding category are shown on Figure ES-2. It should be noted the reference numbers shown on the figure 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.

The CIP identifies and prioritizes short-, medium-, and long-term capital projects of all types based on the water system master planning process. Capital water 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 water system improvements projects will be prioritized with the most urgent projects first, or projects that should be completed as part of another improvement, such as street reconstruction. Ongoing operating costs are not included in the CIP estimated project costs.

Development of a CIP is a collaborative effort between the City manager, 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.

A summary of the identified improvements and associated costs categorized under the CIP funding category are shown on Figure ES-3. It should be noted the reference numbers shown on the figure have been assigned based on City-established priorities (1 being the highest and 11 being the lowest). The priorities are based on the relative urgency of addressing the identified existing deficiencies that are recommended regardless of population growth and associated development.

The estimated costs represent 2023 dollars. As project funding is established, costs should be projected to the year of the anticipated expenditure to account for inflation. It should be noted that due to the COVID-19 Pandemic and other global geopolitical issues, the current construction market pricing is abnormally high. This should be considered when projecting cost estimates for future water system improvements projects.

Action Items and Implementation Schedule

To move forward with completing the water system improvements summarized in this WSMP, the following actions are recommended.

Action Items

The City will need to:

- Submit and obtain approval of this WSMP from the DWS.
- Finalize and adopt this WSMP and the recommended improvements once agencies review and approve the draft WSMP.
- Review and update the City's Comprehensive Plan to incorporate the findings of the WSMP.
- Hold public information meetings to inform citizens of the need for and scope of the improvements projects, answer questions, and explain the need for potential increases in user fees.
- Develop a funding plan for the desired improvements during the time frames indicated in the CIP.
- Begin discussions with property owners to identify available lands for potential land acquisition associated with recommended improvements.
- Develop the required permitting (e.g., new water rights, boring under highways, river crossings, etc.)
- Obtain additional water rights to secure additional, future City water supply sources.

- Prepare funding applications, as applicable, for the associated water system improvements projects and submit them to the appropriate funding agencies.

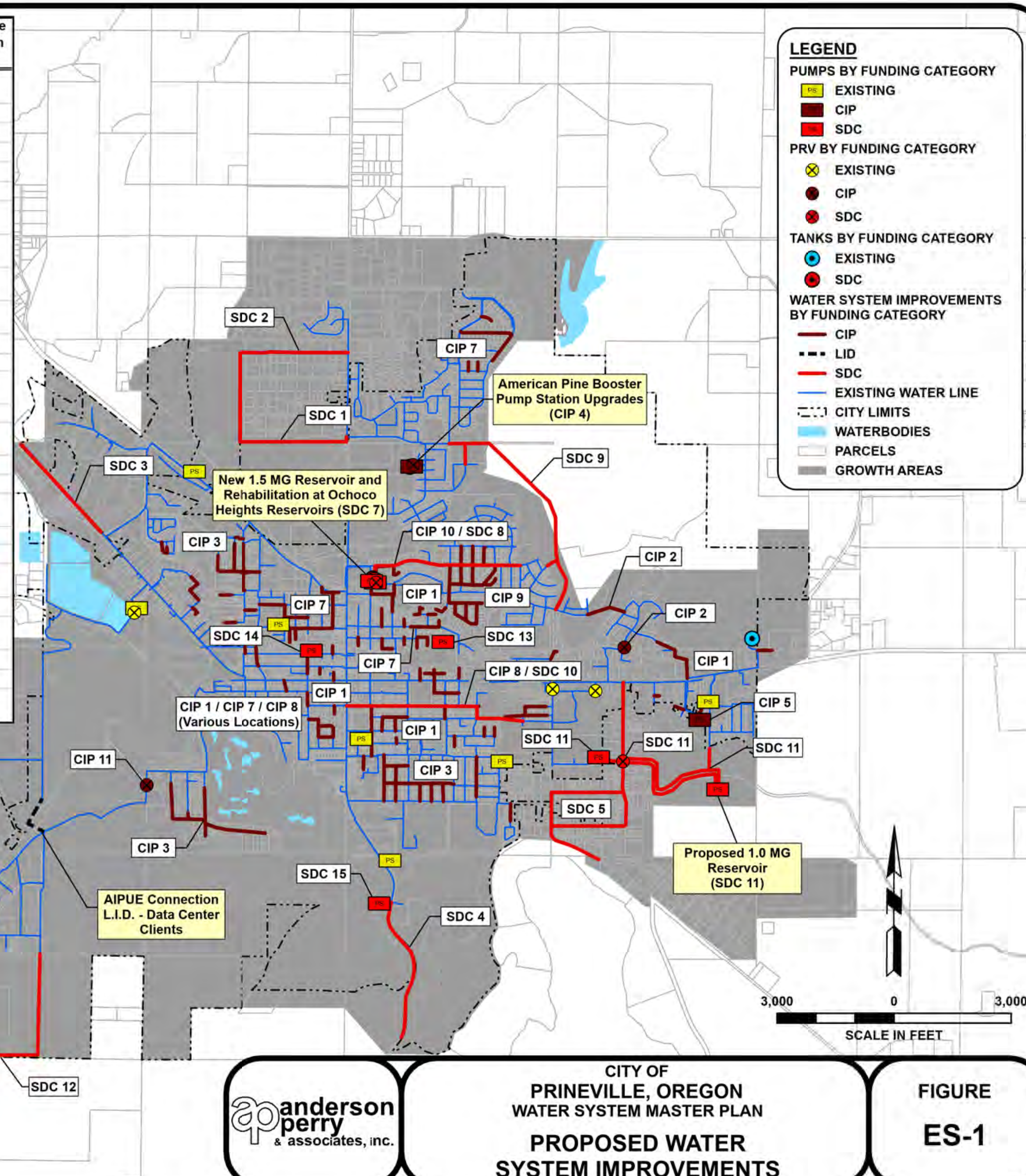
Recommended Improvements Summary Implementation Plan

To implement the recommended improvements, the City will need to secure monies to fund these improvements, while working closely with its citizens to inform them of the water system needs and the necessity for a possible increase in water user rates.

Water system improvements as outlined in this WSMP are intended to provide the City with a reliable, quality water system that will meet the needs of the City for the 20-year planning period and beyond. As development occurs, water system improvements will help the City meet these needs. With the CIP approach, the City may reduce or eliminate the need to borrow additional funds to complete some of the improvement projects. However, this approach can limit the speed at which more expensive improvements are implemented. If the City wishes to implement the water system improvements immediately due to rapid growth or aging infrastructure, funding from outside agencies would be needed. However, growth related improvements can also be funded from the SDC funding category, which is discussed further in Chapter 6. All of the options may require water user rates to be raised to adequately fund the recommended improvements over the 20-year planning period.

For a more detailed discussion of the City's financial status and project financing options, see Chapter 7.

Improvement No.	Improvement Description	Approximate Pipe Length (LF)
CIP 1	Replace existing small diameter (less than 6 inches) piping and wood stave piping and replace existing wrapped steel piping with new minimum 8-inch PVC water line.	36,470
CIP 2	Connect Ochoco Heights Pressure Zone to lower pressure zones.	1,000
CIP 3	Connect existing City residences not connected to City water.	12,460
CIP 4	American Pine booster pump station upgrades.	N/A
CIP 5	Reconstruct Stearns Well.	N/A
CIP 6	System-wide supervisory control and data acquisition upgrade.	N/A
CIP 7	Proposed improvements to increase existing system fire flows (upsize 6-inch pipe or install pipe where no pipe exists).	7,120
CIP 8	Replace existing outside diameter and wrapped main line on 1st Street between Main Street and Combs Flat.	5,600
CIP 9	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 6-inch PVC water line).	4,080
CIP 10	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 8-inch water main line).	1,485
CIP 11	Park Drive pressure reducing valve upgrades.	N/A
SDC 1	Proposed 12-inch main line extension west of Main Street to serve future development south of Reata.	4,020
SDC 2	Proposed 12-inch main line extension west of Main Street to serve future development west of Main Street.	3,950
SDC 3	Proposed 12-inch main line extension north of Gardner to serve new development along Highway 26.	2,800
SDC 4	Proposed 16-inch extension south of Main Street to serve new development southeast of the Water Treatment Plant, and the installation of a BPS and pressure reducing valve.	3,600
SDC 5	Proposed Williamson Pressure Zone piping with BPS.	10,000
SDC 6	Aquifer storage and recovery Wells No. 2 and 3.	300
SDC 7	Construct a new Ochoco Heights reservoir, demolish an existing reservoir, rehabilitate an existing reservoir, and install a BPS with a permanent backup generator.	N/A
SDC 8	Proposed increase of existing 6-inch main line to 12-inch to increase system flows in Ochoco Heights.	4,080
SDC 9	Proposed 16-inch transmission main line from east side of Prineville to Northridge.	6,400
SDC 10	Proposed increase of existing 6-inch main line to 12-inch to better serve central system east of Main Street.	5,600
SDC 11	Proposed new 1.0 million gallon reservoir (to serve new pressure zone).	7,900
SDC 12	Proposed Airport Pressure Zone piping (distribution mains to connect undeveloped areas to City system).	13,000
SDC 13	Construct a new Juniper Well.	N/A
SDC 14	Construct a new 5th Street Well.	N/A
SDC 15	Construct a new 3,000 gallon per minute Ranney horizontal collector well at the Crooked River Wellfield.	N/A



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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
PROPOSED WATER SYSTEM IMPROVEMENTS

FIGURE
ES-1

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CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF PROPOSED SDC-FUNDED IMPROVEMENTS AND ESTIMATED PROJECT COSTS
(YEAR 2023 COSTS)

Improvement No.[1]	Improvement Description	Approximate Pipe Length (LF)	Total Estimated Costs
SDC 1	Proposed 12-inch main line extension west of Main Street to serve future development south of Reata.	4,020	$ 1,700,000
SDC 2	Proposed 12-inch main line extension west of Main Street to serve future development west of Main Street.	3,950	1,914,000
SDC 3	Proposed 12-inch main line extension north of Gardner to serve new development along Highway 26.	2,800	1,010,000
SDC 4	Proposed 16-inch extension south of Main Street to serve new development southeast of the Water Treatment Plant, and the installation of a BPS and pressure reducing valve.	3,600	2,579,000
SDC 5	Proposed Williamson Pressure Zone piping with BPS.	10,000	5,066,000
SDC 6	Aquifer storage and recovery Wells No. 2 and 3.	300	5,052,000
SDC 7	Construct a new Ochoco Heights reservoir, demolish an existing reservoir, rehabilitate an existing reservoir, and install a BPS with a permanent backup generator.	N/A	7,231,000
SDC 8[2]	Proposed increase of existing 6-inch main line to 12-inch to increase system flows in Ochoco Heights.	4,080	1,118,000
SDC 9[3]	Proposed 16-inch transmission main line from east side of Prineville to Northridge.	6,400	3,021,000
SDC 10	Proposed increase of existing 6-inch main line to 12-inch to better serve central system east of Main Street.	5,600	1,313,000
SDC 11	Proposed new 1.0 million gallon reservoir (to serve new pressure zone).	7,900	8,775,000
SDC 12	Proposed Airport Pressure Zone piping (distribution mains to connect undeveloped areas to City system).	13,000	5,466,000
SDC 13	Construct a new Juniper Well.	N/A	850,000
SDC 14	Construct a new 5th Street Well.	N/A	850,000
SDC 15	Construct a new 3,000 gallon per minute Ranney horizontal collector well at the Crooked River Wellfield.	N/A	3,327,000
	TOTAL ESTIMATED SDC-FUNDED IMPROVEMENTS COST (2023 DOLLARS)		**$ 49,272,000**

[1] The SDC-funded improvements are not listed in order of priority. The improvement to be completed first will depend on where growth and development occur within the City.

[2] Cost to increase in size for future growth. Replacement cost shared with CIP 9.

[3] Cost to increase in size for future growth. Replacement cost shared with CIP 8.

BPS = booster pump station

CIP = Capital Improvements Plan

LF = linear feet

N/A = not applicable

SDC = system development charge

CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF PROPOSED CIP-FUNDED IMPROVEMENTS
AND ESTIMATED PROJECT COSTS
(YEAR 2023 COSTS)

Improvement No.[1]	Improvement Description	Approximate Pipe Length (LF)	Total Estimated Costs	Time Frame When Improvements Completed
CIP 1	Replace existing small diameter (less than 6 inches) piping and wood stave piping and replace existing wrapped steel piping with new minimum 8-inch PVC water line.	36,470	$ 14,708,000	0 to 40 years
CIP 2	Connect Ochoco Heights Pressure Zone to lower pressure zones.	1,000	2,379,000	0 to 10 years
CIP 3	Connect existing City residences not connected to City water.[2]	12,460	6,272,000	0 to 10 years
CIP 4	American Pine booster pump station upgrades.	N/A	325,000	0 to 10 years
CIP 5	Reconstruct Stearns Well.	N/A	693,000	0 to 10 years
CIP 6	System-wide supervisory control and data acquisition upgrade.	N/A	1,207,000	0 to 10 years
CIP 7	Proposed improvements to increase existing system fire flows (upsize 6-inch pipe or install pipe where no pipe exists).	7,120	2,463,000	0 to 20 years
CIP 8	Replace existing outside diameter and wrapped main line on 1st Street between Main Street and Combs Flat.[3]	5,600	1,483,000	0 to 20 years
CIP 9	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 6-inch PVC water line).[4]	4,080	1,166,000	0 to 20 years
CIP 10	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 8-inch water main line).	1,485	764,000	0 to 20 years
CIP 11	Park Drive pressure reducing valve upgrades.	N/A	42,000	10 to 20 years
	TOTAL ESTIMATED CIP-FUNDED IMPROVEMENTS COST (2023 DOLLARS)		**$ 31,502,000**	

[1] Improvements listed in order of City-identified priority, with CIP 1 being the highest priority and CIP 11 being the lowest. CIPs 1, 3, and 10 will be pursued as funding allows. Individual improvements will be selected due to extreme deficiency, increased maintenance costs, system growth, or the ability to coordinate work with other City projects.

[2] Funding source to be determined.

[3] Replacement cost only. Increase in size for future growth capacity captured in SDC 10.

[4] Replacement cost only. Increase in size for future growth capacity captured in SDC 8.

LF = linear feet
N/A = not applicable
PVC = polyvinyl chloride
SDC = system development charge

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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF PROPOSED CIP-FUNDED IMPROVEMENTS AND ESTIMATED PROJECT COSTS

FIGURE
ES-3

Chapter 1 - Introduction

Purpose of Study

In 2018, Anderson Perry & Associates, Inc. (AP) completed a Water System Master Plan (WSMP) for the City of Prineville. Due to population and commercial growth beyond expectations, as well as the development of new water supply sources, the City has requested a comprehensive update to the 2018 WSMP. This WSMP is intended to replace the 2018 WSMP and provide updated information on which future operation of Prineville's municipal water system can be based. This WSMP is also intended to satisfy the criteria of the Oregon Health Authority - Drinking Water Services (DWS) and Oregon Administrative Rules 333-061-0060. This WSMP is intended to fulfill the DWS requirements for a current master plan for the next 20 years.

Preparation of this WSMP was authorized by an agreement between the City and AP, dated March 18, 2022. The primary purposes for developing this WSMP are to establish water system design criteria for a 20-year planning period; evaluate the adequacy of the existing water supply, treatment, storage, and distribution systems; evaluate alternatives and priorities for improving the City's water system; and identify a financial plan for implementing the recommended improvements. This WSMP will also serve as the basis for updating the existing Capital Improvements Plan (CIP) based on the identified improvements and priorities.

Organization of Study

This WSMP is divided into seven main chapters with an Executive Summary and Appendices. Specifically, the WSMP includes the following:

- The Executive Summary of the overall WSMP describes water quality and service goals (design criteria), present and future water system deficiencies, the City's selected and prioritized improvements for achieving the goals and correcting the deficiencies, and the recommended implementation schedule and financing program for constructing improvements.
- Chapter 1 - Introduction discusses the objectives of the WSMP, describes the community and environment, and provides a brief history of past development and operation of the City of Prineville's water system.
- Chapter 2 - Water System Requirements develops the data on which recommended improvements to the water system are based. Data relating to elements such as service area, population, land use, water use, fire flows, state and federal regulations, and the design criteria developed for this WSMP are presented. A description is also provided of the water quality and level of service goals (design criteria) for the water system considering existing and anticipated future regulatory requirements, non-regulatory water quality needs of water users, flow and pressure requirements, capacity needs related to water use, and fire flow needs.
- Chapter 3 - Water Supply and Treatment discusses the operation, capacity, and quality of the existing water supply and treatment systems with respect to existing and future system demands and regulations. Information is presented concerning water rights and permits for the appropriation of water from various sources. An evaluation of the existing water treatment

system is also included, as well as alternatives to address current treatment system deficiencies. A comparison of alternatives to obtain additional water supply sources is also provided.

- Chapter 4 - Water Storage discusses the existing storage reservoirs, presents the four primary components of water storage relative to the City's design criteria, evaluates alternative storage facilities, and provides recommendations for storage improvements.
- Chapter 5 - Distribution System presents information related to the existing distribution system facilities and fire protection. Existing deficiencies and deficiencies likely to develop during the planning period are identified.
- Chapter 6 - Summary of Proposed Improvements and Capital Improvements Plan presents information related to water supply, treatment, storage, and distribution system improvements developed through analysis of the system. Cost estimates are provided for each of the recommended water system improvements.
- Chapter 7 - Project Financing and Implementation provides a description of alternatives to finance water system improvements including local financing such as user rates, taxes, and financing assistance programs. A recommended water system improvement implementation process, including an evaluation of financing alternatives and identification of key implementation steps, is also provided.
- The Appendices contain key materials referenced in this WSMP, which are provided for future reference by City staff. This information includes well log and water rights information, testing results, and other applicable water system information.

Sources of Information

The conclusions and recommendations outlined in this WSMP are based on data, information, and records provided by the City. This information includes, in part, past flow records (supply and usage); financial data (operational cost, revenues, and cost distribution); descriptions of system operation, condition of system components, and identification of problem areas; water quality data; and system layout and sizing. The recommendations and conclusions are, therefore, dependent on the completeness and accuracy of the base information provided.

Review and Updating of Study

This WSMP should be periodically reviewed and updated to stay current with population growth, water system demands, and changing state and federal regulations. This WSMP is recommended to be reviewed at five-year intervals and be updated at ten-year intervals, or as growth dictates.

Objectives of Study

The primary objectives of this WSMP are to:

1. Establish planning criteria including service area boundaries; population growth projections; past, present, and future water usage patterns; fire flow requirements; federal and state standards; system pressures; and service goals.
2. Analyze the individual components of the existing water supply system considering capacity, compliance with current water quality standards, water rights, condition of components,

operational dependability, and cost of operation. Develop the water supply needs for the planning period and identify alternatives for meeting long-term water supply and treatment needs. Outline general operation and maintenance requirements for the water supply system.

3. Analyze the existing water storage facilities considering capacity, condition of the reservoirs, and distribution system pressures. Assess the City's storage capacity considering emergency storage, operational storage, equalization storage, and fire flow storage. Identify the storage requirements of the water system for the planning period.
4. Develop a Geographic Information System-based map of the distribution system including line sizes, line types, valve and hydrant locations, etc., when known.
5. Utilizing existing distribution system maps, a computer model, and City records, review the condition and adequacy of the distribution system piping. Identify system deficiencies and alternatives for meeting current and future system needs. Provide estimated costs for implementation of recommended improvements.
6. Analyze the hydraulic capacity and system pressures in the existing water distribution system under average daily and peak daily demand conditions using an existing computer model. Identify distribution system deficiencies such as low system pressures, low fire flow capacities, dead-end or undersized lines, etc. Identify opportunities for distribution system improvements to address any noted deficiencies.
7. Provide a summary of the existing water department financial condition.
8. Provide information on potential state and federal grant and loan programs that may be available to assist the City in implementing any needed system improvements.
9. Prepare a summary identifying current and future water system needs with their associated estimated cost. Make recommendations for meeting the water system needs for the planning period.
10. Provide an implementation schedule for recommended water system improvements outlining the key steps the City would need to undertake to implement the improvements.

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 steep escarpments that rise to an extensive lava plateau south of the Prineville area. Location and vicinity maps and aerial maps for the City are shown on Figures 1-1, 1-2A, and 1-2B. The City of Prineville is the county seat and the only incorporated city in Crook County, with a population of 10,736 at the 2020 Census. The 2021 certified estimated population for Prineville was 11,042, as provided 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° Fahrenheit (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 the City of Prineville is approximately 48°F, and the annual average precipitation is approximately 9.9 inches.

Transportation is provided to the City of Prineville by Highways 26 and 126. The City of Prineville is positioned at the intersection of these two highways. It is located approximately 16 miles east of Highway 97, which is a major north-south highway in 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.

Location

The City of Prineville is located in central Oregon at the intersection of Highways 26 and 126, adjacent to the Crooked River in Crook County. The general location of the community is shown on Figure 1-1, Location and Vicinity Maps.

The area of analysis provided in this WSMP encompasses the entire area within the city limits and urban growth boundary (UGB), as shown on Figure 1-1.

Water System History

General

The majority of the historical information for the water system was obtained from City records; conversations with Eric Klann, Prineville Interim City Engineer; the City's Water Management and Conservation Plan prepared in 2016 by GSI Water Solutions, Inc.; and the 2018 WSMP completed by AP.

The City of Prineville owns and operates a municipal water system that obtains water from several wells. The water is stored in ground-level storage reservoirs and distributed to residential, commercial, large commercial, and public customers within the city limits and approximately 120 residences outside the city limits but within the UGB. An estimated 330 residences exist within the city limits that are currently served by private wells and are not connected to the City's water system.

The City's water system was privately owned and operated by the Deschutes Power and Light Company until 1928, when it was acquired by Inland Power and Light Company, and then sold to Pacific Power and Light in 1930. The City acquired the water system from Pacific Power and Light in January 1985.

Approximately 10 percent of the water mains are 4-inch diameter and smaller, and some are galvanized steel pipe. Over the years, the City has replaced some undersized mains and installed new mains, additional wells, and storage reservoirs.

Previous Study

The primary recommendations in the 2018 WSMP were to increase supply, storage, and distribution system capacity. These improvements included replacing existing undersized water mains, outside diameter and wrapped (O.D. and wrapped) steel pipes, and wood stave pipes, as well as developing several wells and constructing additional storage capacity and a booster pump station. In response to the 2018 WSMP, the City constructed the Airport Industrial Park Utility Extension project to better connect the airport area and valley floor sources, installed a 16-inch water line from the south side of the airport to the industrial area north of Highway 126 and west of Tom McCall Road, constructed the Crooked River Wellfield and Water Treatment Plant (WTP), retrofitted the Airport No. 4/Heliport Well for aquifer storage and recovery (ASR) injection and recovery, constructed two new wells to replace the existing Yancey Well, constructed the Lamonta No. 2 Well, completed the 4th Street Deep No. 2 Well, and removed a significant amount of wood stave and undersized pipes.

Water Supply Sources

The City's water sources are wells tapped into the alluvial aquifer beneath the Prineville valley floor and the Airport Area Aquifer System. The water is pumped from 28 groundwater wells, seven of which pump directly into the distribution system to fill four aboveground reservoirs. The four wells located near the airport pump into a fill line that supplies water to the two airport reservoirs. The remaining 17 wells pump into a raw water system to the WTP for treatment prior to entering the distribution system.

The City holds surface water rights to the Crooked River, Prineville Reservoir, and Ochoco Creek. While much of this water is used for irrigation and livestock purposes, a portion of the surface water from Prineville Reservoir, through mitigation credits, has been used for a shallow groundwater wellfield in Crooked River Park near the Crooked River. Municipal water for the City of Prineville is sourced from 11 wells that supply individually into the system as well as 17 wells in the Crooked River Wellfield that supply water to the City's WTP for treatment prior to entry into the distribution system. Seven of the individual wells and the 17 wells in the Crooked River Wellfield are located on the Prineville valley floor and appropriate water from an alluvial aquifer with a total reported production capacity of 4,750 gallons per minute (gpm). The other four wells are located west of the City and source water from the Airport Area Aquifer System, which has a reported production limit of 1,770 gpm. This aquifer is currently being monitored to determine its long-term reliability. All the wells in the system are controlled by telemetry with the exception of the Stearns Well and the Stadium Well, which are controlled manually. The well locations are shown on Figures 1-2A and 1-2B and a summary of production well data is presented on Table 3-1 in Chapter 3. A brief description of each of the City's water supply sources follows.

Stearns Well

The Stearns Well is located on S.E. Stearns Road south of Highway 26. In January 1973, the well was drilled to a depth of 246 feet below ground surface (BGS) and was artesian. A project to replace or reconstruct the Stearns Well is identified in the existing CIP to update this aging well to new well construction standards.

4th Street Deep Well/4th Street Deep No. 2 Well

The 4th Street Deep Well is centrally located in the City approximately 525 feet from the intersection of S.E. Belknap Street and S.E. 4th Street. The well was drilled to a depth of 252 feet with a diameter of 12 inches. The static water level was 22 feet BGS when the well was drilled on October 12, 1960.

In 2021, a second well was drilled at this location, which is called the 4th Street Deep No. 2 Well. It is located approximately 30 feet southeast of the existing 4th Street Deep Well. The well was drilled to a depth of 257 feet at a diameter of 24 inches, which was completed on January 24, 2022.

4th Street Shallow Well

The 4th Street Shallow Well is located adjacent to the 4th Street Deep Well. The well was drilled to a depth of 75 feet and cased to a depth of 61 feet. Construction was completed in August 1950.

Lamonta Well/Lamonta No. 2 Well

The Lamonta Well is located on Lamonta Road north of the City. Completed on September 4, 1957, the well was drilled to a depth of 256 feet with a diameter of 24 inches.

In 2020, a new well was drilled to a depth of 226 feet located approximately 37 feet northwest of the existing well.

Yancey Well/Yancey No. 2 Well/Yancey No. 3 Well

The original Yancey Well is located north of Highway 26 on N.W. Fairmont Street. The well was reportedly drilled in 1917 to a depth of 228 feet and was reconstructed in 1975.

In 2019, a new well located approximately 40 feet west of the existing well was drilled to a depth of 242 feet. The well has an 8-inch casing to a depth of 227 feet and stainless steel screen from 227 to 242 feet.

In 2022, an additional well was drilled to a depth of 243 feet. Yancey No. 3 Well is located approximately 78 feet northwest of Yancey No. 2 Well.

Stadium Well

The Stadium Well is located on 5th Street adjacent to the high school track and stadium. Construction was completed in February 1987, and the well was drilled to a depth of 259 feet. This well is utilized manually as a backup for emergencies and used only for short periods of time.

Barney Well

The Barney Well is located close to the Barnes Butte Reservoir and Stearns Well on the east side of the City. Construction was completed in December 1994, and the well was drilled to a depth of 280 feet.

Ochoco Heights Well

The Ochoco Heights Well is located adjacent to the Ochoco Heights reservoirs north of the City off Main Street. The well is currently inoperable. The well was drilled to a depth of 1,002 feet and was cased to approximately 300 feet. Construction was completed in 1943 and, at that time, the water level was 52 feet BGS.

Crooked River Wellfield

In 2017, the City began construction of a wellfield along the Crooked River south of Prineville in Crooked River Park. The wellfield was completed in 2021 and consists of 17 completed wells ranging from 84 to 140 feet deep. The wells feed collectively into a 16-inch high density polyethylene raw water pipe that delivers the raw water to the WTP, where it is treated and disinfected prior to entry into the distribution system.

Airport Area Aquifer System

There are four airport wells, each of which is located southwest of the City, neighboring the Prineville Airport. These wells appropriate water from a separate aquifer than the wells located in the Prineville valley. The aquifer is still being monitored to determine whether the aquifer is a reliable source of water. The wells were drilled between 1980 and 2014. Per information available from the well logs, the static water level appears to be deeper than other City wells, at approximately 440 feet BGS.

An elevation schematic of the water system is provided on Figure 1-3. Detailed information regarding the City's wells can be found in Chapter 3.

Water Storage Reservoirs

The City of Prineville has six aboveground covered water storage reservoirs. The total capacity of the reservoirs is 4.5 million gallons (MG).

Ochoco Heights Reservoirs

The Ochoco Heights reservoirs are identical and are located north of the City. Ochoco Heights Reservoir No. 1 was constructed in 1955. The reservoir is an aboveground welded steel tank with a diameter of 41.5 feet and a height of 50 feet. Ochoco Heights Reservoir No. 2 was built in 1964 directly adjacent to Ochoco Heights Reservoir No. 1 with the same material and dimensions. The Ochoco Heights reservoirs are filled by the wells located on the valley floor. The reservoirs feed the Ochoco Heights Booster Pump Station, which feeds the Ochoco Heights Pressure Zone, the Valley Floor Pressure Zone, and the American Pine Reservoir.

American Pine Reservoir

The American Pine Reservoir is located north of the Ochoco Heights reservoirs, south of Peters Road. Constructed in 2002, this reservoir is an aboveground welded steel reservoir. The reservoir has a diameter of 73 feet and a height of 33 feet. Because the City was unable to obtain the property for a proposed Yellowpine reservoir at the north end of the Northridge area, the City elected to construct this reservoir with a booster pump station to provide water to the Northridge area. The reservoir is fed by an altitude valve and provides water to the Northridge Pressure Zone, discussed further in Chapter 5.

Barnes Butte Reservoir

The Barnes Butte Reservoir is located near the Barney and Stearns Wells north of Highway 26. The welded steel aboveground reservoir was constructed in 1978. The reservoir is 40 feet tall with a diameter of 47 feet.

Airport No. 1 Reservoir/Airport No. 2 Reservoir

The Airport No. 1 Reservoir is an aboveground bolted steel tank built in 1996 with a diameter of 85 feet, a wall height of 24 feet, and an operating range of 22.5 to 23.8 feet. The Airport No. 2 Reservoir, built in 2014, is an 80-foot diameter welded steel tank adjacent to the Airport No. 1 Reservoir. The operating range is set to match the Airport No. 1 Reservoir.

Additional information for the City's water storage reservoirs can be found in Chapter 4. Table 1-1 provides a summary of these reservoirs.

TABLE 1-1
SUMMARY OF SYSTEM RESERVOIRS

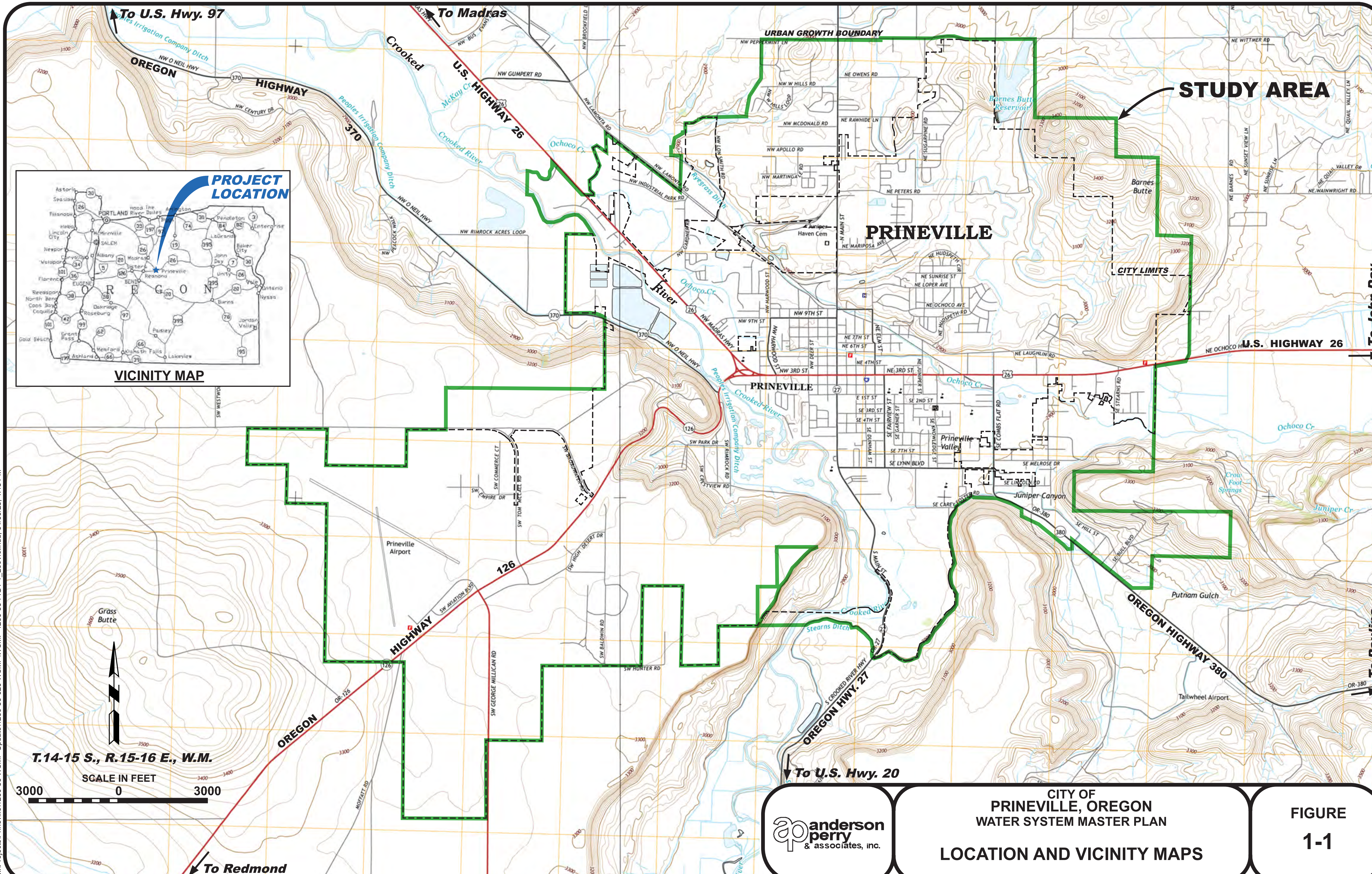
Reservoir	Volume (MG)	Completion Date
Ochoco Heights Reservoir No. 1	0.5	1955
Ochoco Heights Reservoir No. 2	0.5	1964
American Pine Reservoir	1.0	2002
Barnes Butte Reservoir	0.5	1978
Airport No. 1 Reservoir	1.0	1996
Airport No. 2 Reservoir	1.0	2014
Total	**4.5**	

Aquifer Storage and Recovery

In 2019, the City acquired a Limited License (LL-26) to begin pilot testing for an ASR injection and recovery operation. In 2019, the City began a series of three cycles of pilot testing by utilizing the Airport No. 4/Heliport Well after the well was retrofitted to accommodate the ASR injection and recovery operation. The Limited License allows for storage of up to 870 MG in up to five wells with a maximum injection rate of 1,100 gpm per well and a maximum recovery rate of 1,400 gpm per well. Further details regarding the ASR project are provided in Chapter 3.

Distribution System

The City's water distribution system consists of an assortment of pipe materials including asbestos cement, cast iron, ductile iron, steel, wood stave, and polyvinyl chloride pipe. Pipelines range in size from 1 to 18 inches in diameter. The City's distribution system main lines are primarily 6 to 12 inches in diameter, although there are also areas with smaller lines. However, distribution system improvements have been made in recent years to improve flow and pressure in the system. The distribution system is generally laid out with looped piping to assist with water circulation through the system. The City has indicated the water main lines in the distribution system are generally in fair condition. The distribution system is discussed in more detail in Chapter 5.



anderson perry & associates, inc.

CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

LOCATION AND VICINITY MAPS

FIGURE
1-1

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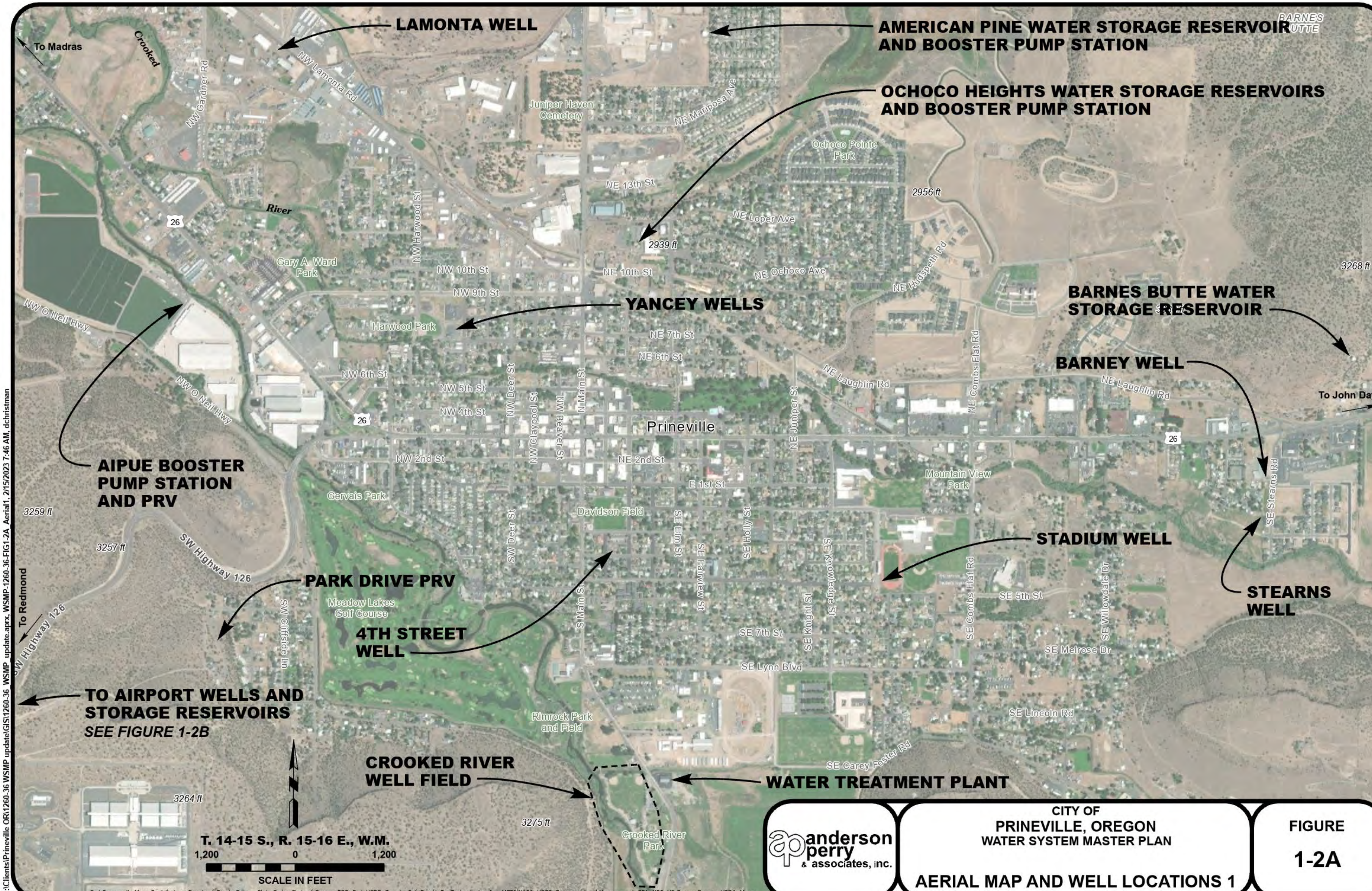

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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

AERIAL MAP AND WELL LOCATIONS 1

FIGURE
1-2A

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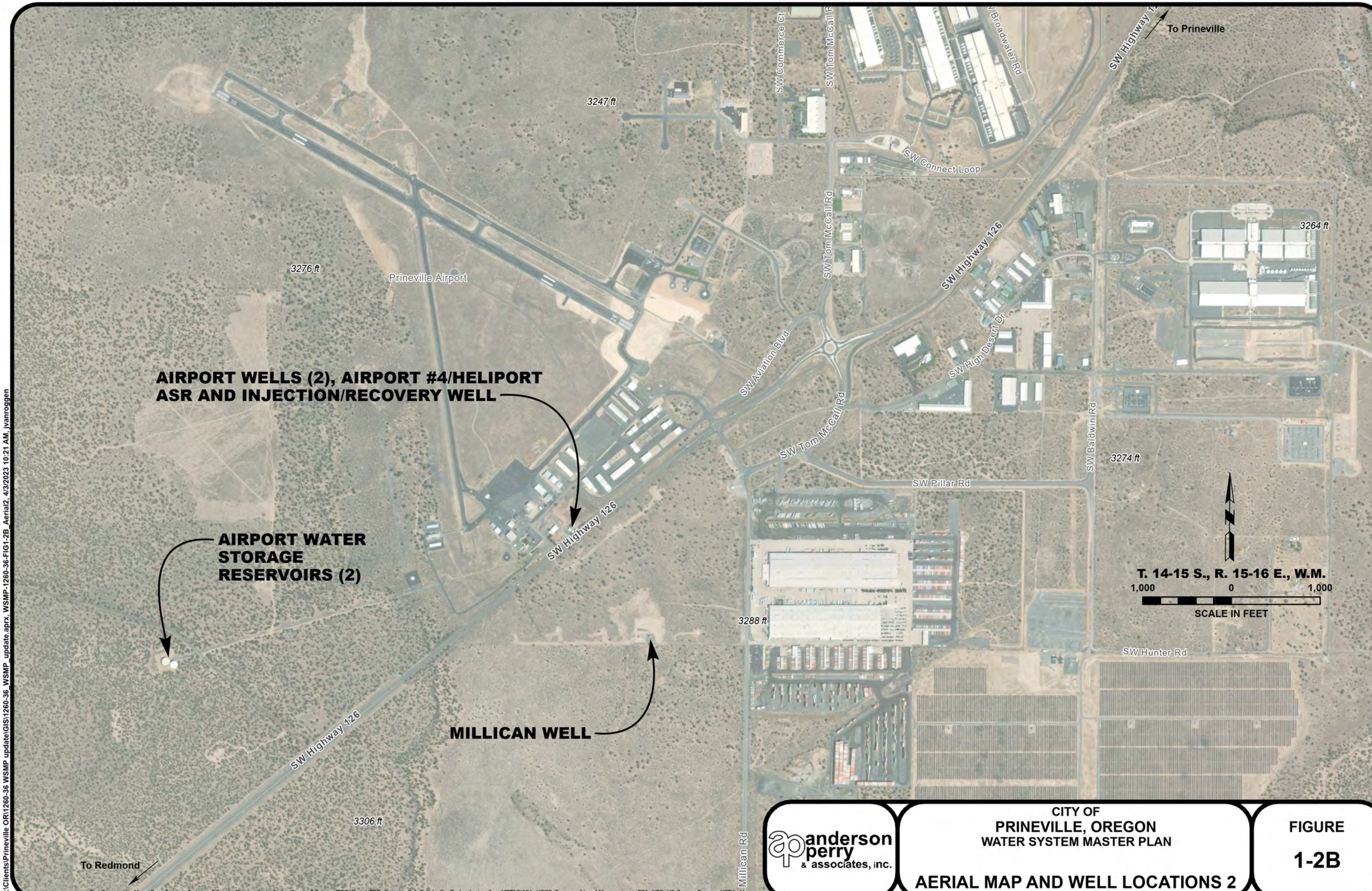

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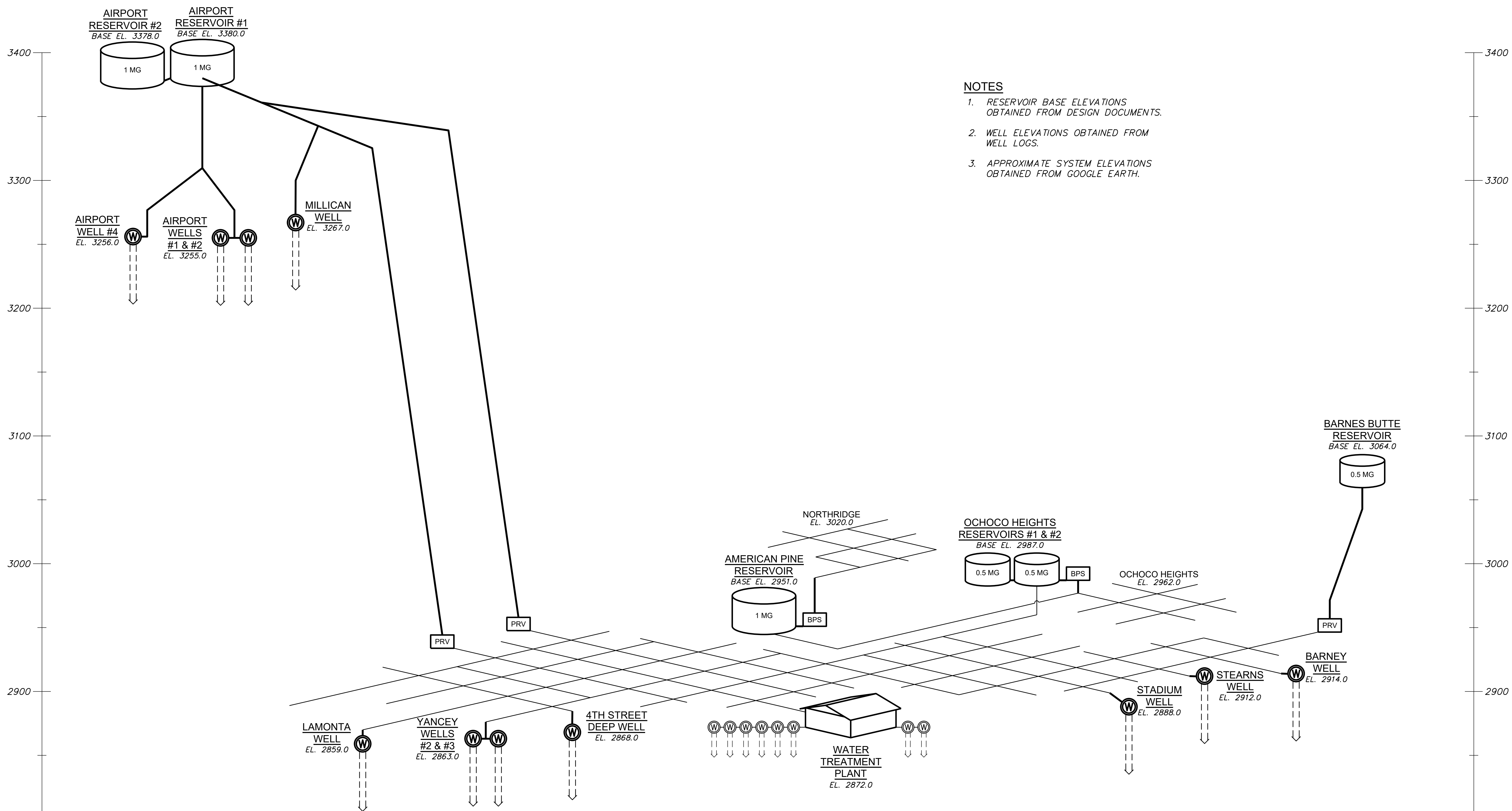
CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

AERIAL MAP AND WELL LOCATIONS 2

FIGURE 1-2B



NOTES

1. RESERVOIR BASE ELEVATIONS OBTAINED FROM DESIGN DOCUMENTS.
2. WELL ELEVATIONS OBTAINED FROM WELL LOGS.
3. APPROXIMATE SYSTEM ELEVATIONS OBTAINED FROM GOOGLE EARTH.

