# City of Lowell

**LANE COUNTY, OREGON**

## Water Master Plan

**November 2022**

Civil West
Engineering Services, Inc.

www.civilwest.com | Willamette Valley | North Coast | South Coast | Rogue Valley

# City of Lowell

**LANE COUNTY, OREGON**

## Water Master Plan

**November 2022**

REGISTERED PROFESSIONAL
ENGINEER
93327PE
OREGON
MAR. 13, 2018
DANIEL CRAIG VAAGE
EXPIRATION DATE: 06/30/2024

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# 1 EXECUTIVE SUMMARY

## 1.1 Introduction

The City of Lowell is located north of Dexter Reservoir in Lane County, approximately 20 miles southeast of Springfield on State Highway 58. Lowell was incorporated in 1954 at the site of an abandoned town that originally housed workers from the U.S. Army Corps of Engineers for the construction of both the Dexter and Lookout Point Reservoirs. The City of Lowell is primarily a residential community with no major industries. The City owns and operates a community water system that is comprised of the following primary assets:

- An intake structure east of the covered bridge and associated piping running from the intake structure to the water treatment plant on the north bank of the Dexter Reservoir
- Three inactive wells, LANE 19572, LANE 1637, and L3714
- A conventional water treatment plant
- A 35,000-gallon clearwell underneath the water treatment plant
- One 460,000-gallon concrete finished water storage reservoir
- One 440,000-gallon glass-fused steel finished water storage reservoir
- Distribution pump station
- Booster pump station for high elevation service
- 2,500-gallon storage tank servicing high elevation pressure zone
- Approximately 30,000’ of distribution mains and transmission piping

The City of Lowell needs a new Water Master Plan, as their last master plan update was completed in the fall of 2006. Completion of this plan will enable City staff to prepare more appropriately for future growth and for water system improvements needed to address existing issues related to water system supply, treatment, storage, and distribution.

## 1.2 Water Demand

### 1.2.1 Current Water Demand

Daily total billing and production data was obtained from the City. Monthly billing data from the study period of 2016 - 2020 (60 months) show that a total of 151.7 million gallons of treated water was sold. For the study period, total unaccounted water averaged 26%. Average monthly production is 3.8 MG, and the average monthly quantity billed is 2.5 MG.

The average daily demand (ADD) for the dataset (2016 – 2020) was 123,064 gallons per day.

The maximum daily demand (MDD) for the dataset (2016 – 2020) was calculated by applying a peaking factor of 2 to the ADD and is 246,127 gallons per day.

The peak hourly demand (PHD) for the dataset (2016 – 2020) was calculated by applying a peaking factor of 5 to the ADD and is 615,318 gallons per day or 427 gpm.

Based on treatment plant records, (the 5-year totals 2016 - 2020) of the 44.9 million gallons pumped into distribution per year; 30.3 million gallons goes to metered water sales, 2.6 million gallons per year to miscellaneous use and main breaks, with 0.4 million gallons going to line flushing and fire protection testing/use. This leaves a remainder of 11.6 million gallons as unaccounted water.

### 1.2.2 Future Water Demand

Water demand projections over the planning period are estimated by multiplying the current per capita demand numbers by the projected future population estimates.
According to the 2020 US Census, the population of Lowell was 1,196. Since 2020, there have been several new developments in town that were not accounted for in the PSU estimate. These developments are adding approximately 35 EDUs to the system, which will add approximately 94 persons to the 2020 census number, pushing the population to 1,290. Using the AAGR (from the table below) beyond this slated bump in population from 2021 onward, the service population at the end of this planning period (2045) is projected to be 1,560.

*TABLE 1.2 – LANE COUNTY POPULATION FORECAST AND AAGR*

**Figure 1. Lane County and Sub-Areas—Historical and Forecast Populations, and Average Annual Growth Rates (AAGR)**

| | Historical | | | Forecast | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | AAGR (2000-2010) | 2019 | 2044 | 2069 | AAGR (2010-2019) | AAGR (2019-2044) | AAGR (2044-2069) |
| **Lane County** | **322,959** | **351,715** | ***0.9%*** | **371,361** | **426,041** | **480,634** | ***0.6%*** | ***0.6%*** | ***0.5%*** |
| Coburg | 969 | 1,032 | *0.6%* | 1,308 | 1,687 | 1,955 | *2.6%* | *1.0%* | *0.6%* |
| Cottage Grove | 8,952 | 10,164 | *1.3%* | 10,284 | 11,677 | 13,172 | *0.1%* | *0.5%* | *0.5%* |
| Creswell | 3,959 | 5,333 | *3.0%* | 5,663 | 7,573 | 9,813 | *0.7%* | *1.2%* | *1.0%* |
| Dunes City | 1,229 | 1,303 | *0.6%* | 1,292 | 1,474 | 1,665 | *-0.1%* | *0.5%* | *0.5%* |
| Eugene | 160,551 | 177,369 | *1.0%* | 192,607 | 232,099 | 273,794 | *0.9%* | *0.7%* | *0.7%* |
| Florence | 8,783 | 10,230 | *1.5%* | 10,579 | 12,518 | 14,635 | *0.4%* | *0.7%* | *0.6%* |
| Junction City | 5,942 | 6,100 | *0.3%* | 6,919 | 9,080 | 11,328 | *1.4%* | *1.1%* | *0.9%* |
| Lowell | 857 | 1,045 | *2.0%* | 1,108 | 1,352 | 1,620 | *0.6%* | *0.8%* | *0.7%* |
| Oakridge | 3,239 | 3,308 | *0.2%* | 3,278 | 3,344 | 3,320 | *-0.1%* | *0.1%* | *0.0%* |
| Springfield | 61,910 | 67,738 | *0.9%* | 70,278 | 76,443 | 81,677 | *0.4%* | *0.3%* | *0.3%* |
| Veneta | 2,737 | 4,561 | *5.2%* | 4,767 | 6,591 | 8,662 | *0.5%* | *1.3%* | *1.1%* |
| Westfir | 287 | 255 | *-1.2%* | 254 | 272 | 288 | *0.0%* | *0.3%* | *0.2%* |
| Outside UGBs | 63,544 | 63,277 | *0.0%* | 63,023 | 61,930 | 58,707 | *0.0%* | *-0.1%* | *-0.2%* |

*Sources: U.S. Census Bureau, 2000 and 2010 Censuses; Forecast by Population Research Center (PRC).*

*Note: For simplicity each UGB is referred to by its primary city's name.*

This population projection implemented a 0.8% Average Annual Growth Rate (AAGR) from 2019-2044 and a 0.7% AAGR from 2044-2069 and was based on information from the Office of Economic Analysis Population Forecast from the PRC at PSU.

The ADD is projected to increase to 160,518 gallons per day while the MDD is projected to increase to 321,035 gallons per day. PHD is calculated to increase to 802,588 gpd, or 557 gpm.

*TABLE 1.2.2 - 20-YEAR WATER DEMAND DESIGN VALUES*

| Lowell 2016-2020 Data | | Population = | 1,196 |
|---|---|---|---|
| Unit | ADD | MDD | PHD |
| gpd | 123,064 | 246,127 | 615,318 |
| Peaking Factor | 1 | 2 | 5 |
| gpcpd | 103 | 206 | 514 |
| | | | |
| Lowell 2045 Data | | Population = | 1,560 |
| Unit | ADD | MDD | PHD |
| gpd | 160,518 | 321,035 | 802,588 |
| Peaking Factor | 1 | 2 | 5 |
| gpcpd | 103 | 206 | 514 |

## 1.3 Existing Water System

### 1.3.1 Water Supply

The City currently relies upon a screened intake submerged in Dexter Reservoir for their raw water supply. In addition to the raw water intake in Dexter Reservoir, the City also has three inactive wells, two of which, well #1 LANE 19572 and well #2 LANE 1637, were most recently used.

### 1.3.2 Water Treatment Plant

The Lowell WTP is a conventional rapid media filter plant. The basic plant processes include chemical coagulation, mechanical flocculation, tube-settler sedimentation, dual-media filtration, and chemical disinfection and conditioning. The major system components that accomplish these processes are described in more detail in section 7.

*PHOTO 1.3.2 – LOWELL WTP – FILTER BASIN*

### 1.3.3 Treated Water Storage

*PHOTO 1.3.3.1 – 440,000 GALLON RESERVOIR*

The City currently uses a 440,000-gallon glass-fused to steel tank, and an older 460,000-gallon concrete tank for water storage. The two tanks sit adjacent to each other on a lot north of the intersection of East 1st Street and Sunridge Lane. The tanks share a base elevation of ~922'. The tanks can both be filled to approximately 952' while leaving two feet available for freeboard. There is also a 2,500-gallon tank that services a small upper pressure zone. This upper tank is fed from a booster pump.

### 1.3.4 Distribution System

The major components and layout of the water distribution system for the City are shown on the Water System Map. The existing system consists of a distribution grid consisting of a range of pipe materials and sizes from 2" up to 12". The various pipe materials in the distribution system include the following: galvanized steel, PVC, cast iron, steel and asbestos concrete.

*PHOTO 1.3.3.2 – 460,000 GALLON RESERVOIR*

The layout of the distribution system is generally grid-like in shape, and adequate to deliver the required flowrates to the community. Looped distribution lines allow the use of smaller diameter pipes and improves both the reliability and the redundancy of the system, as the water can reach the point of demand by more than one path. There are two longer lines that do not loop back into the rest of the system, one running west down Shoreline Drive, and the main line running north up Moss Street. With the exception of these two lines, the water distribution system in the City of Lowell is fairly well laid-out. WaterCAD modeling has determined that the distribution pipeline network will provide adequate domestic and fire flows for the duration of the planning period. Please see Appendix WCM for the data output detailing the WaterCAD analysis.

## 1.4 Improvement Needs

### 1.4.1 Data Collection and Management

The City presently has an early generation SCADA monitoring and control system, but the system hardware/firmware is very old and needs updating. Some of the equipment is newer and may be left in service. It is recommended that the City investigate outright replacement of the most antiquated SCADA equipment.

### 1.4.2 Water Supply

The GSI 2022 WMCP found that the City's surface water has proven to be an adequate source of supply. Certificate 23721 authorizes diversions from the Middle Fork of the Willamette River of up to 1.0 cfs, exceeding the City's historical average MDD. Further, the City has not experienced and does not anticipate experiencing restrictions on the rate of diversion associated with this certificate.

The two groundwater rights are adequate to meet the City's average MDD of 0.34 cfs (0.22 mgd), however, both sources have elevated arsenic. As the City's WTP was not designed to treat for arsenic, the only way the groundwater sources could utilized, would be if they were blended with the surface water to an acceptable arsenic level. The City would only consider blending in the unlikely event that the surface water source was not able to fully meet demand. Given the historical arsenic levels ~0.030 mg/L, the surface water to groundwater blend would need to be at least 2 parts surface water two one part groundwater to maintain arsenic levels below the MCL of 0.010 mg/L.

### 1.4.3 Water Treatment Plant

The conventional water treatment plant processes (in order of flow) include:

- Chemical coagulation
- Mechanical flocculation
- Tube-settler sedimentation
- Dual-media filtration
- Chemical disinfection (on-site generated sodium hypochlorite)

Production of water at the conventionally filtered WTP is highly limited upon the flow rate through the sedimentation basin. If the flow rate is pushed too high, the basin tends to cause turbidity spikes in the finished water.