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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

WATER SYSTEM SCHEMATIC

FIGURE 1-3

Chapter 2 - Water System Requirements

Introduction

This chapter presents basic information from which criteria have been developed for evaluating the City of Prineville's existing water system and for defining and sizing the required components of the system for the 20-year planning period. Information concerning the service area, population projections, water use, and state and federal requirements is presented.

Service Area

The term "service area" refers to the area being served with water from the City's water system. Both the present and future service areas are considered in this Water System Master Plan (WSMP). The present service area primarily consists of the developed lands within the boundaries of the city limits; however, there is one small area serviced outside the city limits. The area is on S.W. Saddle Ridge Loop, which is outside the city limits yet inside the urban growth boundary (UGB). For the purposes of this WSMP, the future service area will consist of the present service area plus all areas within the current UGB. The City's zoning map is shown on Figure 2-1.

The service area is located in a valley known as the Crooked River-Ochoco Creek Valley. Dominant geographic features include rimrock formations in the southern part of the service area and Barnes Butte located in the northeastern portion of the area. Surface elevations range from 2,800 to 3,600 feet above mean sea level. Many areas with large tracts of undeveloped land currently exist within the UGB (see Figure 1-1 in Chapter 1). With a significant area of open, undeveloped land available, the City has the potential for residential, commercial, and large commercial growth.

Service Population and Planning Period

To estimate the demands that may be placed on a municipal water system, a determination of the population to be served must be made. Population estimates must be made with reference to time. Projections are usually made on the basis of an annual percentage increase estimated from past growth rates tempered by future expectations. It is difficult to accurately predict the population of a community over an extended period of time.

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

The City's water system serves residential, commercial, large commercial, and public customers within the city limits, with the exception of an estimated 330 residences currently served by private wells not connected to the City's water system. In addition to the customers within the city limits, the City currently serves an estimated 120 residences outside the city limits but within the UGB.

The certified 2021 population of the City of Prineville was 11,042, according to Portland State University's (PSU) Population Research Center (PRC). This agency is the official source of population data available in Oregon between the official Census data generated at the beginning of each decade.

For planning purposes, the certified population of 11,042 was utilized for the 2022 population. Assuming an average number of persons per household of 2.46 per PRC data, an estimated 812 people within the city limits do not receive City-supplied water and an estimated 295 people outside the city limits but within the UGB do receive City-supplied water. Therefore, the net 2022 population served by City-supplied water is estimated to be 10,525.

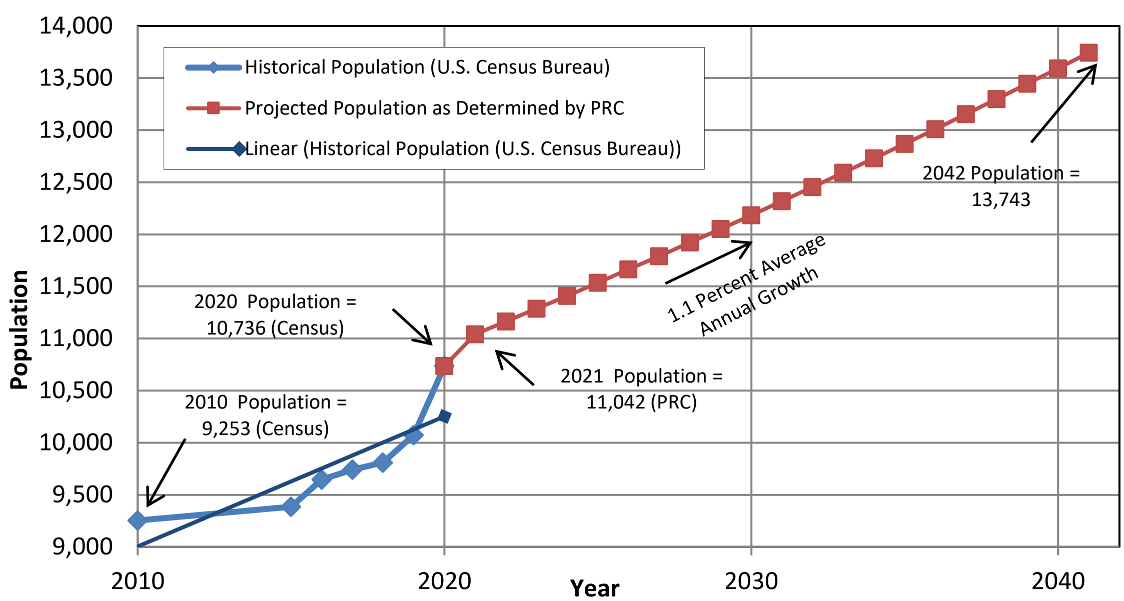
Projections are usually made on the basis of an annual percentage increase estimated from past growth rates combined with future expectations. The historical population data shown hereafter on Table 2-1 was provided by the PSU Oregon Population Forecast Program. In 2013, the Oregon legislature approved legislation assigning coordinated population forecasting to the PRC. Utilizing average annual growth rates (AAGR) provided by the PRC, historical population trends for the City are shown on Table 2-1 and Chart 2-1. The historical population data shown on Chart 2-1 for 2010 and 2020 were provided by the U.S. Census Bureau.

TABLE 2-1
HISTORICAL[1] AND FORECASTED[2] POPULATIONS

Historical			Forecast			
2010	2020	AAGR (2010 to 2020)	2021	2042	AAGR (2022 to 2047)	AAGR (2047 to 2072)
9,253	10,736	*1.6 percent*	11,042	13,743	*1.1 percent*	*1.3 percent*

[1]As provided by the U.S. Census Bureau.
[2]As provided by the PRC.
For planning purposes, the PRC's 2021 certified population was used for 2022.

CHART 2-1
HISTORICAL AND PROJECTED POPULATION



The assumed 1.1 percent AAGR between the years 2022 and 2047 results in a 2042 population of 13,743. This value takes into consideration connecting all residences within the city limits but does not include the projected growth in the UGB. When the assumed 20 percent of UGB residences are connected, the total 2042 population estimated to be served by the City's water system is 14,722. However, over the planning period of this WSMP, actual growth could exceed or fall well below the figures presented on Chart 2-1. A more detailed discussion of the design population is presented later in this chapter.

In addition to substantial residential growth within the city limits, Prineville has experienced large demands on the water system related to large commercial growth, most notably demand from data centers. The increased usage by large commercial users is not incorporated into the additional demand attributed to population growth. The projected future demands of large commercial users are estimated separately from the standard residential population growth. For Prineville, this is a significant portion of the projected future demand on the water system and is discussed in greater detail later in this chapter.

Land Use

The current zoning in the City of Prineville is shown on Figure 2-1. Four Comprehensive Plan land use designations have been identified within the city limits: residential, commercial, large commercial, and public. The majority of the City is designated for residential use. Areas along Highway 126 are primarily designated as multipurpose and airport.

Regulatory Requirements

The City of Prineville's water system is under the jurisdiction of the Oregon Health Authority - Drinking Water Services (DWS). The DWS assumed primacy (responsibility) from the U.S. Environmental Protection Agency (EPA) in February 1986 for enforcement of the federal Safe Drinking Water Act (SDWA). Therefore, the City of Prineville is currently, and will principally be, working with the DWS as the regulating agency with regard to their water system. The City is required to publish annual Consumer Confidence Reports; a copy of the 2021 Report is located in Appendix A.

Regulatory Background

The SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources (rivers, lakes, reservoirs, springs, and groundwater wells). The primary regulations associated with the SDWA address requirements concerning trace minerals, compounds, and microorganisms that may affect the health of water consumers. The SDWA provides for monitoring, testing requirements, reporting, recordkeeping, and public notification procedures in the event of non-compliance.

The 1986 amendments to the SDWA included provisions for wellhead protection, new monitoring for certain substances, filtration for certain surface water systems, disinfection for certain groundwater systems, and restrictions on lead content in pipe solder and plumbing.

The 1996 amendments to the SDWA included provisions for consumer confidence reporting, stronger protection for microbial contaminants and disinfection byproducts, operator certification, lowering maximum contaminant levels (MCL), and source water assessments.

Enacted in 1981, the Oregon Drinking Water Quality Act established periodically amended statutes and subsequent administrative rules to enforce, at a minimum, the federal SDWA requirements. The DWS focuses resources in the areas of highest public health benefit and promotes voluntary compliance with state and federal drinking water standards. The DWS also emphasizes prevention of contamination through source water protection, provides technical assistance to water system owners, and provides water system operator training. They also work closely with public water systems to ensure public notification is made in accordance with regulatory guidelines, when required. If the City is unaware of their compliance status or in need of regulatory guidance, it is recommended that the regional DWS office be contacted.

The Arsenic Rule, which became effective in February 2002, lowered the MCL for arsenic allowed in a community water system from 50 parts per billion (ppb) to 10 ppb. The City has not received any violations of this rule within the last five years.

Recent Regulatory History (Past 15 Years)

Following is a list of regulations that have been enacted in the past 15 years:

1. **Reduction of Lead in Drinking Water Act**. This requires any new installation or purchase of materials used in potable locations to be “lead-free.” Lead-free has been redefined as “(A) not containing more than 0.2 percent lead when used with respect to solder and flux; and (B) not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.” This law was enacted on January 4, 2014. Oregon requires drinking water components to be National Sanitation Foundation/American National Standards Institute Standard 61 compliant to meet the intent of this law.
2. **Stage 2 Disinfectants and Disinfection Byproduct Rule (D/DBPR)**. This rule focuses on public health protection by limiting exposure to disinfection byproducts. The D/DBPR specifically targets total trihalomethanes and five haloacetic acids, which can form in water through disinfectants used to control microbial pathogens. This rule applies to all community water systems (CWSs) and non-transient non-community (NTNC) water systems that add a primary or residual disinfectant other than ultraviolet light. Stage 2 of the D/DBPR was enacted in 2012 for large CWSs and NTNCs and in October 2013 for all CWSs and NTNC water systems.
3. **Unregulated Contaminant Monitoring Rule 5 (UCMR5)**. The EPA uses the UCMR program to collect data for contaminants suspected to be present in drinking water but that do not have health-based standards set under the SDWA. Every five years, the EPA develops a new list of UCMR contaminants, largely based on the Contaminant Candidate List. Oregon Administrative Rule 333-061-0043 requires CWSs to report detection of unregulated contaminants in their annual Consumer Confidence Report. UCMR5 was published on December 27, 2021, and requires sample collection of 30 contaminants between 2023 and 2025 using EPA-developed analytical methods. The UCMR5 will provide new data to improve the EPA’s understanding of the frequency of 29 polyfluoroalkyl substances (PFAS) and lithium in the nation’s drinking water and the associated levels.

4. **Revised Coliform Monitoring Requirements**. This rule requires that total coliform samples be collected by public water systems at sites representative of water quality throughout the distribution system according to a written sample site identification plan. Total coliform occurrence will continue to be investigated; however, it is no longer associated with an MCL. Emphasis is placed on the MCL for *E. coli* because it is a reliable indicator of fecal contamination. The MCL for *E. coli* is exceeded if the presence of *E. coli* is confirmed (often via a repeat sample), repeat samples are not collected, or if a total coliform-positive sample is not analyzed for *E. coli*. Monitoring changes were made that include reducing the number of repeat samples to collect after a routine coliform positive from four to three.

5. **Lead and Copper Rule Revisions (LCRR)**. On January 15, 2021, the EPA issued LCRR. The LCRR require public water systems take further actions to minimize lead and copper in drinking water. The goals for the revisions are to identify areas that are most impacted, strengthen treatment requirements, replace lead service lines, increase sampling reliability, improve risk communication, and protect children in schools. The EPA intends to promulgate the Lead and Copper Rule Improvements prior to October 2024.

   The agency has determined that some aspects of the rule will go into effect quickly to support near-term development of actions to reduce lead in drinking water. Specifically, lead service line inventories that will be developed under the LCRR are necessary to achieve 100 percent removal of lead service lines. The EPA is requiring that initial lead service line inventories be completed by the current October 16, 2024, compliance date.

Potential Regulatory Changes

Following is a list of regulations that may be enacted in the future:

1. **Radon in Drinking Water Rule**. This rule would attempt to reduce airborne and waterborne radon concentrations to limit exposure levels. This rule would apply to CWSs that use groundwater or mixed groundwater and surface water. The proposal is currently on hold, and the EPA has no timeline for publishing this rule.

2. **Fourth Contaminant Candidate List (CCL4) Regulatory Determinations**. On February 22, 2021, the EPA reissued final regulatory determinations for contaminants on the CCL4. The EPA is making final determinations to regulate two contaminants in drinking water, perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), and to not regulate six contaminants (1,1-dichloroethane, acetochlor, methyl bromide [bromomethane], metolachlor, nitrobenzene, and hexogen [RDX]). With the final regulatory determinations for PFOA and PFOS, the EPA will move forward to implement the national primary drinking water regulation development process for these two PFAS. In addition to the CCL4 regulatory determinations, the EPA is evaluating additional PFAS, which may include regulatory actions addressing those PFAS. This follows the CCL4 final determination to regulate PFOA and PFOS in drinking water.

3. **Carcinogenic Volatile Organic Chemicals (cVOC) Rule**. The EPA is developing a proposed national primary drinking water regulation for a group of 16 known cancer-causing compounds, including eight currently regulated cVOCs and up to eight from the Third Contaminant Candidate List.

4. **Hexavalent Chromium**. The EPA currently regulates hexavalent chromium as part of the total chromium drinking water standard. New information on health effects has become available since the original standard was set, and the EPA is reviewing this information to determine whether new health risks need to be addressed. The State of California has already implemented a hexavalent chromium-specific MCL.
5. **Fluoridation**. Fluoride MCLs may be lowered in the future as the health impacts of fluoride are fully realized. The current MCL of 4 parts per million could be reduced to 1 or less. This lower MCL could require systems with naturally occurring fluoride above the MCL to treat to reduce levels.
6. **Cybersecurity**. Executive Order 13636: Improving Critical Infrastructure Cybersecurity was established in February 2013. The Order calls for the development of a voluntary, risk-based cybersecurity framework. The EPA will evaluate whether any additional authority and/or regulations to address cybersecurity in the water sector are needed.

Regulatory Requirements Summary

In summary, many regulations affect operation of the City of Prineville's water system. The City has good water quality and a well-run water system meeting federal and state water quality criteria.

The information presented herein is intended to provide the City with a brief summary of the regulations and possible future regulations that will likely affect operation of the City's water system. These regulations continue to expand and will require careful attention to maintain compliance. It is recommended that the City of Prineville consult periodically with the DWS to ensure compliance with current regulatory requirements and to address any regulatory questions or issues.

Regulatory Violations

The City has not had any water quality violations but has had 14 cases of late/nonreporting violations, all of which have been returned to compliance.

Seismic Risk Assessment and Mitigation Plan

To better prepare the state for earthquake preparedness, the Oregon Resilience Plan (ORP) was developed in 2013 by the Oregon Seismic Safety Policy Advisory Commission. The goals of the ORP are to address critical infrastructure needed to supply water in the event of an emergency and identify projects that need to be completed in the next 50 years to ensure that water can be supplied to a community in the event of a strong earthquake. Scientists have recognized the Cascadia subduction zone as an active fault that poses a major geological hazard to Oregon. The ORP addresses vulnerabilities of pipelines, treatment plants, water storage reservoirs, supply wells, and pump stations that compose Oregon's water and wastewater systems and discusses the intervention required to increase the resilience of infrastructure in the event of a Cascadia earthquake.

To assist in the goal of preparing communities, water systems that submit a WSMP to the DWS after January 10, 2018, are required to follow seismic assessment guidelines put forth by the DWS. Community water systems with more than 300 connections must conduct a Seismic Risk Assessment and Mitigation Plan if any of their existing or proposed facilities are located in areas with moderate to very heavy damage potential as determined by the Oregon Department of Geology and Mineral Industries.

According to the ORP, central Oregon is located outside the Cascadia Scenario Light, Moderate, Heavy, and Very Heavy Impact Zones. Therefore, a Seismic Risk Assessment and Mitigation Plan was not conducted as part of this WSMP.

Water System Sanitary Survey

The DWS conducts sanitary surveys of water systems for communities to assist in identifying potential contamination sources that may impact water quality. These surveys are generally scheduled to occur every five years.

The City of Prineville's latest water system sanitary survey was conducted on September 2, 2020. The water system sanitary survey found the following significant deficiencies:

- The sanitary seals and casings on three of the City's wells were not watertight. The seal was deficient in the 4th Street Shallow Well, the Yancey Well, and the Airport 2 Well.
- Water quality monitoring was not current. Adding the new Yancey and Lamonta Wells triggered two 6-month rounds of lead and copper samples in 2020.

These deficiencies were corrected by April 5, 2021, or are on an approved corrective action schedule. A copy of the full 2020 Water System Sanitary Survey is included in Appendix B. Included in the survey is a checklist of sanitary survey items to be checked during inspection of the water system. City staff should periodically review the checklist; this will help the City take a proactive approach to these surveys and also help to avoid potential future violations.

Water Demand

Future water demands, for the purpose of identifying needed future water system improvements, can be estimated from past water use data and population projections. Water use data are usually expressed in terms of various rates of water used for various periods of time. This allows components of the water system to be sized for the maximum demands that will be placed on them. The rates of water use that are important in the evaluation of a water supply system are the average daily demand (ADD), which is the total amount of water used during a one-year period divided by 365 days; the peak daily demand (PDD), which is the maximum total amount of water used during any 24-hour period; and the peak hour or peak instantaneous demand, which is a measure of the maximum flow of water at any given time.

Water supply facilities are normally designed for PDD. As a rule, a well would be sized for supplying the needed water during the PDD without continuous 24-hour operation. For example, if the water usage during high demand summer months required a well pump to operate 18 hours or more per day to keep up with the PDD, the situation may warrant the addition of another well or other water supply source to provide some backup capability and to not over-stress the well pumping equipment. Booster pumps and distribution pipelines are generally sized to deliver peak instantaneous demands, because they must be capable of meeting the highest demand. Storage reservoirs are sized to make up the difference between water supply capacity and peak water use rates, at a minimum. Additional capacity (reserve) is usually provided in water storage reservoirs for both emergencies and fire suppression.

Per Capita Water Use

To be utilized for projecting future water demands, past water use data must be converted to a per capita (per person) rate of use. This is done by dividing the average day, peak day, and peak instantaneous water use rates by the number of people served by the water system. These water demand rates are expressed as gallons per capita day (gpcd). These values multiplied by a population projected for some future year give estimated total demand rates for that year.

Historical Average Water Use

To determine current water demands, production records for the City's water supply system were reviewed from water years 2017 through 2021. Monthly well production for the City of Prineville for 2017 through 2021 is shown on Charts 2-2 through 2-12. A production comparison for all 11 wells and the Crooked River Wellfield is shown on Figure 2-2.