### 1.4.4 Treated Water Storage

The City presently has a combined effective water storage capacity of approximately 845,000 gallons with both reservoirs full. Storage needs for 2021 and 2045 are calculated in section 7.3 at 1.0 and 1.2 million gallons respectively. Currently, the City does not have enough storage to provide for equalization, anticipated fire flows, and emergency storage. The existing system will be deficient by approximately 330,000 gallons by the end of the planning period for this study.

The City also wishes to add an additional high elevation pressure zone to provide water service to anticipated residential growth in the remaining potential buildout section on the northeast side of town. This could be accomplished by building a third storage reservoir.

### 1.4.5 Distribution System

The distribution system mains vary considerably in both size and material, with 6” and 12” PVC comprising nearly half of the system, with a considerable amount of 6” AC still in service. There is still a significant amount of AC pipe in the system (26.2%), that is suspect for potential leakage in the distribution system. We recommend that the City’s number one priority should be replacement of all AC pipe in the distribution system with HDPE. Second priority should be installation of a seismically resistant “backbone” as identified in the SRAMP. Thirdly, the distribution system could benefit from looping of dead-end lines. Please see the table below for further detail regarding the size and material composition of the existing distribution system.

**Length in feet**

| | 2" | 4" | 6" | 8" | 10" | 12" | TOTAL |
|---|---|---|---|---|---|---|---|
| **PVC** | 2,645 | 1,380 | 10,345 | 4,305 | - | 9,240 | **27,915** |
| **STEEL** | - | 1,830 | 510 | 1,710 | - | - | **4,050** |
| **AC** | - | - | 9,595 | - | 1,745 | - | **11,340** |
| **TOTAL** | **2,645** | **3,210** | **20,450** | **6,015** | **1,745** | **9,240** | **43,305** |

**Percentage of total**

| | 2" | 4" | 6" | 8" | 10" | 12" | TOTAL |
|---|---|---|---|---|---|---|---|
| **PVC** | 6.1% | 3.2% | 23.9% | 9.9% | - | 21.3% | **64.5%** |
| **STEEL** | - | 4.2% | 1.2% | 3.9% | - | - | **9.4%** |
| **AC** | - | - | 22.2% | - | 4.0% | - | **26.2%** |
| **TOTAL** | **6.1%** | **7.4%** | **47.2%** | **13.9%** | **4.0%** | **21.3%** | **100%** |

With a few exceptions at the perimeter, the core layout of the existing water system is close to a grid in shape, and adequate to deliver the required flowrates to the community, with most lines being looped back into the system. Looped distribution lines allow the use of smaller diameter pipes and improves both the reliability and the redundancy of the system, as the water can reach the point of demand by more than one path. The water distribution system in the City of Lowell is fairly well laid-out and analysis with WaterCAD modeling indicates that the distribution pipeline network will provide adequate domestic and fire flows for the duration of the planning period. We recommend that the City focus on making the AC pipe replacements as soon as possible. The SRAMP upgrades can be done on a 50-year planning horizon per OHA's recommendations. This would average 185' per year, we recommend these SRAMP waterline replacement projects be bundled to every 5 years or so to make them more cost effective vs. replacement of 185' per year every year. Please see Appendix WCM for the data output detailing the WaterCAD analysis.

To provide fire protection to all structures within city limits, there are 29 hydrants that will need to be added to maintain a maximum spacing of 500' between all hydrants on the main lines.

## 1.5 Recommendations

We are recommending that the following projects be included as part of the City's Capital Improvement Plan for water projects:

*TABLE 1.5 - CIP PRIORITY RECOMMENDATIONS*

| | | |
|---|---|---|
| **Priority One - Should be completed within the next 10 years** | | |
| Treatment - New Ultrafiltration Water Treatment Plant - 500 gpm | $ | 1,843,022.50 |
| SCADA - Upgrading Automation and Data Acquisition | $ | 306,420.00 |
| 0.8 MG Reservoir - Upper Pressure Zone | $ | 2,283,242.50 |
| **Total Priority One Projects:** | **$** | **4,432,685.00** |
| | | |
| | | |
| **Priority Two - Should be completed within 20 - 50 years** | | |
| Distribution - Citywide Fire Protection Upgrade Project | $ | 386,947.00 |
| Distribution - AC Water Main Replacements - SRAMP Backbone Upgrades | $ | 5,876,825.00 |
| **Total Priority Two Projects:** | **$** | **6,263,772.00** |
| | | |
| | | |
| **Priority Three - Should be completed within the planning period** | | |
| Source - Raw Water Intake - Air Burst Retrofit | $ | 122,097.25 |
| **Total Priorty Three:** | **$** | **122,097.25** |
| | | |
| **Total All Projects:** | **$** | **10,818,554.25** |

The costs for the City of Lowell's water system improvement needs are great and there may be reason to prioritize the improvements or take projects on in phases. We further recommend that the City attend a "One-Stop" financing meeting. The One-Stop meeting is held in Salem once a month with the goal of gathering the State and federal funding agencies together at one time and one place to discuss all potential funding possibilities and issues.

We recommend that the WTP replacement project, SCADA project, and new reservoir projects be classified as priority one, and completed within the next 10 years. Of these three projects, the WTP should be done first, as the system struggles more with water production than water storage.

The SCADA upgrade project is also priority one and could be started now and moved over later to the new WTP if desired. It is strongly recommended that any new equipment purchased prior to the new WTP project be compatible with the new WTP.

The reservoir project is also priority one, as the City is currently storage deficient.

The distribution system AC pipe replacement projects should be completed during the planning period, with the SRAMP backbone distribution projects completed on a 50-year planning horizon. The priority two projects would cost approximately $125,000 per year in 2022 dollars over 50 years. We recommend that both distribution replacement projects be budgeted for at ~5-year intervals to provide a more cost-effective project, rather than replacement of a shorter length of pipe each year.

The raw water intake improvement project (air burst screen cleaner) is not a high priority and may be completed as time and budget will allow.

# 2 INTRODUCTION

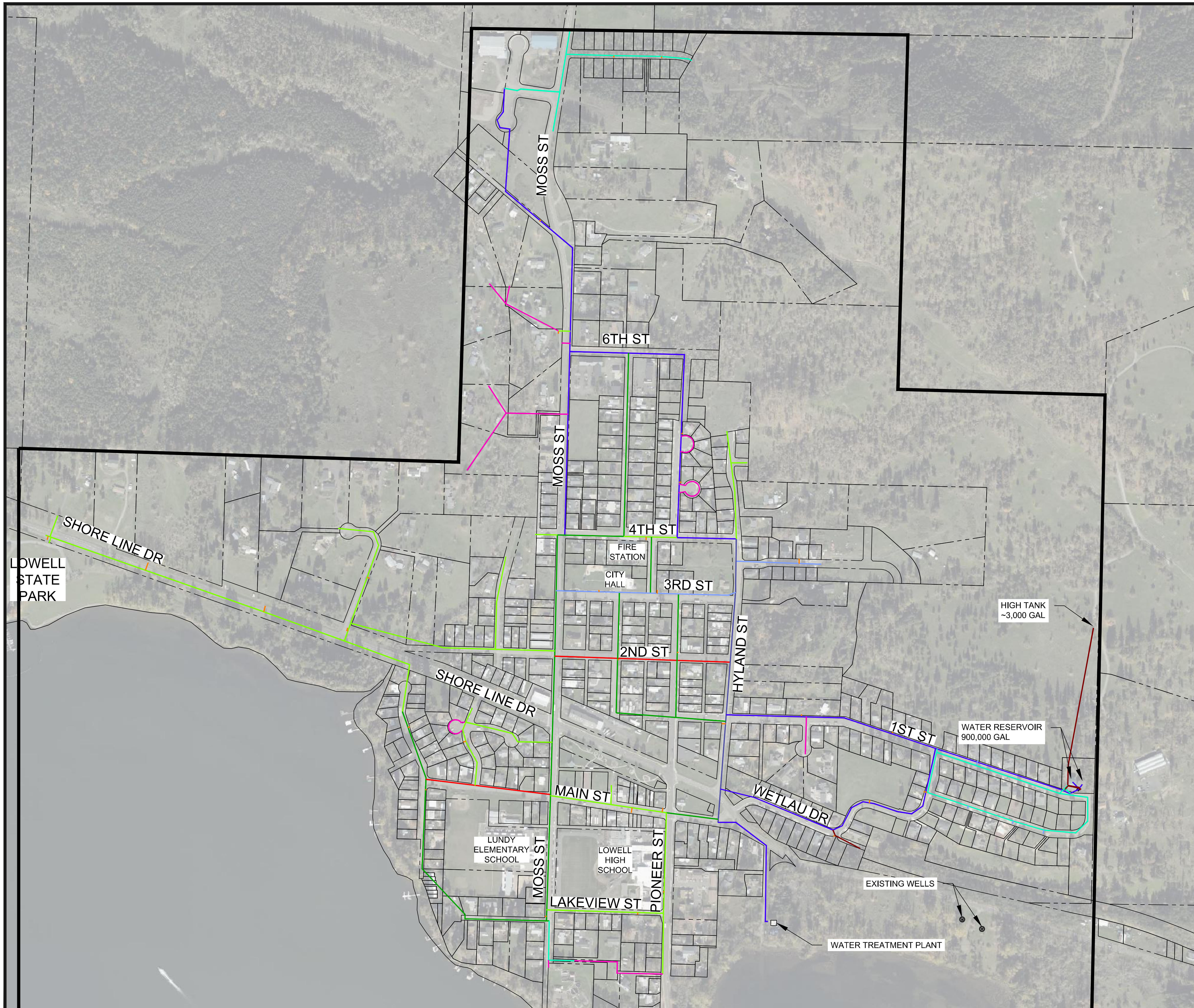
## 2.1 Background and Need

### 2.1.1 Water System Background

The City currently owns and operates a water system that is maintained by a crew of Public Works employees. The water system is comprised of the following primary assets:

- An intake structure east of the covered bridge and associated piping running from the intake structure to the water treatment plant on the north bank of the Dexter Reservoir
- Three inactive wells, LANE 19572, LANE 1637, and L3714
- A conventional water treatment plant
- A 35,000-gallon buried clearwell underneath the water treatment plant
- One 460,000-gallon concrete finished water storage reservoir
- One 440,000-gallon glass-fused steel finished water storage reservoir
- Distribution pump station
- Booster pump station for high elevation service
- 2,500-gallon storage tank servicing high elevation pressure zone
- Approximately 30,000’ of distribution mains and transmission piping

Historically, the City has used groundwater as its primary water source, until 2001 when the MCL for arsenic was lowered from 0.050 ppm to 0.010 ppm. At this time the arsenic levels in the well water were ~0.025 ppm, the City was forced to either treat the well water or go back to their surface water source. At the time, the City switched from their wells to the current Dexter Reservoir intake and conventional surface water treatment plant. The City still owns the original 3 wells located near to the WTP. Please see the water system map on the following page for more detail.