CHART 2-2
AIRPORT WELL NO. 1 MONTHLY PRODUCTION

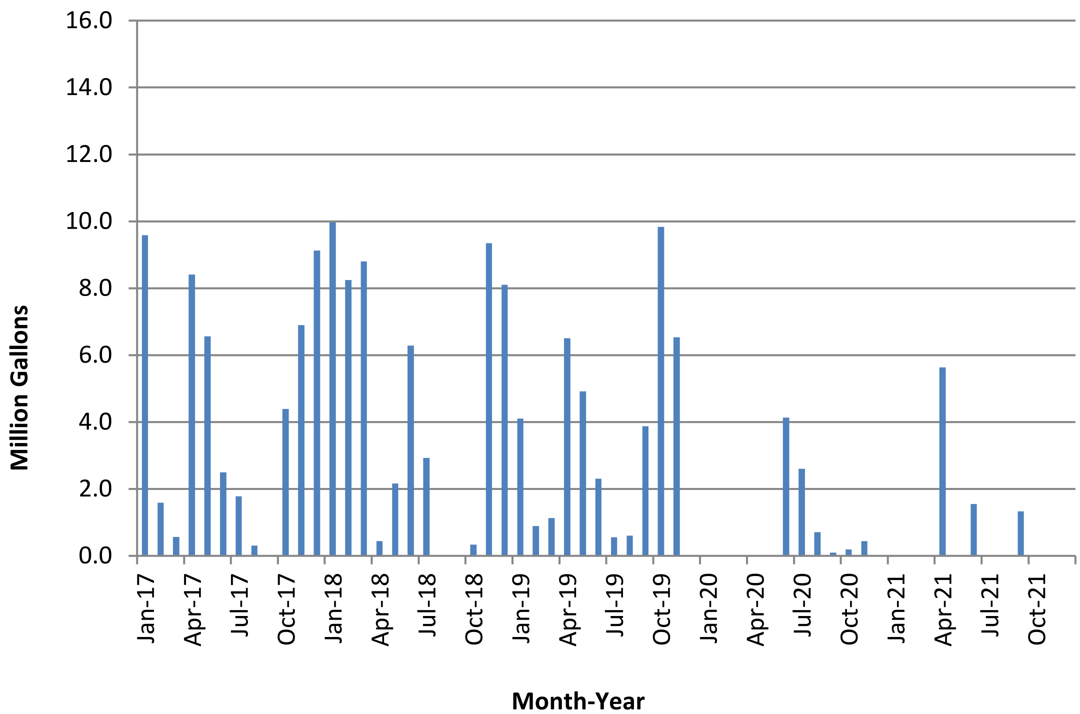


CHART 2-3
AIRPORT WELL NO. 2 MONTHLY PRODUCTION

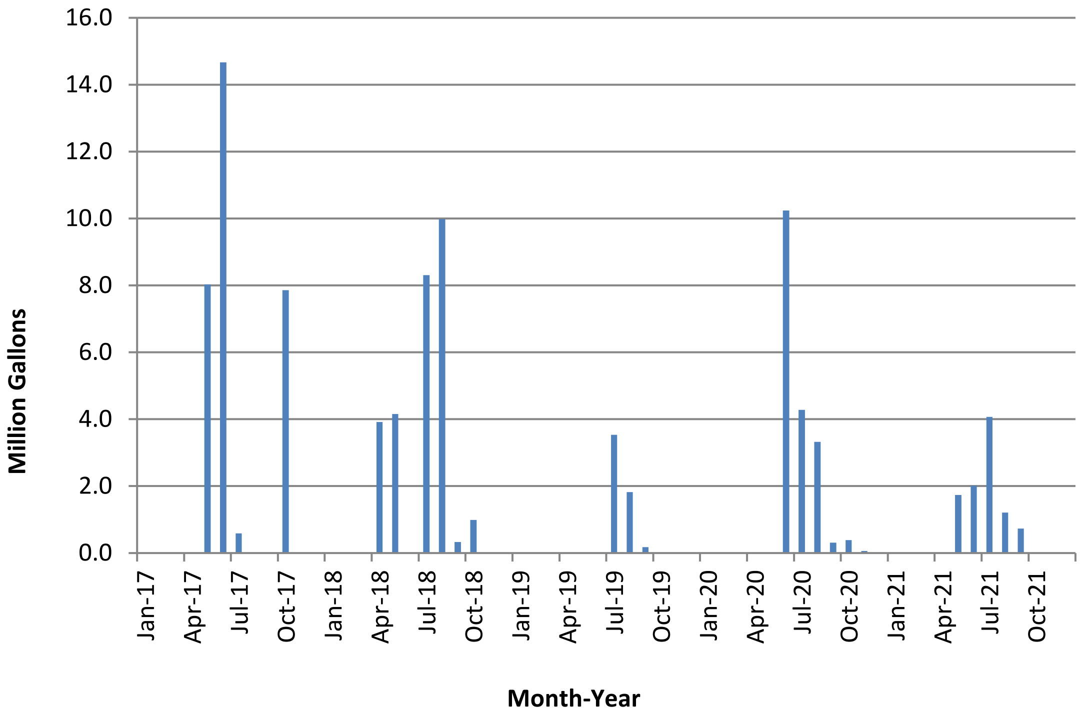


CHART 2-4
AIRPORT WELL NO. 3 MONTHLY PRODUCTION

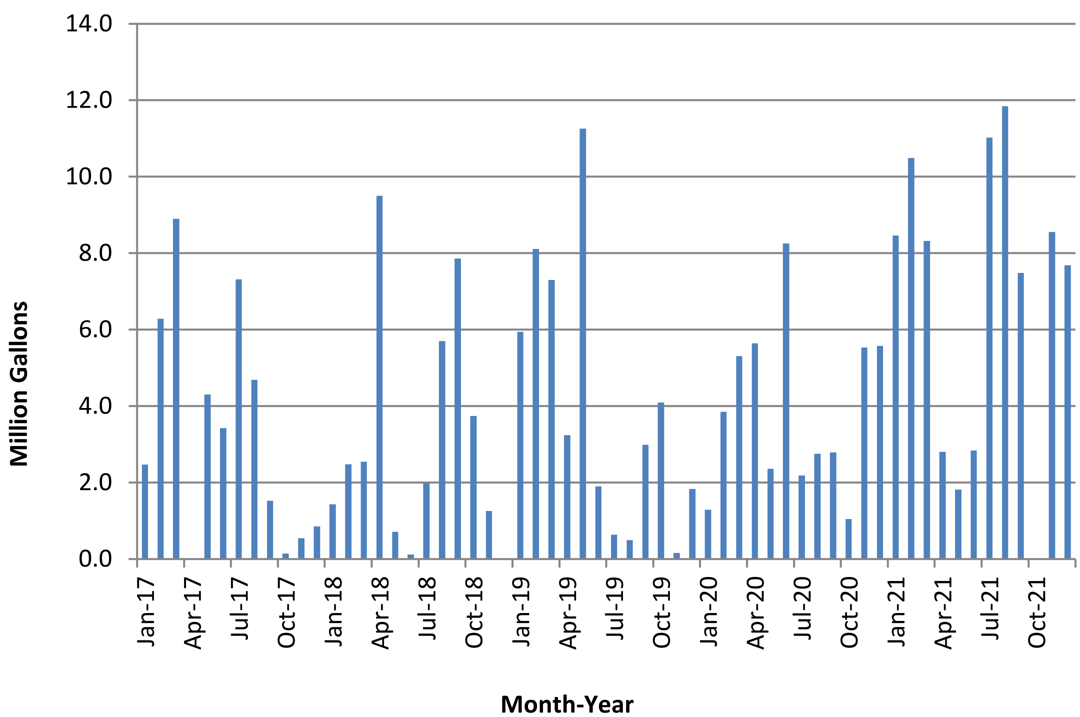


CHART 2-5
AIRPORT WELL NO. 4 MONTHLY PRODUCTION

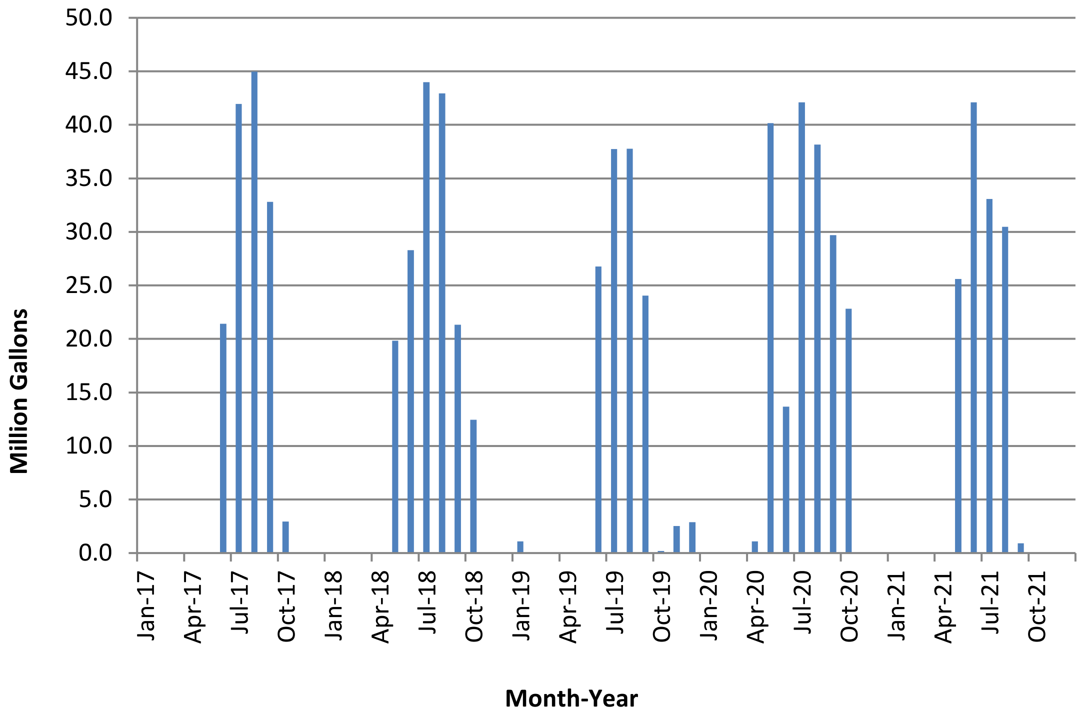


CHART 2-6
ORIGINAL 4TH STREET DEEP WELL MONTHLY PRODUCTION

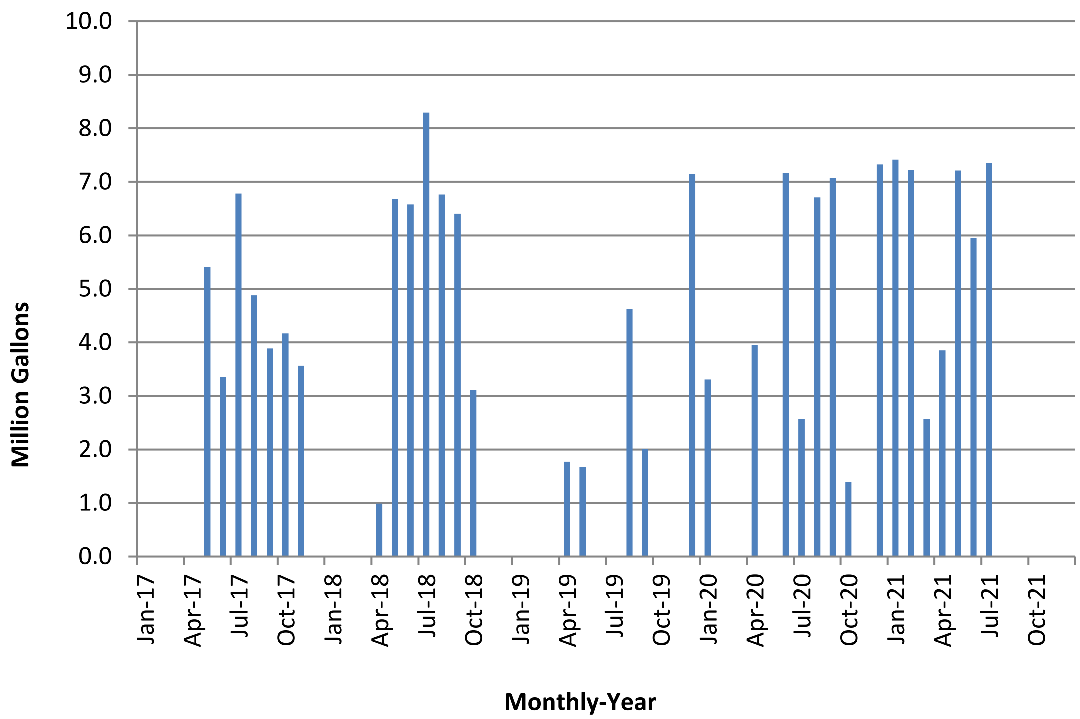


CHART 2-7
LAMONTA WELL (TO APRIL 2020) AND LAMONTA NO. 2 WELL (POST-2020) MONTHLY PRODUCTION

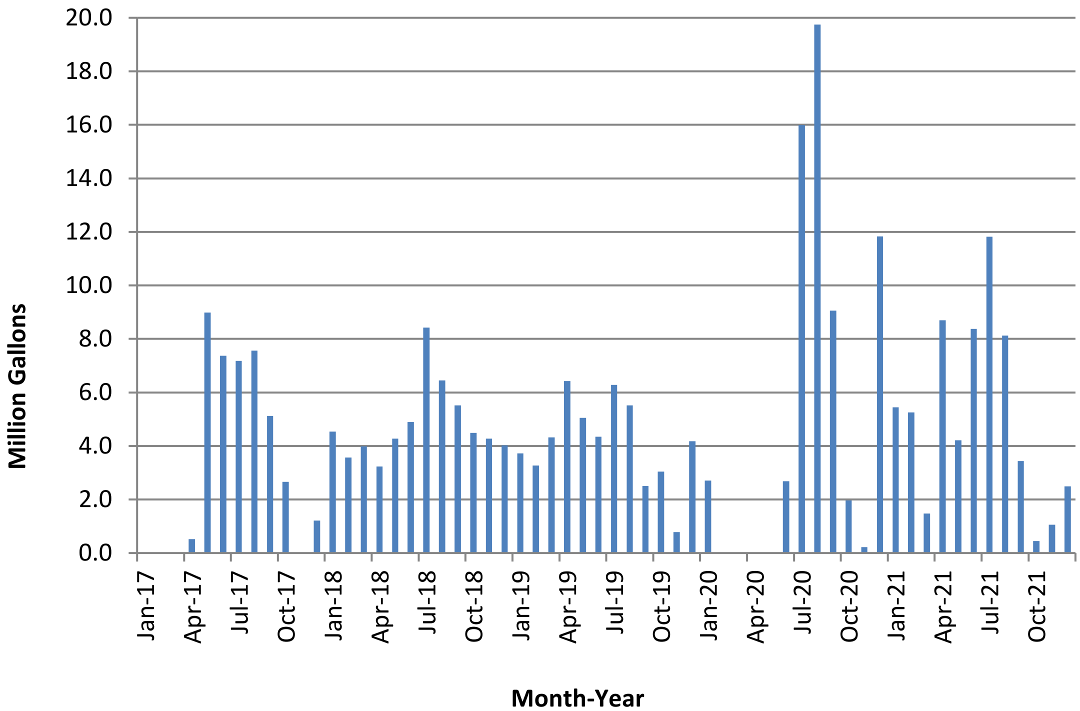


CHART 2-8
STADIUM WELL MONTHLY PRODUCTION

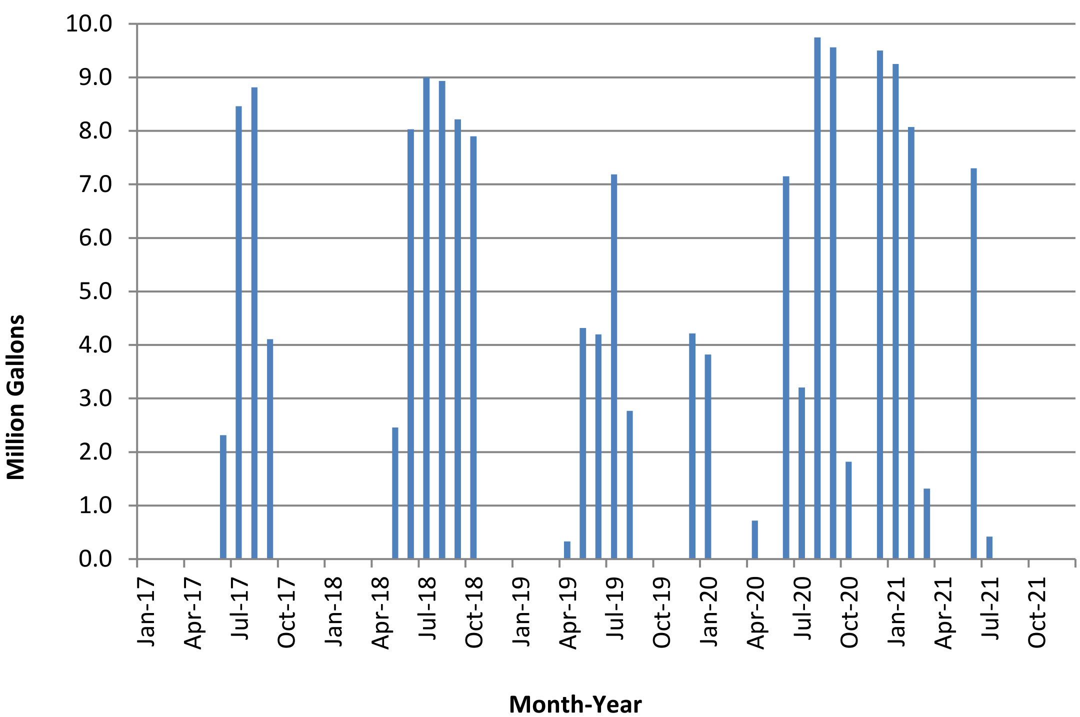


CHART 2-9
STEARNS WELL MONTHLY PRODUCTION

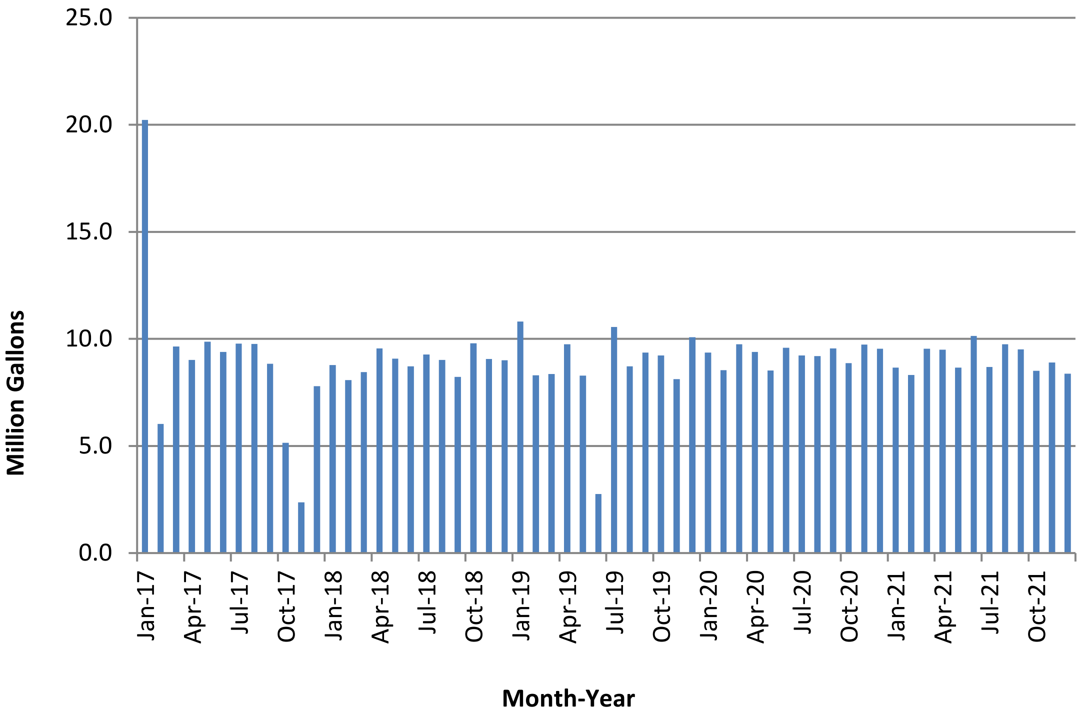


CHART 2-10
BARNEY WELL MONTHLY PRODUCTION

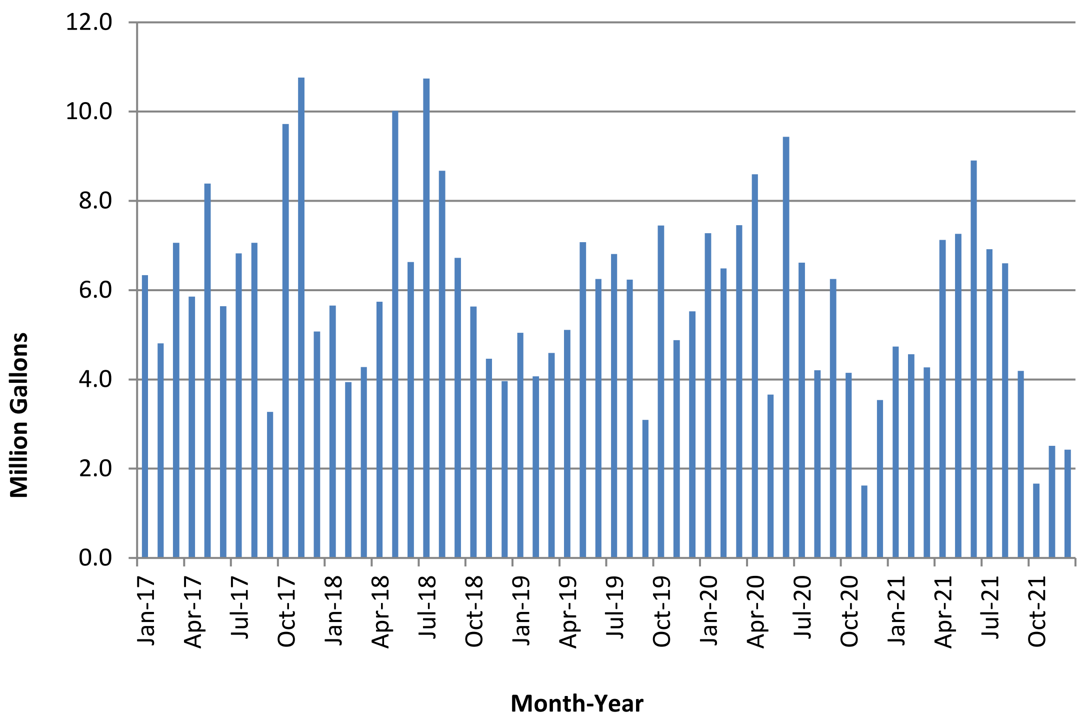


CHART 2-11
YANCEY WELL (2017-18) AND YANCEY NO. 2 WELL (POST-2018) MONTHLY PRODUCTION

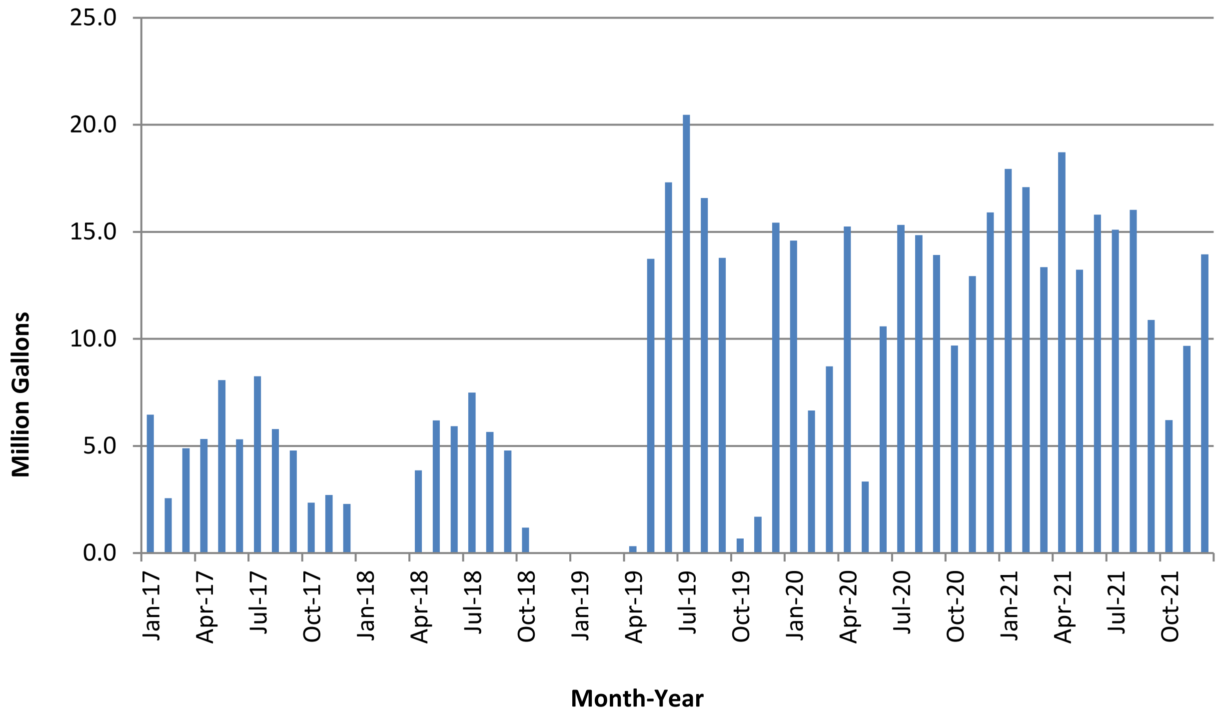
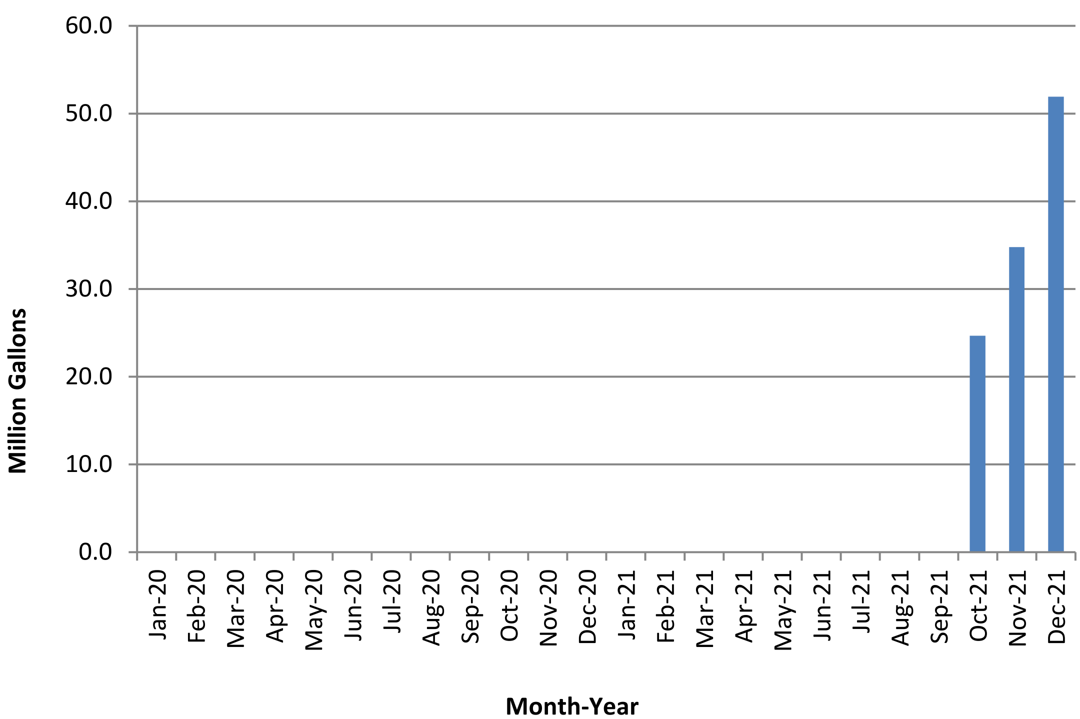


CHART 2-12
CROOKED RIVER WELLFIELD MONTHLY PRODUCTION



Average Daily Demand

The Oregon Water Resources Department maintains a database of water use amounts as reported by the individual water user or entity. Per this database, the total water use reported by the City for the 2017-21 water years is listed below on Table 2-2. For planning purposes, the per capita water use was calculated by dividing the annual water production by the estimated population served during that year.

TABLE 2-2
AVERAGE DAILY DEMAND

Year	Population[1]	Annual Water Production (MG)	Average Daily Demand		
			MGD	gpm	gpcd
2017	9,224	606.8	1.66	1,154	180
2018	9,292	640.5	1.75	1,219	189
2019	9,557	580.6	1.59	1,105	166
2020	10,219	665.1	1.82	1,265	178
2021	10,525	708.3	1.94	1,348	184

[1]The population estimates are from the PRC Certified Populations and U.S. Census (2020).

MG = million gallons

MGD = million gallons per day

gpm = gallons per minute

For this WSMP, the per capita water use of 184 gpcd was selected as the ADD to project future demand needs. This is approximately the average of the five years of data presented, as well as the most recent demand experienced by the City.

Peak Daily Demand

PDD usually occurs during a particular day between June through September, which is when water use is normally at its greatest due to irrigation and other summer uses. PDD can occur in other months but normally occurs during the hottest period of the year. During PDD, the City's wells operate as needed, up to 18 hours per day each, and equalization storage is required to meet demands. During the summer of 2021, the City experienced an extremely hot and dry period, causing the highest water demand the City has on record. On June 29, 2021, the City recorded a water demand of 4,755,700 gallons. With the estimated connected population of 10,525 at that time, the approximate PDD would be 452 gpcd. While this demand will likely not occur on an annual basis, the City has elected to utilize this high demand for planning purposes.

The City's 184 gpcd ADD is in the low range of typical ADD when compared to other cities with water meters in eastern and central Oregon, as shown on Table 2-3. The PDD and associated peak factor of 2.5 is within the expected range and is comparable to other communities.

TABLE 2-3
COMPARATIVE WATER USAGE
TYPICAL FOR SMALL CITIES IN CENTRAL AND EASTERN OREGON, METERED SYSTEMS

City	Average Daily Demand (gpcd)	Peak Daily Demand (gpcd)	Peak Factor (peak daily)	Population
Echo	175	525	3.0	700
Prineville	**184**	**452**	**2.5**	**10,525**
Adams	195	625	3.2	265
Umatilla	210	483	2.3	4,686
Cove	215	628	2.9	594
Baker City	227	834	3.7	10,035
La Grande	230	667	2.9	13,238
Prairie City	234	549	2.3	1,195
Mt. Vernon	240	585	2.4	617
Stanfield	240	600	2.5	1,770
Hermiston	250	600	2.4	17,730
Athena	250	710	2.8	1,142
Vale	250	625	2.5	1,890
Island City	270	810	3	989
John Day	270	865	3.2	2,010
Boardman	275	960	3	3,445
La Pine	280	700	2.5	982
Irrigon	290	800	2.8	1,790
Hines	350	1,600	2.5	1,700
Joseph	375	1,100	2.9	1,060
Ione	461	1,865	4	250

The ADD and PDD assumed for planning purposes are summarized on Table 2-4. These demands have also been summarized as a flow rate to provide the basis for comparison to water supply capacity. The assumed service population for determining the actual daily demand rates is 10,525, as discussed earlier in this chapter.

TABLE 2-4
YEAR 2022 TOTAL AVERAGE AND PEAK DAILY DEMAND DATA

Parameter	System Demand (gpcd)	Total Demand (gpm)	Percentage of System Capacity (Assumed Total Capacity of 6,436 gpm)	Percentage of System Capacity (18-hours-per-day operation)
ADD	184	1,348	21	28
PDD	452	3,303	51	68

Water supply facilities (well pumps) are normally designed to meet PDD without providing 24-hour service. It is preferable that well pumps operate a maximum of 18 hours per day, if possible. The current total production capability of the valley floor and airport area is approximately 4,666 gpm and 1,770 gpm, respectively. The combined capacity is 6,436 gpm. When assuming an 18-hour operation, the total pumping capacity is reduced by 25 percent, and the current 18-hour pumping capacity can meet both the current ADD and PDD assuming an 18-hour maximum operation.

Description of Customers Served

The City of Prineville's water service accounts, as of 2022, are summarized on Table 2-5.

TABLE 2-5
WATER ACCOUNT INFORMATION

Account Type	Number of Accounts	Percent of Total Accounts	Percent of Water Use in 2021
Residential	3,254	89	51.4
Commercial	381	10	20.3
Large Commercial	29	<1	28.3
TOTAL	**3,663**	**100**	**100**

The commercial users noted on Table 2-5 consist of schools, churches, City property, and businesses. Large commercial users include lumber mills, the hospital, manufacturing, and data centers. As shown on Table 2-5, residential water users account for approximately 89 percent of the total water users in the City, while commercial and large commercial users account for approximately 11 percent. However, residential water use accounts for only approximately 51 percent of water use, while commercial and large commercial users account for the remaining approximately 49 percent.

Design Criteria

In establishing design standards for a water system, primary consideration must be given to state and federal rules and regulations governing water quality and construction standards. These regulations, as previously stated, are set by both the EPA and DWS. In addition to these public health and safety requirements, many other factors control the design parameters for municipal water systems. The City must evaluate factors such as financial feasibility, philosophy and policies of the City Council, past system performance and service, and expectations of the water users. All of these factors are important and can influence the standards by which water system improvements are made.

Figure 2-3 presents a summary of the water system design criteria for evaluating the existing water system and developing improvements to satisfy present and future needs. Application of these criteria is discussed further in the specific chapters that address the water supply and treatment, storage, and distribution system facilities. Figure 2-3 presents design criteria based on the estimated present service population of 10,525 and present estimated ADD and PDD. Design criteria are shown for the year 2042 based on a 1.1 (2022 through 2042) AAGR in the City. Storage volumes are derived from calculations summarized in Chapter 4. The design criteria presented on Figure 2-3 are used as base information in later chapters for evaluating existing and future system needs and capability.

Additional Projected Large Commercial Water Demands

In recognizing the potential need to provide additional water service to future large commercial and industrial service customers located in undeveloped areas of the UGB, an additional allowance for the growth of the water service population should be accounted for separately from this WSMP's water demand projections. The PRC population projections were discussed with the City's Public Works staff, and it was determined that an additional allowance for large commercial business growth is needed to identify projected demands on the water system. The City has recently received requests from potential commercial tenants looking to site new facilities in the Prineville area. Several of the proposed facilities require a large quantity of water, and City leaders have indicated a desire to accommodate these proposed facilities. Based on this, Figures 2-4, 2-5, and 2-6 show both an additional 1.0 MGD and 2.0 MGD of large commercial demands in 2022 and 2042 in addition to the projected population growth. Further discussion of the potential large commercial water demands can be found in Chapters 3 and 4.

It should be recognized that, over the planning period of this WSMP, actual growth could exceed or fall below the projections presented on Figures 2-3 through 2-6 and discussed herein.

Additional Projected Residential Water Demand

To the east of the Prineville city limits and south of Highway 26, a development within the UGB is currently experiencing failing drinking water wells and septic systems. This area is known as the Melrose/Willowdale area. Due to the size of the existing lots and setback rules, replacing the failing septic systems is not an option. With the wells in this area being very shallow, there is concern that the groundwater may become contaminated by the failing septic systems. This contamination would affect individual residences as well as potentially cause contamination of the aquifer. At this time, some of the lots in this area are faced with condemnation as they are unable to make needed improvements due to income or lot size restrictions.

The City has been approached by members of the Melrose/Willowdale area and has expressed a desire to assist these residents. Project SDC 10 included in this WSMP would extend water distribution main lines into this area to provide the needed infrastructure to facilitate domestic water connections and fire protection. Additional improvements would be needed to extend smaller diameter main lines into side streets as well as to make service connections available.

The estimated number of residences in this area is 250. Using the current data of 2.46 persons per household, the estimated number of persons to connect is 615. The estimated additional demand to the water system is summarized on Table 2-6.

TABLE 2-6
MELROSE/WILLOWDALE ADDITIONAL SYSTEM DEMAND

Parameter	System Demand (gpcd)	Total Demand (gpm)	Gallons Per Day
ADD	184	78	113,160
PDD	452	190	278,000

Based on Table 2-6, the existing water system has the capacity to accommodate the addition of the Melrose/Willowdale area residents.

Fire Demand

Fire Protection Ratings

Flow rates for fire suppression in residential, commercial, and large commercial areas within developed communities are usually determined from the size, density, and occupancy of buildings, type of construction materials, and desired fire insurance rating. Incorporated cities and some rural areas are given a fire suppression rating by Insurance Services Office, Inc. (ISO). The rating is used by insurance companies to determine the cost for providing fire insurance to home and business owners. ISO's fire suppression rating schedule is used to review those features of available public fire protection that have a significant influence on minimizing damage once a fire has begun. These features include receiving and handling fire alarms; the fire district's manpower, equipment, and training; and the capability of the water system to provide the needed fire flows.

ISO periodically evaluates fire suppression capabilities of incorporated cities and rural fire districts. Prior to 2014, the numerical ratings ranged from Class 1 to Class 10, with Class 1 indicating the highest fire suppression capability and Class 10 the lowest. The rating for Class 1 through Class 8 represented a fire suppression system that included a Fire Suppression Rating Schedule, creditable dispatch center, fire department, and water supply. The number assigned to the community depended on the community's score on a 100-point scale. The score was based on ISO's evaluation of the community according to a uniform set of criteria, incorporating nationally recognized standards developed by the National Fire Protection Association and the American Water Works Association. A Class 10 rating was reserved for unprotected areas that have no fire department and no water supply system. Most protected areas outside of cities had a Class 9 rating, and most small rural cities with municipal water systems were rated Class 8, 7, or 6, depending on the strength of their water system and fire department. The ISO rating for the City of Prineville, reflecting the revised classification system adopted in 2014, and based on the 2018 evaluation, is Class 04/10. Class 10 is an additional classification that recognizes the distance between a property and a creditable water supply. Because Crook County Fire and Rescue is both a rural and urban fire protection agency, Class 10 classifies those properties more than 5 miles from a recognized fire station and more than 1,000 feet from a creditable water supply. The ISO rating information is presented in Appendix C.

ISO's fire suppression rating schedule evaluates the City's fire department capabilities and the domestic water supply capacity on an approximately equal basis (50 percent and 40 percent of the rating schedule, respectively). To reduce the cost of fire insurance in a community, improvements usually must be made to the fire department, the water system, or both, depending on their present condition. It is difficult to determine possible fire insurance savings on commercial buildings, because the insurance costs are determined by many other factors related to the type of occupancy and the type of building construction.

Recommended Fire Flows

ISO also recommends fire flows for various conditions in both residential and commercial settings. Recommended fire flows for residential areas are set forth in the 2014 ISO Schedule as shown below.

Distance Between Buildings	Required Fire Flows
Over 30 feet	500 gpm
21 to 30 feet	750 gpm
11 to 20 feet	1,000 gpm
10 feet or less	1,500 gpm

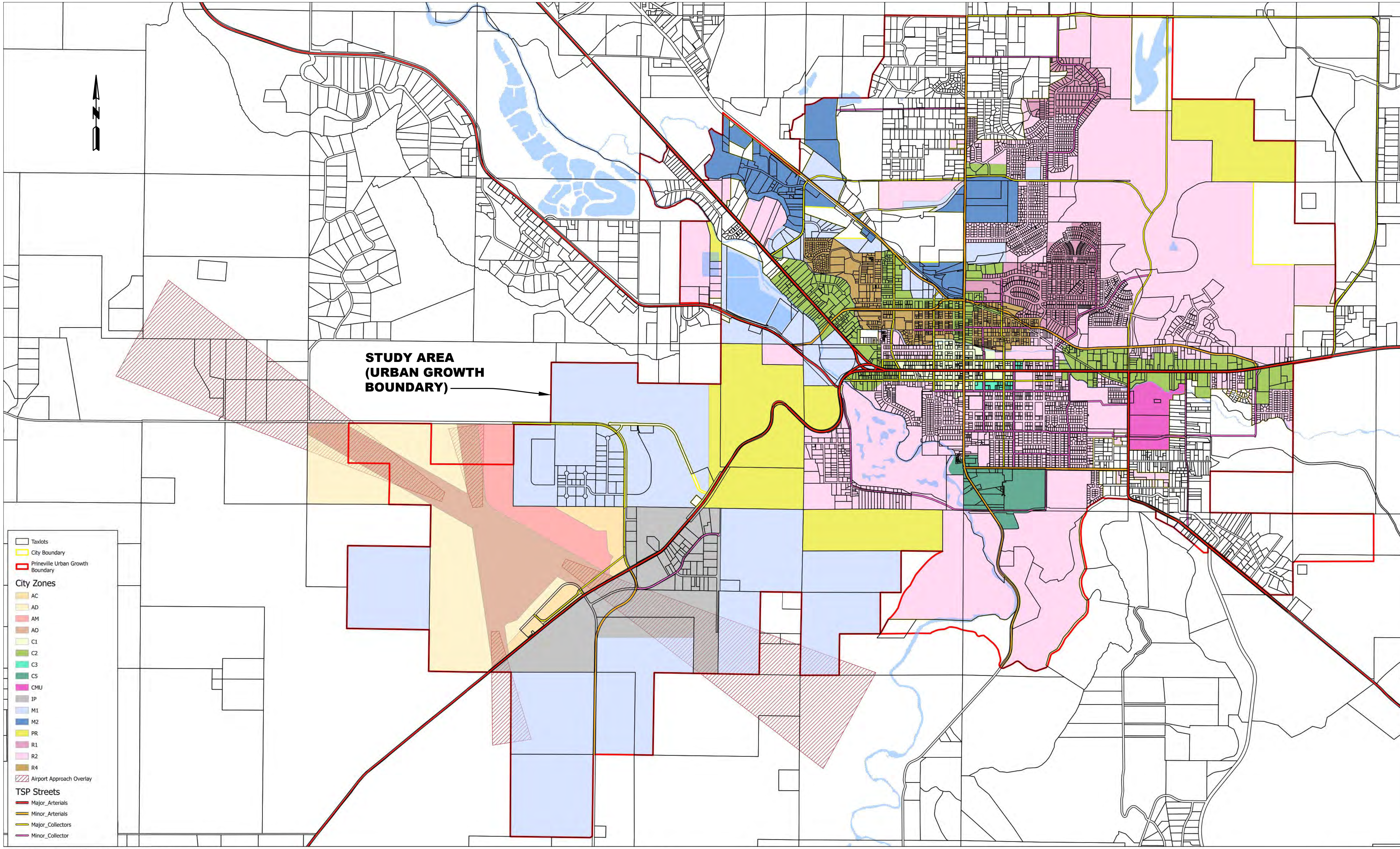
Recommended fire flows for commercial buildings are based on many factors including building size, construction materials used, and what is housed in the building.

The Oregon Fire Code (OFC) requires a minimum flow of 1,000 gpm in residential areas and a minimum of 1,500 gpm for a minimum of two hours in all other occupancies. These requirements increase with square footage of the building and can be quite large for commercial and institutional buildings (schools). These fire flows must be maintained with a system-wide minimum of 20 pounds per square inch (psi) residual pressure. Attaining the required fire flows for commercial areas may not be realistically achievable. The OFC has an allowance for decreases in fire flows for small communities (if approved by the local fire chief), where development of full fire flows is impractical.

The 2012 ISO Hydrant Flow Data Summary recommends needed fire flow protection rates for both residential and commercial districts to receive full credit ratings. ISO does not consider needed fire flows over 3,500 gpm in determining the Public Protection classification for cities. The fire flow design criterion for this WSMP is based on the typical maximum fire flow recommended by ISO, which is 3,500 gpm for a two-hour duration. This maximum fire flow is typically recommended for school areas and other high-density development.

Available Fire Flow

The City routinely tests fire hydrants to help ensure the hydrants remain operable and to estimate available fire flows. Fire hydrant flushing and flow testing data were provided by the City for this WSMP. Based on the test results, the City of Prineville's water system is generally able to deliver water flows ranging from approximately 95 to 3,500 gpm at individual fire hydrants while maintaining working distribution system pressures from 50 to 65 psi. A copy of the fire hydrant flow test results is included in Appendix D. Refer to Chapter 5 for a more detailed discussion of fire flow capacity.



ZONING MAP OBTAINED FROM CITY OF PRINEVILLE'S WEBSITE

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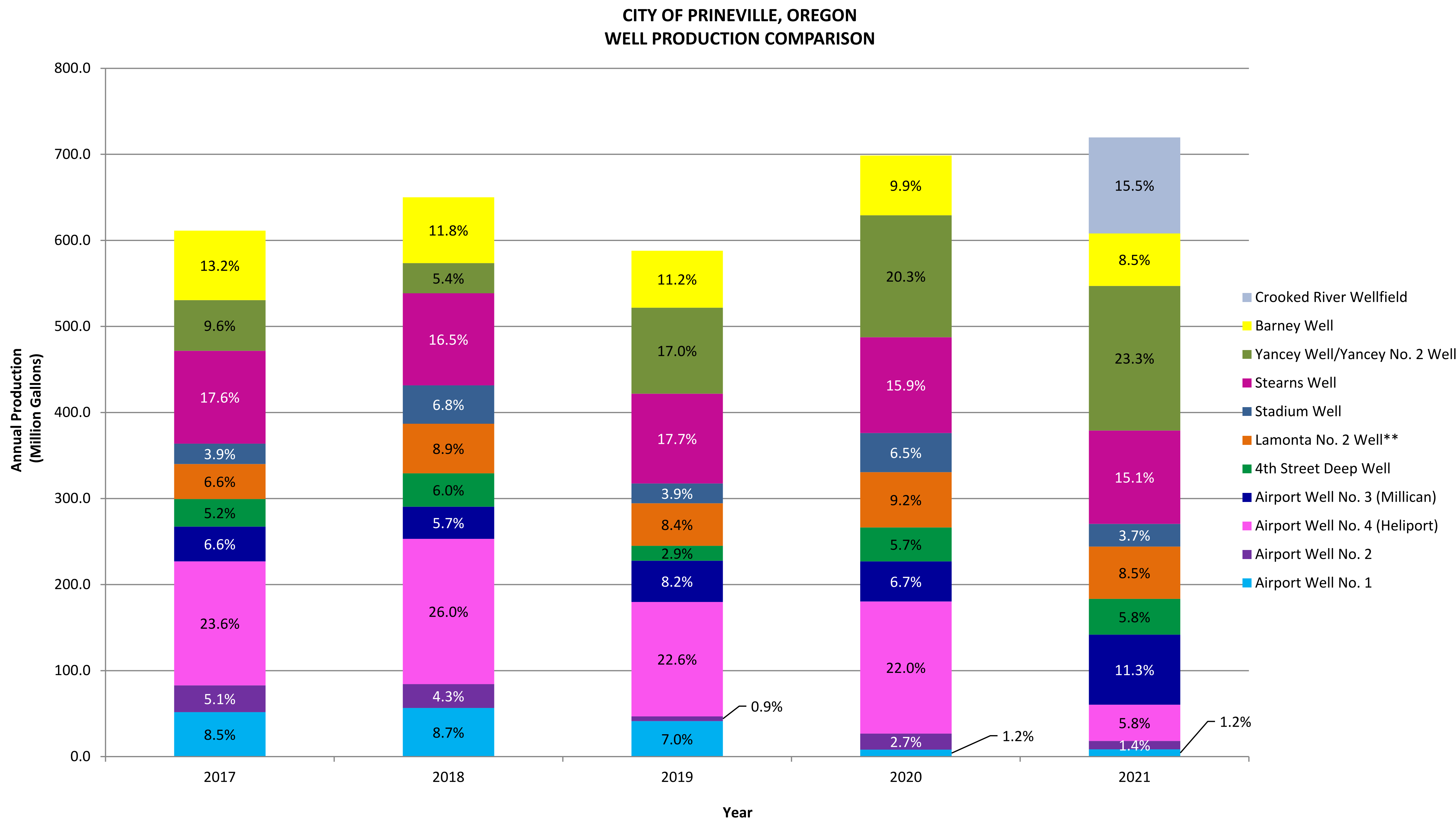
CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

ZONING MAP

FIGURE
2-1



* Yancey No. 2 Well was brought online in 2019. Data shown for 2017 and 2018 are from the original Yancey Well.
** Due to no data being available for Lamonta No. 3 Well at the time this Water System Master Plan was written, data shown are for Lamonta No. 2 Well only.

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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

WELL PRODUCTION COMPARISON

FIGURE
2-2

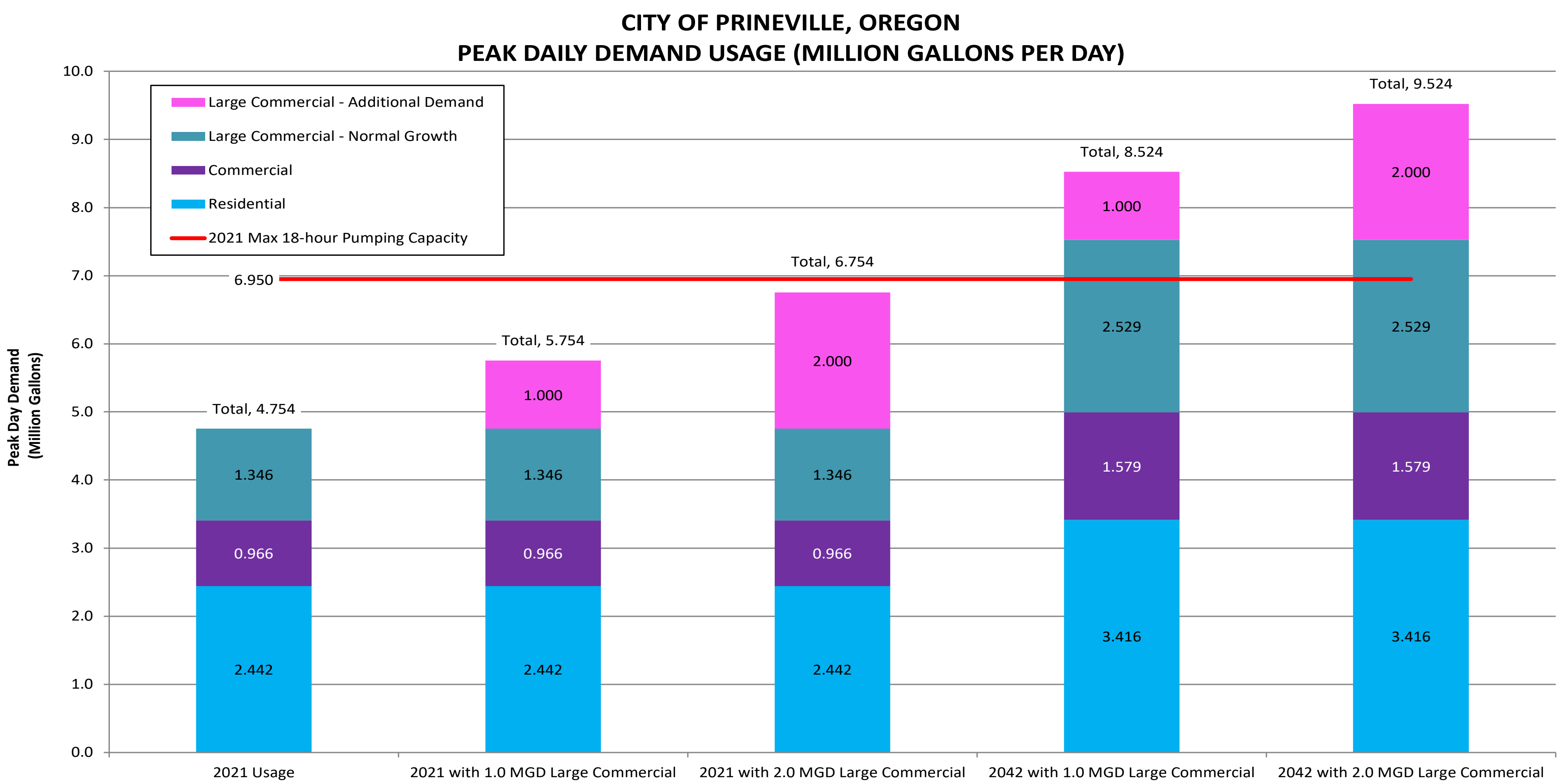
WATER SYSTEM DESIGN CRITERIA

	Existing Connected Population 2022[1]	Existing Connected Population with Improvements 2022[2]	Existing Connected Population with Improvements and Anticipated Connections within Urban Growth Boundary 2022[3]	Future Connected Population* with Improvements and Anticipated Connections within Urban Growth Boundary 2042[4]
Design Population	10,525	11,337	11,822	14,722
Total System				
Average Daily Demand (gpcd)	184	184	184	255
Average Daily Flow (gpd)	1,936,600	2,086,000	2,175,200	3,758,400
Average Daily Flow (gpm)	1,340	1,450	1,510	2,610
Peak Daily Demand[5] (gpcd)	452	452	452	511
Peak Daily Flow[6] (gpd)	4,757,300	5,124,300	5,343,500	7,523,600
Peak Daily Flow (gpm)	3,300	3,560	3,710	5,220
Peak Hourly Flow[7] (gpm)	8,250	8,900	9,275	13,050
Estimated Supply Flow Available[8] (gpm)	6,436	6,436	6,436	6,436
Estimated Supply Flow Required[9] (gpm)	4,400	4,750	4,950	6,960
Residential				
Average Daily Flow (gpd)	993,500	1,077,000	1,123,100	1,394,000
Average Daily Flow (gpm)	690	750	780	970
Commercial				
Average Daily Flow (gpd)	393,900	393,900	393,900	644,244
Average Daily Flow (gpm)	270	270	270	450
Large Commercial				
Average Daily Flow (gpd)	549,200	549,200	549,200	1,708,864
Average Daily Flow (gpm)	380	380	380	1,190
Residential				
Peak Daily Demand (gpcd)	232	232	232	232
Peak Daily Flow (gpd)	2,441,800	2,630,000	2,743,000	3,416,000
Peak Daily Flow (gpm)	1,700	1,830	1,900	2,370
Commercial				
Peak Daily Flow (gpd)	966,000	966,000	966,000	1,579,000
Peak Daily Flow (gpm)	670	670	670	1,100
Large Commercial				
Peak Daily Flow (gpd)	1,346,000	1,346,000	1,346,000	2,528,600
Peak Daily Flow (gpm)	930	930	930	1,760
Fire Demand				
Residential (gpm)	1,500	1,500	1,500	1,500
Commercial/Public (gpm)	3,500	3,500	3,500	3,500
Duration (hour)	2	2	2	2
Minimum Residual Line Pressure Under Peak Demands Plus Fire Flow (psi)	20	20	20	20
Storage				
Operating Storage[10] (gal)	500,000	500,000	500,000	500,000
Equalization Storage[11] (gal)	272,100	369,600	425,850	992,100
Fire Reserve[12] (gal)	420,000	420,000	420,000	420,000
Dead Storage[13] (gal)	225,000	225,000	225,000	225,000
Emergency Reserve[14] (gal)	1,936,600	2,020,200	2,066,200	3,758,400
Total Recommended Storage[15] (gal)	3,353,700	3,534,800	3,637,050	5,895,500
Total Existing Storage (gal)	4,500,000	4,500,000	4,500,000	4,500,000
Potential Storage Need (gal)	0	0	0	1,395,500

gal = gallons
gpcd = gallons per capita day
gpd = gallons per day
gpm = gallons per minute
PRC = Population Research Center
psi = pounds per square inch

*Population forecasting provided by Portland State University.

[1] City billing reports were utilized to find the number of residences within the city limits not connected to water (330) and the number of residences located outside the city limits connected to water (120). According to the PRC, the average person per household within the City is 2.46. The certified population for 2021 was 11,042. For planning purposes, this population is utilized as the 2022 population.
[2] Includes all residences within the city limits that could be served plus the number of residences located outside the city limits currently connected to water (120).
[3] Includes all residences within the city limits that could be served (11,337), plus the number of residences located outside the city limits currently connected to water (120), plus residences directly outside the city limits that could be served in the future (assumed to be 20 percent of total residences in the urban growth boundary, which equates to 197 residences).
[4] Utilized the average annual growth rate values declared by the PRC. This calculation represents a significant, large commercial projection in addition to the residential population growth.
[5] Peak day use obtained from City water use reports from 2017 through 2021. The peak day flow used for planning purposes occurred in June 2021.
[6] Per City Records, usage of 4,755,700 gallons occurred June 29, 2021.
[7] 2.5 times peak daily flow.
[8] Total pumping capacity at 24 hours per day.
[9] Total capacity required to operate well pumps a maximum of 18 hours per day and meet peak demands.
[10] Based on a 2.3 psi range of operating pressure from supply on to supply off.
[11] Difference between peak hourly flow and available supply for a 2-1/2-hour period.
[12] 3,500 gpm flow for two-hour duration, assuming only storage is used.
[13] Assumes 5 percent of overall system storage volume. This volume is not considered usable for consumption.
[14] One-day supply at average daily demand, assuming only storage is used.
[15] Sum of equalization, operating, fire reserve, dead storage, and emergency reserve.



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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

PEAK DAILY DEMAND USAGE

FIGURE
2-4

SUMMARY OF WATER SYSTEM DESIGN CRITERIA
PEAK DAILY DEMAND - 2021

	Year 2021	Year 2021 with 1.0 MGD Additional Large Commercial Demand[1]	Year 2021 with 2.0 MGD Additional Large Commercial Demand[1]
Population[2]	10,525		
Peak Daily Large Commercial Demand, gpd	1,346,000	2,346,000	3,346,000
Peak Daily Commercial Demand, gpd	966,000	966,000	966,000
Peak Residential Demand[3], gpd	2,441,800	2,441,800	2,441,800
Total Peak Demand			
Peak Daily Flow (gpd)	4,753,800	5,753,800	6,753,800
Peak Daily Flow (gpm)	3,300	4,000	4,690
Pumping Capacity			
Maximum Flow Available, gpm	6,436	6,436	6,436
Supply Flow Required[4], gpm	4,400	5,330	6,250
Supply Deficit[5], gpm	0	0	0

gpd = gallons per day
gpm = gallons per minute

[1]Based on current requested capacity increase.
[2]Current connected population.
[3]Based on historical usage data.
[4]Total capacity required to operate well pumps 18 hours per day and meet peak demands.
[5]Based on current total well pumping capacity of 6,436 gpm.

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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF WATER SYSTEM DESIGN CRITERIA
PEAK DAILY DEMAND - 2021

FIGURE
2-5

SUMMARY OF WATER SYSTEM DESIGN CRITERIA
PEAK DAILY DEMAND - 2042

	Year 2042	Year 2042 with 1.0 MGD Additional Large Commercial Demand[1]	Year 2042 with 2.0 MGD Additional Large Commercial Demand[1]
Population[2]	14,722		
Peak Daily Large Commercial Demand, gpd	2,528,600	3,528,600	4,528,600
Peak Daily Commercial Demand, gpd	1,579,000	1,579,000	1,579,000
Peak Residential Demand[3], gpd	3,416,000	3,416,000	3,416,000
Total Peak Demand			
Peak Daily Flow (gpd)	7,523,600	8,523,600	9,523,600
Peak Daily Flow (gpm)	5,220	5,920	6,610
Pumping Capacity			
Maximum Flow Available, gpm	6,436	6,436	6,436
Supply Flow Required[4], gpm	6,960	7,890	8,810
Supply Deficit[5], gpm	(524)	(1,454)	(2,374)

gpcd = gallons per capita day
gpd = gallons per day
gpm = gallons per minute

[1]Based on current requested capacity increase.
[2]Future connected population.
[3]Based on current residential peak gpcd demand times population.
[4]Total capacity required to operate well pumps 18 hours per day and meet peak demands.
[5]Based on current total well pumping capacity of 6,436 gpm.

anderson perry & associates, inc.

CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF WATER SYSTEM DESIGN CRITERIA
PEAK DAILY DEMAND - 2042

FIGURE
2-6

Chapter 3 - Water Supply and Treatment

Introduction

This chapter includes a description of the City of Prineville's present water supply sources, water rights, and treatment systems and a discussion of the water system's capacity to meet present and future needs. The City's current water supply system consists of production from water wells located in the City. The only treatment currently required for the well water is chlorination for distribution system residual maintenance and disinfection purposes. The exception is the Crooked River Wellfield, which pumps to the Water Treatment Plant (WTP) for treatment prior to distribution, as discusser later in this chapter.

Existing Water Supply System

General

Prineville's water currently comes from two groundwater sources supplied by 28 production wells. Seven wells pump water from the deep alluvial aquifer underlying the valley floor, and 17 wells pump water from the shallow alluvial aquifer near the Crooked River. Four additional wells pump water from the Airport Area Aquifer System, located on the plateau west of the City adjacent to the Prineville Airport. The locations of the City's production wells are shown on Figures 1-2A and 1-2B in Chapter 1. The City does not have interconnections with other municipal water supply systems.

Although the City also holds surface water rights for the use of water from the Crooked River, Prineville Reservoir, and Ochoco Creek, surface water is not currently used as a source for the municipal water supply system (surface water rights are primarily used for agricultural purposes).

A summary of the wells and capacity data is provided on Table 3-1 below.

TABLE 3-1
SUMMARY OF PRODUCTION WELL DATA

Well	OWRD Well Log Number	Year Constructed	Depth (feet)	Static Water Level at Construction (feet)	Current (2018 to 2022) Static Water Level (feet)	Pump Motor Horsepower	Estimated Capacity (gpm)
Prineville Valley Floor Aquifer Wells							
Barney	CROO 3132	1994	280	35	130.5	60	340
Stearns	CROO 2083	1973	246	0 (Artesian)	164.9	75	210
Stadium	CROO 184	1987	259	31	32.6	40	205
4th Street Deep*	CROO 2133	1960	252	22	9.8	30	175
4th Street Deep No. 2	CROO 55194	2022	257	49		--	400
4th Street Shallow*	CROO 52542 CROO 2130	1950	75	4.5	2.1	--	90
Yancey*	CROO 50181	1917	228	16.2	11	--	210
Yancey No. 2	CROO 54711	2019	242	10.5		60	600

Yancey No. 3	CROO 55225	2022	243	13		60	400
Lamonta*	CROO 1540	1957	256	0 (Artesian)	50	--	210
Lamonta No. 2	CROO 54871	2020	298	8		75	600
						Subtotal	**2,755**
***No longer in service (abandoned) and not included in subtotal.**							
Crooked River Wellfield							
DTW-1	CROO 54593	2017	140	4.5			80
DTW-2	CROO 54592	2017	140	4			94
DTW-3	CROO 54588	2018	140	4			130
DTW-4	CROO 54785	2019	95	6			220
DTW-5	CROO 54792	2019	107	9			112
DTW-6	CROO 54834	2019	98	9			93
DTW-7	CROO 54832	2019	84	9			46
DTW-8	CROO 54833	2019	85	9			78
DTW-9	CROO 54830	2019	93	10			158
DTW-10	CROO 54831	2019	95	10			113
DTW-11	CROO 54829	2019	94	5			161
DTW-12	CROO 54810	2019	93	10			192
DTW-13	CROO 54789	2019	95	6			192
DTW-14	CROO 54869	2019	95	4			118
DTW-15	CROO 54750	2019	85	3			124
DTW-17							
DTW-18	CROO 53215	2020	255	20.8			68
						Subtotal**	**1,911**
****Capacity rate with all wells flowing into raw water system (entire plant).**							
Airport Area Wells							
Airport Well No. 1	CROO 1894 CROO 54206	1980/1996	575	435.7	446.9	60	300
Airport Well No. 2	CROO 53453	2007	546	408	449.8	150	640
Airport Well No. 3	CROO 53956 CROO 54149	2012	703	480	373.5	100 (derated to 90)	285
Airport Well No. 4	CROO 54191	2014	607	432	436.2	250	1,100
						Subtotal	**2,325**
						Total Production Capacity	**6,991**
Water Source Not Connected to Municipal Water Supply System							
Freight Depot	CROO 35759	2010	280				
10th Street	CROO 1549	1943	223				
Ochoco Heights	CROO 1577	1943	1,002				
Northridge A	CROO 426	1992	940				
Stearns No. 1	--	--	--				
Clear Pine	CROO 1551	1948	400				
Simmons Well	CROO 50124	1996	148				

-- = Data not available

gpm = gallons per minute

OWRD = Oregon Water Resources Department

Prineville Valley Floor Aquifer

The Prineville Valley Floor aquifer is located within the alluvial deposits that have filled the Crooked River Valley. The alluvial system contains a shallow unconfined aquifer and a deeper confined aquifer. The majority of water production in the valley is from the deeper confined aquifer, including all of the City's valley floor municipal production wells. The confined aquifer system has a seasonal water level fluctuation pattern. Water levels are near ground surface during late winter and spring and then decline during the summer. The valley water levels typically recover fully each year. Although this valley aquifer appears to be able to support the current level of production, the City continues to monitor its long-term resiliency of the alluvial aquifer system.

The Crooked River Wellfield produces water from an aquifer that is hydraulically connected to the Crooked River upstream of the wellfield location. The wells are constructed to withdraw water from an aquifer that is mostly confined by a layer of natural clay with a water-bearing zone consisting of alluvial materials, although the entire limits of this particular aquifer are not entirely known.

Airport Area Aquifer System

The Airport Area Aquifer System has been developed into a sequence of permeable materials deposited at the base of a narrow ancestral paleochannel that existed beneath the plateau in the vicinity of the Prineville Airport. The deposits within the ancestral canyon are part of the eastern edge of the older Deschutes Formation. The groundwater flow within the ancestral canyon is present in the more permeable deposits found at the base of the paleochannel. The City's Airport Area production wells are located in two distinct water-bearing units: the fractured basalt flow located at the bottom of the ancestral canyon (lower aquifer) and the coarse sand and gravel deposit that represents the ancestral river's alluvial channel deposits (upper aquifer).

Valley Floor Wells

The City's seven main valley floor wells currently provide approximately two-thirds of the City's water supply, with each well capable of providing between 205 and 600 gpm. Four wells have been drilled in the Valley Floor aquifer since 2019 to replace aging wells at three locations: 4th Street, Lamonta, and Yancey. Two new wells have been constructed at the Yancey site, with the latest being completed in April 2022. The existing 4th Street Deep, Lamonta, and Yancey Wells, along with the 4th Street Shallow Well, have been abandoned or are awaiting final abandonment. The Valley Floor wells range in depth from 242 to 298 feet. Well logs for all the City's municipal water supply wells are included in Appendix E.

Figure 3-1 shows estimated current production capacity for the wells connected to the municipal water system. The City considers its most reliable Valley Floor wells to be the Stearns, 4th Street, Lamonta, Yancey, Stadium, and Barney Wells. The current combined capacity of the City's Valley Floor wells is approximately 6.14 cubic feet per second (cfs) (2,755 gpm).

Stearns Well

The Stearns Well is located on S.E. Stearns Road south of Highway 26. In January 1973, the well was drilled to a depth of 246 feet below ground surface (BGS) and was artesian. A casing with diameters of 24 and 12 inches was installed to a depth of 225 and 226 feet, respectively, with cement grout from 32 to 75 feet. A stainless steel screen was installed from 226 to 246 feet. The materials observed during drilling included silty sand, clays, and gravel. An initial well test at the time of construction showed the well yield was 820 gpm with a 136-foot drawdown for 10 hours. The 75 horsepower (Hp) line-shaft turbine pump has a current capacity of 210 gpm. A project to replace or reconstruct the Stearns Well is identified in the existing Capital Improvements Plan to update this aging well to new well construction standards.

4th Street Deep Well/4th Street Deep No. 2 Well

The 4th Street Deep Well is centrally located in the City approximately 525 feet from the intersection of S.E. Belknap Street and S.E. 4th Street. The well was drilled to a depth of 252 feet with a diameter of 12 inches. The static water level was 22 feet BGS when the well was drilled on October 12, 1960. A stainless steel screen was installed from 222 to 242.5 feet. Casing was installed from the surface to 222 feet with diameters of 24 and 12 inches. Casing was also installed with a diameter of 12 inches from 242.5 feet to 252 feet. The materials observed during drilling included silty clay, silts, water-bearing sand, and gravel. An initial well test at the time of construction showed the well yield was 650 gpm with a 74-foot drawdown after 12 hours. The well was rehabilitated in 2005, and the 30 Hp submersible pump had a capacity of 175 gpm.

In 2021, a second well was drilled at this location, which is called the 4th Street Deep No. 2 Well. It is located approximately 30 feet southeast of the existing 4th Street Deep Well. The well was drilled to a depth of 257 feet at a diameter of 24 inches, which was completed on January 24, 2022. The well has a 12-inch steel casing to 225 feet, stainless steel screen from 225 to 245 feet, and 12-inch steel casing from 245 to 257 feet. The static water level measured on January 24, 2022, was 49 feet BGS. The 60 Hp submersible pump has a capacity of 400 gpm. With construction of the 4th Street Deep No. 2 Well, the original 4th Street Deep is sitting idle and awaiting final abandonment.

4th Street Shallow Well

The 4th Street Shallow Well is located adjacent to the 4th Street Deep Well. The well was drilled to a depth of 75 feet and cased to a depth of 61 feet. Construction was completed in August 1950. The aquifer was recorded to be gravel from 13 to 28 feet, and the well casing is perforated from 13 to 22 feet. Materials observed included clay, silt, gravel, and sand. The submersible pump has a rated capacity of 90 gpm. The well was the City’s backup source, has not been utilized in recent history, and has now been abandoned.

Lamonta Well/Lamonta No. 2 Well

The Lamonta Well is located on Lamonta Road north of the City. Completed on September 4, 1957, the well was drilled to a depth of 256 feet with a diameter of 24 inches. Wire-wound screen was installed from 228 to 253 feet. The static water level is 17 feet BGS. An initial well test at the time of construction showed the well yield was 800 gpm with a 200-foot drawdown after one hour. Materials observed in the well included sand, sandstone, surface water, clay, sandy silt, sticky shale, and gravel. The 60 Hp turbine pump produced an average of 210 gpm with a rated capacity of 450 gpm. In 2020 a new well was drilled to a depth of 226 feet located approximately 37 feet northwest of the existing well. The well has a 12-inch casing to a depth of 291 feet, a stainless steel screen from 226 to 291 feet, and steel casing from 291 to 298 feet. The static water level was recorded to be 8 feet BGS on February 14, 2020. During a well pump test, the drawdown was reported to be 165 feet after 73 hours of pumping at 600 gpm. The 60 Hp submersible pump has a capacity of 600 gpm. With the construction of the new Lamonta No. 2 Well, the original well has been abandoned.

Yancey Well/Yancey No. 2 Well/Yancey No. 3 Well

The original Yancey Well is located north of Highway 26 on N.W. Fairmont Street. The well was reportedly drilled in 1917 to a depth of 228 feet and was reconstructed in 1975. The well has an 8-inch casing to a depth of 239 feet. The static water level was recorded to be 16.2 feet BGS on October 26, 1944. The 30 Hp turbine pump has a capacity of 210 gpm. During a well pump test, the drawdown was reported to be 96 feet after 20 hours of pumping at 360 gpm.

In 2019 a new well located approximately 40 feet west of the existing well was drilled to a depth of 242 feet. The well has an 8-inch casing to a depth of 227 feet and stainless steel screen from 227 to 242 feet. The static water level was reported to be 10.5 feet BGS on February 5, 2019. During a well pump test, the drawdown was reported to be 121 feet after 120 hours of pumping at 600 gpm. The 60 Hp submersible pump has a capacity of 600 gpm. With the construction of Yancey No. 2 Well, the original Yancey Well is sitting idle and awaiting final abandonment.

In 2022, an additional well was drilled to a depth of 243 feet at the Yancey site. Yancey No. 3 Well is located approximately 78 feet northwest of Yancey No. 2 Well. The well has a 12-inch casing to a depth of 218 feet and stainless steel screen from 218 to 243 feet. The static water level was reported to be 13 feet BGS on April 13, 2022. The 60 Hp submersible pump has a capacity of 400 gpm.

Stadium Well

The Stadium Well is located on 5th Street adjacent to the high school track and stadium. Construction was completed in February 1987, and the well was drilled to a depth of 259 feet. At the time of drilling, the static water level was 31 feet BGS. The well is cased with a 12- and 10-inch diameter welded steel liner from 3.5 feet to 228 feet and 218 to 259 feet, respectively. Materials observed during drilling include clay, gravel, and sand. The 40 Hp submersible pump has a limited capacity of 205 gpm with significant drawdown. A filter has been installed in the well due to sand and iron problems. This well is utilized manually as a backup for emergencies and used only for short periods of time.

Barney Well

The Barney Well is located close to the Barnes Butte Reservoir and Stearns Well on the east side of the City. Construction was completed in December 1994, and the well was drilled to a depth of 280 feet. The static water level was 35 feet BGS at the time of drilling. During initial well tests, the yield was 700 gpm for one hour with a drawdown of 110 feet. Materials observed during drilling include gravel, clay, and coarse sand. The well was rehabilitated in 2002 and currently produces approximately 340 gpm with a 60 Hp submersible pump.

Ochoco Heights Well

The Ochoco Heights Well is located adjacent to the Ochoco Heights reservoirs north of the City off Main Street. The well is currently inoperable. Presently, no well pump is installed, but there is a possibility of utilizing this well for monitoring if another well is constructed in the vicinity. The well was drilled to a depth of 1,002 feet and was cased to approximately 300 feet. Construction was completed in 1943 and, at that time, the water level was 52 feet BGS.

Crooked River Wellfield

In 2017, the City began construction of a wellfield along the Crooked River south of Prineville in Crooked River Park. The 2017 work consisted of test well construction to confirm water availability, chemistry, and treatment procedures, which were confirmed through a pilot test study. The wellfield was completed in 2021 and consists of 17 completed wells ranging from 84 to 140 feet deep. Materials observed during drilling include gravels, clay, silt, and sand. All wells are constructed with steel casing and stainless steel screen with sand pack in the water-bearing zone. Submersible pumps and motors supplied by variable frequency drives control the pumping system, with automated meter and well depth readings supplied constantly to the supervisory control and data acquisition system. The entire wellfield has a pumping capacity of approximately 4.26 cfs (1,911 gpm) when all wells are pumping into the raw water system. The wells feed collectively into a 16-inch high density polyethylene raw water pipe that delivers the raw water to the WTP, where it is treated and disinfected prior to entry into the distribution system.

Airport Wells

The City's four Airport Area Aquifer System wells (Airport Wells No. 1 through 4) currently provide the other one-third of the City's water supply, although the volume supplied by the Airport wells has been increasing over the past 10 years as the City has developed its groundwater rights for the Airport Area Aquifer System. The Airport wells range in depth from 546 to 703 feet and draw water from the upper and lower water-bearing units within the ancestral Crooked River channel, as described previously in this chapter. The well in the fractured basalt flow (Airport Well No. 3) produces 285 gpm, and the wells in the coarse sand and gravel deposits produce up to 1,100 gpm.

Airport Wells No. 1 through 4 have a combined instantaneous capacity of 5.18 cfs (2,325 gpm). However, all four wells are not operated simultaneously due to water rights constraints. The City's current water rights for its Airport wells limit the total supply capacity to a maximum withdrawal rate of 3.94 cfs (1,768 gpm).

With all the supply sources noted previously, the City's current municipal water supply wells have a combined production capacity of 15.58 cfs (6,991 gpm); however, the water rights limitations for the Airport wells currently cap production capacity at 14.33 cfs (6,436 gpm).

Critical Groundwater Areas

The City's wells are not located in an area designated by the OWRD as a critical groundwater area or groundwater limited area. However, the wells are located within the Upper Deschutes Basin, which is regulated under the OWRD's Deschutes Basin Groundwater Mitigation Program.

Deschutes Basin Groundwater Mitigation Program

A joint OWRD and U.S. Geological Survey study of the Upper Deschutes Basin (Deschutes Groundwater Study Area) determined that the high permeability of the Deschutes Formation also results in a hydraulic connection between groundwater and surface water. Specifically, the OWRD concluded that groundwater uses within the Groundwater Study Area have the potential for substantial interference with surface water rights and will reduce scenic waterway flows unless mitigation is provided, as defined in Oregon Administrative Rules (OAR) Chapter 690, Division 505. As a consequence, new groundwater permits are conditioned to require mitigation that meets the OWRD's requirements.

The City of Prineville and surrounding lands are located within the Upper Deschutes Basin Groundwater Study Area. The City provides mitigation in the Crooked River zone of impact for water pumped from its Airport Area Aquifer System wells and will need to provide mitigation for groundwater withdrawals under any new groundwater permit.

The City has obtained a water right for the release of up to 5,100 acre-feet (AF) of stored water from Prineville Reservoir for groundwater pumping (downstream fish and wildlife use) mitigation credits. These mitigation credits are part of the federal Crooked River Collaborative Water Security and Jobs Act of 2014 and required a change in use of the storage right for Prineville Reservoir through a transfer and a new secondary water right to establish mitigation credits.

Existing Treatment Systems

Treatment of the well supply sources that pump directly into the distribution system has been designated as residual maintenance chlorination by the Oregon Health Authority - Drinking Water Services (DWS). This means the source water does not require treatment and, therefore, chlorine contact time is not required. Chlorination is completed at each well source through injection of a sodium hypochlorite solution for most wells, with Airport Wells No. 1 and 2 using a shared gas chlorination system for the purpose of preventing the potential development of algae and pathogens in the distribution system. Chlorine residuals are measured and recorded regularly to help ensure chlorine levels are maintained appropriately.

In 2021, the City constructed a WTP to treat the raw water from the Crooked River Wellfield. The WTP uses biological filtration on granular activated carbon media to remove ammonia from the source water while utilizing pyrolusite media for removal of iron and manganese. The water is disinfected at the WTP prior to entry into the distribution system through the use of on-site sodium hypochlorite generation. The WTP is currently rated for a production capacity of 2,000 gpm with an additional expansion capacity of 1,000 gpm. The City began producing finished water from the WTP for public consumption in 2021.

Static Water Level Trends

Prineville Valley Floor Aquifer

The Prineville Valley Floor aquifer has a seasonal water level fluctuation pattern. Water levels are near ground surface during late winter and spring and then decline during the summer. The Valley Floor aquifer water levels typically recover fully each year. Although this aquifer appears to be able to support the current level of production, the City needs to continue to monitor the long-term resiliency of the alluvial aquifer system.

Airport Area Aquifer System

Water levels in the Airport Area Aquifer System fluctuate seasonally, with the water tables dropping during the summer, then recovering during the winter. In addition to the seasonal fluctuations, the water levels in both of the Airport Area aquifers have shown a long-term decline over the past three years of monitoring. Water levels have declined at average rates of more than 3.5 feet per year in the upper aquifer and slightly less than 1 foot per year in the lower aquifer during the three-year groundwater mitigation plan data collection effort. Factors that are likely contributing to the measured declines include climate fluctuations (short- and long-term) and an increase in annual withdrawals from these aquifers. The precipitation record from the Prineville Valley indicates the Prineville area was in a drying trend between 2017 and 2021, which may be one reason for the observed long-term water level decline. However, the recent increases in annual withdrawal from these aquifers may also be a contributing factor to the observed declining water level trend. A longer-term water level dataset that includes a wet climate cycle will assist in further assessment of these relationships. The City needs to continue to monitor water levels in the Airport Area Aquifer System to further understand and evaluate both current and long-term trends.

Well Maintenance

Wells require periodic maintenance to keep them functioning properly and working efficiently. Many wells, particularly wells that source their water from an alluvial aquifer, have a tendency to lose efficiency over time. The result of lost efficiency is either decreased yield (gpm) or greater pumping drawdown. This results in higher pumping costs and loss of production.

Specific capacity (production in gpm per foot of drawdown) is a measure of the well's ability to yield water. Wells can lose efficiency and capacity for a variety of reasons, including mechanical clogging, bacterial clogging, and loss of pump efficiency. Observing changes in a well's specific capacity over time will alert a well owner of developing well efficiency problems.

It is recommended the City perform specific capacity pumping tests either annually or biannually on each well. The results should be recorded and plotted on a graph over time. A specific capacity test is performed by pumping the well using the existing well pump and documenting the static water levels, drawdown, and pumping rate of the well. This is best done during a period when the well has been sitting idle for a reasonable period of time (e.g., one week). The idle time is needed to normalize the well's static water level. Noting a reduction in specific capacity will indicate problems with the well or pumping system and the need to take corrective action before the problem becomes irreversible and also to minimize operating costs.

Rehabilitation work may include a variety of approaches, depending on the nature of lost efficiency. Rehabilitation work may be accomplished using mechanical cleaning or non-mechanical methods such as shocking with percussion apparatuses, chemical addition, or chlorination. In some cases, it may be necessary to use a combination of mechanical and non-mechanical methods. Generally, the longer rehabilitation work is delayed, the greater the risk that the lost capacity cannot be recovered. Tracking well production over time by performing this specific capacity test will provide good information to project forward and budget for a maintenance activity that may be required on the well. If specific capacity has not decreased but pumping rates have, this may indicate a problem with the pump rather than the well.

Water Rights

The City of Prineville holds 33 water rights for the use of both groundwater and surface water for municipal, irrigation, group domestic, and industrial supply. Of these 33 water rights, a majority are for either municipal or irrigation purposes. The City's water rights are summarized on Figures 3-1 and 3-2 as provided by GSI Water Solutions, Inc., and are described in more detail in the following sections. Copies of the water rights certificates are included in Appendix F.

Municipal Water Rights

The City currently holds a total of 13 groundwater rights for municipal use, which include eight certificates, one transfer, and four groundwater permits. The City's municipal water supply currently comes from groundwater supplied by 28 wells, appropriating water under nine of the City's municipal use water rights with a total authorized rate of appropriation of 19.66 cfs (8,825 gpm). Although the City has municipal use water rights authorizing 19.66 cfs, current production capacity of the associated wells is approximately 15.58 cfs (6,991 gpm). However, the water rights limitations for the Airport wells currently cap production capacity at 14.33 cfs (6,436 gpm).

Prineville Valley Floor Aquifer Groundwater Rights

The City holds seven water rights certificates, one transfer, and one permit (Permit G-11993) for the use of water for the municipal supply from the Prineville Valley Floor alluvial aquifer. These Valley Floor aquifer water rights total 10.02 cfs (4,498 gpm). The current combined production capacity of the City's Valley Floor wells is 6.14 cfs (2,756 gpm); therefore, there is 3.88 cfs (1,742 gpm) in excess water rights capacity available for use in the Valley Floor alluvial aquifer. Except for Permit G-11993, all of the City's alluvial aquifer water rights are certificated. Permit G-11993 was partially perfected, with Certificate 87714 issued in 2012. An application for extension of time is currently pending for the remaining unperfected portion of Permit G-11993.

Permit G-18482 authorizes the use of water from the new Yancey Wells, new Lamonta Well, new 4th Street Well, and six other wells that are either not in use or have not yet been constructed. Because Permit G-18482 is for industrial use, the City must apply water appropriated under the permit to industrial water use to certify the water right and obtain a water right certificate. As needed, the City can then seek to transfer the water right to municipal use. The City submitted a permit amendment application, T-13836, in October 2021 to add multiple wells to Permit G-18482. The deadline for applying water to beneficial use under Permit G-18482 is October 1, 2026. Transfer T-13176 authorizes the use of water from the new Yancey Wells for municipal use. This authorization is a backup for, not additive to, the authorization for industrial use under Permit G-18482. The deadline to make full beneficial use of the water under T-13176 is October 1, 2025. Considering the time constraints on these water rights transfers, it is recommended that the City start budgeting for and completing the needed beneficial use documentation in the fall of 2024.

Airport Area Aquifer System Groundwater Rights

Native Groundwater

The City holds two groundwater permits in the Airport Area Aquifer System: Permit G-17577 (commonly referred to as Permit A) and Permit G-18155 (commonly referred to as Permit B). These groundwater permits are for the use of "native groundwater," water stored in the aquifer due to natural recharge, as distinguished from water injected into the aquifer and recovered as part of the City's aquifer storage and recovery (ASR) project, described below. Combined, the City can currently appropriate up to 3.94 cfs (1,769) under the two permits.

Both Permit G-17577 and Permit G-18155 require mitigation under the Deschutes Basin Groundwater Mitigation Program (OAR Chapter 690, Division 505) and are, therefore, subject to maximum annual volume limits.

Permit G-17577 is for the use of up to 1.71 cfs (770 gpm), further limited to a maximum annual volume of 1,242 AF from four wells (Airport Wells No. 1 through 4) in the Airport Area Aquifer System.

Permit G-18155 is for the use of up to 8.02 cfs (3,560 gpm) from up to nine wells, further limited to a maximum annual volume of 2360.7 AF. The authorized rate is also subject to the following limitations: use of no more than 5.57 cfs (2,500 gpm) from Airport Wells No. 1 through 4 and future Wells No. 5 through 7, being no more than 2.23 cfs (1,000 gpm) in total from Airport Wells No. 1 through 4, no more than 1.11 cfs (500 gpm) in total from future Wells No. 5 and 6, and no more than 2.23 cfs (1,000 gpm) from future Well No. 7. There are no well-specific rate limitations on future Wells No. 8 and 9.

Currently, only Airport Wells No. 1 through 4 (the same wells authorized under Permit G-17577) are constructed and utilize; as a result, the combined authorized rate allowed under the two permits is 3.94 cfs (1,769 gpm) (1.71 cfs [770 gpm] under Permit A and 2.23 cfs [1,000 gpm] under Permit B). For operational flexibility, the combined capacity of Airport Wells No. 1 through 4 is approximately 5.21 cfs (2,340 gpm). The proposed Wells No. 5 and 6 would appropriate water from near Powell Butte, Well No. 7 from an area northwest of the Prineville Airport, and Wells No. 8 and 9 from the basalt Deschutes Regional Aquifer near Redmond. The current authorized locations of Wells No. 1 through 9 are provided on Figure 3-3.

Under the Deschutes Basin Groundwater Mitigation Program, the City must provide mitigation pursuant to the rules in OAR Chapter 690, Division 505. To date, the City has provided 263.6 mitigation credits under Permit G-17577 and 340.3 credits under Permit G-18155. The City must provide mitigation for OWRD's estimate of consumptive use. OWRD has generally determined that the use of water for year-round municipal supply is 40 percent consumptive, so with the mitigation currently provided the City can appropriate a maximum of 1,509.8 AF from the Airport Area Aquifer wells.

Aquifer Storage and Recovery

In addition to the City's native groundwater rights, the City holds a Limited License for ASR pilot testing. The City pumps treated and disinfected water from the Crooked River Wellfield for injection into Airport Well No. 4. During the summer, the City can legally recover 95 percent of the volume of water injected into Well No. 4. The City is currently limited to a maximum injection rate of 2.45 cfs (1,100 gpm) and a maximum recovery rate of 3.12 cfs (1,400 gpm) per well, as discussed below. The maximum rate authorized for ASR recovery is in addition to the maximum rate of appropriation under the City's native groundwater permits. As a condition of the City's ASR Limited License, the City must first recover 95 percent of stored water in Well No. 4 prior to using Well No. 4 to pump native groundwater. In 2019, the City began a series of three cycles of pilot testing by utilizing the Airport No. 4/Heliport Well after the well was retrofitted to accommodate the ASR injection and recovery operation. The Limited License allows for storage of up to 870 million gallons (MG) through up to five wells with a maximum injection rate of 1,100 gpm per well and a maximum recovery rate of 1,400 gpm per well. The ASR pilot testing has stored and recovered approximately 34 MG and 98 MG of water during the first two years of pilot testing, respectively, and has stored and recovered approximately 130 MG during the third year of testing.

The three pilot test cycles are summarized on Table 3-2 below.

TABLE 3-2
SUMMARY OF ASR PILOT TESTING PROGRAM*

	Cycle 1 December 2019 through January 2020		**Cycle 2 December 2020 through March 2021**		**Cycle 3 November 2021 through March 2022**	
	Gallons	**Days**	**Gallons**	**Days**	**Gallons**	**Days**
November					30,207,000	28
December	20,077,129	19	31,882,400	31	22,040,000	21
January	13,581,871	12	33,228,000	31	35,164,000	31
February			30,677,000	28	30,464,000	28
March			2,367,000	1.2	11,877,000	11
Total Injected =	33,659,000	31	98,154,400	91.2	129,752,000	119
Total Recovered =	31,976,050		93,246,680		123,264,400	

** Data provided by GSI Water Solutions, Inc.*

Based on early results of the City's ASR testing, the City may be able to obtain approval to recover water from additional wells or at higher rates. With sufficient well capacity, this would allow the City to recover the volume of stored water more quickly to meet periods of high maximum demands. It may also be possible for the City to request an increase in the maximum rate limitation under the City's native groundwater rights. Because ASR testing has shown that groundwater levels are stable or increasing, OWRD may consider relaxing the rate limitation of 1,000 gpm under Permit G-18155 for Wells No. 1 through 4. The City could also increase the maximum authorized rate of use from the Airport Area aquifer by requesting to recover water stored through the City's ASR program at higher rates.

Municipal Water Rights for Wells Not Connected to the City Municipal Water Supply System

The City also holds three additional municipal use groundwater certificates, which are not currently being used, to supply water to the City's municipal water system. These rights are used to supply water for industrial use or are not used by the City due to water quality, production, or other issues. One of these rights is a surface water withdrawal from Ochoco Creek. Figure 3-2 provides further details regarding these water rights. Because these water rights are not used to supply water to the City's municipal system, they are not discussed further in this Water System Master Plan (WSMP). Although the wells associated with these groundwater rights are not connected to the City's municipal system, the water rights associated with the wells may be utilized at other points of appropriation in the Prineville Valley Floor Area aquifer through a water rights transfer, should the City develop additional wells from that source of supply over the long term.

Other City Water Rights

The City holds one certificate and two groundwater permits for uses that include group domestic, industrial, fire protection, and sewerage (see Figure 3-2). Because these water rights are not used to supply water to the City's municipal system, they are not discussed further in this WSMP. The City also holds surface water Certificate 531 in reserve for potential future needs.

Irrigation Water Rights

The City holds 18 water right certificates for primary irrigation of 1,169.3 acres and supplemental irrigation of 562.5 acres. These rights are all surface water rights, with the exception of one supplemental irrigation right associated with a groundwater well. These irrigation water rights are shown on Figure 3-2. The City uses a portion of these rights, in combination with reclaimed water, to irrigate City-owned lands. Both the City golf course and pasture lands near the wastewater treatment plant are irrigated with surface water in this manner. Some of the City's surface water irrigation rights are also to provide in-stream water rights each year. Because these water rights are not used to supply water to the City's municipal system, they are not discussed further in this WSMP.

Water Supply Analytical Testing

General Supply Well Testing Data

Summaries of analytical data related to the City's water quality testing were obtained from the DWS website. The City's well sources have been sampled for the constituents required by the DWS, including total and fecal coliforms, volatile organic compounds, synthetic organic compounds, inorganic compounds, radiological agents, pesticides, fluoride, nitrates, nitrites, arsenic, asbestos, and several metals.

As shown in the City's testing data, most of the constituents were not detected in samples obtained from the wells. Of those detected, the concentrations were significantly less than their corresponding U.S. Environmental Protection Agency (EPA) primary drinking water maximum contaminant levels (MCL). Based on the latest chemical results, groundwater from the City's supply wells does not contain bacteriological or chemical constituents at concentrations greater than the corresponding EPA primary drinking water MCL. The DWS water quality testing summaries are presented in Appendix G.

Distribution System Water Quality Testing

Although the distribution system is discussed in greater detail in Chapter 5, a brief discussion of water distribution system sample analytical testing is presented herein for completeness. The City routinely obtains samples from the water distribution system for analysis of total coliform and fecal coliforms. In general, coliforms are not present in routine water distribution system samples, although the water has tested positive for total coliforms in the past, but not recently. These past positive test results were reported to the DWS, and the DWS recorded the positive test as an alert, although it was not considered a violation. Total coliform bacteria are commonly found in the environment (e.g., soil or vegetation) and are generally harmless. When only total coliform bacteria are detected in drinking water, the likely source is environmental, and fecal contamination is not likely. However, if environmental contamination can enter the system, that may indicate there is a way for pathogens to enter the system and, therefore, it is important to find the source and resolve the issue.

The City also obtains samples from the distribution system for chemical analysis of disinfection byproducts (DBP), asbestos, lead, and copper. From 1993 through 2015, all detected concentrations of DBP, asbestos, lead, and copper were less than their corresponding EPA action levels. Results from the City's coliform, lead, and copper tests are summarized in the DWS water quality testing summaries in Appendix G.

Source Water Assessment Update

The 1996 amendments to the Safe Drinking Water Act required states to provide the information needed by public water systems to develop source water assessments if they chose to do so. The information provided in the source water assessment includes identification of the area most critical to maintaining safe drinking water (i.e., the Drinking Water Protection Area [DWPA]), an inventory of potential sources of contamination within the DWPA, and an assessment of the relative threat that these potential sources pose to the water system. The DWS is the principal agency involved with source water assessments in Oregon. As part of the source water assessment, the DWS developed time of travel delineations for the City of Prineville's water supply wells. In 2020, the DWS certified the City's updated DWPA designated time of travel delineations. The City also completed an Inventory of Potential Contaminant Sources associated with the updated DWPA time of travel delineations in 2020. A copy of the Source Water Assessment (Report) is included in Appendix H.

The Report includes information related to the City's water sources, including delineation of the source water protection area, a sensitivity analysis, an inventory of potential contamination sources, and the susceptibility of the drinking water sources. Refer to Appendix H for information relative to the City's water supply well source aquifers present beneath the Prineville area. The DWPA delineations are intended to identify the area that supplies the system's drinking water. The DWPA is designated for projected 1-, 2-, 5-, and 10-year time of travel periods for water from the aquifer to enter Prineville's water supply sources. Figures showing the DWPA, the times of travel for groundwater to the wells, and potential contamination sources are included in the Report in Appendix H.

The City utilizes the local groundwater aquifer to supply water to the system. Because groundwater sources can be susceptible and sensitive to contamination, it is important to understand and protect the groundwater systems the local population relies on for their drinking water. Potential contaminant sources for each City well were identified and labeled on figures in the Inventory of Potential Contaminant Sources included in the Report located in Appendix H. Potential contaminant sources identified by the Report include leaking underground storage tank sites, commercial and industrial properties, and agricultural facilities. The full list of potential contaminant sources can be found on tables associated with the Report.

The documents conclude the City of Prineville's water system obtains water from several local aquifers that could be impacted by the release of contaminants on the ground or into the subsurface. Several high to moderate risk potential contaminant sources were identified within the protection area of several of the City's water wells.

Water Conservation

Although it does not impact system capacity, water conservation can create water savings and reduction in water demand that can eliminate or delay the need for the development of new sources. The City has implemented a number of conservation measures and is considering future conservation program enhancements as outlined in the City's 2011 Water Management and Conservation Plan prepared by GSI Water Solutions, Inc.

The City has employed several basic conservation programs including annual water audits, water meter upgrades to radio read metering (including testing and maintenance of meters), a tiered water rate structure, encouragement of conservation measures, leak detection and repair, public education, and providing free water conserving devices.

Water Supply Reliability

The reliability of the water supply is one of the most important components of any water system. Because the health and safety of the community depends on a reliable water source, high priority should be given to help ensure a municipal water system always has the ability to meet the water needs of its customers. A number of factors, such as mechanical failures, water quality concerns, power outages, primary water transmission line failures, etc., can affect the reliability of a water supply. It is nearly impossible to ensure 100 percent reliability of any system. However, having proper system components can reduce the risk of a water supply failure.

The City of Prineville uses a combination of both deep and shallow wells for their water supply. In general, a groundwater well source is less susceptible to seasonal fluctuations in weather patterns, drought, or contamination than a surface water source. The water levels in the City's wells do have some seasonal fluctuations; however, over time, the static water levels have remained fairly constant. Although the City's water sources have been reliable, certain events could affect the City's water supply. When evaluating the system's performance, potential weaknesses were identified as follows:

1. Transmission line failure
2. Source contamination
3. Equipment failure at the Airport Area Aquifer System wells and/or Valley Floor Area wells
4. WTP failure
5. Booster pump station equipment failure
6. Contamination in reservoirs and the distribution system

To date, the City has been able to meet system demands, currently possessing approximately 1,826 gpm of additional pumping capacity above peak daily demands (PDD). Recent improvements to the water system include a 16-inch pipe connecting the Airport and the Valley Floor areas of the water system, which provides redundancy to both systems, as water can be pumped to the airport as well as received from the Airport area to supply the Valley Floor area. Additional redundancy improvements include a backup power generation system capable of maintaining system electrical and controls to the Crooked River Wellfield and WTP. Additional backup power is available at the Airport No. 4/Heliport Well, which currently serves as the City's ASR injection and recovery well, as well as from a portable generator that can be used to provide power to individual sites in the event of a long-term power outage.

Reservoir storage is further discussed in Chapter 4, and the distribution system and delivery of water supply from the Airport Area Aquifer System wells to other zones within the City are discussed in detail in Chapter 5.

Water Supply Enhancement Alternatives

The City has constructed four new wells since 2019 that have replaced aging Valley Floor Area wells: Yancey No. 2 and 3, Lamonta No. 2, and 4th Street Deep No. 2. Additionally, the City has constructed the Crooked River Wellfield and WTP. The combined increase in available flow from the wells in the Valley Floor area is approximately 3,226 gpm more than the previous well pumping capacity. This increased flow provides the City enough source capacity to meet current PDDs. As shown on Figure 2-3 in Chapter 2, the peak daily flow requirements, assuming the wells operate 18 hours per day, are estimated to be approximately 4,405 gpm and 6,960 gpm for current and projected future (2042), respectively. It should be noted that increased population growth and large commercial use could significantly increase the PDDs in the near future, and the continued development of additional water sources should be pursued. Assuming the recommended daily operating time limit of 18 hours for the well pumps is implemented, the City will need to develop an additional pumping capacity of 524 gpm to meet the 20-year projected demands.

Develop Additional Well Sources Alternative

Drilling and developing additional wells to appropriate water from the Deschutes Regional Aquifer is an option the City could consider. As discussed above, Wells No. 1 through 4 have a physical pumping capacity of 2,325 gpm but are limited by the water rights permit to an instantaneous water right withdrawal rate of 1,770 gpm. Water rights from proposed Wells No. 5 through 7 (see Figure 3-3) allow no more than 500 gpm in total from Wells No. 5 and 6 and no more than 1,000 gpm from Well No. 7, or 1,500 gpm total. There are no well-specific rate limitations on proposed Wells No. 8 and 9. Well No. 7 would be the most feasible well to drill and develop as it has the closest proximity to the City and would require the shortest pipeline to allow it to be connected to the City's water system; it also has double the available water right when compared to Wells No. 5 and 6. As shown on Figure 3-3, all the proposed wells would require miles of pipeline to be constructed to connect them to the City's system. These pipelines would have a high capital cost to construct and, unless Well No. 8 or 9 was connected, would not provide the City with the long-term capacity needed to meet the projected demands. For these reasons, the development of these proposed wells does not appear to be the most cost-effective option potentially available to the City.

Additional ASR capabilities should also be explored as additional wells are constructed in the Deschutes Regional Aquifer. Currently the City has one ASR injection and recovery well, which is allowed up to 1,100 gpm of injection and 1,400 gpm of recovery. Additional wells, up to five total, are anticipated to have the same limitations up to a total ASR storage of 870 MG per the Limited License (LL-26) currently held by the City. Further expansion of the ASR program would allow for storage of water during cooler months for use in warmer periods, which would reduce the use of native groundwater and any urgent need for additional groundwater rights.