- 2 IN GALVANIZED STEEL
- 2 IN PVC
- 4 IN CAST IRON
- 4 IN PVC
- 6 IN AC
- 6 IN PVC
- 6 IN STEEL
- 8 IN PVC
- 8 IN STEEL
- 10 IN AC
- 12 IN PVC
- URBAN GROWTH BOUNDARY

Civil West Engineering Services, Inc.

CITY OF LOWELL
LANE COUNTY, OR

# EXHIBIT 2-1

2022 WATER MASTER PLAN

0 600' 1"

DRAWN BY: ERM
DATE: JANUARY, 2022

FIGURE 2-1

DATE:4/4/22 FILE:O:\CW_Projects\2101 Lowell\2101-020 Water Master Plan\04 Study\Drawings\Dwg\SYSTEM MAP.dwg

### 2.1.2 Need for Plan

The last update to the City of Lowell's Water Master Plan was in 2006. A new Water Master Plan (WMP) and Management and Conservation Plan (WMCP) should be developed to both:

- Meet requirements for approval of a water rights permit application extension
- Provide much needed guidance on water infrastructure improvement needs

This new WMP/WMCP is necessary to evaluate the state of existing water system infrastructure and operations, and to reevaluate overall system needs to ensure that the City is able to maintain regulatory compliance through the planning period (2022 – 2045). This document will serve as the master plan to guide the City's efforts to upgrade the existing treatment, distribution, and storage systems, to provide a safe and adequate supply of potable water, and to protect the public health.

### 2.1.3 Plan Authorization

The services of Civil West Engineering Services, Inc. were approved by vote of the City Council to complete a new Water Master Plan for the City in June of 2021.

### 2.1.4 Past Studies and Reports

The following plans and reports were used as background:

- The City's Water Master Plan Update, was prepared by HBH Consulting Engineers in December 2006

- Water Management and Conservation Plan, prepared by Systems West Engineers, Inc. in September 2001

## 2.2 Study Objective

The purpose of this Water Master Plan is to develop a comprehensive planning document for the City that includes the results of an engineering assessment of the existing water system infrastructure and operations, and to provide guidance for future planning and management of the water system. According to Oregon Administrative Rule (OAR) 333-061-0060, every community with 300 or more service connections must maintain a current master plan for the water system. The principal objectives of this planning effort aligning with the OARs includes the following:

- A summary of the plan that includes the water quality and service goals, identified present and future water system deficiencies, the engineer's recommended alternative for achieving the goals and correcting the deficiencies, and the recommended implementation schedule and financing program for constructing improvements.

- A description of the existing water system which includes service area, source(s) of supply, status of water rights, status of drinking water quality and compliance with regulatory standards, maps or schematics of the water system showing size and location of facilities, estimates of water use, and operation and maintenance requirements.

- A description of water quality and level of service goals for the water system, considering, as appropriate, existing, and future regulatory requirements, non-regulatory water quality needs of water users, flow and pressure requirements, and capacity needs related to water use and fire flow needs.

- An estimate of the projected growth of the water system during the master plan period and the impacts on the service area boundaries, water supply source(s) and availability, and customer water use.

- An engineering evaluation of the ability of the existing water system facilities to meet the water quality and level of service goals, identification of any existing water system deficiencies, and deficiencies likely to develop within the master plan period. The evaluation shall include the water supply source, water treatment, storage, distribution facilities, and operation and maintenance requirements. The evaluation shall also include a description of the water rights with a determination of additional water availability, and the impacts of present and probable future drinking water quality regulations.

- Identification of alternative engineering solutions, environmental impacts, and associated capital and operation and maintenance costs, to correct water system deficiencies and achieve system expansion to meet anticipated growth, including identification of available options for cooperative or coordinated water system improvements with other local water suppliers.

- A description of alternatives to finance water system improvements including local financing, (such as user rates and system development charges) and financing assistance programs.
- A recommended water system improvement program (Capital Improvement Projects/CIP) including the recommended engineering alternative and associated costs, maps or schematics showing size and location of proposed facilities, the recommended financing alternative, and a recommended schedule for water system design and construction.
- If required as a condition of a water use permit issued by the Water Resources Department, the Master Plan shall address the requirements of OAR 690-086-0120 (Water Management and Conservation Plans).

This Plan details the existing water system as well as improvements recommended to:

- Maintain compliance with State and Federal standards
- Maintain a high level of service to customers
- Provide system capacities for anticipated growth.

Capital improvement recommendations (CIP) will include proposed project scopes, including budgetary cost estimates, to facilitate City planning and budgeting efforts. All portions of the master plan must be consistent with OAR 333-061 (Public Drinking Water Systems, Oregon Health Authority), OAR 660-011 (Public Facilities Planning, Department of Land Conservation and Development) and OAR 690-086 (Water Management and Conservation Plans, Water Resources Department).

## 2.3 Scope of Study

### 2.3.1 Planning Period

Water System Master Plans are typically developed with a planning period of 20 years in accordance with OAR 333-061-0060(5)(b) and OAR 690-086-0170. The period is short enough for current users to benefit from system improvements but long enough to provide additional capacity necessary to support projected growth and increased demands. The end of the planning period for this Master Plan is the year 2045, approximately 23 years from the anticipated completion of this Plan. We are adding 3 years to the plan to account for the time it is likely to take for the recommended planning projects to break ground.

### 2.3.2 Planning Area

The planning area for this report is limited to the present UGB of the City. The topography within the study area ranges from relatively flat for most of the town to steeper slopes and hills to the north and west of the City. The elevation within the study area ranges from approximately 750 feet in the central area, to elevations of ~950 feet along the northern and western boundaries of the City. Additional information and detailed maps of the planning area are presented in Section 3.0.

### 2.3.3 Work Tasks

In compliance with Drinking Water program standards, this plan provides descriptions, analysis, projections, and recommendations for the water system through the year 2045. The following elements are included:

- Study area characteristics, including land use and population trends and projections
- Description of the existing water system including storage and distribution
- Existing regulatory environment including regulations, rules, and plan requirements
- Current water usage quantities and allocations
- Projected water demands
- Existing system capacity analysis and evaluation
- Improvement alternatives and recommendations, including associated budgetary costs
- A summary of recommendations with a Capital Improvement Plan
- Maps of the existing system and recommended improvements
- Funding options

### 2.3.4 Report Organization

This Water System Master Plan for the City of Lowell is comprised of the following sections:

- Section 1 – Executive Summary. Provides a brief overview of the WMP, including important facts and findings contained within.

- Section 2 – Introduction. Provides a brief background of the existing water system in Lowell outlining the purpose and objectives of this Plan related to the OARs.

- Section 3 – Study Area. Describes the planning area, including details about climate, zoning, floodplains and other information relevant to water system planning. It also includes historic, existing, and projected populations for Lowell.

- Section 4 – Water Demand Analysis. Provides detailed information about current and anticipated future water demands.

- Section 5 – Design Criteria and Service Goals. Reviews water system infrastructure and operational strategies, providing details about design criteria and service goals.

- Section 6 – Regulatory Conditions. Discusses current and future regulatory conditions that affect water system planning.

- Section 7 – Existing Water System. Describes the existing water system in detail and discusses the current condition of water system assets.

- Section 8 – Improvement Alternatives. Provides alternatives and recommended improvements to the system over the course of the WMP planning period.

- Section 9 – Capital Improvement Plan. Summarizes proposed Capital Improvement Plan projects and associated budgetary cost estimates. It also presents possible scenarios and options for funding of recommended capital projects.

- Section 10 – Financing. Explores water rates/charges and funding options available.

## 2.4 Acknowledgements

Various members of the City of Lowell Public Works Department and City Staff have contributed significant time and effort to provide complete and accurate information and data required for proper planning of the community's water system needs. Water treatment operators, water distribution staff, billing records personnel and others have all helped to complete this effort. We wish to acknowledge and thank the following persons in particular:

Don Bennett – Mayor
Jeremy Caudle – City Administrator
Samantha Dragt – City Clerk
Max Baker – Public Works Director
Hunter Harris – Water System Operator
Nick Harris – Water System Operator

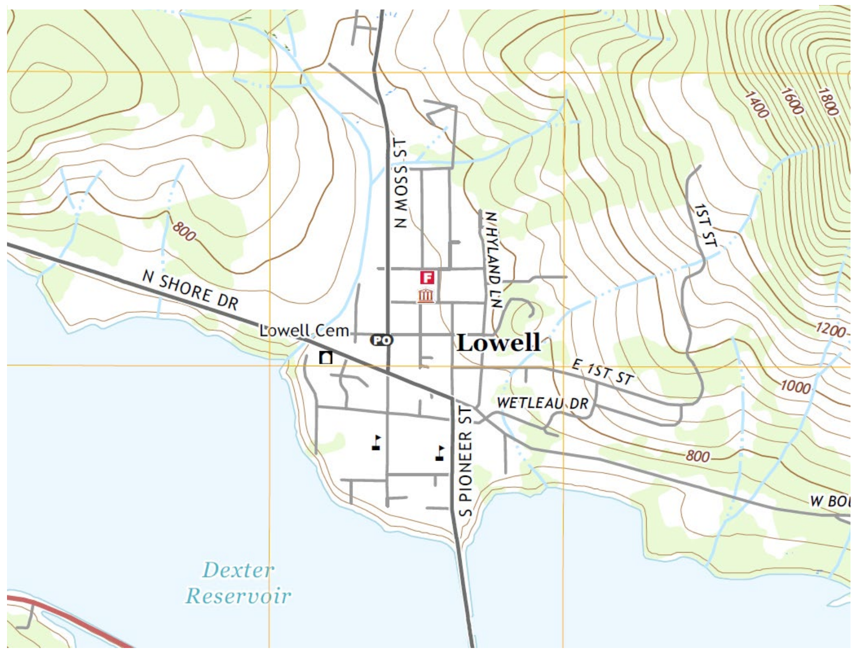
# 3 STUDY AREA

## 3.1 Physical Environment

### 3.1.1 Topography

The planning area for this report is limited to the present UGB of the City of Lowell. The topography within the study area ranges from relatively flat for most of the town to steeper slopes and hills to the north and west of the City. The elevation within the study area ranges from approximately 750 feet in the central area, to elevations of ~950 feet along the eastern and western boundaries of the City.