A list of advantages and disadvantages associated with this option follows:

Advantages

- Storage and reuse of excess water during low-demand periods
- Stored water can be recovered as needed during high-demand periods without using native groundwater
- Airport Area sources and storage can gravity feed the lower pressure zones
- Water sources in this area currently do not require treatment beyond chlorination for residual only

Disadvantages

- Higher capital cost for initial well construction
- Higher capital cost for piping improvements to connect to existing system

Expansion of Shallow Groundwater Source(s) Adjacent to the Crooked River

The City completed construction of the Crooked River Wellfield and WTP in 2021. The current pumping capacity of the wells in the wellfield, full plant, is approximately 1,900 gpm, and the WTP capacity is 2,000 gpm. The WTP was constructed in a manner to accommodate a future expansion of 1,000 gpm. Further expansion of the wellfield and WTP should be explored as a source for an additional 1,000 gpm potential capacity.

A list of advantages and disadvantages associated with this option follows:

Advantages

- Existing treatment facility was constructed to accept additional capacity
- Lower capital cost for shallow well construction
- Much of the needed infrastructure is already installed
- Produces source water for ASR storage

Disadvantages

- Location requires extensive pumping to serve the distribution system
- Raw water requires treatment prior to distribution
- Higher operation and maintenance costs to operate WTP

Recommendations

To obtain the projected additional water supply capacity, the City should consider increasing its water supply capacity. This could be done by developing the proposed wells in the Deschutes Regional Aquifer or through additional development of the shallow groundwater sources located near the Crooked River. Both proposed options can work with the other to improve the source capacity, redundancy, and reliability of the system. The most feasible option available to the City appears to be from the shallow groundwater sources since the existing infrastructure has the potential to increase flows by approximately 1,000 gpm. Additional well drilling and exploration in the Deschutes Regional Aquifer is ongoing and has had reasonable success, so this option could also be explored further along with expansion of the City's ASR program.

Water Rights for Water Sources Currently or Recently Connected to the Municipal Water System

Well	Application	Permit	Certificate	Claim or Transfer	Entity Name on Water Right	Type of Beneficial Use	Priority Date	Source of Water	Water Right Authorized Rate gpm	Water Right Authorized Rate cfs	Water Right Authorized Rate mgd	Water Right Authorized Rate Max AF/year	Current Capacity gpm	Current Capacity cfs	Status
Water Rights for Sources Currently or Recently Connected to Municipal Water System															
Barney	G-6313	G-9154	94816		City of Prineville	MU	10/5/1973	Prineville Valley Aquifer	605	1.35	0.87		340	0.76	
Stearns 2													210	0.47	
Stadium	G-12344	G-11993	87714 (PP)		City of Prineville	MU	12/14/1990	Prineville Valley Aquifer	271	0.60	0.39		205	0.46	
									154	0.34	0.22				Permit completion date 10/1/1998. Extension application pending. Addendum submitted 1/17/2018.
4th Deep 2	U-402	U-372	94817		City of Prineville	MU	12/8/1950	Prineville Valley Aquifer	192.5	0.43	0.28		450	1.00	New 4th Street Deep well drilled 2021 (CROO 55194). 4th Deep well also added to permit G-18482 through permit amendment T-13836 (pending).
4th Shallow (Abandoned)	U-396	U-370	88146		City of Prineville	MU	10/11/1950	Prineville Valley Aquifer	135	0.30	0.19		0	0	Well decommissioned 3/2021. Considering options for transfer of water right.
Yancey 3	U-241	U-215	94815		Pacific Power & Light Co.	MU	6/17/1947	Prineville Valley Aquifer	220	0.49	0.32		400	0.89	New Yancey well drilled 2021. Yancey 3 well also added to permit G-18482 through permit amendment T-13836 (pending).
Lamonta 2	G-605	G-506	94818		City of Prineville	MU	4/5/1957	Prineville Valley Aquifer	231	0.51	0.33		600	1.34	New Lamonta well drilled 2020. Lamonta also added to permit G-18482 through permit amendment T-13446.
Ochoco Heights	U-147	U-140	94819		City of Prineville	MU	5/20/1942	Prineville Valley Aquifer	297.5	0.66	0.43		0	0	Well not currently in use
Yancey 2 (Municipal Backup Transfer)	G-6313	G-9154	~~83993~~	T-13176	City of Prineville	MU	10/5/1973	Prineville Valley Aquifer	95	0.21	0.14		600	1.34	T-13176 C-date - 10/1/2025
	U-402	U-372	~~86889~~				12/8/1950		144.5	0.32	0.21				
	U-241	U-215	~~22839~~				6/17/1947		139	0.31	0.20				
	G-605	G-506	~~86337~~				4/5/1957		115	0.26	0.17				
	U-147	U-140	~~86558~~				5/20/1942		61.5	0.14	0.09				
	U-140	U-133	~~15539~~				5/16/1941		45	0.10	0.06				
Clear Pine Permit: Yancey 2	G-13238	~~G-12541~~ ~~G-18304~~ G-18482		T-13026 T-13446 T-13836	City of Prineville	Industrial Use Including Fire Protection and Dust Control	1/6/1993	Prineville Valley Aquifer	1,791	3.99	2.58		600	1.34	Yancey 2 added via Permit Amendment T-13026.
Lamonta 2													600	1.34	Lamonta 2 added via Permit Amendment T-13446.
New Ochoco Heights Well													0	0	Well not developed yet. Added via permit amendment T-13026.
Stryker Park Well													0	0	Well not developed yet. Added via permit amendment T-13026.
Juniper Well													0	0	Well not developed yet. Added via permit amendment T-13026.
4th Deep 2													450	1.00	4th Deep 2 added via permit amendment T-13836 (pending).
Yancey 3													400	0.89	Yancey 3 added via permit amendment T-13836 (pending).
Stearns 3													0	0	Well not developed yet. Added via permit amendment T-13836 (pending).
5th and Deer													0	0	Well not developed yet. Added via permit amendment T-13836 (pending).
Airport Well 1	G-15974	G-17577		T-10378 T-11647 T-12192 T-13826	City of Prineville	MU	3/31/2003	Airport Area Aquifer System	770	1.72	1.11	1242	2325	5.18	Completion date 12/29/2026
Airport Well 2															
Airport Well 3 (Millican Well)															
Airport Well 4 (Heliport Well 4)															
Airport Well 1	G-16900	G-18155		T-11685 T-13826	City of Prineville	MU	6/27/2007	Airport Area Aquifer System	1,000	2.23	1.44	3682.7			Completion Date 10/1/2031. Well A, B, and C proposed for inclusion in permit amendment application T-13826. These are the same as ASR wells 2, 3, and 4. Addition to permit G-18155 would allow the wells to be used both for ASR recovery or native groundwater pumping.
Airport Well 2															
Airport Well 3 (Millican Well)															
Airport Well 4 (Heliport Well 4)															
Well A													0	0	
Well B													0	0	
Well C													0	0	
Wells 5-9								Deschutes Regional Aquifer	2,599	5.79	3.74		0	0	
Les Schwab Wellfield (Wells 1 - 25), H1, H2, H3	G-18662	G-18154		T-13621	City of Prineville	MU	4/25/2018	Prineville Valley Aquifer	2000	4.46	2.88	3,230	2000	4.46	Permit Amendment T-13621 redescribes location of 17 valley floor wells and proposed to add nine new wells (2, 22, 24, 25, 26, & 27, H1, H2, H3)
	G-19263				City of Prineville	MU	3/18/2022	Prineville Valley Aquifer	Proposed: 2,000	Proposed: 4.46	Proposed: 2.88	Proposed: 3,230	N/A - WATER RIGHT PERMIT NOT YET ISSUED		OWRD has not issued a permit for this application.
Valley Floor Deep Aquifer Subtotal (not including proposed):									4,497	10.02	6.48	N/A	2,805	6.25	Production rates authorized for 4th Deep 2, Yancey 3, Lamonta 2, and Yancey 2 are authorized by multiple water rights, but well capacity is not double-counted in this total.
Airport Area Aquifer System Subtotal (not including ASR Recovery):									1,770	3.94	2.55	4,924.70	2,325	5.18	
Powell Butte/Redmond Area Water Right Capacity Remaining (gpm):									2,599	5.79	3.74		0	0	All water right capacity for Airport and Redmond Area wells requires mitigation. Airport Area Wells limited to 1,770 gpm. All remaining capacity is for proposed wells to be located west of the airport area near Powell Butte and Redmond.
Les Schwab Wellfield Aquifer Subtotal (not including proposed):									2,000	4.46	2.88	3,230.00	2,000	4.46	Includes only permit G-18154.

Municipal Water Rights for Sources Not Connected to the Municipal Water System

Well	Application	Permit	Certificate	Claim or Transfer	Entity Name on Water Right	Type of Beneficial Use	Priority Date	Source of Water	Water Right Authorized Rate gpm	Water Right Authorized Rate cfs	Water Right Authorized Rate mgd
Municipal Water Rights for Sources Not Connected to Municipal Water Supply System											
Freight Depot	G-605	G-506	~~T-11026~~ 89853		City of Prineville	MU	4/5/1957	Prineville Valley Aquifer	148	0.33	0.21
10th Street	U-140	U-133	15539	City of Prineville	MU	5/16/1941		Prineville Valley Aquifer	45	0.1	0.06
Ochoco Creek	Crooked River Decree	--	531		City of Prineville	MU, FP, Sewerage	12/31/1879	Ochoco Creek	Reasonable Amount	Reasonable Amount	Reasonable Amount

GSI Water Solutions, Inc.

anderson perry & associates, inc.

CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
CITY-HELD MUNICIPAL
WATER RIGHTS

FIGURE
3-1

Other Water Rights Held by the City (Sources Not Connected to the City's Municipal Water System)

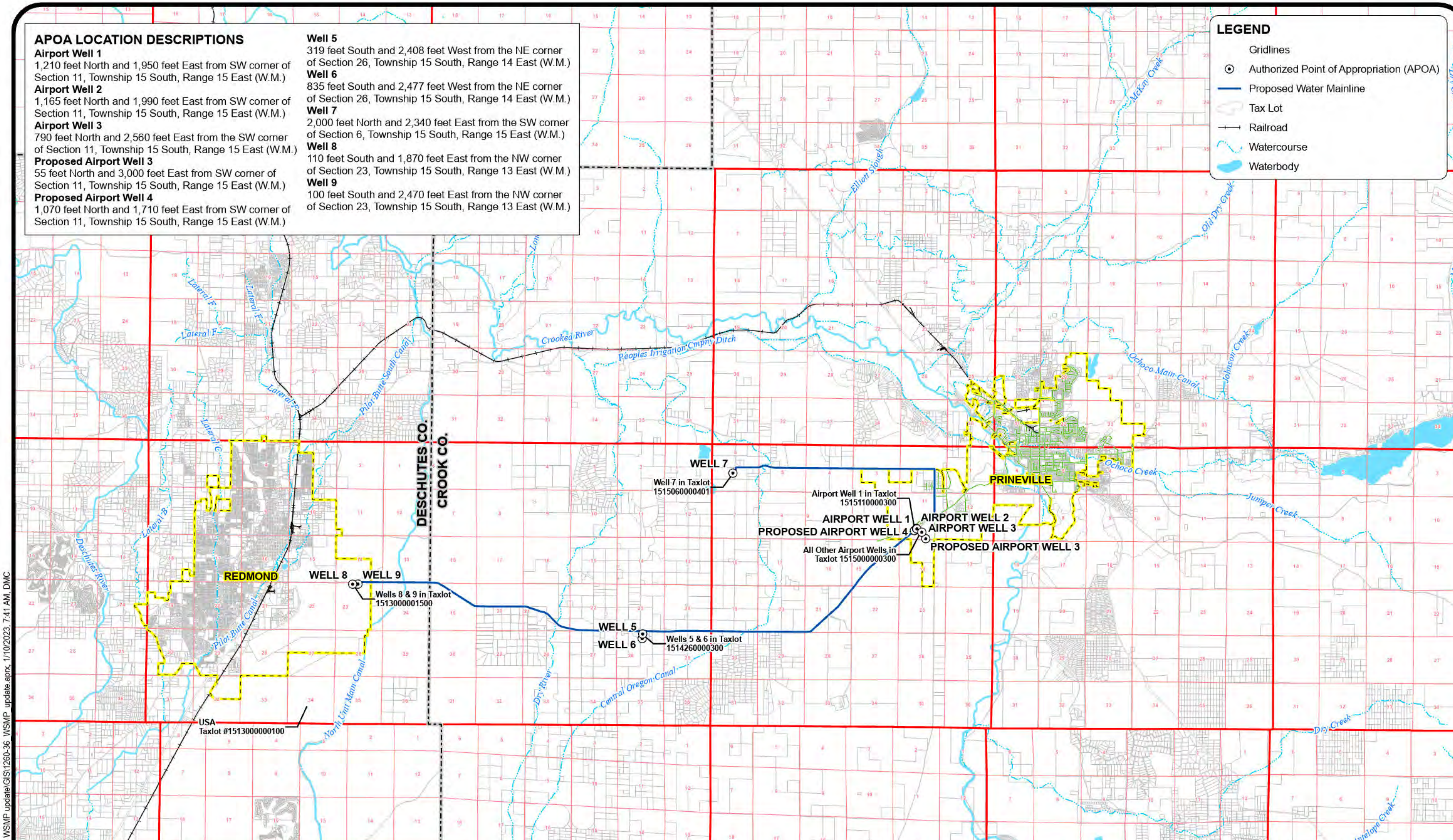
Well	Application /Decree	Permit	Certificate, Claim or Transfer	Entity Name on Water Right	Type of Beneficial Use	Priority Date	Source of Water	Authorized Rate			Primary Acres	Supplemental Acres	Status/Comments
								gpm	cfs	mgd			
Other Water Rights Held by the City													
Northridge A	G-13280	G-13280		City of Prineville	GD	2/5/1993	Prineville Valley Floor Aquifer	67.0	0.15	0.10			Completion date 10/1/2017. Not connected to City's Municipal Water Supply System
Stearns #1	G-3139	G-2919	57438	Pacific Power & Light Co.	GD	6/17/1965	Prineville Valley Floor Aquifer	112	0.25	0.16			Currently not in use due to water quality and/or production issues

Irrigation Water Rights Held by the City (Sources Not Connected to the City's Municipal Water System)

Source	Application /Decree	Permit	Certificate, Claim or Transfer	Entity Name on Water Right	Type of Beneficial Use	Priority Date	Source of Water	Authorized Rate			Primary Acres	Supplemental Acres	Status/Comments
								gpm	cfs	mgd			
Surface Water Irrigation Rights													
Surface Water	S-25184	S-19956	33012	Claude Williams	SUP IR	8/25/1950	Crooked River	480	1.07	0.69	85.4		
	S-15522	S-11411	75485	Peoples Irrigation Co.	Primary IR	9/11/1934	Crooked River	449	1	0.65	78.4		
	S-15629	S-11494	75487	Peoples Irrigation Co.	IR	11/21/1934	Crooked River	72	0.16	0.10	12.4		
	S-4788	S-5426	82246	Ochoco Irrigation District	IR	3/13/1916 (from McKay) 8/10/1917 (from other sources)	Ochoco Creek, McKay Creek, Dry Creek, Lytle Creek, Johnson Creek, Ochoco Reservoir, Waste and Return Water Flowing in All Unnamed Waterways				304.7		
	S-32641	S-25991	~~68395~~ ~~T-8648~~ 82247	US Bureau of Reclamation	SUP IR	4/8/1914	Crooked River and Prineville Reservoir	13	0.03	0.02	2.5	304.7	
			82247	US Bureau of Reclamation	IR	4/8/1914	Crooked River and Prineville Reservoir	31	0.07	0.05	2.8		
	S-15766	S-11619	87546	Peoples Irrigation Co.	IR	3/28/1935	Crooked River	85	0.19	0.12	15		
	Crooked River Decree		87547	Peoples Irrigation Co.	IR, LV	1893	Crooked River	304	0.6775	0.44	54.2		
	S-32641	S-25991	87548	US Bureau of Reclamation and Peoples Irrigation Company	IR, SUP IR	4/8/1914	Crooked River and Prineville Reservoir	395 gpm primary; 1522 gpm supplemental	0.88 cfs primary; 3.39 cfs supplemental		32.5	129.3	
	S-32641	S-25991	~~T-11103~~ 83850	Bureau of Reclamation	SUP IR	4/8/1914	Crooked River and Prineville Reservoir	415	0.925	0.60	37		
			~~T-11134~~ 83850	Bureau of Reclamation	IR, SUP IR	4/8/1914	Crooked River, Prineville Reservoir	471	1.05	0.68	21.8	20	
	S-15766	S-11619	~~T-11134~~ 90380	Peoples Irrigation Co.	IR	3/28/1935	Crooked River	139	0.31	0.20	25		
	Crooked River Decree		~~T-11134~~ 90381	Peoples Irrigation Co.	IR, LV	12/31/1893 12/31/1895	Crooked River	166	0.37	0.24	29.3		
	S-32641	S-25991	~~T-11134~~ 90382	US Bureau of Reclamation and Peoples Irrigation Company	IR, SUP IR	4/8/1914	Crooked River, Prineville Reservoir	705	1.57	1.01	8.3	54.3	
	Crooked River Decree		~~T-11134~~ 90383	Peoples Irrigation Co.	IR, DOM, LV	1895	Crooked River	112	0.25	0.16	20		
	Crooked River Decree		90397	Peoples Irrigation Co.	IR, DOM, LV	1895	Crooked River	224	0.5	0.32	40		
	Crooked River Decree	--	531	City of Prineville	IR	12/31/1879		2,244	5.00	3.23	400		
Groundwater Irrigation Rights													
Simmons Well	G-13068	G-12511	87724	City of Prineville	SUP IR	8/7/1992	Prineville Valley Floor Aquifer	301	0.67	0.43		54.2	Not connected to City's Municipal Water Supply System
										Total:	1,169.3	562.5	

CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
CITY-HELD IRRIGATION AND OTHER WATER RIGHTS

FIGURE
3-2



DISCLAIMER

This map was prepared for the purpose of identifying the location of a water right only and it is not intended to provide legal dimensions or location of property ownership lines.

Date: January 10, 2023
Data Sources: OWRD, Crook Co. GIS, OGIC, ESRI

anderson perry & associates, inc.

CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

AUTHORIZED POINTS OF APPROPRIATION (APOA)

FIGURE
3-3

Chapter 4 - Water Storage

Introduction

This chapter presents information about the City of Prineville's water storage facilities and discusses the purpose for storage in municipal water systems. The condition and needs of the City's existing storage reservoirs are outlined, recommended storage requirements to meet current and 2042 design criteria are presented, and the types of storage facilities generally available are outlined. Cost estimates for storage reservoir improvements are presented at the end of this chapter.

General

Water storage facilities are constructed to serve several purposes. First, storage reservoirs are often used to provide control for well or booster pump system operation. When a reservoir drops a few feet or more from the full level, the water level can be used as a control for well pump or booster pump activation. The amount of storage required for this type of control is called "operating storage." Second, stored water must be available to supply water during periods in which the demand for water exceeds the available water supply. This reserve is called "equalization storage." Third, reserve storage is usually provided to supply unusually high, short duration demands, such as fire flows. This is referred to as "fire reserve." Reserve storage is also often provided for emergencies that may arise and interfere with production from water supply sources. Such emergencies could be created by power outages, mechanical equipment failure, or sudden water contamination. The amount of storage to be provided for an emergency depends on the likelihood and the impact of such an occurrence. The amount of emergency storage provided usually becomes a balance between what is needed and what can be afforded. This storage allowance is usually called "emergency reserve." Finally, a certain amount of water within the water storage reservoirs is not usable in the system due to physical constraints such as inlet/outlet piping or pump suction limitations. This storage is referred to as "dead storage."

Storage facilities can be located at approximately the same elevation as the water distribution system. Storage facilities of this type require continuous operation of a booster pump system to maintain distribution system pressure. Storage facilities can also be elevated, in which case the water is stored at an elevation considerably above the distribution system to generate adequate system pressure. For example, a water elevation 120 feet above a distribution system would be required to generate a distribution system static pressure of approximately 50 pounds per square inch. Reservoirs may be elevated by locating them on natural ground high enough above the service area or by construction on top of a steel support frame.

Storage reservoirs are generally constructed of steel, reinforced concrete, or prestressed concrete. The choice is usually based on an economic analysis made for the particular installation. Reservoirs may be constructed either above ground or buried, with the choice made on cost, location, and community acceptance. The remainder of this chapter reviews the City's existing storage facilities, presents a discussion of future storage needs, and provides alternatives for satisfying those needs.

Existing Facilities

The City's existing municipal water storage consists of six water storage reservoirs with a total storage volume of 4.5 million gallons (MG). Refer to an overview of the reservoirs in Chapter 1 and Table 4-1 below for a summary of operational parameters and age.

TABLE 4-1
SUMMARY OF SYSTEM RESERVOIRS

Reservoir	Volume (MG)	Base Elevation (feet)*	Overflow Elevation (feet)*	Height (feet)	Completion Date
Ochoco Heights Reservoir No. 1	0.5	2,937	2,987	50	1955
Ochoco Heights Reservoir No. 2	0.5	2,937	2,987	50	1964
American Pine Reservoir	1.0	2,951	2,984	33	2002
Barnes Butte Reservoir	0.5	3,064	3,104	40	1978
Airport No. 1 Reservoir	1.0	3,380	3,404	24	1996
Airport No. 2 Reservoir	1.0	3,378	3,404	26	2014
Total	**4.5**				

** Elevations are based on North American Vertical Datum 88.*

The most recent detailed inspections of the six reservoirs were completed in September 2018 by Inland Potable Services, Inc., of Centennial, Colorado. Copies of the available inspection reports for the reservoirs are included in Appendix I. Additional information was gathered from inspection video from each reservoir. Table 4-2 summarizes the existing conditions and recommendations provided by Inland Potable Services, Inc., for each reservoir.

TABLE 4-2
EXISTING CONDITIONS AND RECOMMENDATIONS

Reservoir	Inspection Summary	Recommendations
Airport No. 1	The exterior and interior of the reservoir were generally found to be in good condition.	Install gasket on access hatch. Replace vent screen.
Airport No. 2	The exterior and interior of the reservoir were generally found to be in good to excellent condition.	
Ochoco Heights No. 1	The reservoir exterior was generally found to be in fair to good condition, with surface corrosion ranging from less than 1 percent to 10 percent. The interior of the reservoir was generally found to be in good to fair condition, with micro and macro blistering, heavy corrosion in areas, sediment staining, coating delamination, and up to 10 percent corrosion noted.	Install gasket on access hatch. Sandblast and recoat interior of the reservoir Repair the epoxy coating on the exterior of the reservoir.
Ochoco Heights No. 2	The exterior of the reservoir was generally found to be in good condition, with up to 5 percent surface corrosion.	Install gasket on access hatch. Sandblast and recoat interior of the reservoir.

Reservoir	Inspection Summary	Recommendations
	The interior of the reservoir was generally found to be in good to fair condition, with pitting, 10 percent rust nodules, and up to 16 percent corrosion noted.	Repair the epoxy coating on the exterior of the reservoir.
Barnes Butte	The reservoir was generally found to be in good condition.	Install gasket on access hatch.
American Pine	The reservoir was generally found to be in good condition.	Install gasket on access hatch.

Based on reservoir operation and historic sediment volume deposited in the reservoirs, inspections are recommended to be completed every three to seven years. The Ochoco Heights reservoirs are recommended to be cleaned and inspected within the next fiscal year to develop a re-coating plan in the near future.

System Pressures Provided by the Reservoirs

The City of Prineville currently has six pressure zones serving the distribution system. Where practical, the distribution system is gravity-fed from the reservoirs. Chapter 5 provides further detail of the existing pressure zones. Fire flow capacity and the evaluation of the distribution system are also discussed in Chapter 5, as is the water modeling performed as part of this Water System Master Plan (WSMP), which considers varying system demand conditions and their impact on distribution system pressures.

Storage Requirements

Water storage is usually provided for several purposes. Various methods are used to calculate the volumes of each type of storage component required. Most involve a rational approach to estimating the volume of each storage component consisting of operating, equalization, fire reserve, emergency reserve, and dead storage. The decision can then be made as to which component controls and which storage volumes will be necessary. For example, the decision may be made to provide storage for operating, equalization, and fire reserve only, assuming any emergency storage would be available from the fire reserve or the City's wells with backup power capacity. All five of the storage components listed below were considered when evaluating the City's potential storage needs. Refer to the design criteria presented on Figure 2-3 in Chapter 2 for further information on the storage components discussed herein.

Operating Storage

Operating storage is generally provided to facilitate operation of wells or booster pumps in a water system. For example, when water system demands result in the water level lowering in a reservoir, the water level will reach a certain point that can be used to trigger activation of well pumps to refill the reservoir. The storage needed to activate water supply sources is typically referred to as operating storage. This zone of operation can be set as desired but is often set to help ensure circulation occurs during each pump run cycle, allowing water to cycle through the reservoir to help maintain water quality while keeping the reservoir as full as possible.

Equalization Storage

Equalization storage should be provided to balance the difference between peak hour demand and water supply capacity during a peak day demand period. An empirical method for estimating the required equalization storage uses the difference between the peak hourly flow and the peak water supply availability for a specific number of peak hours per day. For the purposes of this evaluation, 2-1/2 hours of peak hourly flow has been assumed. Based on providing the current estimated peak hourly flow of 8,250 gallons per minute (gpm) for 2-1/2 hours and using the current pumping capacity available of approximately 6,436 gpm, 272,100 gallons of equalization storage is currently required. The required equalization storage is anticipated to increase to 992,100 gallons in the 20-year design period to accommodate an anticipated increase in population (if additional water supply sources are not developed).

Fire Reserve

Reserve storage for fire suppression is usually determined from either the Insurance Services Office, Inc. (ISO) recommended fire flow or the fire flow recommended by the City's fire chief. Based on the typical maximum fire flow recommended by ISO, a 3,500 gpm fire flow with a 2-hour duration has been set as the design fire flow for the City, as discussed in Chapter 2. A total of 420,000 gallons of fire reserve storage is needed to sustain a fire flow of 3,500 gpm for a 2-hour duration.

Emergency Reserve

Emergency storage is usually provided for a minimum of one to three days' supply in the event of a power outage, mechanical problems, or other problems that would interrupt the reliable supply of water. In most cases, this would be the minimum amount of time to repair or replace a well pump or other equipment. Generally, the City has emergency power supply provisions to operate wells in the event of a power outage and would be less reliant on reserves should a power outage occur. Currently, to serve the City for one day of emergency reserve at the average daily demand, 1,936,600 gallons would be needed. This amount is anticipated to increase to 3,747,000 gallons in the year 2042.

Dead Storage

Dead storage represents the water stored in the reservoirs that cannot be utilized due to physical constraints such as inlet/outlet piping configuration. This makes a portion of stored water not available to be drawn out of the reservoirs. For the purposes of this WSMP, 5 percent of the total storage volume is used to represent dead storage.

The City's water storage reservoirs provide the operating storage, equalization storage, fire reserve, dead storage, and emergency reserve for the existing pressure zones. It should be noted that not all pressure zones are tied to a specific reservoir. For example, the Valley Floor Pressure Zone can receive water from the Ochoco Heights reservoirs and the Airport reservoirs. The Airport reservoirs supply water to the Valley Floor Pressure Zone through two pressure reducing valves (PRV). The Barnes Butte Pressure Zone receives water from the Barnes Butte Reservoir. The Williamson Pressure Zone receives water from the Barnes Butte Reservoir and the Ochoco Heights reservoirs through the Combs Flat, Wilco, and Williamson PRVs. The Valley Floor Pressure Zone is also able to send water to the higher Airport Area Pressure Zone through a booster pump station located adjacent to the City's wastewater treatment facility. Refer to Chapter 5 for further discussion on the City's pressure zones and system operation.

Storage Components Summary

Considering all five of the storage components discussed previously, it appears the current storage of 4.5 MG is adequate to meet current demand; however, an additional 1.4 MG is recommended to meet projected 2042 demands. Additional storage capacity and upgrades to current storage facilities are currently proposed in both the Capital Improvements and System Development Charge (SDC) Plans, which are discussed further in Chapter 6.

Current Storage Improvements

The area in and around the City of Prineville has numerous desirable qualities that certain large commercial industries have discovered. These qualities include robust electric and communication infrastructure, a moderate climate, qualified workforce, and state-level tax incentives. As these large commercial industries have established themselves in Prineville, there are understandable concerns about existing City infrastructure and its ability to serve the large commercial clients while maintaining reliable, quality service to its residents. In response to these concerns, some large commercial industries have approached the City and proposed funding of specific capital improvements to meet their needs. These proposed improvements currently consist of a 1.5 MG reservoir near the Airport No. 1 and Airport No. 2 Reservoirs, a large-diameter water transmission main line, and construction of an aquifer storage and recovery injection and recovery well. Preliminary design work has already begun for these initial improvements. Other possible improvements include additional storage, well capacity, and system piping improvements. Construction of these proposed improvements could provide the needed additional storage capacity without modifications to existing storage or construction of new storage by the City.

Future Growth

Anticipated future growth in the east portion of Prineville (south of Barnes Butte) may occur in areas that cannot be served by the current water system pressure zones' existing capacity. Establishing an addition to the Williamson Pressure Zone to provide adequate system capacity for future development on the east side of Prineville is recommended. It is further recommended to construct an additional 1.0 MG reservoir to supply the new Williamson Pressure Zone with necessary operation, equalization, fire reserve, and emergency reserve storage. The location of this reservoir is generally anticipated to be located approximately 1/2 mile south of Highway 26 and 1 mile east of Highway 380 at an approximate ground elevation of 3,060 feet, which is the same elevation as the Barnes Butte Reservoir. The implementation period for construction of this improvement is dependent on the rate of demand increases in east Prineville.

Operation and Maintenance

As noted previously in this chapter, the City of Prineville has conducted periodic inspections of its reservoirs. These inspections indicate Ochoco Reservoirs No. 1 and 2 are deteriorating and require maintenance. The recommended maintenance requires the draining of one of the reservoirs, sandblasting, and recoating of both the interior and exterior surfaces. To achieve the best results, this work should be completed in the summer months. The downside is that the summer months have the greatest water usage and removing a reservoir from service for maintenance could leave the system vulnerable to peak demand conditions.

Due to current conditions, removal of one of the Ochoco Heights reservoirs from the system to complete the recommended maintenance operations is not recommended. A new 1.5 MG reservoir is recommended to be constructed alongside the existing reservoirs. The design criteria on Figure 2-3 show the City will need an additional 1.4 MG storage for the 20-year planning period. However, the life of a properly maintained storage reservoir can be more than 50 years. The relative comparative cost of constructing a 1.5 MG reservoir to replace the existing 0.5 MG reservoir is an advantageous investment for the City for long-term planning purposes. Once the new reservoir is constructed and in operation, one of the existing 0.5 MG reservoirs can be taken out of service to complete renovations and repairs. Once the rehabilitation work is complete, the renovated and repaired reservoir would work in conjunction with the new reservoir, providing a total of 2.0 MG storage at the site. The second existing 0.5 MG reservoir would be demolished.

It should be noted that the proposed 1.5 MG reservoir planned for the airport area would still require improvements to the Ochoco Heights reservoirs. Improvements are needed to facilitate continued operation of the Ochoco booster pump station, which utilizes the Ochoco Heights reservoirs as an intake and would require significant modification to boost distribution system pressure to serve both the Ochoco Heights and Northridge Pressure Zones.

Cost Estimates

The anticipated cost to construct a new 1.5 MG reservoir, rehabilitate one of the existing 0.5 MG reservoirs, replace the Ochoco booster pump station, and decommission the second existing 0.5 MG reservoir is $7,230,000 (2023 cost). These improvements are anticipated to be included on the City's SDC Funded Projects list. The anticipated cost for a new 1.0 MG reservoir to serve an expanded pressure zone in east Prineville is $8,775,000. SDCs are anticipated to help pay for this construction, as the reservoir will serve future growth. Further discussion regarding capital improvements projects, SDCs, and detailed breakdowns of estimated costs is provided in Chapter 6.

Summary

The City currently has six operating storage reservoirs with a total volume of 4.5 MG. With the exception of the Ochoco Heights reservoirs, the existing condition of these reservoirs is generally good to very good. However, improvements and rehabilitation are recommended for the Ochoco Heights reservoirs. The storage needed for the 2042 planning period is approximately 5.9 MG, so an additional 1.4 MG of storage is recommended. Anticipated future growth in east Prineville will require additional storage capacity to serve an expanded pressure zone. A new reservoir is recommended to be constructed with the projected growth in east Prineville to provide adequate system pressures and fire protection. The lower elevations of the expanded pressure zone would be served by gravity flow from the new reservoir. A booster pump station would be necessary to provide adequate pressures to fill the new reservoir.

Due to the logistics and coordination to provide needed maintenance to the existing Ochoco Heights reservoirs, a new larger reservoir is recommended to be constructed at the site. This would enable the existing reservoirs to continue to serve the system as the new reservoir is constructed. Once in operation, the new reservoir could then serve the system as one of the existing reservoirs is repaired and the other is demolished. Upon completion, a more reliable and easier-to-maintain system would be in place.

The proposed 1.5 MG reservoir to be located near the existing Airport reservoirs presents an opportunity for needed future storage as well as the ability to gravity-feed lower elevation portions of the distribution system. While the proposed Airport reservoir improvements are identified to provide storage for specific large commercial clients, the ability to utilize these improvements system-wide during normal operating conditions will provide the system with improved resiliency, capacity, and reliability.

Chapter 5 - Distribution System

Introduction

This chapter discusses the City of Prineville's existing water distribution system, which delivers water to residential and commercial users. Components of the distribution system include pipelines, valves, pressure reducing valves (PRVs), booster pump stations (BPSs), water meters, water service lines, and fire hydrants. The distribution system has been evaluated for both present and future needs. Recommended distribution system Improvements have been developed to address existing identified deficiencies and provide future service to help meet both Oregon Health Authority - Drinking Water Services (DWS) requirements and Oregon Fire Code (OFC) fire flow requirements.

Existing System

The City's distribution system main lines are composed of several types of pipe including steel, asbestos cement (AC), ductile iron (DI), polyvinyl chloride (PVC), and wood stave.

The existing distribution system layout, including pipe size and locations, is shown on Figure 5-1, Existing Water System Map with Pressure Zones. Available resources were utilized to verify the map is as accurate as possible. However, there may be inaccuracies in the depiction of the water distribution system layout, and the possibility exists that water distribution system lines and other features are present at locations not shown on the map or are not positioned as shown. Figure 5-1 has been prepared electronically, and if distribution system main lines or other system features are added in the future, the map can easily be updated as improvements occur, to allow the City to always have the most accurate map available for City staff use.

The map developed as part of this Water System Master Plan (WSMP) shows that approximately 92 percent of the distribution system piping is composed of 6-inch diameter or larger pipes. The remaining 8 percent are 4-inch diameter or smaller pipes. The 4-inch diameter or smaller pipes limit hydraulic capacity and are too small to support fire hydrants.

Since the 2018 WSMP, the City has replaced more than 11,000 feet of undersized or deteriorating main line pipe within the system, as well as the associated water services, valves, and fire hydrants. These ongoing projects have improved available fire flows and circulation and reduced the frequency of needed repairs.

In general, the distribution system is fairly well-looped. Some dead-end and/or undersized main lines exist that can limit capacity and water circulation in the system. These areas are discussed in more detail later in this chapter.

The City has indicated the majority of the water main lines in the distribution system are generally in good condition. However, it is recommended the remaining 300 feet of existing wood stave lines in the system be replaced. A breakdown of the City's pipelines by pipe diameter is provided on Table 5-1.

TABLE 5-1
SUMMARY OF SYSTEM PIPELINES

Pipe Diameter (inches)	Total Length (feet)	Total Length (miles)	Percent of Total System Piping
2 or Smaller	11,862	2.2	3
3	1,623	0.3	Less than 1
4	18,816	3.6	4
6	57,338	10.9	14
8	177,762	33.7	43
10	18,385	3.5	4
12	93,958	17.8	23
16	34,090	6.5	8
18	3,173	0.6	Less than 1
TOTAL	**417,007**	**79.0**	**100**

Booster Pump Stations

The City's water system includes three major BPSs that increase system pressures in areas that cannot be served adequately by gravity. These BPSs do not have any known deficiencies and appear to be sized appropriately for the current demand. The American Pine BPS has a capacity of 2,500 gallons per minute (gpm), which is generally adequate to provide fire flows for the majority of the predominately residential service area. The Ochoco Heights BPS has a capacity of 1,500 gpm, which provides adequate fire flow for the majority of its residential service area. There are other limitations due to small diameter mains within the Ochoco Heights Pressure Zone that limit fire flow for isolated areas of this zone.

In 2019, as part of the Airport Industrial Park Utility Extension (AIPUE) project, a BPS was constructed at the wastewater treatment plant to provide redundant service and to act as an aquifer storage and recovery source for the airport area. The 125 and 250 horsepower booster pumps supply water to the airport area at 500 gpm and 1,000 gpm, respectively, at 240 pounds per square inch (psi) to overcome the elevation difference of approximately 390 feet. The BPS is supplied by a 16-inch water line that crosses under the Crooked River and is connected along Highway 26. The BPS discharges through a 16-inch water line that connects at the Prineville Airport. An 8-inch PRV is also installed at the BPS location to allow water to flow from the airport area to the valley floor.

Due to a pipe size restriction at the Highway 126 crossing, the Airport Area Pressure Zone includes a separate BPS for the purpose of increasing pressure to provide adequate fire flows within this zone. Fire flow tests performed by City staff indicated the BPS is no longer needed and is recommended to be abandoned.

Currently, PRVs are located on the discharge side of the American Pine and Ochoco Heights BPSs to regulate pressure. Equipping these BPSs with variable frequency drives will allow the BPSs to adjust motor/pump speed based on demand conditions to help keep the desired downstream pressure constant and allow the PRVs to be abandoned. The ability to adjust motor/pump speed will provide for more efficient operation of the pumps and reduced utility charges to the City.

Table 5-2 summarizes the flow capacities and pumps installed at each existing booster pump station.

TABLE 5-2
SUMMARY OF BOOSTER PUMP STATIONS

Booster Pump Station	Flow
American Pine BPS	Two 250 gpm domestic pumps
	Two 1,000 gpm fire flow pumps
Ochoco Heights BPS	Three domestic pumps - 200, 400, and 900 gpm, respectively
AIPUE BPS	Two domestic pumps - 500 and 1,000 gpm, respectively

Water Meters

All services within the City's system are metered. Currently, the City is in the process of replacing all its residential meters with automatic meter reading (AMR) meters. City staff monitor and test meters monthly for atypical reads and/or missing data and repair or replace meters as necessary. Between 2017 and 2021, the City replaced 1,107 meters in the system.

Water Loss

The City has successfully implemented several water management and conservation measures including conducting annual water audits; replacing residential meters with AMR meters, including software to improve leak detection; utilizing a computerized bulk water station to more accurately track bulk water consumption; continuing to replace old, deteriorating distribution piping; encouraging conservation efforts through education programs; and providing free conservation items to water customers. These important conservation efforts continue to provide beneficial results to the community and its resources.

The City should continue to encourage water conservation through the measures described above along with continuing to investigate other reuse, recycling, and non-potable water use opportunities. In addition, the City should continue to encourage other high-water-use facilities to develop and implement their own internal water conservation plans.

Distribution System Pressure

As discussed in Chapter 4, the City has six pressure zones serving the distribution system, with system pressures provided by the elevation of the reservoirs and BPSs for areas of the system that cannot be served by gravity. A summary of the pressure zones is included on Table 5-3, and the pressure zones are shown on Figure 5-1.

TABLE 5-3
SUMMARY OF PRESSURE ZONES

Pressure Zone	Ground Elevation Currently Served (feet)[1]		Hydraulic Control Element	Hydraulic Grade Line (feet) (Tank Full or PRV Setting)	Typical Pressure Range (psi)[2]
Valley	2,918	2,846	Ochoco Heights Reservoirs	2,983	30 to 60
Barnes Butte	2,981	2,906	Barnes Butte Reservoir	3,099	50 to 80
Williamson	3,029	2,884	Williamson PRV	3,097 (82 psi)	30 to 90
Ochoco Heights	2,961	2,885	Ochoco Heights BPS with PRV	3,120 (80 psi)	65 to 100
Northridge	3,056	2,922	American Pine Reservoir BPS with PRV	3,136 (80 psi)	35 to 90
Airport	3,288	3,025	Airport Reservoirs	3,402	65 to 240[3]

[1] Service elevations do not include locations in the immediate vicinity of reservoirs, PRVs, or BPSs.

[2] Pressure range estimated based on computer water model under 2022 average daily demand (ADD) conditions. Pressures reported do not necessarily reflect service line pressures at places of distribution and include portions of the system used for storage and conveyance where no services exist.

[3] Pressure on upstream side of AIPUE PRV.

The Valley Floor Pressure Zone is the largest zone and is served by five groundwater wells that pump directly into the distribution system: Yancey No. 2 and 3, Lamonta, 4th Street Deep, and Stadium Wells. This pressure zone is also supplied by the Water Treatment Plant (WTP), which provides approximately 1,990 gpm to the Valley Floor area. The wells supply system pressure to the distribution system while also providing flow to fill the reservoirs.

The Barnes Butte Pressure Zone is served by gravity from the Barnes Butte Reservoir. The reservoir is filled by the Barney and Stearns groundwater wells within the zone. Water from Barnes Butte can supplement the system's lower pressure zones through the Williamson, Wilco, and Combs Flat PRVs. These PRVs are adjusted higher in the summer and lower in the winter.

The Ochoco Heights Pressure Zone receives its water from the Ochoco Heights reservoirs. The reservoirs supply water to the Ochoco Heights BPS to help serve the pressure zone. A PRV is located on the discharge side of the BPS to regulate pressure.

The Northridge Pressure Zone receives water from the American Pine Reservoir. The reservoir supplies water to the American Pine BPS to serve the pressures zone. A PRV is located on the downstream side of the BPS to regulate pressure. The American Pine Reservoir is filled from the Ochoco Heights BPS. A control valve on the inlet is used to fill the reservoir based on level readings from a transducer inside the reservoir. A PRV is located on the discharge side of the BPS to regulate pressure.

The Airport Area Pressure Zone is served by gravity from the Airport reservoirs. This pressure zone includes three groundwater wells that fill the Airport reservoirs and one groundwater well that pumps directly into the distribution system. Water from the Airport Area Pressure Zone can supplement the Valley Floor Pressure Zone through the Park Drive and AIPUE PRVs.

A proposed connection is identified in the Capital Improvements Plan (CIP) between the Ochoco Heights Pressure Zone and the lower pressure zones to be completed as soon as budget allows. The proposed connection will resolve a current issue where places of distribution on N.E. Wayfinder Drive, N.E. Stringline Court, and N.E. Angler Street within the Williamson Pressure Zone are significantly higher in elevation than lower lying areas, thus lowering residual system pressure below the 20 psi threshold during fire flow demands. With the addition of a PRV near N.E. Wayfinder Drive and N.E. Laughlin Road, the distribution locations with higher elevations become part of the Ochoco Heights Pressure Zone, and modeled available fire flow to the remaining portions in the Williamson Pressure Zone increase from existing conditions. The connection and PRV will be set such that flow between the Ochoco Heights Pressure Zone and lower pressure zones will occur only under extreme conditions. This improvement is identified in Chapter 6.

According to the hydraulic model completed as part of this WSMP, the normal operating pressures in the system during the 2022 ADD range from approximately 30 to 90 psi, as depicted on Figure 5-2. However, these extremes are not indicative of typical places of delivery, which more generally range from 34 to 102 psi. But some areas of higher and lower pressure do exist. Higher and lower pressures are typically near reservoirs, on the intake or discharge of BPSs, or on a bluff where no service lines or fire hydrants exist. The City generally has adequate pressure throughout the system. It should be noted that portions of the system provide pressures in excess of what is typically recommended for residential fixtures, appliances, etc. The City should maintain an educational program to ensure residents are aware that PRVs need to be installed on individual services in high pressure areas. System pressures are discussed in more detail later in this chapter.

Fire Protection

General

The City's existing water supply, storage, and distribution systems provide adequate fire protection to the majority of the water system, although certain areas of the City do not have adequate fire protection. The DWS regulations and the 2019 OFC require the entire water system remain above 20 psi residual pressure while fire flow demands are placed on the system. The City generally has adequate pressure in the system during fire flow events but has a few isolated areas that do not have adequate pressures and/or the recommended fire flows discussed in Chapter 2. A computer model of system fire flows, along with recommended improvements to address fire flow deficiencies, is discussed in more detail later in this chapter.

Fire Hydrant Flow Tests

For this WSMP, the City completed flow tests on fire hydrants in the distribution system to help with water model calibration. The flow and pressure data gathered during the flow tests were used to compare water model pressures to data collected in the field and, if necessary, to adjust the model input data so the model more closely resembled the field results. Based on the hydrants tested as part of the hydrant flushing plan, fire flows ranged from approximately 422 to 2,573 gpm with residual pressures of 36 to 82 psi at nearby hydrants. These are the measured flows observed during flow tests. Higher fire flows may be available if more than one hydrant is tested at a time and system pressures are allowed to drop further.

Theoretical Fire Flows

In some cases the available flow from a fire hydrant is calculated using a theoretical formula. The formula assumes the water supply "feeding" the tested area is generally not limited and the 20 psi residual pressure resulting from the fire flow occurs where the hydrants are being tested. In reality, there are likely other connections in the distribution system, such as users in the City on small diameter main lines or at higher elevation areas that would fall below 20 psi sooner than the formula predicts. Considering this, the theoretical formula can overestimate available fire flows at 20 psi. The hydraulic computer modeling, completed as part of this WSMP and discussed later in this chapter, is believed to present more accurate available fire flows throughout the City.

Fire Hydrant Limitations

The fire flow tests completed by the City are generally conducted by opening one fire hydrant at a time. If large enough main lines are present, individual fire hydrants can typically provide flows in the range of 800 to 1,200 gpm from a small port and nearly 2,000 gpm from both small ports and the larger "pumper" port, assuming the hydrant has a large port. During a fire there will be water use from other users on the system, so the actual available flow in the distribution system will be less due to other uses and pipeline pressure losses resulting from higher flows.

Generally, the City's water system provides adequate fire flows. The discussion presented herein is intended to provide caution concerning the actual available fire flows from the City's distribution system and fire hydrants. Considering the limitations previously discussed, the City's water system appears limited in its capacity to meet a fire flow of 1,000 to 2,500 gpm in a few areas of the City. System improvements are needed to provide the recommended fire flows of 1,000 gpm for some residential areas and 3,500 gpm for some commercial areas while maintaining 20 psi in the system.

Fire Hydrant Coverage

The OFC outlines maximum recommended fire hydrant spacing depending on several factors, such as the area's fire flow requirements and number of available fire hydrants, and if the area is on a dead-end street, has limited access, etc. As required by the 2019 OFC, the maximum spacing between any two hydrants for a fire flow requirement of 1,750 gpm or less is 500 feet, and is as little as 350 feet for a fire flow requirement of 3,500 to 4,000 gpm. The maximum required distance from any point of a street or road frontage to a hydrant is 250 feet for 1,750 gpm or less and 210 feet for 3,500 to 4,000 gpm. It is recommended the City install fire hydrants in areas that need improved coverage as part of an improvements project. All fire hydrant installations should be reviewed and approved by the City's fire chief.

Water System Modeling

General

As part of this WSMP, a detailed water model of the City's water system was reviewed and updated to analyze system pressures, hydraulic capacity, and available fire flows from the City's fire hydrants. A general description and the results of each computer run performed for both the existing and improved water systems are described herein.

The City's existing water distribution system model contains all existing piping and water system elements, excluding the wellfield wells feeding the WTP. For this WSMP, a hydraulic model previously developed by DOWL during preparation of the 2018 WSMP was imported into InfoWater Pro 2023, reviewed, and updated with water main extension projects completed since 2018. User demands for the year 2022 and 2042 ADD and Peak Daily Demand (PDD) were incorporated for the scenarios presented herein. Elevations at the locations of new water system features, such as pipe connections and wells, were obtained from as-built drawings provided by the City.

The computer model evaluates pressure and flows in the distribution system during a simulated water use demand scenario. Typical water system demands used for the computer model include the ADD and the PDD previously discussed in Chapter 2. Typical water system pressures are determined during the ADD. Available fire flows are determined during the PDD.

The computer model also utilizes detailed information regarding the distribution system pipes. Each individual pipe is assigned a roughness coefficient based on the type of pipe material, such as PVC, DI, AC, steel, etc. This allows the water model program to calculate water main line pressure losses under any desired demand condition, including fire flow analyses. Junctions are used to represent fittings where pipe intersections occur and are assigned an elevation. Water demands are placed on the distribution system at each junction (node) to simulate ADD or PDD use demands.

Model Overview

The hydraulic model of the City's water distribution system was developed utilizing the InfoWater Pro modeling system by Innovyze. Demand scenarios for years 2022 and 2042 were derived from the design criteria presented in Chapter 2. Fire flow test data, provided by the City, were used to check accuracy and calibrate the computer model compared to field conditions. The model was calibrated by adjusting pipe roughness coefficients to simulate available flows and system pressures similar to those reported during the City's fire hydrant tests, where possible. Discrepancies that may exist between the model and system conditions in the field can be due to incorrect pipe sizes, missing pipe connections, or other unknown field conditions. In general, the model depicts the existing system conditions relatively well based on the majority of the available hydrant test data.

A water model run provides distribution system pipe flows and junction pressure under a given demand on the system. To represent current conditions, the year 2022 water system demands were distributed among the junctions in the distribution system based on water meter usage records. To represent future conditions in the year 2042, demands were added for existing properties within the urban growth boundary (UGB). The anticipated increase in demand from year 2022 to 2042 was distributed between properties not currently connected to the system. The ground elevation of each growth area was also evaluated to determine the pressure zone the area could most reasonably connect to. The demand conditions used in modeling the system are as follows:

- **Year 2022 ADD**. The current ADD for the City is estimated to be 184 gallons per capita day (gpcd) or 1,340 gpm at the current connected population of 10,525.
- **Year 2042 ADD**. The future ADD for the City is estimated to be 255 gpcd or 2,610 gpm at a future connected population of 14,722.
- **Year 2022 PDD**. The current PDD for the City is estimated to be 452 gpcd or 3,300 gpm at the current connected population of 10,525.

- **Year 2042 PDD**. The future PDD for the City is estimated to be 452 gpcd or 4,620 gpm at a future connected population of 14,722.

The existing system pressures under the 2022 ADD scenario are presented on Figure 5-2. Figure 5-2 shows the system has a few areas with pressures below 35 psi. Improvements are required to provide additional pressure to the system in these areas. As previously discussed, portions of the system provide pressures in excess of what is typically recommended for residential fixtures, appliances, etc. In areas with higher-than-average pressures provided by the system, the City should continue to inform citizens of the high pressures and ensure that individual PRVs are installed on service lines.

Figure 5-3 presents the fire flow available in the existing system under the 2022 PDD. As previously discussed, fire flow capacity of 1,500 gpm is recommended in residential areas, 2,500 gpm for industrial and commercial areas, and approximately 3,500 gpm in areas where the Insurance Services Office, Inc., report identified higher flows are needed, such as schools and hospitals. Figure 5-4 identifies the areas in the system not capable of providing the recommended fire flow of the underlying zone. Some areas of the northeast quadrant and higher elevation areas of the City are largely unable to provide recommended fire flows to portions of residential and commercial areas. The deficiencies are due in part to small diameter (less than 6-inch) pipelines in the system, higher elevation areas not adequately served by existing pressure zones, and the inability of the existing system to distribute high flows without excessive pressure loss.

The majority of the City's water supply is located in the Airport Area Pressure Zone. Water from this pressure zone has two ways to feed the lower Valley Floor Pressure Zone: an 8-inch diameter pipeline with a PRV and a 16-inch diameter pipeline and 8-inch PRV. Improvements since the 2018 WSMP have increased available water supply capacity significantly within the lower Valley Floor Pressure Zone. These improvements include upgrades to existing wells, new wells, and the new Crooked River Wellfield and WTP, which have reduced the need to regularly provide water to the lower Valley Floor Pressure Zone from the Airport Area Pressure Zone.

Limitations of Water Model Results

Reported fire flows from the water model analysis indicate theoretical distribution system piping capacity. Actual field conditions and headloss in fire hydrants may reduce fire flows beyond what is indicated. Individual fire hydrants also generally have a maximum capacity of 1,000 to 1,500 gpm, so multiple hydrants may need to be operated to attain the flows indicated in the model.

Undersized Main Lines

The City, like many municipalities, has adopted minimum water main line size standards, requiring at least 8-inch diameter main lines be installed. The significant capacity advantages of an 8-inch diameter main line compared to a 6-inch line normally outweigh the additional cost to install an 8-inch line.

For the purpose of this WSMP, undersized mains have been identified as those mains that do not allow the fire flow demand and minimum pressure criteria shown on Figure 2-3 in Chapter 2 to be met. Approximately 24,900 feet of small diameter pipelines (less than 6-inch and not including water service pipelines) are located within the City's distribution system.

In addition to these undersized main lines, physical restraints, such as higher elevation areas in the City, result in a few low system pressure areas.

Recommended Distribution System Improvements

In general, the City's distribution system is fairly well-looped and provides adequate system-wide pressures under normal operating conditions. Fire flow availability is limited in areas of the system due to several undersized main lines and areas of higher elevation. The undersized main lines in the system result in fire flow capacity limitations and water circulation issues. Some of these lines have been recommended for upgrading where improved fire flow capacities are needed. It is recommended the City complete improvements to the distribution system to eliminate as many undersized main lines as possible and provide improved system fire flow capacities in areas lacking adequate fire flows. Key water system improvements have been identified to address deficiencies identified in this WSMP:

- Improve System Distribution
  - Construct a new transmission main, BPS, PRV, and reservoir to serve the eastern portion of the City. In addition, this improvement will also eliminate some of the low pressure issues currently experienced in the system at higher elevations.
  - Construct a new transmission main line from the east side of the City to the northeast area. This improvement will be a source of redundant supply to the Northridge and Ochoco Heights Pressure Zones.
- Improve Water Quality and Circulation
  - Replace old, undersized, deteriorating pipe.
  - Increase flow capacity to the existing system to provide adequate fire flows to residential and commercial areas.
  - Replace existing small diameter or wood stave pipe. Upsize and/or loop water pipes in key locations to increase fire flow.
- Improve the System to Serve Future Growth
  - Construct future mains, reservoirs, PRVs, and BPSs to serve growth within the UGB.
- Increase Service Area to Connect all Residents Within the City Limits
  - Connect existing residences in the vicinity of the Fairview, Crestview, and Seehale areas to City water. These residences are shown on Figure 6-3 in Chapter 6.

The recommended distribution system improvements are shown on Figure 5-5. The future conditions water model incorporates the recommended improvements and future growth areas and demands. Figure 5-6 depicts the year 2042 ADD system flows and residual system pressures. System pressures are adequate with the recommended improvements, and many of the isolated low pressure areas under existing conditions have been eliminated. Areas of marginal pressure (35 to 45 psi) in the Valley Floor Pressure Zone are also improved. The majority of reservoirs are filling under peak day conditions, indicating the system has adequate supply. One exception is the American Pine Reservoir, which is draining under peak day conditions. This is likely due to the Ochoco Heights PRV, which limits the filling rate of the reservoir. The PRV setting may need to be adjusted in the future to allow the filling rate of the reservoir to match the PDD of the Northridge Pressure Zone.

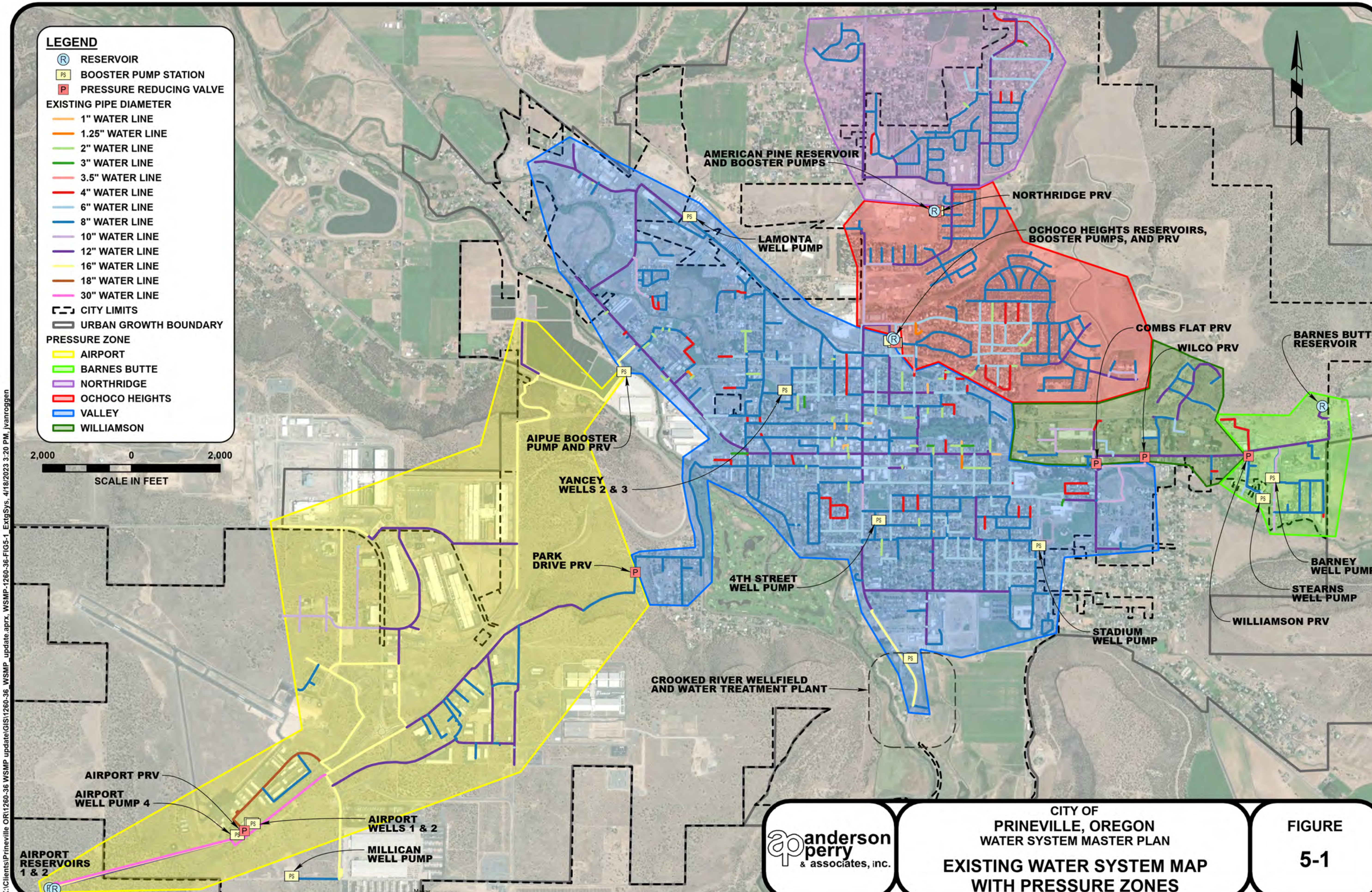
Figure 5-7 depicts the year 2042 available fire flows with the recommended water system improvements. Fire flow availability is generally adequate under future 2042 conditions with the recommended improvements. Figure 5-8 identifies the areas in the system not capable of providing the recommended fire flow of the underlying zone with the recommended improvements under the 2042 PDD.

Maintenance Records

One of the important operational functions related to the City's distribution system is maintaining accurate records of various system components. These records become valuable over time in planning future improvements and replacing old or deteriorated components. It is recommended the City continue to track and keep accurate records of all distribution system components. The City should continue monitoring residential meters monthly, test compound meters annually, check hydrants annually for proper operation, and exercise all water valves annually, with records kept on their operating condition, location, etc. The City should also have a program in place to have all backflow prevention devices checked annually, either by property owners or the City.

Summary

In general, the City's distribution piping system is in relatively good condition, although a few isolated areas currently cannot provide adequate fire flow, and water circulation is limited. Undersized and old distribution system piping within the City contribute to specific areas of low fire flow capacity and issues with water circulation. Improvements outlined in this chapter include replacing old, undersized, and deteriorating lines and adding additional distribution piping to improve system looping, circulation, and fire flow capacities. These improvements were selected to address key areas of concern to improve capacity in the system and are prioritized and further discussed as part of the CIP and System Development Charge Plan presented in Chapter 6. Also included in Chapter 6 are detailed breakdowns of estimated costs.



CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM MAP WITH PRESSURE ZONES

FIGURE 5-1

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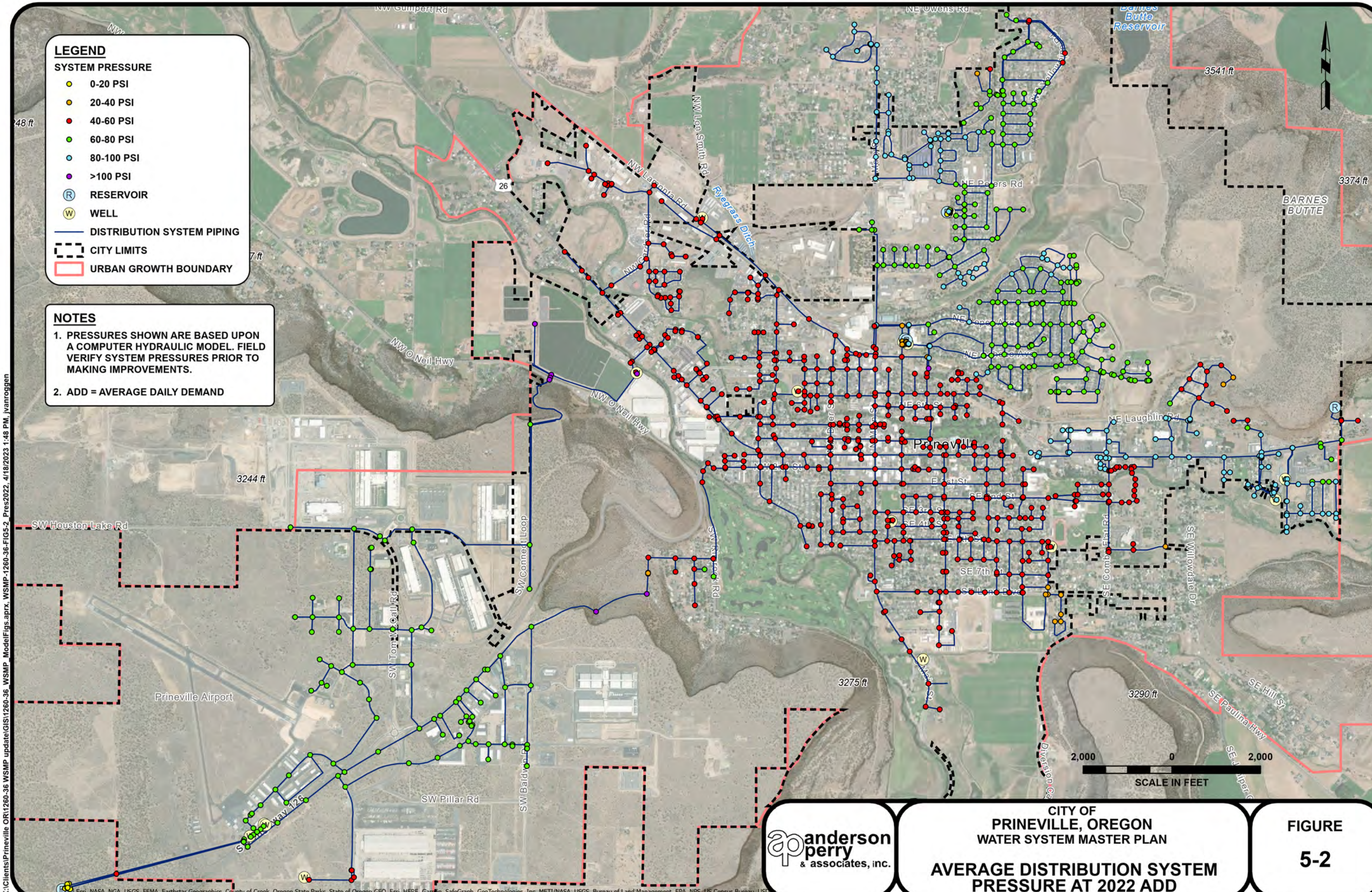

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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

AVERAGE DISTRIBUTION SYSTEM PRESSURE AT 2022 ADD

FIGURE 5-2

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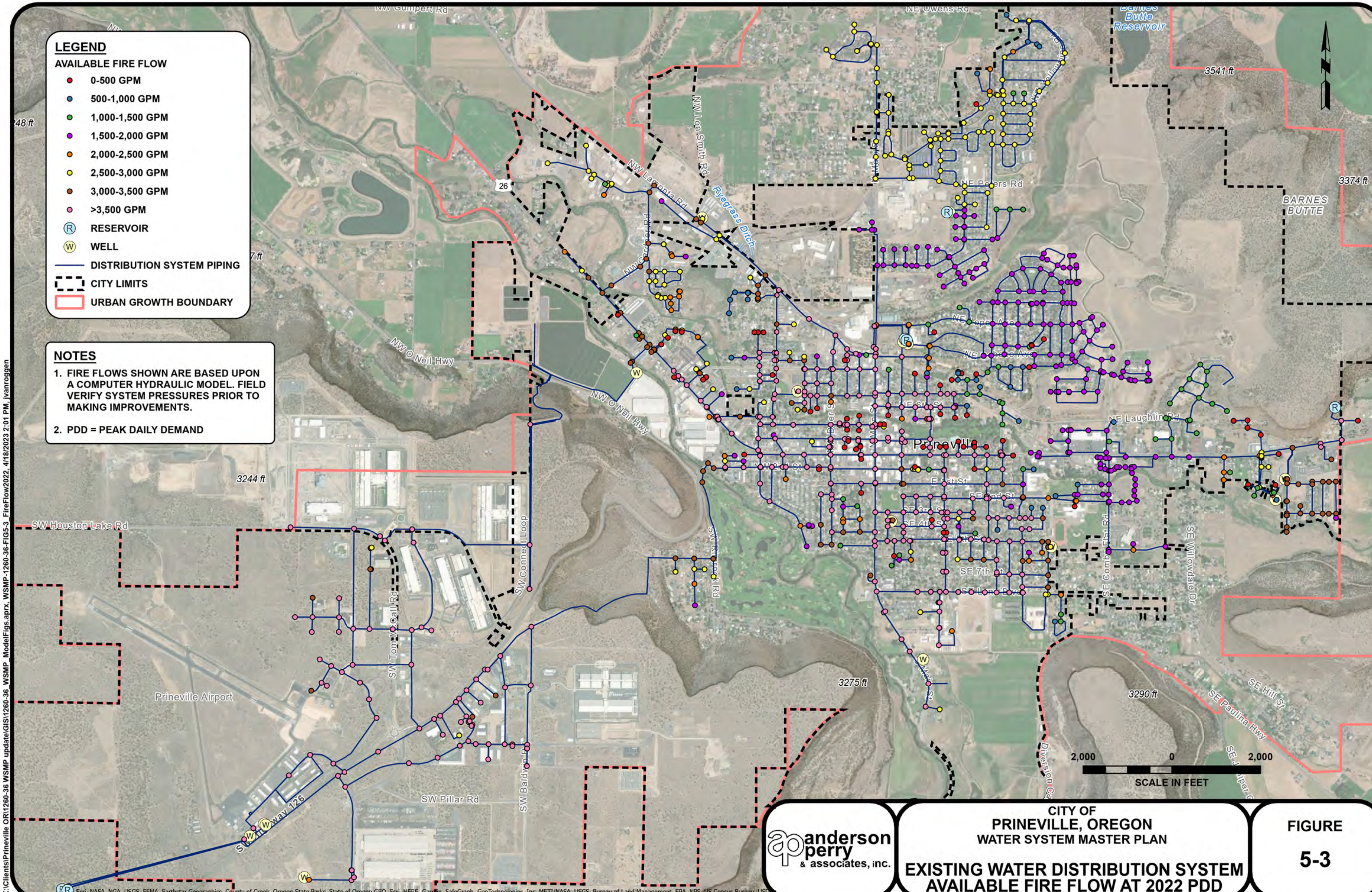

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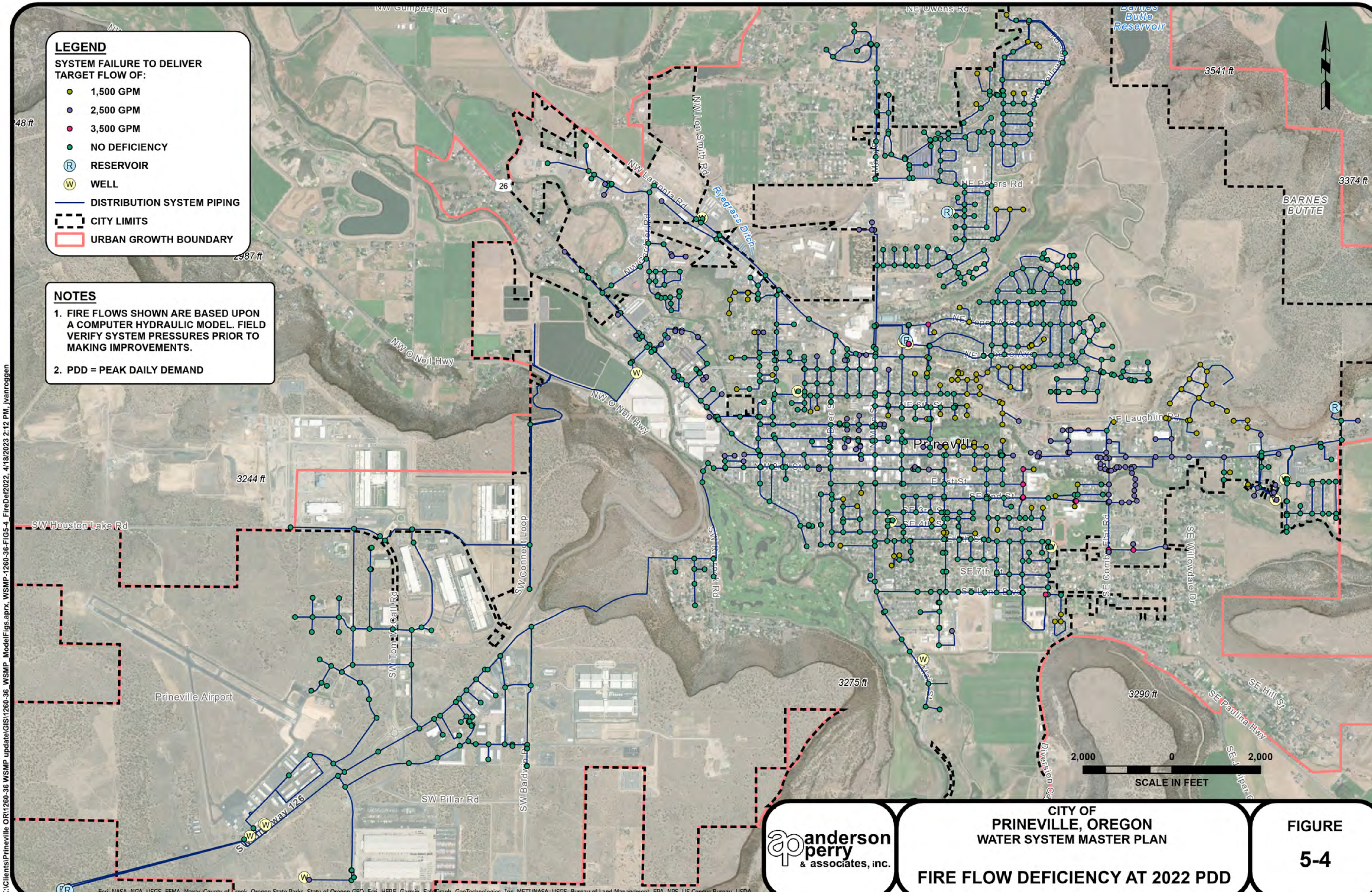

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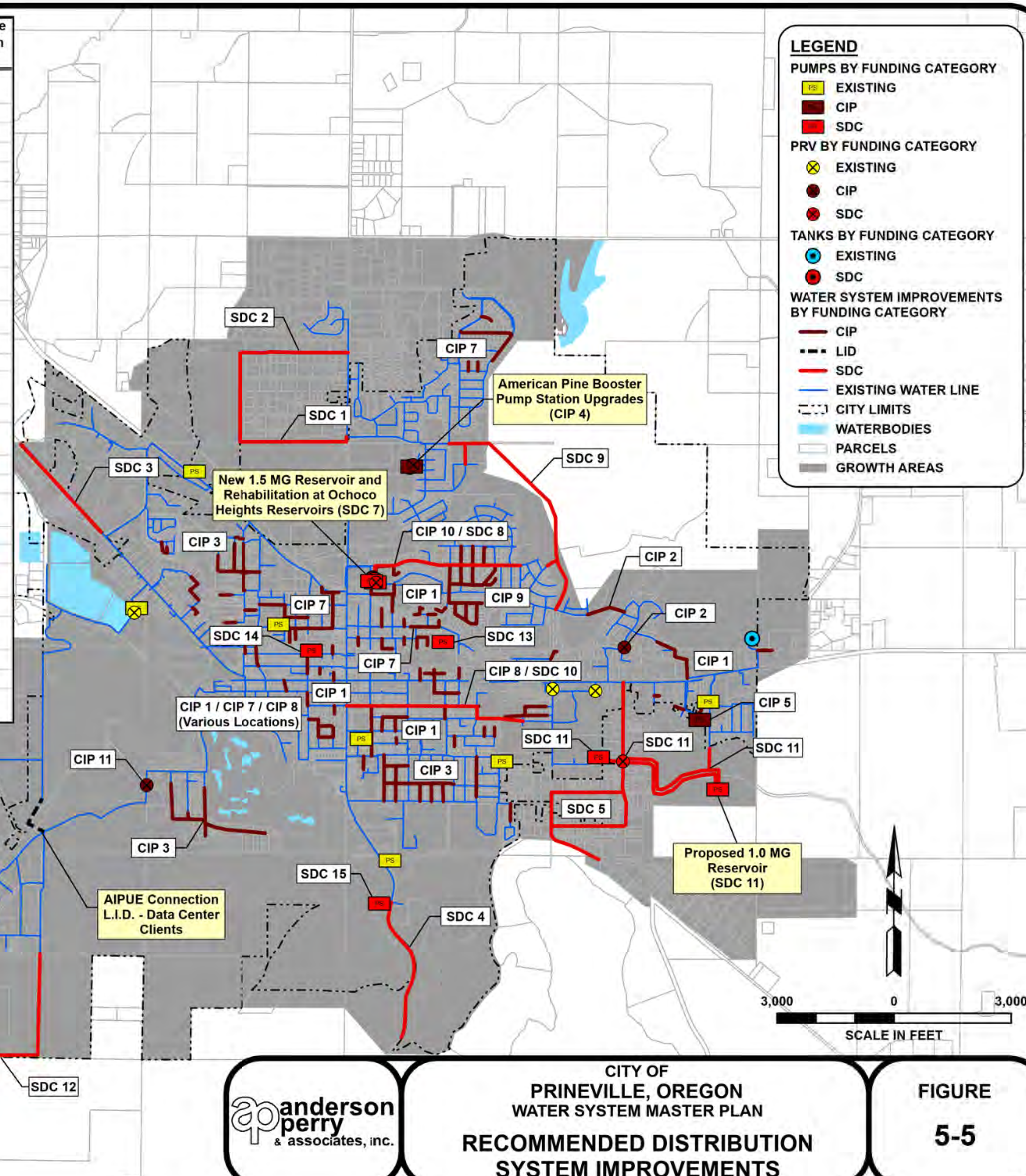
Improvement No.	Improvement Description	Approximate Pipe Length (LF)
CIP 1	Replace existing small diameter (less than 6 inches) piping and wood stave piping and replace existing wrapped steel piping with new minimum 8-inch PVC water line.	36,470
CIP 2	Connect Ochoco Heights Pressure Zone to lower pressure zones.	1,000
CIP 3	Connect existing City residences not connected to City water.	12,460
CIP 4	American Pine booster pump station upgrades.	N/A
CIP 5	Reconstruct Stearns Well.	N/A
CIP 6	System-wide supervisory control and data acquisition upgrade.	N/A
CIP 7	Proposed improvements to increase existing system fire flows (upsize 6-inch pipe or install pipe where no pipe exists).	7,120
CIP 8	Replace existing outside diameter and wrapped main line on 1st Street between Main Street and Combs Flat.	5,600
CIP 9	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 6-inch PVC water line).	4,080
CIP 10	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 8-inch water main line).	1,485
CIP 11	Park Drive pressure reducing valve upgrades.	N/A
SDC 1	Proposed 12-inch main line extension west of Main Street to serve future development south of Reata.	4,020
SDC 2	Proposed 12-inch main line extension west of Main Street to serve future development west of Main Street.	3,950
SDC 3	Proposed 12-inch main line extension north of Gardner to serve new development along Highway 26.	2,800
SDC 4	Proposed 16-inch extension south of Main Street to serve new development southeast of the Water Treatment Plant, and the installation of a BPS and pressure reducing valve.	3,600
SDC 5	Proposed Williamson Pressure Zone piping with BPS.	10,000
SDC 6	Aquifer storage and recovery Wells No. 2 and 3.	300
SDC 7	Construct a new Ochoco Heights reservoir, demolish an existing reservoir, rehabilitate an existing reservoir, and install a BPS with a permanent backup generator.	N/A
SDC 8	Proposed increase of existing 6-inch main line to 12-inch to increase system flows in Ochoco Heights.	4,080
SDC 9	Proposed 16-inch transmission main line from east side of Prineville to Northridge.	6,400
SDC 10	Proposed increase of existing 6-inch main line to 12-inch to better serve central system east of Main Street.	5,600
SDC 11	Proposed new 1.0 million gallon reservoir (to serve new pressure zone).	7,900
SDC 12	Proposed Airport Pressure Zone piping (distribution mains to connect undeveloped areas to City system).	13,000
SDC 13	Construct a new Juniper Well.	N/A
SDC 14	Construct a new 5th Street Well.	N/A
SDC 15	Construct a new 3,000 gallon per minute Ranney horizontal collector well at the Crooked River Wellfield.	N/A



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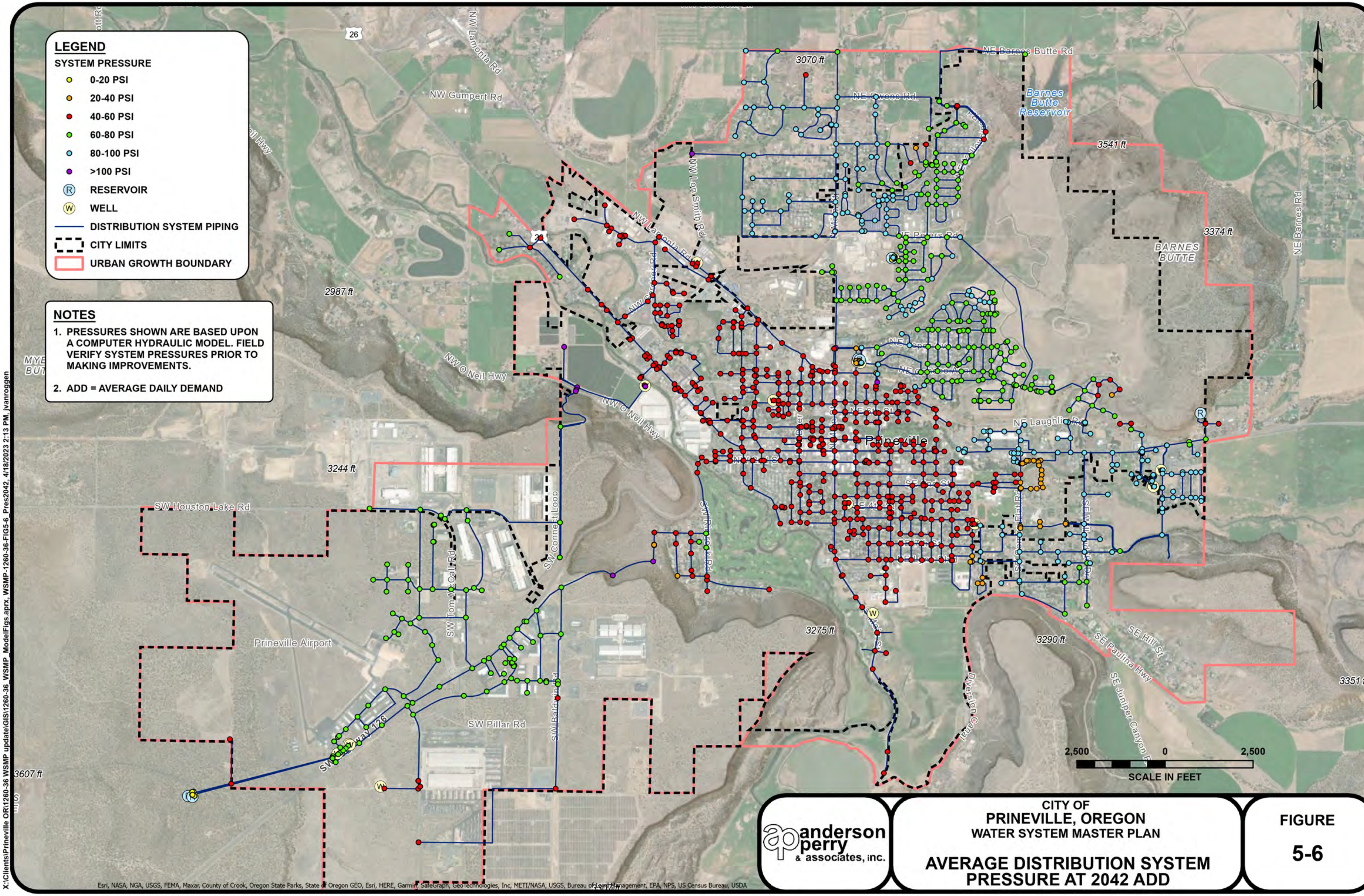
WATER SYSTEM MASTER PLAN