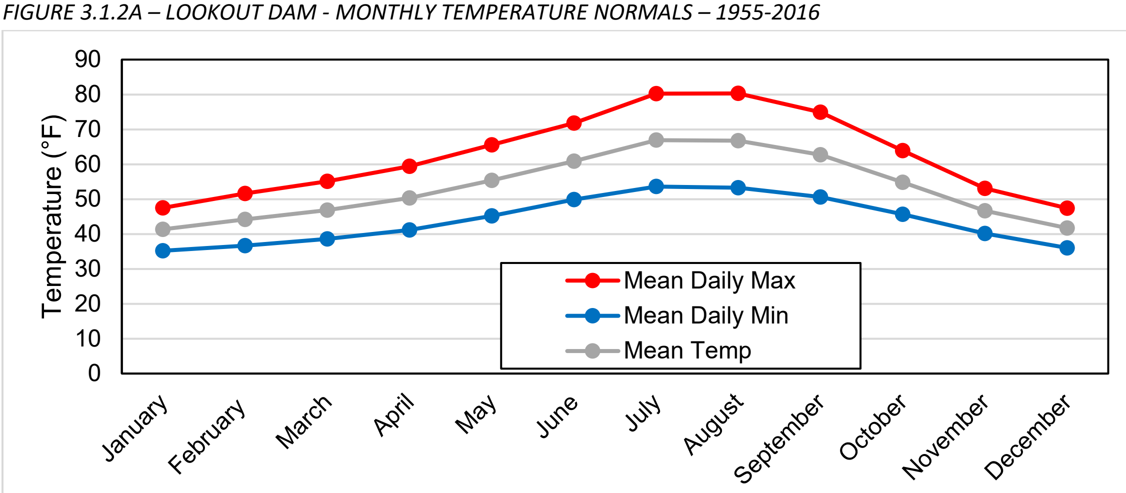
*FIGURE 3.1.1 – TOPOGRAPHIC MAP*




### 3.1.2 Climate

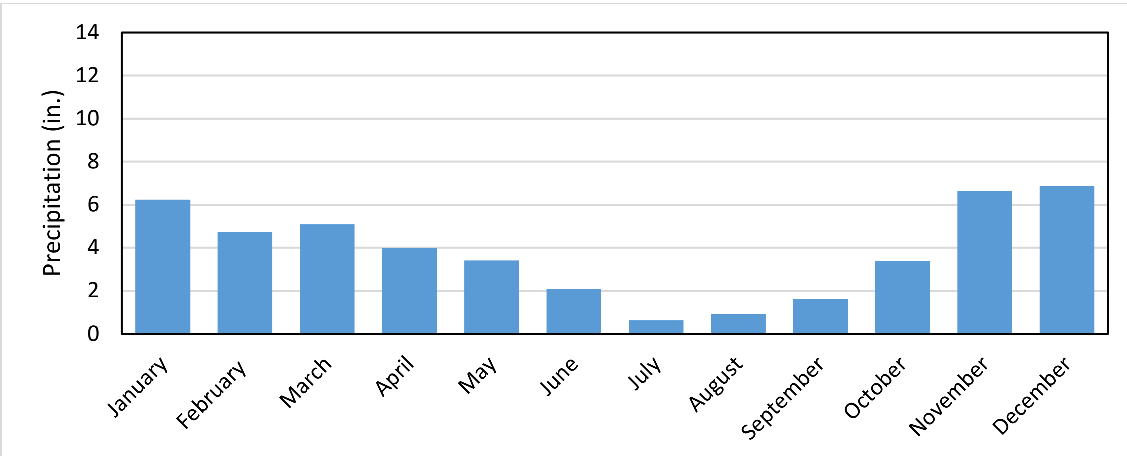
Climate data was obtained using long-term (1955-2016) records collected at the closest weather station, the Lookout Point Dam (Station 355050), as reported by the Western Regional Climate Center. The average monthly temperature in Lowell ranges from 41 to 67°F with an annual mean of 53°F. Monthly temperature normals are shown in the following chart.

*FIGURE 3.1.2A – LOOKOUT DAM - MONTHLY TEMPERATURE NORMALS – 1955-2016*



Average annual precipitation is approximately 46" in Lowell. Record low and high precipitation years recorded were 22.99-inches in 1944 and 73.21-inches in 1996. The maximum recorded 24-hour rainfall was 4.45-inches on November 19, 1996. Snowfall is minimal with most years recording little snowfall. The mean annual snowfall during the period from 1955 to 2016 is 1.8". Based on the NOAA Atlas 2 Isopluvial maps, the 2-year storm 24-hour rainfall is 3.44". Precipitation normals from the WRCC are shown in the following chart.

*FIGURE 3.1.2B – LOOKOUT DAM - MONTHLY PRECIPITATION NORMALS – 1955-2016*




## 3.2 General Information

This section provides a detailed description of the project location, physical environment along with an evaluation of the population trends and projections.

### 3.2.1 Planning Area Location

The City of Lowell is located adjacent to the northern bank of Dexter Reservoir in Lane County, approximately 20 miles southeast of Springfield on State Highway 58. Lowell was incorporated in 1954 at the site of an abandoned town that originally housed workers from the U.S. Army Corps of Engineers for the duration of construction of both the Dexter and Lookout Point Reservoirs.

The city limit and urban growth boundary (UGB) for Lowell are virtually identical at present, with an area of approximately 762 acres (1.19 square miles), of which about 286 acres (38%) are undeveloped.

### 3.2.2 Cultural Resources

According to the National Register of Historic Places (NRHP), there are two historic properties located in Lowell, please see the table below for a list of the historic properties.

*TABLE 3.1.2 – HISTORIC PLACES IN LOWELL*

| | |
|---|---|
| Lowell Bridge – 1907/1945(rebuilt) | South Pioneer Street |
| Lowell Grange - 1913 | 51 East 2nd Street |

In the future, cultural resources should always be considered during planning for system upgrades and/or improvements.

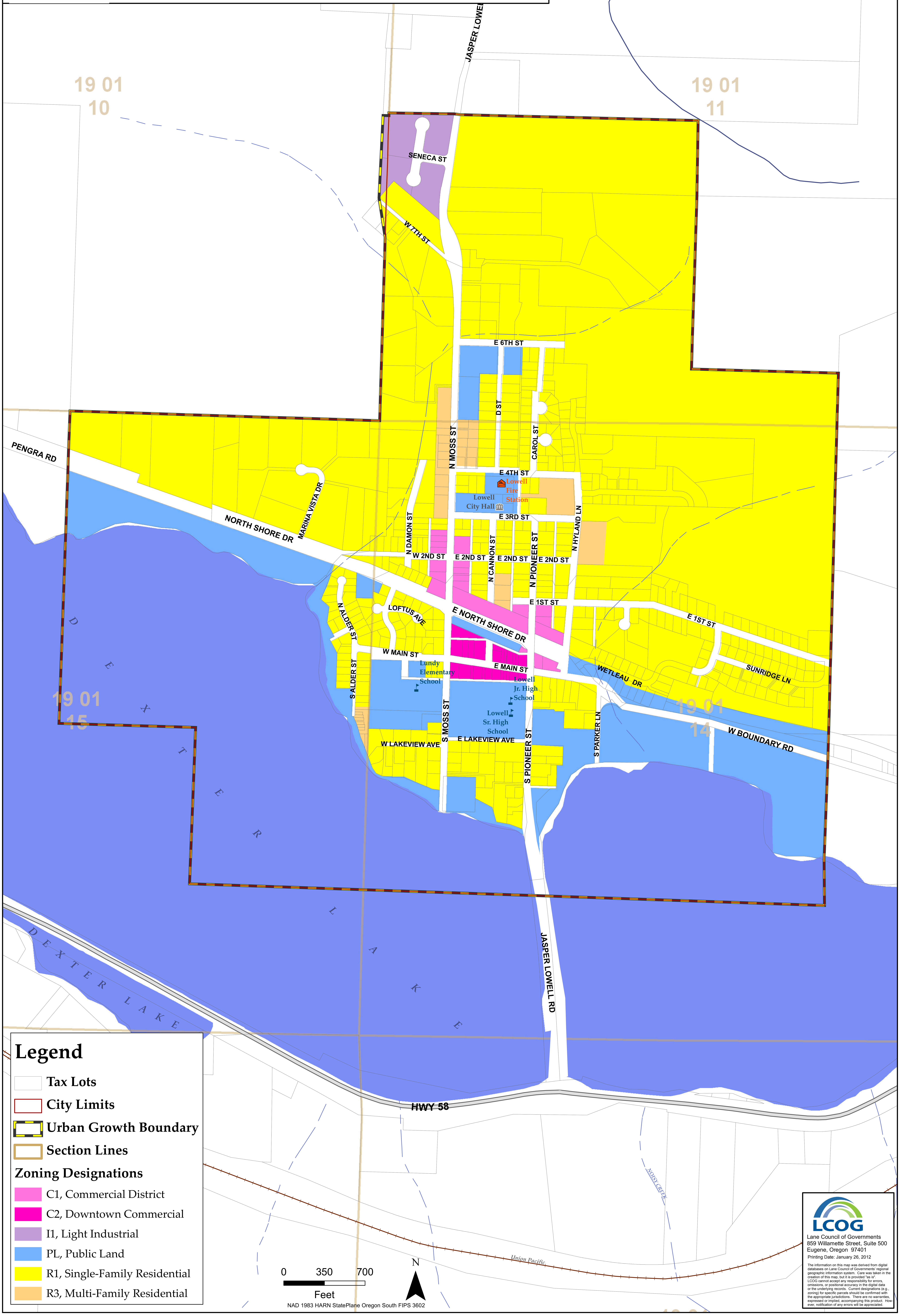
### 3.2.3 Land Use

The City of Lowell is in a primarily rural area. Land use within the City of Lowell is mostly residential, with some light commercial properties. The City has a total area of 1.19 square miles.

### 3.2.4 Zoning Information

The planning area for this report is limited to the land within the present UGB of the City. Currently the zoning within the City limits is divided into 6 categories: Single-Family Residential, Multi-Family Residential, Commercial, Downtown Commercial, Light Industrial, and Public Land. A Zoning Map of the City limits and the UGB is provided on the following page.

# Lowell Zoning Districts



### 3.2.5 Socio-Economic Conditions and Trends

The Median Household Income (MHI) for Lowell was $55,795, based on the 2020 *American Community Survey 5-Year Estimates.* The state of Oregon's 2020 MHI was $65,667.

As of the census of 2020, there were 1,196 people residing in the city. There were 467 housing units at an average density of 1,000 persons per square mile. The racial makeup of the city was 94.9% White, 0.3% African American, 0.8% Native American, 0.3% Asian, 1.1% from other races, and 7.0% from two or more races. Hispanic or Latino people of any race were 5.1% of the population.

The City of Lowell has slightly better poverty rates compared to both the national average and the Oregon average. In 2000, the U.S. Census Bureau found that 8.3% of families and 11.5% of all people living in Lowell had incomes below the poverty level, compared to 14.8% in Oregon and 14.3% in the United States.

### 3.2.6 Air

The Air Quality Index (AQI) for Lane County averaged to approximately 40 in 2020 where 0-50 is good air quality. The United States mean AQI is 42.

### 3.2.7 Soils

Soils within the Lowell area are dominated by silty clay loams. Within the study area there are several soil groups represented. See the soils legend and map on the following pages.