RECOMMENDED DISTRIBUTION SYSTEM IMPROVEMENTS

FIGURE 5-5



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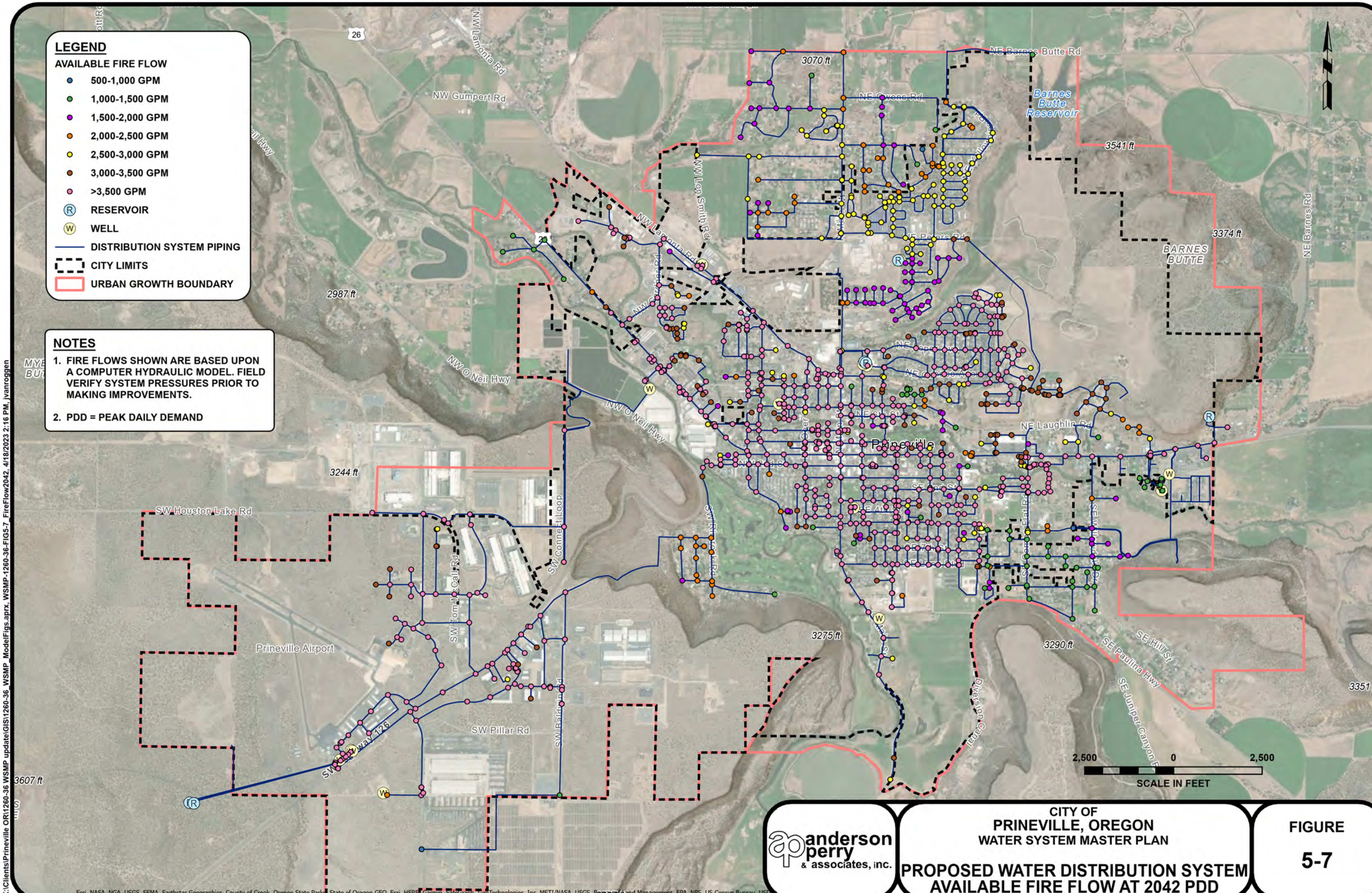
CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

AVERAGE DISTRIBUTION SYSTEM PRESSURE AT 2042 ADD

FIGURE 5-6



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CITY OF
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WATER SYSTEM MASTER PLAN

PROPOSED WATER DISTRIBUTION SYSTEM AVAILABLE FIRE FLOW AT 2042 PDD

FIGURE 5-7

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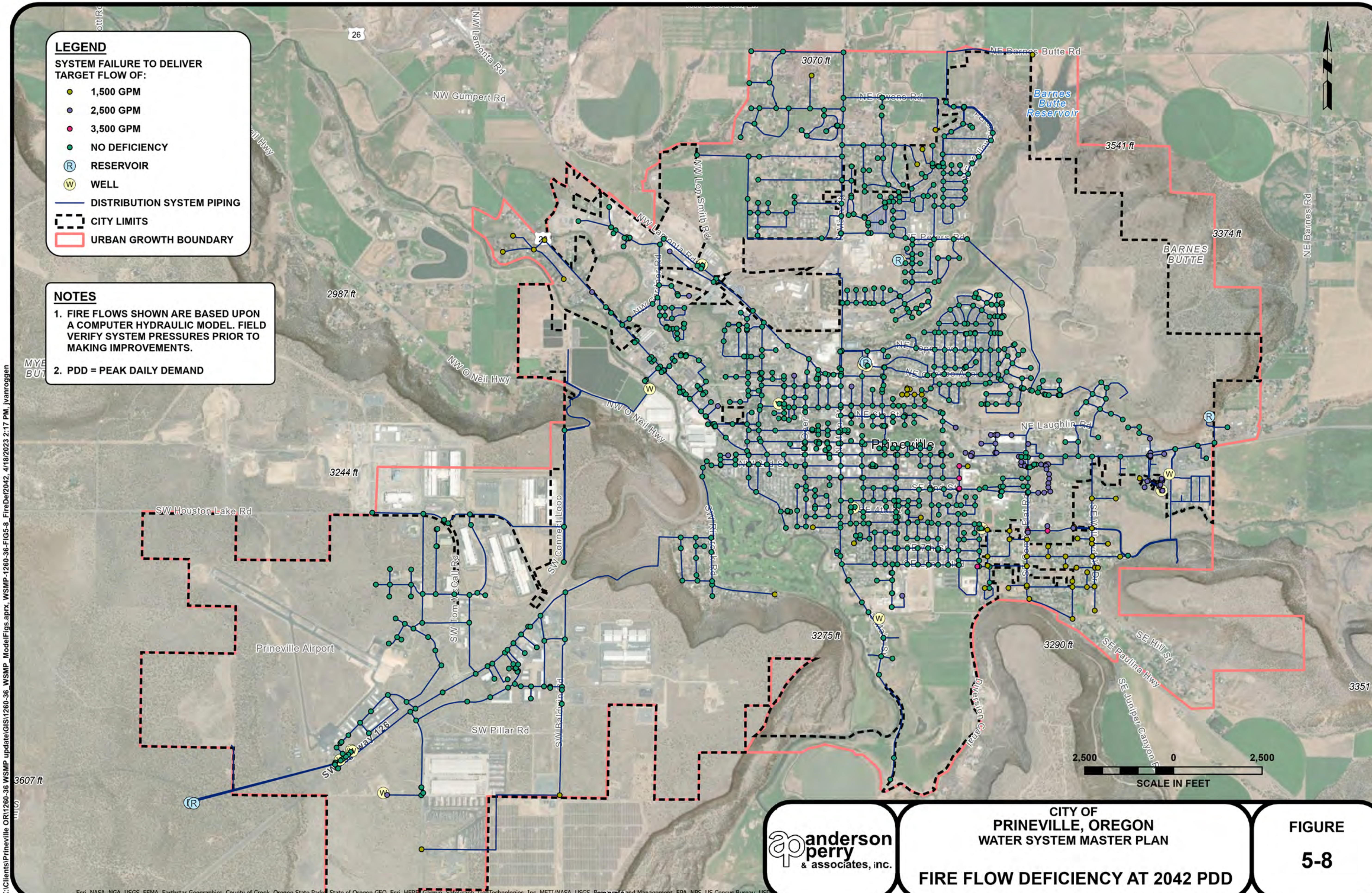

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WATER SYSTEM MASTER PLAN

FIRE FLOW DEFICIENCY AT 2042 PDD

FIGURE
5-8

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Chapter 6 - Summary of Proposed Improvements and Capital Improvements Plan

Introduction

This chapter summarizes the proposed improvements to the water system identified as part of this Water System Master Plan (WSMP) to address deficiencies and support anticipated growth and increased demands. The System Development Charge (SDC), Capital Improvements Plan (CIP), and Local Improvement District (LID) improvements categories are identified and discussed. Priorities for improvements under the CIP category are outlined chronologically, while SDC improvement costs are provided in no particular order. Estimated costs to complete the improvements are also presented. It should be noted that environmental, cultural, and natural resources costs have been applied individually to improvements as the majority of the improvements are within existing areas of disturbance. However, any required environmental, cultural, or natural resources permitting shall be completed as required.

Categories of Improvements

The City of Prineville is proposing to complete water system improvements utilizing two funding categories, as follows:

> **CIP** - Improvements identified under the CIP category include capital improvements projects that need to be completed to address existing system deficiencies irrespective of growth.
>
> **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.

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 with the improvement being financed by the City and repaid by owners of benefited properties. It should be noted that the implementation of both SDCs and LIDs are governed by Oregon state law. Consultation with the City's attorney is advised prior to implementing either SDC or LID improvements and associated charges.

Summary of Improvements

Presented hereafter is a summary of the proposed improvements identified based on the evaluation and computer water modeling efforts completed as part of this WSMP. Figure 6-1 presents a map of the system that shows the proposed CIP improvement locations along with a table inset describing the improvements. Figure 6-2 presents a map of the system that shows the proposed SDC-funded improvement locations along with a table inset describing the improvements. For a more comprehensive discussion with respect to the different elements (supply, storage, and distribution) of the water system and detailed evaluation, the reader is encouraged to reference other chapters of this WSMP.

Water Supply

As discussed in Chapter 2, the City has enough source capacity to meet current demands. The peak daily flow requirements, assuming the wells operate 18 hours per day, are estimated to be approximately 4,405 gallons per minute (gpm) and 6,960 gpm for current and projected future (2042) system demands, respectively. The current combined instantaneous water right withdrawal allowance from all well sources is 6,991 gpm, with an available pumping capacity of 6,436 gpm. Therefore, the City’s pumping capacity can exceed the available permitted supply capacity, as well as the current demands. However, it is recommended that the City continue to pursue improvements to increase source capacity as well as redundancy in the system. Proposed source improvements include the recommendations below.

As discussed in Chapter 3, it is recommended that the Stearns Well be reconstructed. This well was completed in 1973 and has been used as the primary water source for the City since its construction. The well’s capacity has begun to decrease as its casing has deteriorated and the water-bearing zone has become restricted with rust, sand, and corrosion. Reconstruction of the Stearns Well will be an important improvement to the water system, as this well will continue to operate as a primary water source for the east side of the City.

As also discussed in Chapter 3, the most feasible option to provide additional pumping capacity is the drilling and development of additional aquifer storage and recovery (ASR) injection and recovery wells in the Deschutes Regional Aquifer. The expansion of the ASR program has the potential to provide additional capacity through the use of stored system water, as well as native groundwater, within permit limitations. Additionally, further expansion of the Water Treatment Plant to its design capacity of 3,000 gpm should be explored through the addition of a third filter train and additional source water to provide the additional 1,000 gpm of capacity. It is recommended that one or both of these options be pursued for completion within the next 10 years.

Water Storage

Currently, the City has six operating storage reservoirs with a total volume of 4.5 million gallons (MG). With the exception of the Ochoco Heights reservoirs, the existing condition of the reservoirs is generally good to very good. Based on the projected storage needs for the year 2042 planning period, an additional 1.4 MG of storage capacity is recommended to meet future demands. Additionally, replacement and rehabilitation improvements are recommended for the Ochoco Heights reservoirs and have been included in the SDC category.

Anticipated future growth in the east and southeast portions of the City will require the addition of a new reservoir and pressure reducing valve (PRV) connected to the existing Valley Floor Pressure Zone. A new 1.0 MG reservoir is recommended to be constructed to serve the growth in this area. The proposed reservoir would be constructed at an elevation similar to the Barnes Butte Reservoir to permit gravity service of the Valley Floor area while maintaining pressure downstream of the Combs Flat, Wilco, and Williamson PRVs. This additional downstream pressure will maintain system pressures upstream as well as water levels in the Barnes Butte Reservoir.

As discussed in Chapter 4, it is recommended that a 1.5 MG reservoir be constructed at the existing Ochoco Heights reservoirs site. This will enable the existing reservoirs to continue to serve the system as the new reservoir is constructed. Once the new reservoir is constructed and in operation, one of the existing 0.5 MG reservoirs can be taken out of service to complete renovations and repairs. Once the rehabilitation work is complete, the renovated and repaired reservoir will work in conjunction with the new reservoir, providing a total of 2.0 MG of storage at the site. The second existing 0.5 MG reservoir will be demolished. These proposed improvements have been included in the SDC category.

Water Distribution

As outlined in detail in Chapter 5, the City's distribution system is generally well-looped and provides adequate system-wide pressures under normal operating conditions. Due to several undersized main lines and areas of higher elevation, fire flow availability is limited in certain areas of the system. The undersized main lines in the system result in fire flow capacity limitations and water circulation issues. Some of these lines, where improved fire flow capacities are needed, are recommended for upgrading. It is recommended the City complete improvements to the distribution system to eliminate as many deteriorating and undersized main lines as possible and provide improved system fire flow capacities in areas lacking adequate fire flows. Key water distribution system improvements have been identified to meet the following objectives:

- Improve water quality and circulation by replacing old, undersized, and deteriorating pipe. Increase flow capacity to the existing system to provide adequate fire flows to residential, commercial, and industrial areas.
- Construct new water mains and services to City residences not currently connected to the water system in the Fairview, Crestview, and Seehale areas.
- Create a connection between the Ochoco Heights Pressure Zone and the lower pressure zones. A connection from Barnes Butte Elementary School to N.E. Laughlin Road with a PRV will provide this needed connection.
- Replace existing small diameter or wood stave water pipes. Upsize and/or loop water pipes in key locations to increase fire flow.
- Construct a new transmission main, booster pump station (BPS), PRV, and reservoir to serve the eastern portion of the City. This improvement will also eliminate some of the low pressure issues currently experienced in the system associated with high elevation areas. This improvement will also be a source of redundant supply for the other pressure zones.
- Construct new water main lines to service the Melrose/Willowdale area.
- Construct a new BPS with backup power generation to replace the existing Ochoco Heights BPS.
- Upgrade electrical and controls at the American Pine BPS.
- Perform system-wide upgrades for the supervisory control and data acquisition (SCADA) and control systems.
- Improve the distribution system to serve future growth.
- Construct future mains and BPSs to serve growth within the urban growth boundary.

Connecting Existing City Residences Not Currently Connected to City Water

Approximately 330 residences within the city limits in the Fairview, Crestview, and Seehale areas are currently not connected to City water. These residences are identified on Figure 6-3. The necessary distribution system improvements to connect these residences is identified as CIP 3 in the CIP.

The installation of new infrastructure to connect existing City residences poses a challenge in identifying the proper funding category to address these improvements. SDC, CIP, and LID guidelines share positive and negative requirements related to these improvements; however, an additional funding strategy may need to be pursued. The use of each category for funding these improvements is outlined below:

System Development Charge

Water distribution infrastructure does not exist in the locations not currently connected to City water, although it is nearby. The lack of existing infrastructure lends itself to the use of SDC funds for these improvements. However, as this is an existing area, the use of a reimbursement fee for the cost of construction may create reimbursement fees that are unaffordable to many residents. Treating existing residences as new developments without creating excess capacity with value that can be reimbursed may create significant cost burdens that will likely be unpopular, specifically because additional users beyond those identified are unlikely to use the new improvements.

Capital Improvements Plan

The improvements are identified as CIP 3 in the CIP with estimated costs of $6,271,900. The City will fund a portion of the improvements with standard connection and usage fees assessed to the newly connected residences and the remaining costs included in the CIP.

Local Improvement District

The formation of an LID for these improvements could be a means for equitable reimbursement of the improvements. In terms of affordability, this will need to be addressed, as the cost for the improvements imposed on the individual connections will be approximately $19,570. It should be noted that LIDs are historically difficult to manage and rely solely on the residents' ability to afford the required fee. However, it is possible that the City could offer low-interest financing or fee reductions for low-income households.

Infill System Development

A separate funding category to address connecting existing residences to City water could be developed. Improvements to the distribution system without a specific need for additional capacity improvements could be evaluated as a different type of improvement, sharing components of both CIP and SDC funding. In this scenario, the City could fund a portion of the improvements under the CIP category. While not addressing an existing deficiency, the proposed improvements do create new loop connections and pathways within the distribution system to assist with water circulation and fire flow. By utilizing the

SDC Reimbursement Fee component to address the remaining costs, the City could offer low-interest financing and fee reductions to low-income residents to avoid financial hardship. The SDC Reimbursement Fee in this funding category would be similar to an LID rather than the development of additional capacity that would be reimbursed through future connections (as many of these areas are unlikely to see future connections). However, a Buildable Lands Inventory is recommended for each area to determine if the potential for future connections exists.

Infill System Development funding requires an assessment of the worth of the proposed improvements to the City. Those improvements include additional fire flow and water circulation that should be of value. Additionally, the value of the improvement in future rates and connection fees, as well as the value of those improvements regarding fire protection, should be assessed.

Once the value of the improvements to the City has been determined, the remaining cost can be isolated and reviewed. This remaining cost could then be divided proportionately according to service type and size and be equally distributed accordingly to those residents connecting to the improvement. In most cases, the service connection sizes will be the same but a factor for additional service connection sizes should be created that can be applied consistently should a similar situation arise. The factor should be a multiplier rather than a dollar figure because costs of improvements will fluctuate.

To meet these objectives, the recommended distribution system improvements have been identified and are shown on Figure 6-1 for CIP Improvements and Figure 6-2 for SDC Improvements.

Capital Improvements Plan

A CIP provides a framework to prioritize and implement a 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 a city, while providing continued delivery of utility and other services to residents and businesses.

As part of this WSMP, the City is developing a CIP based on identified deficiencies and improvements required to address the City’s water system needs 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. Additionally, improvements may be prioritized as components of another project, such as a street improvements project. The schedule of these other improvements will have an impact on the priorities identified in the CIP if water system upgrades are needed within a broader project area.

The CIP is a tool to be used in the development of responsible and progressive financial planning and generally 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.

The CIP identifies and prioritizes short-, medium-, and long-term projects of all types based on the water system master planning process. Water system improvements projects will be coordinated with the annual budget process to maintain full utilization of available resources. For each improvements project, the CIP provides a variety of information including a project description and the service needing to be addressed, a proposed timetable, and proposed funding levels. Water system improvements projects will be prioritized with the most urgent projects first. Ongoing operating costs are not included in the CIP estimated project costs. It should be noted that while improvements projects are listed in order of priority, the ability to fund the project will determine the length of time to complete the entirety of the identified improvements. For this reason, these improvements will need to be further evaluated based on priority improvements to be funded individually, along with other necessary projects.

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 participate in CIP development via specific master plans and other planning tools. Major improvements projects require City Council interaction during project development and where funding allocations are made.

Identified Capital Improvements Plan Improvements and Estimated Costs

This section describes identified improvements included in the CIP funding category. Priorities are outlined chronologically, 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 provide the means to connect a portion of those residences located in the City to the municipal water system.

Proposed Improvements to be Completed within 10 Years

CIP 1 - Replace Existing Small Diameter (less than 6 inches) Piping and Wood Stave Pipe and Replace Existing Wrapped Steel Piping with New Minimum 8-inch Polyvinyl Chloride Water Line

CIP 1 has been designated as a top priority to be completed by the City. The improvements identified are intended to improve water quality and circulation by replacing old, undersized, deteriorating pipe and increase flow capacity to the existing system to provide adequate fire flows to residential, commercial, and industrial areas. This includes replacing approximately 300 feet of remaining wood stave pipe. It is recommended that 8-inch pipe be the minimum size installed. However, pipe size will be determined by the flow requirements in the area.

CIP 1 has been identified as requiring up to 40 years for completion due to the number of pipe replacements needed. However, the City is currently replacing pipes annually in conjunction with other projects as funding allows and will continue to do so until all necessary pipe replacements are complete.

CIP 2 - Connect Ochoco Heights Pressure Zone to Lower Pressure Zones

This improvement will provide a needed connection between the Ochoco Heights Pressure Zone and the lower pressure zones to allow for two-way movement of water between the zones as needed.

CIP 3 - Connect Existing City Residences Not Connected to City Water

Improvements include installing new water lines in the Fairview, Crestview, and Seehale areas. The improvements will include fire hydrants, new service line connections to the main line, new service lines, and new water meters. Constructing these improvements will provide the main water line necessary to allow the residences in the Fairview, Crestview, and Seehale areas to connect to the municipal water system.

CIP 4 - American Pine Booster Pump Station Upgrades

This improvement will replace the existing electrical and controls system at the American Pine BPS with variable frequency drives to allow the removal of the restrictive PRV used on the discharge piping. Along with an improved controls system, the BPS will be able to operate more efficiently, requiring fewer site visits and adjustments.

CIP 5 - Reconstruct Stearns Well

The Stearns Well was constructed in 1973 and is experiencing a reduction in specific capacity. A reconstruction of this important water source will allow it to be brought to current standards and improve its overall production, reliability, and efficiency.

CIP 6 - System-wide Supervisory Control and Data Acquisition Upgrade

These improvements will upgrade the existing SCADA hardware and the SCADA operating system to a standardized system capable of continued upgrades as SCADA technology improves. The current system does not allow for ongoing upgrades and has begun to fail, requiring additional water system personnel time to observe and report on system conditions.

CIP 7 - Proposed Improvements to Increase Existing System Fire Flows (Upsize 6-inch Pipe or Install Pipe Where No Pipe Exists)

These improvements include the replacement of undersized main lines or the installation of new main lines. The pipeline installations will improve system flows and water circulation within the system.

CIP 8 - Replace Existing Outside Diameter and Wrapped Main Line on 1st Street Between Main Street and Combs Flat

This improvement will replace the existing outside diameter (O.D.) and wrapped steel 6-inch pipe on First Street. This existing main line has deteriorated and should be replaced. SDC 10 will increase the size of the main line to 12 inches in diameter.

CIP 9 - Proposed Improvements to Increase Existing System Fire Flows in Ochoco Heights (New 6-inch Polyvinyl Chloride Water Line)

This improvement will replace the existing O.D. and wrapped steel 6-inch pipe on Loper Avenue. The existing main line has deteriorated and should be replaced. SDC 8 will increase the size of the main line to 12 inches in diameter.

Proposed Improvements to be Completed in 10 to 20 Years

CIP 10 - Proposed Improvements to Increase Existing System Fire Flows in Ochoco Heights (New 8-inch Water Main Line)

These improvements include the installation of new 8-inch polyvinyl chloride water lines and associated appurtenances in Ochoco Heights to increase the existing fire flow capacity in the area.

CIP 11 - Park Drive Pressure Reducing Valve Upgrades

These improvements will upgrade the existing Park Drive PRV with new piping and a PRV control system.

The identified improvements categorized under the CIP funding category are shown on Figure 6-1, estimated costs are presented on Figure 6-4, and a summary of the improvements and estimated costs are shown on Figure 6-5. It should be noted that the reference numbers shown on the figures have been assigned based on City-established priorities (1 being the highest and 11 the lowest).

Improvements Included in the System Development Charge Funding Category

This section summarizes and describes those identified improvements that have been 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 that 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 upon 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 Improvement Fee

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

The Reimbursement Fee and the Capital Improvement Fee are combined to result in the total SDC fee.

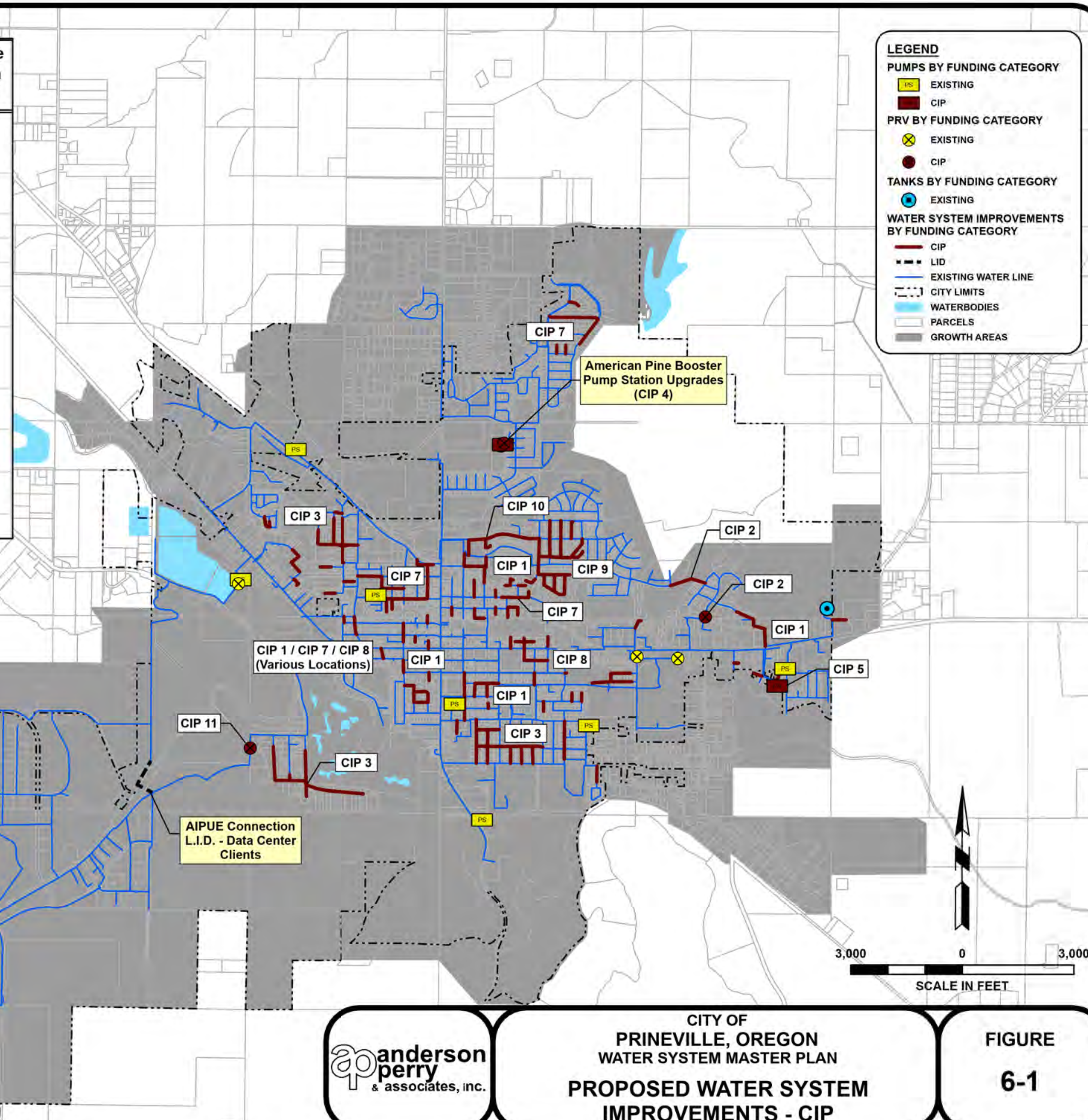
Establishment of System Development Charges

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

Identified System Development Charge Improvements and Estimated Costs

As discussed earlier, improvements for the 20-year planning period have been identified that are necessary to support future development and expand the water system. The identified improvements in the SDC funding category are shown on Figure 6-2, estimated costs are presented on Figure 6-6, and a summary of the improvements and estimated costs is shown on Figure 6-7. Figure 6-2 also includes improvements that have been assumed to be completed by the formation of LIDs. Estimated costs for assumed LIDs were not developed as part of this WSMP, as that is beyond the scope of work associated with this WSMP. It should be noted that 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 will occur within the City.

Improvement No.	Improvement Description	Approximate Pipe Length (LF)
CIP 1	Replace existing small diameter (less than 6 inches) piping and wood stave piping and replace existing wrapped steel piping with new minimum 8-inch PVC water line.	36,470
CIP 2	Connect Ochoco Heights Pressure Zone to lower pressure zones.	1,000
CIP 3	Connect existing City residences not connected to City	12,460
CIP 4	American Pine booster pump station upgrades.	N/A
CIP 5	Reconstruct Stearns Well.	N/A
CIP 6	System-wide supervisory control and data acquisition upgrade.	N/A
CIP 7	Proposed improvements to increase existing system fire flows (upsize 6-inch pipe or install pipe where no pipe exists).	7,120
CIP 8	Replace existing outside diameter and wrapped main line on 1st Street between Main Street and Combs Flat.	5,600
CIP 9	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 6-inch PVC water line).	4,080
CIP 10	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 8-inch water main line).	1,485
CIP 11	Park Drive pressure reducing valve upgrades.	N/A



anderson perry & associates, inc.

CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN

PROPOSED WATER SYSTEM IMPROVEMENTS - CIP

FIGURE 6-1

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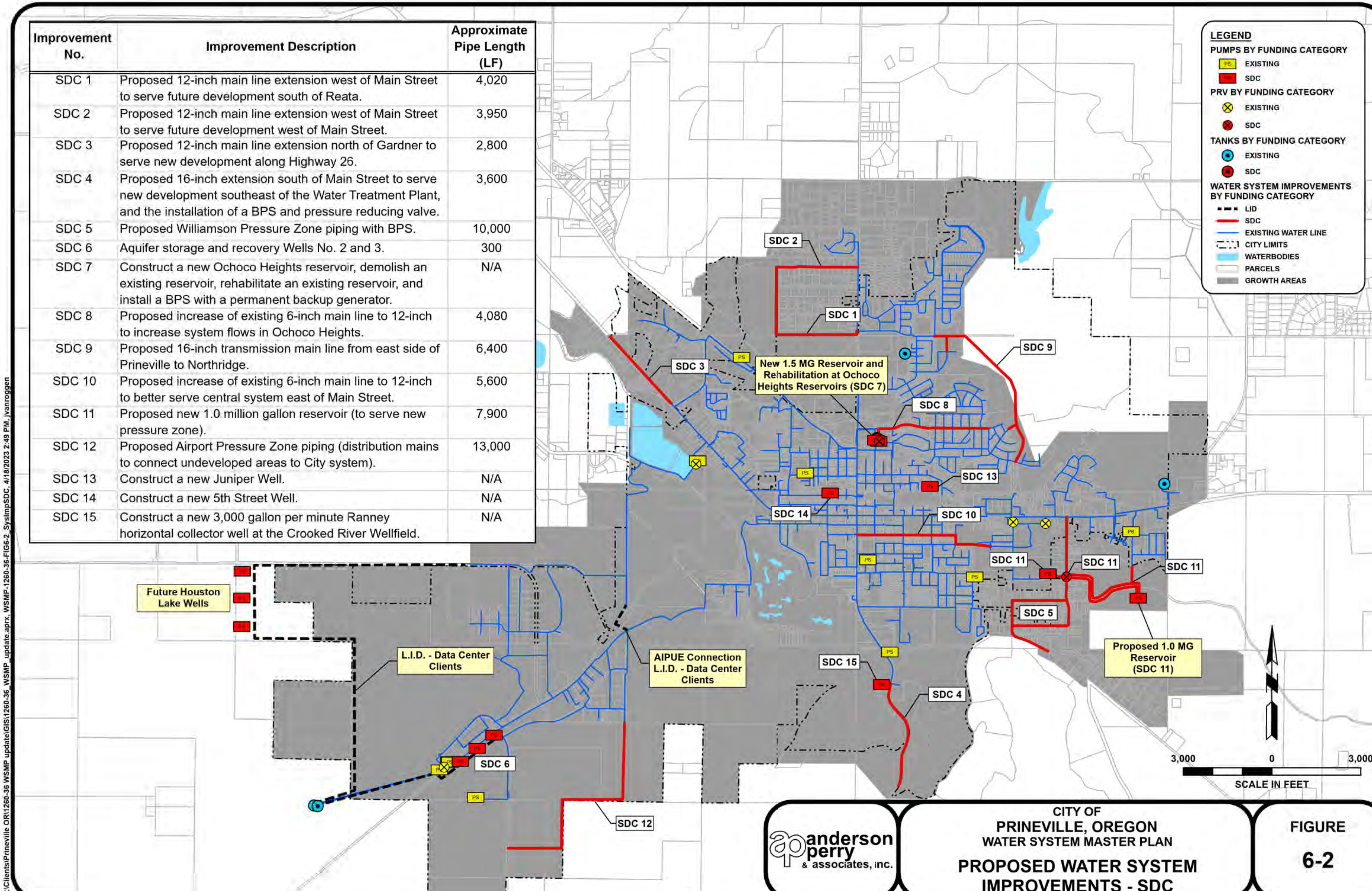
Improvement No.	Improvement Description	Approximate Pipe Length (LF)
SDC 1	Proposed 12-inch main line extension west of Main Street to serve future development south of Reata.	4,020
SDC 2	Proposed 12-inch main line extension west of Main Street to serve future development west of Main Street.	3,950
SDC 3	Proposed 12-inch main line extension north of Gardner to serve new development along Highway 26.	2,800
SDC 4	Proposed 16-inch extension south of Main Street to serve new development southeast of the Water Treatment Plant, and the installation of a BPS and pressure reducing valve.	3,600
SDC 5	Proposed Williamson Pressure Zone piping with BPS.	10,000
SDC 6	Aquifer storage and recovery Wells No. 2 and 3.	300
SDC 7	Construct a new Ochoco Heights reservoir, demolish an existing reservoir, rehabilitate an existing reservoir, and install a BPS with a permanent backup generator.	N/A
SDC 8	Proposed increase of existing 6-inch main line to 12-inch to increase system flows in Ochoco Heights.	4,080
SDC 9	Proposed 16-inch transmission main line from east side of Prineville to Northridge.	6,400
SDC 10	Proposed increase of existing 6-inch main line to 12-inch to better serve central system east of Main Street.	5,600
SDC 11	Proposed new 1.0 million gallon reservoir (to serve new pressure zone).	7,900
SDC 12	Proposed Airport Pressure Zone piping (distribution mains to connect undeveloped areas to City system).	13,000
SDC 13	Construct a new Juniper Well.	N/A
SDC 14	Construct a new 5th Street Well.	N/A
SDC 15	Construct a new 3,000 gallon per minute Ranney horizontal collector well at the Crooked River Wellfield.	N/A



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CITY OF
PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
PROPOSED WATER SYSTEM IMPROVEMENTS - SDC

FIGURE 6-2

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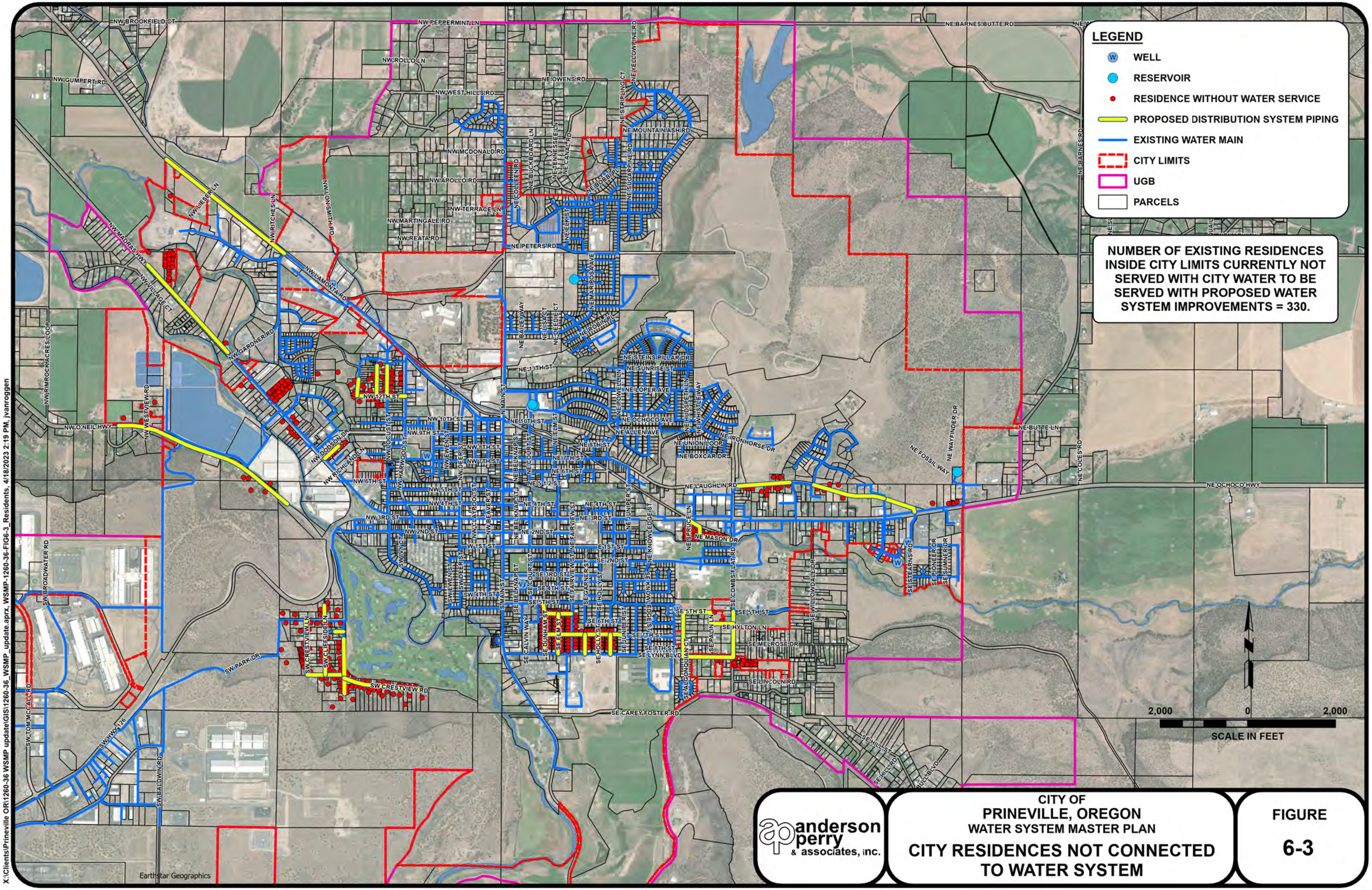

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CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
PROPOSED CIP-FUNDED IMPROVEMENTS
PRELIMINARY COST ESTIMATE
(YEAR 2023 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 1: Replace Existing Small Diameter (Less than 6 inches) Piping and Wood Stave Piping and Replace Existing Wrapped Steel Piping with New Minimum 8-inch Polyvinyl Chloride Water Line					
1	Mobilization/Demobilization	LS	$ 507,000	All Req'd	$ 507,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	275,000	All Req'd	275,000
3	8-inch Polyvinyl Chloride Water Line, including Valves and Fittings	LF	140	36,470	5,105,800
4	New Fire Hydrant and Auxiliary Valve	EA	7,500	160	1,200,000
5	Existing Water Service Connection to New Main Line	EA	400	500	200,000
6	Existing Fire Hydrant Connection to Main Line	EA	2,000	15	30,000
7	New Water Service (to Existing Lot, including Service Line and Meter)	EA	2,800	318	890,400
8	Connection to Existing Main Line	EA	5,000	130	650,000
9	Asphalt Surface Restoration	SY	40	45,000	1,800,000
				Estimated Construction Cost	**$ 10,659,000**
				Construction Contingency Cost (15%)	1,598,000
				Total Estimated Construction Cost	**$ 12,257,000**
				Preliminary, Design, and Construction Engineering (20%)	2,451,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 14,708,000**

CIP = Capital Improvements Plan

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE

CIP 2: Connect Ochoco Heights Pressure Zone to Lower Pressure Zones

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 75,000	All Req'd	$ 75,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	135,000	All Req'd	135,000
3	12-inch Polyvinyl Chloride Water Line, including Valves	LF	300	1,000	300,000
4	Pressure Reducing Valve	LS	50,000	All Req'd	50,000
5	New Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	2	15,000
6	New Water Service (to Existing Lot, including Service Line and Meter)	EA	3,000	330	990,000
7	Connection to Existing Main Line	EA	5,000	14	70,000
8	Asphalt Surface Restoration	SY	90	500	45,000
9	Gravel Surface Restoration	SY	30	1,500	45,000
				Estimated Construction Cost	**$ 1,725,000**
				Construction Contingency Cost (15%)	258,000
				Total Estimated Construction Cost	**$ 1,983,000**
				Preliminary, Design, and Construction Engineering (20%)	396,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 2,379,000**

CIP = Capital Improvements Plan

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 3: Connect Existing City Residences Not Connected to City Water					
1	Mobilization/Demobilization	LS	$ 216,000	All Req'd	$ 216,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	135,000	All Req'd	135,000
3	8-inch Polyvinyl Chloride Water Line, including Valves	LF	140	12,460	1,744,400
4	New Fire Hydrant and Auxiliary Valve	EA	7,500	27	202,500
5	New Water Service (to Existing Lot, including Service Line and Meter)	EA	3,000	330	990,000
6	Connection to Existing Main Line	EA	5,000	14	70,000
7	Asphalt Surface Restoration	SY	40	29,700	1,188,000
				Estimated Construction Cost	**$ 4,546,000**
				Construction Contingency Cost (15%)	681,000
				Total Estimated Construction Cost	**$ 5,227,000**
				Preliminary, Design, and Construction Engineering (20%)	1,045,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 6,272,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 4: American Pine Booster Pump Station Upgrades					
1	Mobilization/Demobilization	LS	$ 11,000	All Req'd	$ 11,000
2	Variable Frequency Drive Upgrade - Pumps	LS	100,000	All Req'd	100,000
3	Supervisory Control and Data Acquisition/Instrumentation Upgrade	LS	100,000	All Req'd	100,000
4	Remove Existing Pressure Reducing Valve	LS	25,000	All Req'd	25,000
				Estimated Construction Cost	**$ 236,000**
				Construction Contingency Cost (15%)	35,000
				Total Estimated Construction Cost	**$ 271,000**
				Preliminary, Design, and Construction Engineering (20%)	54,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 325,000**