*TABLE 3.2.4 – SOIL TYPE LEGEND*

| Symbol | Soil Type Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 11E | BELLPINE SILTY CLAY LOAM, 20 TO 30 PERCENT SLOPES | 5 | 0.2% |
| 28C | CHEHULPUM SILT LOAM, 3 TO 12 PERCENT SLOPES | 16 | 0.8% |
| 43C | DIXONVILLE-PHILOMATH-HAZELAIR COMPLEX, 3 TO 12 PERCENT SLOPES | 10 | 0.5% |
| 43E | DIXONVILLE-PHILOMATH-HAZELAIR COMPLEX, 12 TO 35 PERCENT SLOPES | 286 | 13.4% |
| 52B | HAZELAIR SILTY CLAY LOAM, 2 TO 7 PERCENT SLOPES | 150 | 7.0% |
| 52D | HAZELAIR SILTY CLAY LOAM, 7 TO 20 PERCENT SLOPES | 298 | 13.9% |
| 89C | NEKIA SILTY CLAY LOAM, 2 TO 12 PERCENT SLOPES | 91 | 4.2% |
| 89D | NEKIA SILTY CLAY LOAM, 12 TO 20 PERCENT SLOPES | 130 | 6.1% |
| 89E | NEKIA SILTY CLAY LOAM, 20 TO 30 PERCENT SLOPES | 72 | 3.3% |
| 89F | NEKIA SILTY CLAY LOAM, 30 TO 50 PERCENT SLOPES | 59 | 2.7% |
| 100 | OXLEY GRAVELLY SILT LOAM | 18 | 0.9% |
| 102C | PANTHER SILTY CLAY LOAM, 2 TO 12 PERCENT SLOPES | 52 | 2.4% |
| 104G | PEAVINE SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES | 2 | 0.1% |

| | | | |
|---|---|---|---|
| 105A | PENGRA SILT LOAM, 1 TO 4 PERCENT SLOPES | 23 | 1.1% |
| 107C | PHILOMATH SILTY CLAY, 3 TO 12 PERCENT SLOPES | 64 | 3.0% |
| 108C | PHILOMATH COBBLY SILTY CLAY, 3 TO 12 PERCENT SLOPES | 3 | 0.1% |
| 108F | PHILOMATH COBBLY SILTY CLAY, 12 TO 45 PERCENT SLOPES | 6 | 0.3% |
| 113C | RITNER COBBLY SILTY CLAY LOAM, 2 TO 12 PERCENT SLOPES | 59 | 2.7% |
| 113E | RITNER COBBLY SILTY CLAY LOAM, 12 TO 30 PERCENT SLOPES | 98 | 4.6% |
| 113G | RITNER COBBLY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES | 219 | 10.2% |
| 115H | ROCK OUTCROP-KILCHIS COMPLEX, 30 TO 90 PERCENT SLOPES | 5 | 0.2% |
| 116G | ROCK OUTCROP-WITZEL COMPLEX, 10 TO 70 PERCENT SLOPES | 3 | 0.1% |
| 121B | SALKUM SILTY CLAY LOAM, 2 TO 8 PERCENT SLOPES | 47 | 2.2% |
| 121C | SALKUM SILTY CLAY LOAM, 8 TO 16 PERCENT SLOPES | 16 | 0.7% |
| 138E | WITZEL VERY COBBLY LOAM, 3 TO 30 PERCENT SLOPES | 78 | 3.6% |
| 138G | WITZEL VERY COBBLY LOAM, 30 TO 75 PERCENT SLOPES | 18 | 0.8% |
| 2224A | COURTNEY GRAVELLY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES | 29 | 1.3% |
| W | WATER | 288 | 13.4% |


*FIGURE 3.2.4 – SOIL TYPE MAP*

### 3.2.8 Wetlands

The U.S. Fish and Wildlife Service manages the National Wetlands Inventory (NWI) for wetlands and other aquatic habitats that may be subject to regulation under Section 404 of the Clean Water Act or other State/Federal statutes. A search of the NWI for Lowell shows several small wetlands and other aquatic habitats which are within or partially within the Lowell UGB. There is a single freshwater emergent area on the far north end of town. Please see the following page and appendix DAWM for maps of the wetland area.

*FIGURE 3.2.8 – WETLAND MAP*

### 3.2.9 Environmentally Sensitive Areas

There are no identified environmentally sensitive areas within the City limits of Lowell.

### 3.2.10 Flora and Fauna

No endangered species, either plant or animal, are known to inhabit the Lowell area.

### 3.2.11 Floodplains

The City of Lowell has areas defined on FEMA maps as susceptible to flooding in a 100-year flood event. This area is limited to the south side of town, where along the Dexter Reservoir. Of note, the 100-year floodplain just barely reaches the southern edge of the existing water treatment plant. Please see Figure 3.2.11 for this critical area of the FEMA Flood Hazard Map below.

*FIGURE 3.2.11 – FEMA FLOODPLAIN MAP*

# 3.3 Population

## 3.3.1 Historical and Existing Population

A population analysis for Lowell was completed using data from the US Census, and PSU Population Resource Center (PRC) on past, present, and projected future population growth for cities within Lane County.

*TABLE 3.3.1 – LANE COUNTY HISTORICAL AND FORECAST POPULATIONS*

**Figure 1. Lane County and Sub-Areas—Historical and Forecast Populations, and Average Annual Growth Rates (AAGR)**

| | Historical | | | Forecast | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | AAGR (2000-2010) | 2019 | 2044 | 2069 | AAGR (2010-2019) | AAGR (2019-2044) | AAGR (2044-2069) |
| **Lane County** | **322,959** | **351,715** | ***0.9%*** | **371,361** | **426,041** | **480,634** | ***0.6%*** | ***0.6%*** | ***0.5%*** |
| Coburg | 969 | 1,032 | *0.6%* | 1,308 | 1,687 | 1,955 | *2.6%* | *1.0%* | *0.6%* |
| Cottage Grove | 8,952 | 10,164 | *1.3%* | 10,284 | 11,677 | 13,172 | *0.1%* | *0.5%* | *0.5%* |
| Creswell | 3,959 | 5,333 | *3.0%* | 5,663 | 7,573 | 9,813 | *0.7%* | *1.2%* | *1.0%* |
| Dunes City | 1,229 | 1,303 | *0.6%* | 1,292 | 1,474 | 1,665 | *-0.1%* | *0.5%* | *0.5%* |
| Eugene | 160,551 | 177,369 | *1.0%* | 192,607 | 232,099 | 273,794 | *0.9%* | *0.7%* | *0.7%* |
| Florence | 8,783 | 10,230 | *1.5%* | 10,579 | 12,518 | 14,635 | *0.4%* | *0.7%* | *0.6%* |
| Junction City | 5,942 | 6,100 | *0.3%* | 6,919 | 9,080 | 11,328 | *1.4%* | *1.1%* | *0.9%* |
| Lowell | 857 | 1,045 | *2.0%* | 1,108 | 1,352 | 1,620 | *0.6%* | *0.8%* | *0.7%* |
| Oakridge | 3,239 | 3,308 | *0.2%* | 3,278 | 3,344 | 3,320 | *-0.1%* | *0.1%* | *0.0%* |
| Springfield | 61,910 | 67,738 | *0.9%* | 70,278 | 76,443 | 81,677 | *0.4%* | *0.3%* | *0.3%* |
| Veneta | 2,737 | 4,561 | *5.2%* | 4,767 | 6,591 | 8,662 | *0.5%* | *1.3%* | *1.1%* |
| Westfir | 287 | 255 | *-1.2%* | 254 | 272 | 288 | *0.0%* | *0.3%* | *0.2%* |
| Outside UGBs | 63,544 | 63,277 | *0.0%* | 63,023 | 61,930 | 58,707 | *0.0%* | *-0.1%* | *-0.2%* |

*Sources: U.S. Census Bureau, 2000 and 2010 Censuses; Forecast by Population Research Center (PRC).*

*Note: For simplicity each UGB is referred to by its primary city's name.*

## 3.3.2 Projected Population

According to the 2020 US Census, the population of Lowell was 1,196. Since 2020, there have been several new developments in town that were not accounted for in the PSU estimate. These developments are adding approximately 35 EDUs to the system, which will add approximately 94 persons to the 2020 census number, pushing the population to 1,290. Using the AAGRs (from the table above) beyond this slated bump in population from 2021 onward, the population at the end of this planning period (2045) is projected to be 1,560.

# 4 WATER DEMAND ANALYSIS

## 4.1 Definitions

System water demand is the quantity of water that must enter the distribution system to meet all water needs in the community, including that for customers, system storage and equalization, firefighting, and line flushing. In addition to these demands, overall demand increases when leakage within the system is present.

Unaccounted-for water is the difference between the total amount of water sold (based on billing records) and the total amount delivered to the system (based on production meter readings). Unaccounted water does not include unmetered water that has been tracked, this could be water used to flush lines, test hydrants, line break losses, and any other use that is known and volumes reasonably estimated.

Water demand varies seasonally, typical with western Oregon, with the lowest usage occurring during winter months from November through April, and the highest usage occurring during summer months (peak season) from May through October. This is largely due to increased landscape irrigation during the warm, dry peak season months. For Lowell, the average daily demand during the peak month of August 2020 was 204,486 gallons per day. This is over double the average daily demand during February, March, April, and May of the same year.

The objective of this section is to determine the current water demand characteristics and project future water demand requirements to establish system component adequacy and sizing needs.

Water demand is often described in the following terms:

- **Average Annual Demand (AAD)** - The total volume of water delivered to the system in a full year expressed in gallons. An average over a five-year period is typically used for planning purposes.
- **Average Daily Demand (ADD)** - The total volume of water delivered to the system over a year (AAD) divided by 365 days. The average use in a single day expressed in gallons per day.
- **Maximum Month Demand (MMD)** - The average gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during a summer month.
- **Maximum Day Demand (MDD)** - The largest volume of water delivered to the system in a single day expressed in gallons per day. The water supply and treatment facilities should be designed to handle the maximum day demand.

- **Peak Hourly Demand (PHD)** - The maximum volume of water delivered to the system in a single hour expressed in gallons per day or gallons per minute. Distribution systems should be designed to adequately handle the peak hourly demand or maximum day demand plus fire flows, whichever is greater. During peak hourly flows, storage reservoirs must supply the demand in excess of the maximum day demand.

The demands described above, expressed in gallons per day (gpd), can be divided by the population or Equivalent Dwelling Units (EDUs) served. These calculations provide a demand per person or per capita, expressed in gallons per capita per day (gpcd) or gallons per day per EDU (gpd/EDU), respectively. These unit demands are then multiplied by projected population or EDUs to estimate future water demands for planning purposes. Demand per capita is used in this Plan to predict future water demand.

## 4.2 Current Water Demand

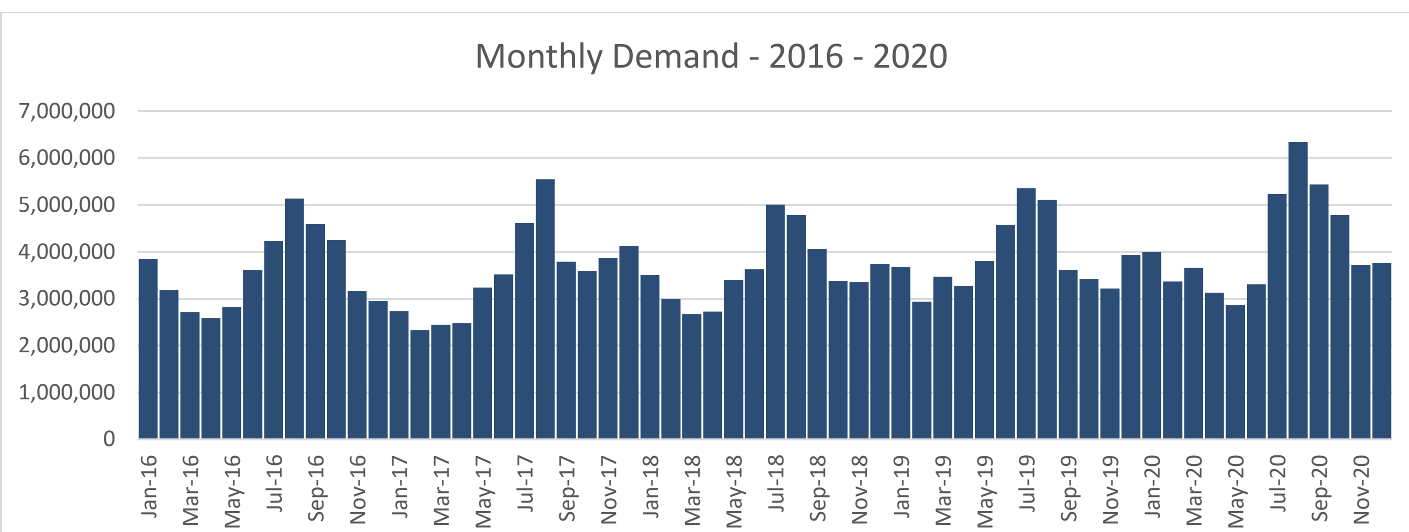
### 4.2.1 Water Production Records

Monthly water plant production records from January of 2016 through December of 2020 show a monthly production range of 2.3 million gallons to 6.3 million gallons to meet overall system demand. On average 123,064 gallons are treated and pumped into distribution daily. The maximum monthly demand was 6.3 million gallons in August of 2020.

### 4.2.2 Water Consumption

Monthly records of water demands were obtained from city staff for 2016 – 2020 and are summarized in Figure 4.2.2 below.

*FIGURE 4.2.2 – MONTHLY WATER CONSUMPTION TRENDS*



The highest monthly consumption of 6.3 MG occurred in August of 2020, while the lowest monthly consumption of 2.3 MG occurred in February of 2017. Several variables such as population, weather conditions, line breaks, construction usage, conservation measures, and/or the economy can lead to fluctuations in water consumption. Section 4.2.3 goes into further detail about some of these variables.

### 4.2.3 Water Demand

The water demand for Lowell from 2016 - 2020 was analyzed in terms of the average daily demand (ADD), maximum daily demand (MDD), and peak hourly demand (PHD) (see Section 4.1 for demand definitions). These values, summarized in Table 4.2.3 below, were calculated based on production data provided by the City for 2016 - 2020.

*TABLE 4.2.3 – WATER DEMANDS, CURRENT AND PROJECTED*

| Lowell 2016-2020 Data | | Population = | 1,196 |
|---|---|---|---|
| Unit | ADD | MDD | PHD |
| gpd | 123,064 | 246,127 | 615,318 |
| Peaking Factor | 1 | 2 | 5 |
| gpcpd | 103 | 206 | 514 |
| | | | |
| Lowell 2045 Data | | Population = | 1,560 |
| Unit | ADD | MDD | PHD |
| gpd | 160,518 | 321,035 | 802,588 |
| Peaking Factor | 1 | 2 | 5 |
| gpcpd | 103 | 206 | 514 |

The MDD and PHD were extrapolated through application of a peaking factor by multiplying the known ADD by the peaking factor. The MDD peaking factor was set at value of 2 for this analysis. The estimated MDD correlates well with the actual 2016-2020 water production records that show a maximum daily demand of 236,396 gallons on August 26$^{th}$, 2020. Hourly flow data is not recorded, so we must rely on the peaking factors to estimate the peak hourly demand. The PHD peaking factor was set at a value of 5 for this analysis. At 802,588 gpd, the PHD equates to 557 gpm.

Many factors may influence MDD. MDD may fluctuate from month to month and year to year due to:

- Unusually high temperatures
- Number of consecutive days with high temperatures
- Overall summer rainfall levels

- Number of consecutive days without rainfall

Unusually hot and/or dry weather results in more outdoor irrigation, which increases the MDD. The economy may also affect MDD. The number tourists visiting the City can have a direct link to the water used and consumed.

Per capita demand, expressed in gallons per capita per day (gpcd), is the City's total demand divided by the estimated water delivery area population. Total demand includes water demand from all customers fed by the City water system, including industrial and commercial customers, such that the calculated per capita demand values exceed the amounts of water used by the typical individual. Per capita demand does not account for differences in customer demographics, climate, rainfall, or economic conditions. Thus, per capita demand may not accurately portray year-to-year water use. Per capita demand also does not account for changes in large volume users, which may not have any relationship to population or actual efficiency of use. Nevertheless, per capita demands do provide insight about water demand trends over time and can be used to compare water demand from the City's customers to that of other communities.

Water use in America is documented by the U.S. Department of the Interior in the 2018 U.S. Geological Survey - Circular 1441, last updated in 2015. According to the study, the average domestic per capita water use for the state of Oregon is 107 gallons per capita per day (gpcd). The average daily per capita unit demand for Lowell varied between 62 and 70 gpcd over the past five years based on population and annual total demand. This low figure for gpcd in Lowell may be due to conservation efforts, and the trend in smaller lot sizes (less irrigation) than the average town in Oregon. It should also be noted that Lowell has fewer than average commercial and industrial users in town, which can skew the data to a larger gpcd in towns with more commercial and industrial users.

### 4.2.4 Unaccounted Water

The difference between the metered quantity of water produced (water demand) and the quantity of water measured exiting the distribution system (water sold) is unaccounted water. This comparison is typically called a "water balance". Measured water exiting the system is primarily measured through individual customer water meters (water sold). Other sources of exiting water include authorized non-consumptive uses such as pipeline flushing and firefighting and unauthorized uses such as water theft, line breaks, and leakage.

In addition to "real" water loss resulting from leakage, unmetered flushing, etc., unaccounted water can also include "apparent" water loss due to meter inaccuracies or meter reading errors. In general, as water meters age they tend to read lower and lower resulting in higher and higher "apparent" water loss.

If there were no leakage in the system, all water meters were 100% accurate, and all water used for firefighting and system flushing was measured, there would be zero unaccounted water. Every water system has a certain amount of leakage, water meters are not 100% accurate, and it is rare for all water used in town to be metered and measured. Annual values for Lowell indicate a 5-year average unaccounted water total of 11.6 million gallons per year or 25.7% of the total water demand. This is quite a significant amount of water loss.

Per OAR 690-086 (Water Resources Department – Water Management and Conservation Plans), if the annual water audit indicates leakage exceeding 10%, a regularly scheduled and systematic program should be in place to detect leaks in the distribution system using methods and technology appropriate to the size and capabilities of the municipal water supplier. Other provisions in OAR 690-086 can require system-wide leak repair or line replacement programs to reduce leakage to no more than 15% under certain circumstances such as water permit extension requests or water diversion expansions or initiations.

Records are not available to determine how much of the current 25.7% unaccounted water is actual leakage. Some of the unaccounted water can be attributed to water system flushing through fire hydrants, unmetered sales of water, and meter inaccuracies. Efforts should be made to measure, and record water used for flushing and other authorized non-metered uses. Metering and recording of all plant use water should also begin. The City should also continue efforts to detect and repair leaks when discovered.

### 4.2.5 EDU Analysis

Based on water sales records from January 2016 to December of 2020, the average quantity of water sold to a typical single-family dwelling unit on a 3/4" meter is 4,716 gallons per month. This volume sold per month becomes the basis for Equivalent Dwelling Unit (EDU) calculations with 1 EDU = 4,716 gallons per month in metered sales. Other users can then be described as an equivalent number of EDUs based on their relative water consumption. For example, a commercial business that had an average metered consumption of 9,432 gallons per month uses twice the amount of water as the typical single-family dwelling and can be considered 2 EDUs. Total water sold for the same period indicates the total number of system EDUs for the City of Lowell water system is 536 EDUs.

*TABLE 4.2.5 – EDU ANALYSIS BY METER SIZE*

| | | Residential | Commercial | | | | Industrial | |
|---|---|---|---|---|---|---|---|---|
| | | 3/4" | 3/4" | 1" | 1-1/2" | 2" | 3/4" | 1" |
| Total Number of Meters: | 457 | 423 | 16 | 2 | 1 | 12 | 2 | 1 |
| Total Number of EDUs: | 536 | 423.00 | 16.00 | 3.56 | 4.00 | 85.33 | 2.00 | 1.78 |

## 4.3 Future Water Demand

### 4.3.1 Basis for Projections

Water demand estimates for future years are determined by multiplying the current unit demand values (gallons per person or per EDU) by the projected number of future users in the water system. It is assumed new users added to the system will consume water at the same rate as current users. Population projections are presented in Section 3.2, and unit water demand values are presented in Section 4.2. The projections are based on the county average annual growth rate of 0.20% - 0.30% for the planning period, as defined in Section 3.2.2.

### 4.3.2 Water Demand Projections

Demand projections for the planning period were calculated based on the following values for ADD and MDD calculated from 2016 - 2020 water demand data provided by the City:

- ADD unit demand = 103 gpcd
- MDD unit demand = 206 gpcd

### 4.3.3 Future Unaccounted Water Assumptions

As discussed earlier in this section, unaccounted water in the City of Lowell averages 25.7%. This means the City is unable to fully account for all water they produce. This could be a result of:

- Meter inaccuracies (master and/or consumption)
- Accounting or entry errors
- Software glitches or errors
- Timing problems (between reading master vs. consumption)
- Not recording all public water use (fire, water plant, City Hall, parks, etc.)
- Actual leakage

Until it is known how much of the unaccounted water levels are a result of leakage, it is not appropriate to assume any change in the future water production rates. Making assumptions that future water demands would be less due to efforts, or results that are only hypothetical at this point, could potentially leave the City in a water supply deficit. However, if in the future the City reduces demand through leak repairs, conservation, or other proactive means, modifying projected water demands in plan updates would be appropriate. Until that time, the projected demands in this report should stand. Therefore, the projected water demands described include the current level of unaccounted water.

# 5 DESIGN CRITERIA AND SERVICE GOALS

## 5.1 Design Life of Improvements

The design life of a water system component is the time that the component is expected to be useful based on its intended use and required function. Design life is sometimes referred to as service life or life expectancy. Actual service life can depend on factors such as the type and intensity of use, type and quality of materials used in construction, and the quality of workmanship during installation and proper maintenance. Establishing a design life also provides an expected service life to aid in planning for future capital improvements.

The planning period for a water system and the design life for its components may not be identical. The typical 20-year planning period is limited due to the need to limit economic burdens on current population and inaccuracies that result from attempts at projecting needs too far into the future. Design life can be greater or less than the planning period. For example, a properly constructed and maintained storage tank may have a design life of 60 years, but the projected fire flow and consumptive water demand for a planning period of 20 years determine the size of the storage tank. At the end of the initial 20-year planning period, water demand may be such that an additional storage tank is required; however, the existing tank with a design life of 60 years would still be useful and remain in service for another 40 years. The typical design life for system components is discussed below.

### 5.1.1 Equipment and Structures

Equipment used in water systems such as pumps, valves, and other major treatment related equipment typically has an expected design life of 20 years and are therefore sized based on projections for their expected useful life. Minor equipment such as chemical feed pumps, turbidimeters, and other instrumentation typically have an expected useful life of 10-15 years and may need to be replaced or updated within the 20-year planning period. The useful life of some equipment can be extended with proper maintenance, and provided that no capacity issues prevent continued use, it is not uncommon for large equipment such as pumps to remain in service for more than 30 years. Major structures used in water systems, such as concrete basins and intake wet wells, have expected useful lives of 50 years or more when properly constructed and maintained.