CIP = Capital Improvements Plan

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 5: Reconstruct Stearns Well					
1	Mobilization/Demobilization	LS	23,000	All Req'd	$ 23,000
2	Well Construction	LS	150,000	All Req'd	150,000
3	Provide and Install Pump	LS	50,000	All Req'd	50,000
4	Electrical and Controls	LS	75,000	All Req'd	75,000
5	Chlorination System	LS	25,000	All Req'd	25,000
6	Mechanical and Piping	LS	50,000	All Req'd	50,000
7	Well Building Improvements	LS	100,000	All Req'd	100,000
8	Fencing and Gate	LS	10,000	All Req'd	10,000
				Estimated Construction Cost	**$ 483,000**
				Construction Contingency Cost (15%)	72,000
				Total Estimated Construction Cost	**$ 555,000**
				Preliminary, Design, and Construction Engineering (20%)	111,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	27,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 693,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 6: System-wide Supervisory Control and Data Acquisition Upgrade					
1	Mobilization/Demobilization	LS	50,000	All Req'd	$ 50,000
2	Supervisory Control and Data Acquisition/Instrumentation Upgrade	LS	1,000,000	All Req'd	1,000,000
				Estimated Construction Cost	**$ 1,050,000**
				Construction Contingency Cost (15%)	157,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 1,207,000**

CIP = Capital Improvements Plan

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE

CIP 7: Proposed Improvements to Increase Existing System Fire Flows (Upsize 6-inch Pipe or Install Pipe Where No Pipe Exists)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 85,000	All Req'd	$ 85,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	125,000	All Req'd	125,000
3	8-inch Polyvinyl Chloride Water Line, including Valves	LF	140	7,120	996,800
4	New Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	13	97,500
5	Existing Fire Hydrant Connection to New Main Line	EA	2,000	5	10,000
6	New Water Service (to Existing Lot, including Service Line and Meter)	EA	2,800	120	336,000
7	Connection to Existing Main Line	EA	5,000	6	30,000
8	Asphalt Surface Restoration	SY	60	1,750	105,000
	Estimated Construction Cost				**$ 1,786,000**
	Construction Contingency Cost (15%)				267,000
	Total Estimated Construction Cost				**$ 2,053,000**
	Preliminary, Design, and Construction Engineering (20%)				410,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 2,463,000**

CIP = Capital Improvements Plan

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE

CIP 8: Replace Exisiting Outside Diameter and Wrapped Main Line on 1st Street Between Main Street and Combs Flat

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 49,000	All Req'd	$ 49,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	6-inch Polyvinyl Chloride (PVC) Water Line	LF	120	5,600	672,000
4	6-inch Gate Valve	EA	2,000	9	18,000
5	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	6	45,000
6	Connection to Existing Main Line	EA	1,000	9	9,000
7	New Water Service (to Existing Lot, including Service Line and Meter)	EA	1,500	53	79,500
8	Asphalt Surface Restoration	SY	60	2,250	135,000
				Estimated Construction Cost	**$ 1,033,000**
				Construction Contingency Cost (15%)	154,000
				Total Estimated Construction Cost	**$ 1,187,000**
				Preliminary, Design, and Construction Engineering (20%)	237,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	59,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 1,483,000**

CIP 9: Proposed Improvements to Increase Existing System Fire Flows in Ochoco Heights (New 6-inch Polyvinyl Chloride Water Line)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 38,000	All Req'd	$ 38,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	35,000	All Req'd	35,000
3	6-inch PVC Water Line	LF	120	4,080	489,600
4	6-inch Gate Valve	EA	2,000	7	14,000
5	Connection to Existing Main Line	EA	1,200	17	20,400
6	New Water Service (to Existing Lot, including Service Line and Meter)	EA	1,500	29	43,500
7	Asphalt Surface Restoration	SY	60	2,800	168,000
8	Gravel Surface Restoration	SY	30	150	4,500
				Estimated Construction Cost	**$ 813,000**
				Construction Contingency Cost (15%)	121,000
				Total Estimated Construction Cost	**$ 934,000**
				Preliminary, Design, and Construction Engineering (20%)	186,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	46,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 1,166,000**

CIP = Capital Improvements Plan

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 10: Proposed Improvements to Increase Existing System Fire Flows in Ochoco Heights (New 8-inch Water Main Line)					
1	Mobilization/Demobilization	LS	$ 26,000	All Req'd	$ 26,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	30,000	All Req'd	30,000
3	8-inch Polyvinyl Chloride Water Line, including Valves	LF	140	1,685	235,900
4	New Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	3	22,500
5	Existing Fire Hydrant Connection to New Main Line	EA	2,000	3	6,000
6	New Water Service (to Existing Lot, including Service Line and Meter	EA	3,000	29	87,000
7	Connection to Existing Main Line	EA	5,000	7	35,000
8	Asphalt Surface Restoration	SY	60	1,850	111,000
				Estimated Construction Cost	**$ 554,000**
				Construction Contingency Cost (15%)	83,000
				Total Estimated Construction Cost	**$ 637,000**
				Preliminary, Design, and Construction Engineering (20%)	127,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 764,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
CIP 11: Park Drive Pressure Reducing Valve Upgrades					
1	Mobilization/Demobilization	LS	$ 1,500	All Req'd	$ 1,500
2	Temporary Protection and Direction of Traffic/Project Safety	LS	5,000	All Req'd	5,000
3	8-inch Ductile Iron Pipe including Restraints and Fittings	LF	300	40	12,000
4	Concrete Vault Modifications	LS	7,500	All Req'd	7,500
5	Existing Pressure Reducing Valve Modifications	LS	5,000	All Req'd	5,000
				Estimated Construction Cost	**$ 31,000**
				Construction Contingency Cost (15%)	4,000
				Total Estimated Construction Cost	**$ 35,000**
				Preliminary, Design, and Construction Engineering (20%)	7,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 42,000**

CIP = Capital Improvements Plan

CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF PROPOSED CIP-FUNDED IMPROVEMENTS
AND ESTIMATED PROJECT COSTS
(YEAR 2023 COSTS)

Improvement No.[1]	Improvement Description	Approximate Pipe Length (LF)	Total Estimated Costs	Time Frame When Improvements Completed
CIP 1	Replace existing small diameter (less than 6 inches) piping and wood stave piping and replace existing wrapped steel piping with new minimum 8-inch PVC water line.	36,470	$ 14,708,000	0 to 40 years
CIP 2	Connect Ochoco Heights Pressure Zone to lower pressure zones.	1,000	2,379,000	0 to 10 years
CIP 3	Connect existing City residences not connected to City water.[2]	12,460	6,272,000	0 to 10 years
CIP 4	American Pine booster pump station upgrades.	N/A	325,000	0 to 10 years
CIP 5	Reconstruct Stearns Well.	N/A	693,000	0 to 10 years
CIP 6	System-wide supervisory control and data acquisition upgrade.	N/A	1,207,000	0 to 10 years
CIP 7	Proposed improvements to increase existing system fire flows (upsize 6-inch pipe or install pipe where no pipe exists).	7,120	2,463,000	0 to 20 years
CIP 8	Replace existing outside diameter and wrapped main line on 1st Street between Main Street and Combs Flat.[3]	5,600	1,483,000	0 to 20 years
CIP 9	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 6-inch PVC water line).[4]	4,080	1,166,000	0 to 20 years
CIP 10	Proposed improvements to increase existing system fire flows in Ochoco Heights (new 8-inch water main line).	1,485	764,000	0 to 20 years
CIP 11	Park Drive pressure reducing valve upgrades.	N/A	42,000	10 to 20 years
	TOTAL ESTIMATED CIP-FUNDED IMPROVEMENTS COST (2023 DOLLARS)		**$ 31,502,000**	

[1] Improvements listed in order of City-identified priority, with CIP 1 being the highest priority and CIP 11 being the lowest. CIPs 1, 3, and 10 will be pursued as funding allows. Individual improvements will be selected due to extreme deficiency, increased maintenance costs, system growth, or the ability to coordinate work with other City projects.

[2] Funding source to be determined.

[3] Replacement cost only. Increase in size for future growth capacity captured in SDC 10.

[4] Replacement cost only. Increase in size for future growth capacity captured in SDC 8.

LF = linear feet
N/A = not applicable
PVC = polyvinyl chloride
SDC = system development charge

CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
PROPOSED SDC-FUNDED IMPROVEMENTS
PRELIMINARY COST ESTIMATE
(YEAR 2023 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 1: Proposed 12-inch Main Line Extension West of Main Street to Serve Future Development South of Reata					
1	Mobilization/Demobilization	LS	$ 56,000	All Req'd	$ 56,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	12-inch Polyvinyl Chloride (PVC) Water Line	LF	250	4,020	1,005,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	8	60,000
5	12-inch Butterfly Valve	EA	4,000	8	32,000
6	Connection to Existing Main Line	EA	5,000	1	5,000
				Estimated Construction Cost	**$ 1,183,000**
				Construction Contingency Cost (15%)	177,000
				Total Estimated Construction Cost	**$ 1,360,000**
				Preliminary, Design, and Construction Engineering (20%)	272,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	68,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 1,700,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 2: Proposed 12-inch Main Line Extension West of Main Street to Serve Future Development West of Main Street					
1	Mobilization/Demobilization	LS	$ 64,000	All Req'd	$ 64,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	12-inch PVC Water Line	LF	250	3,950	987,500
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	8	60,000
5	12-inch Butterfly Valve	EA	4,000	8	32,000
6	Connection to Existing Main Line	EA	5,000	1	5,000
7	Asphalt Surface Restoration	SY	60	3,100	186,000
				Estimated Construction Cost	**$ 1,360,000**
				Construction Contingency Cost (15%)	204,000
				Total Estimated Construction Cost	**$ 1,564,000**
				Preliminary, Design, and Construction Engineering (20%)	272,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	78,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 1,914,000**

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 3: Proposed 12-inch Main Line Extension North of Gardner to Serve New Development Along Highway 26					
1	Mobilization/Demobilization	LS	$ 33,000	All Req'd	$ 33,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	35,000	All Req'd	35,000
3	12-inch Polyvinyl Chloride (PVC) Water Line, Including Valves	LF	200	2,800	560,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	6	45,000
5	12-inch Butterfly Valve	EA	4,000	4	16,000
6	Connection to Existing Main Line	EA	5,000	1	5,000
7	Permanent Seeding	AC	7,500	1.3	9,750
	Estimated Construction Cost				**$ 704,000**
	Construction Contingency Cost (15%)				105,000
	Total Estimated Construction Cost				**$ 809,000**
	Preliminary, Design, and Construction Engineering (20%)				161,000
	Environmental Report, Cultural Resource Investigation, Permitting, Plan Reviews (5%)				40,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 1,010,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 4: Proposed 16-inch Extension South of Main Street to Serve New Development Southeast of the Water Treatment Plant, and the Installation of a Booster Pump Station and Pressure Reducing Valve					
1	Mobilization/Demobilization	LS	$ 85,000	All Req'd	$ 85,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	50,000	All Req'd	50,000
3	16-inch PVC Water Line	LF	260	3,600	936,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	20	150,000
5	16-inch Butterfly Valve	EA	5,000	20	100,000
6	Booster Pump Station[1]	LS	300,000	All Req'd	300,000
7	Pressure Reducing Valve	LS	50,000	All Req'd	50,000
8	Connection to Existing Main Line	EA	5,000	2	10,000
9	Asphalt Surface Restoration	SY	60	1,900	114,000
	Estimated Construction Cost				**$ 1,795,000**
	Construction Contingency Cost (15%)				269,000
	Total Estimated Construction Cost				**$ 2,064,000**
	Preliminary, Design, and Construction Engineering (20%)				412,000
	Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)				103,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 2,579,000**

[1] Booster pump station includes concrete masonry unit building; pumps; piping valves; electrical, controls, and instrumentation; site work; painting; security fencing; an access road; and telemetry and supervisory control and data acquisition development.

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 5: Proposed Williamson Pressure Zone Piping with Booster Pump Station					
1	Mobilization/Demobilization	LS	$ 167,000	All Req'd	$ 167,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	40,000	All Req'd	40,000
3	Right-of-Way/Easements	LS	25,000	All Req'd	25,000
4	12-inch Polyvinyl Chloride (PVC) Water Line	LF	200	7,200	1,440,000
5	8-inch PVC Water Line, including Valves and Fittings	LF	140	2,800	392,000
6	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	20	150,000
7	12-inch Butterfly Valve	EA	4,000	8	32,000
8	Booster Pump Station[1]	LS	300,000	All Req'd	300,000
9	Pressure Reducing Valve	LS	50,000	All Req'd	50,000
10	Connection to Existing Main Line	EA	5,000	1	5,000
11	Asphalt Surface Restoration	SY	40	22,000	880,000
12	Gravel Surface Restoration	SY	30	1,500	45,000
	Estimated Construction Cost				**$ 3,526,000**
	Construction Contingency Cost (15%)				528,000
	Total Estimated Construction Cost				**$ 4,054,000**
	Preliminary, Design, and Construction Engineering (20%)				810,000
	Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)				202,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 5,066,000**

[1] Booster pump station includes concrete masonry unit building; pumps; piping valves; electrical, controls, and instrumentation; site work; painting; security fencing; an access road; and telemetry and supervisory control and data acquisition development.

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 6: Aquifer Storage and Recovery Wells No. 2 and 3					
1	Mobilization/Demobilization	LS	$ 167,000	All Req'd	$ 167,000
2	Well Construction	LS	300,000	All Req'd	300,000
3	Well Pump Purchase and Installation	LS	250,000	All Req'd	250,000
4	Downhole Injection Valves	LS	400,000	All Req'd	400,000
5	Mechanical Piping, Fittings, and Valves	LS	500,000	All Req'd	500,000
6	Electrical and Controls	LS	500,000	All Req'd	500,000
7	Chlorination Systems	LS	150,000	All Req'd	150,000
8	Well Buildings	LS	300,000	All Req'd	300,000
9	Backup Generator System (300 kilowatt)	LS	300,000	All Req'd	300,000
10	Pump to Waste (Complete)	LS	250,000	All Req'd	250,000
11	Fence and Gate	LS	150,000	All Req'd	150,000
12	Gravel Access/Parking	LS	100,000	All Req'd	100,000
13	Connect to Existing Piping	LS	10,000	All Req'd	10,000
14	12-inch Polyvinyl Chloride Water Line	LF	300	300	90,000
15	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	2	15,000
16	Connection to Existing Main Line	EA	5,000	2	10,000
17	Gravel Surface Restoration	SY	30	750	22,500
	Estimated Construction Cost				**$ 3,515,000**
	Construction Contingency Cost (15%)				527,000
	Total Estimated Construction Cost				**$ 4,042,000**
	Preliminary, Design, and Construction Engineering (20%)				808,000
	Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)				202,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 5,052,000**

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 7: Construct a New Ochoco Heights Reservoir, Demolish an Existing Reservoir, Rehabilitate an Existing Reservoir, and Install a Booster Pump Station with a Permanent Backup Generator					
1	Mobilization/Demobilization	LS	$ 239,000	All Req'd	$ 239,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	10,000	All Req'd	10,000
3	Site Earthwork and Foundation	LS	300,000	All Req'd	300,000
4	1.5 Million Gallon (MG) Reservoir	LS	3,000,000	All Req'd	3,000,000
5	Painting of New Reservoir	LS	200,000	All Req'd	200,000
6	Site Piping, Valves, and Appurtenances	LS	200,000	All Req'd	200,000
7	Telemetry and Supervisory Control and Data Acquisition Development	LS	75,000	All Req'd	75,000
8	Existing 0.5 MG Reservoir Rehabilitation (Sandblast and Recoat Interior)	SF	40	6,520	260,800
9	Existing 0.5 MG Reservoir Rehabilitation (Sandblast, Steel Repairs, and Recoat Exterior)	SF	30	6,520	195,600
10	Booster Pump Station[1]	LS	300,000	All Req'd	300,000
11	Backup Generator	LS	150,000	All Req'd	150,000
12	Temporary Barricades, Scaffolding, Runoff Control, and Existing Materials Disposal	LS	50,000	All Req'd	50,000
13	Demolition of Second Existing Reservoir	LS	50,000	All Req'd	50,000
				Estimated Construction Cost	**$ 5,031,000**
				Construction Contingency Cost (15%)	754,000
				Total Estimated Construction Cost	**$ 5,785,000**
				Preliminary, Design, and Construction Engineering (20%)	1,157,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	289,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 7,231,000**

[1] Booster pump station includes a concrete masonry unit building, pumps, piping valves, site work, painting, security fencing, and an access road.

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 8: Proposed Increase of Existing 6-inch Main Line to 12-inch to Increase System Flows in Ochoco Heights					
1	Mobilization/Demobilization	LS	$ 37,000	All Req'd	$ 37,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	35,000	All Req'd	35,000
3	12-inch Polyvinyl Chloride (PVC) Water Line	LF	100	4,080	408,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	5	37,500
5	12-inch Butterfly Valve	EA	2,000	7	14,000
6	Connection to Existing Main Line	EA	1,800	17	30,600
7	New Water Service (to Existing Lot, including Service Line and Meter)	EA	1,500	29	43,500
8	Asphalt Surface Restoration	SY	60	2,800	168,000
9	Gravel Surface Restoration	SY	30	150	4,500
	Estimated Construction Cost				**$ 779,000**
	Construction Contingency Cost (15%)				116,000
	Total Estimated Construction Cost				**$ 895,000**
	Preliminary, Design, and Construction Engineering (20%)				179,000
	Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)				44,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 1,118,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 9: Proposed 16-inch Transmission Main Line from East Side of Prineville to Northridge					
1	Mobilization/Demobilization	LS	$ 100,000	All Req'd	$ 100,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	50,000	All Req'd	50,000
3	16-inch PVC Water Line	LF	260	6,400	1,664,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	7	52,500
5	16-inch Butterfly Valve	EA	5,000	14	70,000
6	Connection to Existing Main Line	EA	5,000	5	25,000
7	Asphalt Surface Restoration	SY	60	2,350	141,000
	Estimated Construction Cost				**$ 2,103,000**
	Construction Contingency Cost (15%)				315,000
	Total Estimated Construction Cost				**$ 2,418,000**
	Preliminary, Design, and Construction Engineering (20%)				483,000
	Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)				120,000
	TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)				**$ 3,021,000**

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 10: Proposed Increase of Existing 6-inch Main Line to 12-inch to Better Serve Central System East of Main Street					
1	Mobilization/Demobilization	LS	$ 42,000	All Req'd	$ 42,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	12-inch Polyvinyl Chloride Water Line	LF	100	5,600	560,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	6	45,000
5	12-inch Butterfly Valve	EA	2,000	9	18,000
6	Connection to Existing Main Line	EA	1,000	9	9,000
7	New Water Service (to Existing Lot, including Service Line and Meter)	EA	1,500	53	79,500
8	Asphalt Surface Restoration	SY	60	2,250	135,000
				Estimated Construction Cost	**$ 914,000**
				Construction Contingency Cost (15%)	137,000
				Total Estimated Construction Cost	**$ 1,051,000**
				Preliminary, Design, and Construction Engineering (20%)	210,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	52,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 1,313,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 11: Proposed New 1.0 Million Gallon Reservoir (to Serve New Pressure Zone)					
1	Mobilization/Demobilization	LS	$ 290,000	All Req'd	$ 290,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	Site Earthwork and Foundation	LS	250,000	All Req'd	250,000
4	1.0 Million Gallon Reservoir	LS	2,000,000	All Req'd	2,000,000
5	Painting of Reservoir	LS	200,000	All Req'd	200,000
6	Site Piping, Valves, and Appurtenances	LS	350,000	All Req'd	350,000
7	Security Fencing and Improvements	LS	100,000	All Req'd	100,000
8	16-inch Transmission Line, including Valves	LF	400	3,700	1,480,000
9	12-inch Fill Line, including Valves	LF	300	4,200	1,260,000
10	Telemetry and Supervisory Control and Data Acquisition Development	LS	150,000	All Req'd	150,000
				Estimated Construction Cost	**$ 6,105,000**
				Construction Contingency Cost (15%)	915,000
				Total Estimated Construction Cost	**$ 7,020,000**
				Preliminary, Design, and Construction Engineering (20%)	1,404,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	351,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 8,775,000**

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 12: Proposed Airport Pressure Zone Piping (Distribution Mains to Connect Undeveloped Areas to City System)					
1	Mobilization/Demobilization	LS	$ 181,000	All Req'd	$ 181,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	12-inch Polyvinyl Chloride (PVC) Water Line	LF	250	13,000	3,250,000
4	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	7	52,500
5	12-inch Butterfly Valve	EA	4,000	15	60,000
6	Connection to Existing Main Line	EA	5,000	2	10,000
7	Gravel Surface Restoration	SY	30	7,500	225,000
				Estimated Construction Cost	**$ 3,804,000**
				Construction Contingency Cost (15%)	570,000
				Total Estimated Construction Cost	**$ 4,374,000**
				Preliminary, Design, and Construction Engineering (20%)	874,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	218,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 5,466,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 13: Construct a New Juniper Well					
1	Mobilization/Demobilization	LS	$ 29,000	All Req'd	$ 29,000
2	Well Construction	LS	160,000	All Req'd	160,000
3	Well Pump Purchase and Installation	LS	50,000	All Req'd	50,000
4	Mechanical Piping, Fittings, and Valves	LS	25,000	All Req'd	25,000
5	Electrical and Controls	LS	25,000	All Req'd	25,000
6	Chlorination Systems	LS	10,000	All Req'd	10,000
7	Well Buildings	LS	150,000	All Req'd	150,000
8	Backup Generator Systems (300 kilowatt)	LS	100,000	All Req'd	100,000
9	Fence and Gate	LS	25,000	All Req'd	25,000
10	Gravel Access/Parking	LS	10,000	All Req'd	10,000
11	Connect to Existing Piping	LS	5,000	All Req'd	5,000
12	12-inch PVC Water Line	LF	200	100	20,000
13	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	1	7,500
				Estimated Construction Cost	**$ 617,000**
				Construction Contingency Cost (15%)	92,000
				Total Estimated Construction Cost	**$ 709,000**
				Preliminary, Design, and Construction Engineering (20%)	141,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 850,000**

SDC = system development charge

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 14: Construct a New 5th Street Well					
1	Mobilization/Demobilization	LS	$ 29,000	All Req'd	$ 29,000
2	Well Construction	LS	160,000	All Req'd	160,000
3	Well Pump Purchase and Installation	LS	50,000	All Req'd	50,000
4	Mechanical Piping, Fittings, and Valves	LS	25,000	All Req'd	25,000
5	Electrical and Controls	LS	25,000	All Req'd	25,000
6	Chlorination Systems	LS	10,000	All Req'd	10,000
7	Well Buildings	LS	150,000	All Req'd	150,000
8	Backup Generator Systems (300 kilowatt)	LS	100,000	All Req'd	100,000
9	Fence and Gate	LS	25,000	All Req'd	25,000
10	Gravel Access/Parking	LS	10,000	All Req'd	10,000
11	Connect to Existing Piping	LS	5,000	All Req'd	5,000
12	12-inch Polyvinyl Chloride Water Line	LF	200	100	20,000
13	Fire Hydrant and Auxiliary Valve Assembly	EA	7,500	1	7,500
				Estimated Construction Cost	**$ 617,000**
				Construction Contingency Cost (15%)	92,000
				Total Estimated Construction Cost	**$ 709,000**
				Preliminary, Design, and Construction Engineering (20%)	141,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 850,000**

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
SDC 15: Construct a New 3,000 Gallon Per Minute Ranney Horizontal Collector Well at Crooked River Wellfield					
1	Mobilization/Demobilization	LS	$ 110,000	All Req'd	$ 110,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	100,000	All Req'd	100,000
3	Dewatering	LS	250,000	All Req'd	250,000
4	Caisson Construction	LS	200,000	All Req'd	200,000
5	Horizontal Well Construction	LF	3,500	300	1,050,000
6	Booster Pump Station[1]	LS	300,000	All Req'd	300,000
7	Electrical and Controls	LS	250,000	All Req'd	250,000
8	Connection to Existing Main Line	EA	5,000	2	10,000
9	Gravel Surface Restoration	SY	30	1,500	45,000
				Estimated Construction Cost	**$ 2,315,000**
				Construction Contingency Cost (15%)	347,000
				Total Estimated Construction Cost	**$ 2,662,000**
				Preliminary, Design, and Construction Engineering (20%)	532,000
				Environmental Report, Cultural Resource Investigation, Permitting, and Plan Reviews (5%)	133,000
				TOTAL ESTIMATED IMPROVEMENT COST (2023 DOLLARS)	**$ 3,327,000**

[1] Booster pump station includes concrete masonry unit building, pumps, piping valves, site work, painting, security fencing, and an access road.

SDC = system development charge

CITY OF PRINEVILLE, OREGON
WATER SYSTEM MASTER PLAN
SUMMARY OF PROPOSED SDC-FUNDED IMPROVEMENTS AND ESTIMATED PROJECT COSTS
(YEAR 2023 COSTS)

Improvement No.[1]	Improvement Description	Approximate Pipe Length (LF)	Total Estimated Costs
SDC 1	Proposed 12-inch main line extension west of Main Street to serve future development south of Reata.	4,020	$ 1,700,000
SDC 2	Proposed 12-inch main line extension west of Main Street to serve future development west of Main Street.	3,950	1,914,000
SDC 3	Proposed 12-inch main line extension north of Gardner to serve new development along Highway 26.	2,800	1,010,000
SDC 4	Proposed 16-inch extension south of Main Street to serve new development southeast of the Water Treatment Plant, and the installation of a BPS and pressure reducing valve.	3,600	2,579,000
SDC 5	Proposed Williamson Pressure Zone piping with BPS.	10,000	5,066,000
SDC 6	Aquifer storage and recovery Wells No. 2 and 3.	300	5,052,000
SDC 7	Construct a new Ochoco Heights reservoir, demolish an existing reservoir, rehabilitate an existing reservoir, and install a BPS with a permanent backup generator.	N/A	7,231,000
SDC 8[2]	Proposed increase of existing 6-inch main line to 12-inch to increase system flows in Ochoco Heights.	4,080	1,118,000
SDC 9[3]	Proposed 16-inch transmission main line from east side of Prineville to Northridge.	6,400	3,021,000
SDC 10	Proposed increase of existing 6-inch main line to 12-inch to better serve central system east of Main Street.	5,600	1,313,000
SDC 11	Proposed new 1.0 million gallon reservoir (to serve new pressure zone).	7,900	8,775,000
SDC 12	Proposed Airport Pressure Zone piping (distribution mains to connect undeveloped areas to City system).	13,000	5,466,000
SDC 13	Construct a new Juniper Well.	N/A	850,000
SDC 14	Construct a new 5th Street Well.	N/A	850,000
SDC 15	Construct a new 3,000 gallon per minute Ranney horizontal collector well at the Crooked River Wellfield.	N/A	3,327,000
	TOTAL ESTIMATED SDC-FUNDED IMPROVEMENTS COST (2023 DOLLARS)		**$ 49,272,000**

[1] The SDC-funded improvements are not listed in order of priority. The improvement to be completed first will depend on where growth and development occur within the City.

[2] Cost to increase in size for future growth. Replacement cost shared with CIP 9.

[3] Cost to increase in size for future growth. Replacement cost shared with CIP 8

BPS = booster pump station

CIP = Capital Improvements Plan

LF = linear feet

N/A = not applicable

SDC = system development charge

Chapter 7 - Project Financing and Implementation

Introduction

This chapter briefly outlines alternatives for financing the City of Prineville's water system improvements. A summary of state and federal funding programs is presented, including a review of funding options potentially available to the City for the water system improvements. To construct some or all of the proposed improvements, a financing plan acceptable to the City must be developed to complete the improvements. Because of the estimated cost of the improvements, it is recommended the City pursue financing resources for some of the proposed improvements utilizing a low-interest loan coupled with grant funds, if available.

The City's current water rate structure is regularly reviewed as part of the City's overall water and wastewater infrastructure planning process. Some discussion of the existing rate structure and how it affects the City's eligibility for certain funding programs is provided herein. The City's annual review of water rate options is used to evaluate the ability of the current rate structure to fund the identified and recommended system improvements while maintaining adequate revenue to support operation and maintenance (O&M) and other system expenditures.

Current Water Use Rates and Revenue

The O&M of the existing water system is financed through the City's annual budget. The City's fund includes expenses and revenues for the water system. Revenue is obtained from water user billings, system development charges, and connection fees.

Water Use Rates

The current base water rate per month for residential services inside the city limits is $20.12 plus $2.25 per unit of consumption. Each unit is 750 gallons or 100 cubic feet. The base water rate per month for commercial services inside the city limits is dependent on meter size and starts at $20.12 for a 3/4-inch meter and increases to $579.53 for a 6-inch meter. The commercial base rate includes a base volume of usage varying by meter size. After the base usage is surpassed, a consumption charge of $2.25 per unit is added. The current residential and commercial monthly water rates are summarized on Table 7-1. The City also utilizes a tiered usage rate system. The current tiered usage rates are summarized on Table 7-2.

TABLE 7-1
2021 RESIDENTIAL AND COMMERCIAL WATER RATE INFORMATION

Meter Size	Units Included	Base Rate Per Month	Water Usage Rate (per 750 gallons/ 100 cubic feet)[1]
3/4-inch	0	$20.12	$2.25
1-inch	0	$31.70	$2.25
1-1/2-inch	0	$60.43	$2.25
2-inch	0	$95.03	$2.25

Meter Size	Units Included	Base Rate Per Month	Water Usage Rate (per 750 gallons/ 100 cubic feet)[1]
3-inch	0	$175.85	$2.25
4-inch	0	$291.18	$2.25
6-inch	0	$579.53	$2.25

[1]Rate for 1 to 25 units (100 cubic feet).

TABLE 7-2
TIERED USAGE WATER RATES

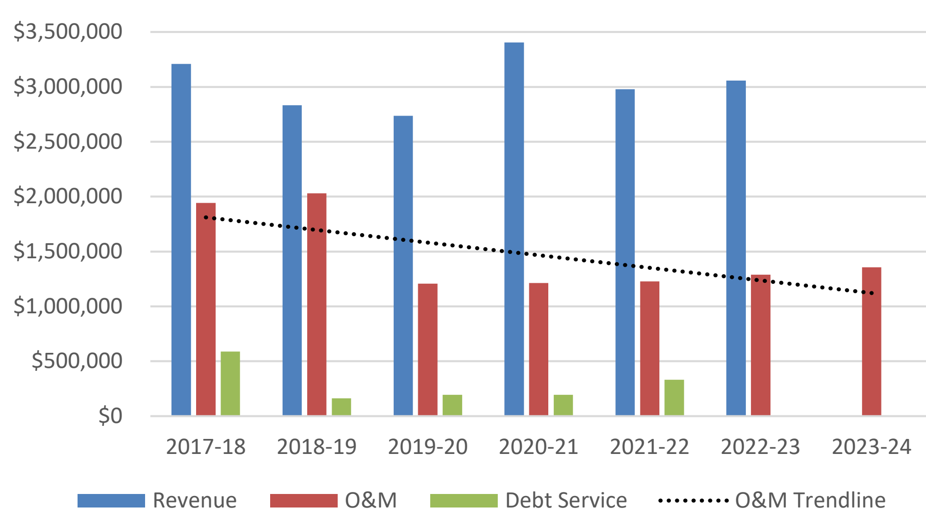
Usage Tier	Units Included	Water Usage Rate (per 750 gallons/ 100 cubic feet)[1]
Tier 1	0 to 25	$2.25
Tier 2	26 to 37	$2.47
Tier 3	38 and over	$2.38

[1]Rate for 1 to 25 units (100 cubic feet).

Current Financial Status

The City conducts regular audits to assess its financial position and the accuracy of the budget process. According to the Annual Comprehensive Financial Report for Fiscal Year Ending June 30, 2021, prepared by the City, operating revenues generated were approximately $3.4 million versus system O&M expenses of approximately $1.2 million. A graphical plot of the City's water system budget, with revenue and expenditures, is shown on Chart 7-1. O&M costs have been projected to the 2023-24 fiscal year by applying a 5.1 percent inflation rate.

CHART 7-1
HISTORICAL AND PROJECTED BUDGET



City expenses are expected to increase as water system additions and repairs are implemented. As these improvements are implemented, the City may need to consider increasing user water rates to increase revenue. Other options to fund improvements are outlined below.

Water System Improvements Funding

To complete the water system improvements discussed in Chapter 6, the City may choose to obtain outside funding assistance. A number of state and federal grant and loan programs can provide assistance on municipal improvement projects to utility districts, cities, and counties. 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, and others.

These agencies can provide low-interest loan funding and possibly grant funding for assisting rural communities on public works projects. Some of the funding programs provide funding only if the improvements address documented water quality compliance or health issues.

Summary of Potential Funding Programs

The following section briefly summarizes the primary funding programs available to assist the City with a water system improvements project. Most of these agencies will require an increase in water rates to support a loan for water system improvements, both as a condition of receiving monies and prior to being considered for grant funds. It should be noted the monthly user rates discussed in this section can represent a combination of monthly usage fees and taxes.

Federal Grant and Loan Programs

Rural Development

RD can provide financial assistance to communities with a population under 50,000 through the Water and Waste Disposal Loan Guarantees Program. Under the loan program, the City can seek private lender funding for projects with the agency providing loan guarantee to the lender on behalf of the City.

U.S. Economic Development Administration

The EDA has grant and loan funds similar to those available through the Business Oregon - Special Public Works Fund (SPWF) program. Monies are available to public agencies to fund projects that stimulate the economy of an area, and the overall goal of the program is to create or retain jobs. The EDA has invested a great deal of money in Oregon to fund public works improvement projects in areas where new industries were locating or planned 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. If the City's water system improvements can be linked directly to commercial or industrial job creation and/or job retention, the City could be in a competitive position to receive funding from the EDA.

State Grant and Loan Programs

Business Oregon - Safe Drinking Water Revolving Loan Fund

This is primarily a loan program for the construction and/or improvement of public and private water systems to address regulatory compliance issues. This is accomplished through two separate programs: the Safe Drinking Water Revolving Loan Fund (SDWRLF) for collection, treatment, distribution, and related infrastructure, and the Drinking Water Protection Loan Fund for protection of sources of drinking water prior to system intake. The SDWRLF program normally lends up to $6 million per project. Awards of $3 million and above are subject to review by the Infrastructure Finance Authority. Loan amounts greater than $6 million are available on a limited basis and must be approved by the Oregon Health Authority's Drinking Water Advisory Committee. The standard SDWRLF loan term is 20 years or the useful life of project assets, whichever is less. Loan terms of up to 30 years may be available for "disadvantaged communities" but shall not exceed the expected useful life of the improvements funded. This program offers subsidized interest rates for all successful projects. Interest rates for a standard loan start at 80 percent of the state/local bond rate. Interest rates for loans to disadvantaged communities are based on a sliding scale between the interest rate for a standard loan and 1 percent. Communities may be eligible for some of the principal on their SDWRLF loan to be "forgiven." This forgivable loan feature is similar to a grant and is offered to disadvantaged communities. Special consideration, including partial principal forgiveness, is provided to projects qualifying or having Green Project Reserve components. The SDWRLF program appears to be a beneficial funding source for the City to pursue.

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 CWA.

While the Water/Wastewater financing program is primarily a loan program, grants are available for municipalities that meet eligibility criteria. The loan/grant amounts are determined by 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 and is 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 applicants 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 median household income (MHI) is equal to or greater than 100 percent of the state average MHI for the same year. Projects that serve primarily low- and moderate-income communities (Head Start, emergency/homeless shelters, etc.) are eligible regardless of the community income level.

Community Development Block Grant Program

The primary objective of the Community Development Block Grant (CDBG) program is 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 incomes (LMIs).

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 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. However, in recent years, the maximum grant funds available to a given project were limited to $2.5 million.

Eligibility for the CDBG program requires that greater than 51 percent of persons within the community fall into the LMI category. According to the 2021 5-Year American Community Survey utilized by Business Oregon, in 2021 approximately 55.3 percent of the City's population was within the LMI category. This puts the City above the threshold criteria to qualify for CDBG funds, but the City has a good chance of obtaining funding if a potential compliance issue is identified.

Special Public Works Fund

The 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 in Oregon. 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 and limited to 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. 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. 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. If the City can tie the needed improvements to job creation, the SPWF may be a potential funding source for water system improvements.

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.

Potential Rate Requirements to Fund System Improvements

To be eligible for RD grant and loan funds, the City must have average water use costs that are comparable to similar systems in the area. Once the City begins to evaluate potential funding sources and attends a "One Stop" meeting (discussed later in this chapter), RD will provide an estimate of the water rates required for the City to be eligible for low-interest loans and grants.

Business Oregon is currently using 1.25 percent of a community's five-year MHI as the basis for residential monthly water user cost requirements to be eligible for grant funding. In the City's case, the average five-year MHI is $42,298. This MHI results in a required monthly residential water user cost of $44.06 to qualify for low-interest loan or grant funding. Business Oregon's residential rate requirement is also based on an assumed residential use of 7,500 gallons per month. With the City's current rates, $20.12 is charged as a base rate and an additional $2.25 per 750 gallons of water use is also charged. If a residential water user consumed 7,500 gallons, the associated cost would be $42.62. Therefore, it appears the City would need to increase its monthly water rate by $1.44 to meet the 1.25 percent MHI threshold to obtain low-interest loans and/or grant funds through Business Oregon. However, additional rate increases may be required to fund the full scope of the proposed water system improvements.

Project One Stop Meeting

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

Local Financing Options

Regardless of the ultimate project scope and agency from which funds are obtained, the City of Prineville may need to develop authorization to incur debt (i.e., bonding) for the selected project improvements. The need to develop authorization to incur debt depends on funding agency requirements and provisions in the City Charter. The need for bonding by the City has been eliminated by most state funding programs. However, if a bond election is required, there are generally two options the City may use for its bonding authority: general obligation bonds and revenue bonds. General obligation bonds require a vote of the people to give the City the authority to repay the debt service through tax assessments, water revenues, or a combination of both. The City's taxing authority provides the guarantee for the debt. Revenue bonds are financed through water system revenues. Authority to issue revenue bonds can come in two forms. One would be through a local bond election similar to that needed to sell a general obligation bond, and the second would be through Council action authorizing the sale of revenue bonds, if the City Charter allows. If 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.

Oregon law currently requires a 50 percent voter turnout to pass a bonded debt tax measure, unless the election is held in November of an even-numbered year. November elections in even-numbered years require only a majority of those who voted to pass a bonded debt tax measure. Due to current tax measure limitations in Oregon, careful consultation with experienced, licensed bonding attorneys should be made if the City begins to obtain bonding authority for the proposed water system improvements.

Private/Public Funding Partnership

Specific users seeking to reserve water system capacity have proposed fully or partially funding certain water system improvements specifically to increase available system capacity for their use. While these specific improvements are intended to augment existing facilities for the benefit of the customer, they will also benefit the operation of the entire system and a majority of system users. Currently, the proposed improvements are additional storage reservoirs, transmission and distribution main lines, and drinking water wells. While no specific timeline has been provided for the proposed improvements, the possibility of a private/public funding partnership for system improvements should be further evaluated.

Project Implementation

For the City to successfully implement the water system improvements evaluated in this Water System Master Plan and presented in the City's Capital Improvements Plan, the City will need to coordinate directly with RD, Business Oregon, and other potential funding agencies if they elect to pursue federal, state, and/or potential local financing opportunities provided through low-interest loans and potential grants.

The City should work closely with its citizens through public meetings to inform them of system needs and the potential for increased water user costs. To reduce the financial impact to users, the City could seek low-interest loans coupled with grant funds. Increasing rates, as required, will adequately fund O&M of the existing and improved water system and keep up with inflation.

Implementation Steps

Should the City wish to proceed with water system improvements, the following Implementation Plan outlines the key steps the City would need to undertake. The following implementation steps and stated completion dates are presented as general guidance only and provide the estimated time needed to complete projects of this complexity and magnitude. The dates are subject to change and will depend on economic conditions within the community, and implementation of the project could be delayed due to economic conditions.

Item No.	Implementation Item	Time Frame
1.	Submit draft WSMP to the City and agencies for review.	May 2023
2.	Finalize and adopt the WSMP.	June 2023
3.	Attend One Stop meeting.	Winter 2023-24
4.	Prepare and submit funding application(s) to appropriate agency(ies).	Spring 2024
5.	Finalize project funding.	Summer 2024
6.	Design system improvements.	Summer 2023 through Summer 2024
7.	Submit design documents for agency review.	Summer 2024
8.	Advertise, bid, and award construction project.	Winter 2024-25

Item No.	Implementation Item	Time Frame
9.	Project construction.	Spring 2025 through Winter 2025-26
10.	Project startup and construction completion.	Spring 2026
11.	Project closeout.	Summer 2026

Summary

The water system improvements outlined herein are anticipated to provide the City with a higher quality water 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 improvements projects are pursued.