### 5.1.2 Distribution Piping

Water distribution piping typically has an expected useful life of more than 50 years, but the quality of materials and workmanship, construction/installation procedures, maintenance programs, operating procedures, and adequate sizing are all critical factors that impact the longevity of a pipeline. Sections of buried steel piping commonly exhibits significant corrosion and leakage within 30 years, while cement mortar lined ductile iron piping can last up to 100 years when properly designed and installed. PVC and HDPE pipe manufacturers also claim a 100-year service life. Properly installed fused HDPE piping has the added benefit over long service life of being highly resistant to damage/breaks due to seismic events.

### 5.1.3 Treated Water Storage

Distribution storage tanks typically have a design life ranging from 60 years (painted steel construction) to 80 years (concrete construction). Steel tanks with a glass-fused coating have a design life close to the 80 years seen in concrete constructed tanks. The actual service life of the finished tank will depend on the quality of materials, the workmanship during installation, and the timely administration of maintenance activities. Several practices, such as: scheduled maintenance and inspections, the use of cathodic protection, regular cleaning and sealing can assure or even extend the service life of the tank.

## 5.2 Sizing Capacity and Service Goals

The 20-year projected water demands presented in Section 4 will be used to size improvements. Methods and demands used are discussed below.

### 5.2.1 Water Supply

The current water supply, including pumping capacity, should at minimum be adequate to meet the projected 20-year maximum daily demand (MDD). Considering the difficulty in obtaining new water rights, raw water supply should meet a longer-term need and it is not unreasonable to plan today for 60-year demand water sources. Currently, the MDD is 246,127 gpd, and at the end of the planning period (2021-2045), the projected MDD is 321,035 gpd. To plan for long-term water supply options, projections beyond the planning period are shown, assuming the same growth rate as the planning period.

- 20-Year Supply Capacity Goal: MDD of 311,650 gpd (0.48 cfs)
- 40-Year Supply Capacity Goal: MDD of 359,377 gpd (0.56 cfs)
- 60-Year Supply Capacity Goal: MDD of 413,180 gpd (0.64 cfs)

### 5.2.2 Water Treatment

Water treatment plant equipment and components such as pumps, filters, flocculators, etc. are typically sized to provide for the 20-year MDD. Filter capacities are typically sized for 20-year flows, but media or membranes may have to be replaced during that 20-year period. Any discussion of treatment sizing must include an additional allowance for water use that would occur at the treatment plant itself if demand estimates do not already include such allowances. Difficult to construct items with a long design life, such as buried piping and concrete wet wells for surface water intakes should, at minimum, be sized to accommodate projected 40 to 50-year flow capacities. Other components such as concrete clearwells and buildings may be oversized beyond the 20-year MDD depending on future plans and ease of providing infrastructure for expansion now versus later.

### 5.2.3 Fire Protection

Per the 2019 Oregon Fire Code, the minimum fire-flow requirements for one- and two-family dwellings not exceeding 3,600 square feet shall be 1,000 gpm for one hour. When square footage exceeds 3,600 or for other types of buildings the minimum fire flow is 1,500 gpm for a minimum of two hours. When flows of 1,750 gpm or less are required a single fire hydrant is required to be accessible within 250 feet (200 feet on dead-end streets) resulting in a maximum hydrant spacing of 500 feet (400 feet on dead-end streets).

For other types of structures, the requirements of the Oregon Fire Code require flows up to 8,000 gpm (2014 OFC Table B105.2). For fire flows less than 2,750 gpm a flow duration of 2 hours is required. For flows between 3,000 and 3,750 gpm a duration of 3 hours is required. For flows of 4,000 gpm and above a duration of 4 hours is required. The minimum number of hydrants available at a specific location, the average spacing between hydrants, and the maximum distance from any point on the street to a hydrant are dependent on the fire-flow requirement. For structures, which require 4,000 gpm, at least 4 hydrants must be available spaced not more than 350 feet apart.

<u>Fire Flow Capacity Goals</u>

- Residential Only Outlying Areas; 1,000 gpm for one hour
- General Commercial Areas; 1,500 gpm for two hours
- Central Town Area, Industrial, and Schools; 3,500 gpm for three hours

### 5.2.4 Treated Water Storage

Total storage capacity must include reserve storage for fire suppression, equalization storage, and emergency storage. In larger communities it is common to provide storage capacity equal to the sum of equalization storage plus the larger of fire storage or emergency storage. In small communities it is recommended that total storage be the sum of all three: fire plus equalization plus emergency storage. This is considered prudent since it is possible for fire danger to increase during water emergencies, such as power failures when alternative sources of heating and cooking might be used.

Equalization storage is typically set at 20-25% of the MDD to balance out the difference between peak demand and supply capacity. When peak hour flows are known, equalization storage is the difference between the MDD and PHD for a duration of 8 hours [(PHD-MDD) x 8 hrs.]. Equalization storage typically rises and falls daily or hourly as storage tank levels fluctuate normally.

Emergency storage is required to protect against a total loss of water supply such as would occur with a broken line, an electrical outage, equipment breakdown, or source contamination. Emergency storage should be an adequate volume to supply the system's average daily demand for the duration of a possible emergency. For most systems, emergency storage should be equal to one maximum day of demand or 2.5 to 3.0 times the average day demand.

Fire reserve storage is needed to supply fire flow throughout the water system to fight a major fire. The fire reserve storage is based on the maximum flow and duration of flow required to confine a major fire.

Another important design parameter for treated water storage reservoirs is elevation. Efforts should be made to locate all reservoirs at the same elevation, if possible, within a pressure zone. If a consistent water surface is maintained in all reservoirs, the need for altitude valves, pressure reducing valves (PRVs), booster pumps and other control devices is minimized. The ideal pressure range for a distribution system is between 40 and 80 psi.

If there are subdivisions at higher elevations than allowed within the main pressure zone, a design review should be done to determine whether elevated storage tanks or booster pump stations are the best solution. Tank size needs to be determined on a case-by-case basis as part of the design review. Fire pumps with a capacity of at least 1,000 gpm together with standby generators should be provided when a storage tank is not possible. Minimum tank size should be 120,000 gallons for fire storage (1,000 gpm for 2 hours) plus the MDD per capita. For very small developments, individual sprinkler systems may be most appropriate.

### 5.2.5 Distribution System

Distribution mains are typically sized to convey projected maximum day flows plus simultaneous fire flows while maintaining at least 20 psi at all connections or projected peak hourly flows while maintaining approximately 40 psi, whichever case is more stringent. Looped mains should be at least six inches in diameter to provide minimum fire flow capacity. The State of Oregon requires a water distribution system be designed and installed to always maintain a pressure of at least 20 psi at all service connections (at the property line), even during fire flow conditions. OAR 333-061-0050 governs the construction standards for water systems including distribution piping. The size and layout of pipelines must be designed to deliver the flows indicated above.

The installation of permanent dead-end mains and dependence of relatively large areas on a single main should be avoided. In all cases, except for minor looping using 6-inch or larger pipe, a hydraulic analysis should be performed to ensure adequate sizing.
Distribution Capacity Goal: Worst Case of projected MDD + fire flow with at least 20 psi residual pressure or Projected PHD with 40 psi residual pressure.

## 5.3 Basis for Cost Estimates

The cost estimates presented in this Plan will typically include four components: construction cost, engineering cost, contingency, and legal/non-engineering project management costs. Each of the cost components is discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. Construction costs are based on competitive bidding as public works projects with State prevailing wage rates. As projects proceed and as site-specific information becomes available, estimates should be updated accordingly. The cost estimates for this plan are in section 8, Improvement Alternatives. Overall costs and totals can be found in section 9, Capital Improvement Plan.

### 5.3.1 Construction Costs

The estimated construction costs in this plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Construction costs are preliminary budget level estimates prepared without design plans and details. Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to an index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index (CCI) is most used. This index is based on the value of 100 for the year 1913. The percent change is also calculated from the previous December to see how the fluctuation of prices has changed from December to December. Cost estimates presented in this Plan are based on May 2022 dollars with an ENR CCI of 13004. For construction performed in later years, costs should be projected based on the then current year ENR Index using the following equation:

*Updated Cost = Plan Cost Estimate x (current ENR CCI /13004)*

### 5.3.2 Engineering Costs

The cost of engineering services for major projects typically includes special investigations, predesign reports, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 18% to 25% of the contract cost when all the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small or complicated projects.

Engineering costs for basic design and construction services presented in this Plan are estimated at 20% of the estimated total construction cost. Other engineering costs such as specialized geotechnical exploration, easement research and preparation, and/or specific pre-design reports will typically be in addition to the basic engineering fees charged by firms.

### 5.3.3 Contingencies

A contingency factor equal to approximately twenty percent (20%) of the estimated construction cost has been added to the budgetary costs estimated in this Plan. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time may tend to increase final costs. Upon final design completion of any project, the contingency can be reduced to 10%. A contingency of at least 10% should always be maintained going into a construction project to allow for variances in quantities of materials and unforeseen conditions.

### 5.3.4 Legal and Management

An allowance of five percent (5%) of construction cost has been added for legal and other project management services. This allowance is intended to include internal project planning and budgeting, funding program management, interest on interim loan financing, legal review fees, advertising costs, wage rate monitoring, and other related expenses associated with the project that could be incurred.

### 5.3.5 Land Acquisition

Some projects may require the acquisition of additional right-of-way, property, or easements for construction of a specific improvement. The need and cost for such expenditures is difficult to predict and must be reviewed as a project is developed. Effort was made to include costs for land acquisition, where expected, within the cost estimates included in this Plan.

# 6 REGULATORY CONDITIONS

## 6.1 Responsibilities as a Water Supplier

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure that the water delivered to water users does not exceed maximum contaminant levels, water system facilities are free of public health hazards and water system operation and maintenance are performed as required by both these rules and the equipment manufacturer's requirements. The list of reasonable precautions includes the following tasks:

1. Routinely collecting and submitting water samples for laboratory analyses at the frequencies prescribed by OAR 333-061-0036
2. Taking immediate corrective action when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040
3. Reporting as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels have not been exceeded
4. Notifying the public and all customers of the water system, as prescribed by OAR 333-061-0042, when any maximum contaminant levels have been exceeded
5. Notifying all customers served by the water system, as prescribed by OAR 333-061-0042, when reporting requirements are not being met, when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance
6. Maintaining monitoring and operating records and making these records available for review when the system is inspected
7. Maintaining a pressure of no less than 20 pounds per square inch (psi) at all service connections
8. Following-up on complaints relating to water quality from users and maintaining records and reports on actions undertaken
9. Conducting an active program for identifying and controlling cross connections
10. Submitting to OHA, plans prepared by a professional engineer registered in Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement
11. Assuring that the water system is in compliance with OAR 333-061-0032 relating to water treatment
12. Assuring that the water system is in compliance with OAR 333-061-0210 through OAR 333-061-0272 relating to certification of water system operators

13. Assuring that Transient Non-Community water systems utilizing surface water sources or groundwater sources under the influence of surface water are in compliance with OAR 333-061-0065(2)(c) relating to required special training

In the last 5 years, the City of Lowell has had no Health Based violations and no reporting violations. For a more detailed explanation of the City of Lowell water system data, refer to the Oregon Public Health Drinking Water Data Online:

https://yourwater.oregon.gov/inventory.php?pwsno=00492

## 6.2 Public Water System Regulations

Water providers should always be informed of current standards, which can change over time, and should also be aware of pending future regulations. As of this writing, OAR Chapter 333, Division 061 covering Public Water Systems is over 300 pages in length, with the most recent version effective as of January 1, 2022. This section is not meant to be a comprehensive list of all requirements but a general overview of the requirements. Refer to OAR 333-061 for further clarification on any subject in this section. The rules can be found online at:

https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/RULES/Documents/pwsrules.pdf

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). This act and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act in 1981, the State of Oregon accepted primary enforcement responsibility for all drinking water regulations within the state. Requirements are detailed in OAR Chapter 333, Division 061. The SDWA and associated regulations have been amended several times since inception with the goal of further protection of public health.

SDWA requires the EPA to regulate contaminants which present health risks, are known or are likely, to occur in public drinking water supplies. For each contaminant requiring federal regulation, EPA sets a non-enforceable health goal, or maximum contaminant level goal (MCLG). This is the level of a contaminant in drinking water below which there is no known or expected health risk. The EPA is then required to establish an enforceable limit, or maximum contaminant level (MCL), which is as close to the MCLG as is technologically feasible, taking cost into consideration. Where analytical methods are not sufficiently developed to measure the concentrations of certain contaminants in drinking water, the EPA specifies a treatment technique instead of an MCL to protect against these contaminants.

Water systems are required to collect water samples at designated intervals and locations. The samples must be tested in State approved laboratories. The test results are then reported to the State, which determines whether the water system complies or is in violation of the regulations.

There are three main types of violations:

- Maximum Contaminant Level (MCL) violation — occurs when tests indicate that the level of a contaminant in treated water is above the EPA or State's legal limit (states may set standards equal to, or more protective than, EPA's). These violations indicate a potential health risk, which may be immediate or long-term.

- Treatment Technique (TT) violation — occurs when a water system fails to treat its water in the way prescribed by EPA (for example, by not disinfecting). Like MCL violations, treatment technique violations indicate a potential health risk to consumers.

- Monitoring and Reporting (M&R) violation — occurs when a system fails to test its water for certain contaminants or fails to report test results in a timely fashion. If a water system does not monitor its water properly, no one can know whether its water poses a health risk to consumers.

If a water system violates EPA/State rules, it is required to notify the State and the public. States are primarily responsible for taking appropriate enforcement actions if systems with violations do not return to compliance. States are also responsible for reporting violation and enforcement information to the EPA quarterly. To comply with the regulations water systems must provide adequate treatment techniques, operate treatment processes to meet performance standards, and properly protect treated water to prevent subsequent contamination after treatment. A separate set of standards exists to address the beneficial use of public water, conservation, curtailment, and water planning. Governed by the Oregon Water Resources Department, OAR 690-086 includes provisions governing water consumption and conservation in Oregon. Section 690-086 requires that all public water systems develop and maintain a planning document known as a Water Management and Conservation Plan (WMCP). The WMCP includes four major components:

- Water System Description
- Water Conservation Plan
- Water Curtailment Plan
- Long-Range Water Supply Plan

The purpose of the plan is to help an agency plan for and responsibly and beneficially utilize public water resources for human demands. The goal of the planning is to reduce or eliminate water demand that is not beneficial through efficiencies, conservation, education, and other practices. The City of Lowell is developing a WMCP in conjunction with this water master planning effort.

## 6.3 Current Standards

The EPA-established, National Primary Drinking Water Regulations, lists 87 contaminants. The list is broken into six categories as follows, with the number of contaminants in parentheses: Microorganism (7), Disinfection Byproduct (4), Disinfectant (3), Inorganic Chemical (16), Organic Chemical (53) and Radionuclides (4). These standards either have established MCLs or treatment techniques. In addition, there is a list of National Secondary Drinking Water Regulations that include 15 contaminants and the desired goals, and in the case of fluoride, may require special public notice.

### 6.3.1 Surface Water Treatment Rules

The Surface Water Treatment Rules (SWTR's) are a group of rules that have been developed by the EPA to protect the drinking water of communities. The Rules include the following:

- Surface Water Treatment Rule – June 1989
- Interim Enhanced Surface Water Treatment Rule (IESWTR) – December 1998
- Filter Backwash Recycling Rule (FBRR) – June 2001
- Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) – January 2002
- Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) – January 2006

Not all the above rules will be discussed in this section. This is intended to provide summaries that are most applicable to the City of Lowell. In the SWTR's and the other related rules, Lowell is referred to as a "Subpart H Schedule 4" system. This refers to a system that uses surface water or ground water under the direct influence of surface water (GWUDI) are filtered using slow sand, diatomaceous earth, or alternative filtration; and serve fewer than 10,000 persons.

All water systems using surface water must provide a total level of filtration and disinfection treatment to remove/inactivate 99.9 percent (3-log) of Giardia lamblia, and to remove/inactivate 99.99 percent (4-log) of viruses. In addition, filtered water systems must physically remove 99 percent (2-log) of Cryptosporidium. Systems with source water Cryptosporidium levels exceeding specified limits must install and operate additional treatment processes.

Filtered water systems must meet specified performance standards for combined filter effluent turbidity levels. Water systems using conventional and direct filtration must also record individual filter effluent turbidity and take action if specified action levels are exceeded. When more than 1 filter exists, each filter's effluent turbidity must be monitored continuously and recorded at least every 15 minutes. The combined flow from all filters must have a turbidity measurement at least every four hours by grab sampling or continuous monitoring. Turbidity monitoring must occur prior to any storage such as a clearwell or contact tank. Turbidity monitoring equipment must be calibrated using an approved method at least once per quarter. General requirements for systems utilizing conventional or direct filtration are:

- Individual filter turbidity monitored continuously and recorded every 15 minutes or less
- Combined filter turbidity monitored continuously or grab sample taken at least every 4 hours
- Combined filter turbidity less than 1 NTU in 100% of measurements
- Combined filter turbidity less than or equal to 0.3 NTU in 95% of measurements in a month
- Specific follow-up actions if individual filter turbidity exceeds 1.0 NTU twice

Filtered water systems that recycle spent filter backwash water or other waste flows must return those flows through all treatment processes in the filtration plant. Systems wishing to recycle filter backwash water must provide notice to the State including a plant schematic showing the origin, conveyance, and return location of recycled flows. Design flows, observed flows, and typical recycle flows are also required along with a state-approved plant operating capacity.

### 6.3.2 Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

LT2ESWTR was published by the EPA on January 5, 2006. The rule requires source water monitoring for public water systems that use surface water or ground water under the direct influence of surface water (GWUDI). Based on the system size and filtration type, systems must monitor for Cryptosporidium, E. coli, and turbidity. Source water monitoring data will be used to categorize the source water Crypto concentration into four "bin" classifications that have associated treatment requirements.

Systems serving fewer than 10,000 people are required to conduct 12 months of E. coli monitoring and 12-24 months of Crypto monitoring if E. coli trigger levels are exceeded. The rule provides other options to comply with the initial source water monitoring that include either submitting previous Crypto data meeting (grandfathered data) the requirements or committing to provide a total of at least 5.5-log treatment for Cryptosporidium. A second round of source water monitoring will follow 6 years after the system makes its initial bin determination.

### 6.3.3 Disinfectants and Disinfection Byproducts

Disinfection treatment chemicals used to kill microorganisms in drinking water can react with naturally occurring organic and inorganic matter in source water called “DBP precursors” to form disinfection byproducts (DBPs). Some disinfection byproducts have been shown to cause cancer and reproductive effects in lab animals and suggested bladder cancer and reproductive effects in humans. The challenge is to apply levels of disinfection treatment needed to kill disease-causing microorganisms while limiting the levels of disinfection byproducts produced. The primary disinfection byproducts of concern in Oregon are the total trihalomethanes (TTHM) and the haloacetic acids (HAA5).

Disinfection byproducts must be monitored throughout the distribution system at frequencies of daily, monthly, quarterly, or annually. This depends on the population served, type of water source, specific disinfectant applied and in accordance with an approved monitoring plan. Disinfectant residuals must be monitored at the same locations and frequency as coliform bacteria.

Total organic carbon (TOC) is an indicator of the levels of DBP precursor compounds in the source water. Systems using surface water sources and conventional filtration treatment must monitor source water for TOC and alkalinity monthly and practice enhanced coagulation to remove TOC if it exceeds 2.0 mg/L as a running annual average.

Compliance is determined based on meeting maximum contaminant levels (MCL’s) for disinfection byproducts and maximum levels for disinfectant residual (MRDL) over a running annual average of the sample results, computed quarterly. A summary is as follows:

- TTHM/HAA5 monitoring required in distribution system. One sample per quarter for systems serving 500-9,999 persons. One sample per year in warmest month required for systems serving less than 500.
- MCL for TTHM is 0.080 mg/L. MCL for HAA5 is 0.060 mg/L.
- Any system having TTHM > 0.064 mg/L or HAA5 > 0.048 based on a running annual average must conduct disinfection profiling.
- TOC and alkalinity monitoring in source water monthly. Enhanced coagulation if TOC greater than 2.0 mg/L
- Comply with MRDL. Limit for chlorine (free Cl2 residual) is 4.0 mg/L. Limit for chloramines is 4.0 mg/L (as total Cl2 residual). Limit for chlorine dioxide is 0.8 mg/L (as ClO2)
- Bromate MCL of 0.010 mg/L
- Chlorite MCL of 1.0 mg/L

### 6.3.4 Stage 2 Disinfectants and Disinfection Byproducts Rule (DBPR)

The Stage 2 DBPR was published by the EPA on January 4, 2006. The rule builds on existing regulations by requiring water systems to meet disinfection byproduct (DBP) MCL's at each monitoring site in the distribution system. The Stage 1 Rule controls average DBP levels across distribution systems, and the Stage 2 Rule controls the occurrence of peak DBP levels within distribution systems.

The rule requires all community water systems to conduct an Initial Distribution System Evaluation (IDSE). The goal of the IDSE is to characterize the distribution system and identify monitoring sites where customers may be exposed to high levels of TTHM and HAA5. There are four ways to comply with the IDSE requirements: Standard Monitoring, System Specific Study, 40/30 Certification and Very Small System (VSS) Waiver.
Standard monitoring (SM) is one year of increased monitoring for TTHM and HAA5 in addition to the data being collected under Stage 1 DBPR. This data will be used with the Stage 1 data to select Stage 2 DBPR TTHM and HAA5 compliance monitoring locations. Any system may conduct standard monitoring to meet the Initial Distribution System Evaluation (IDSE) requirements of the Stage 2 DBPR. The number of monitoring sites, the monitoring periods and monitoring frequency vary depending on population served.
Systems that have extensive TTHM and HAA5 data (including Stage 1 DBPR compliance data) or technical expertise to prepare a hydraulic model may choose to conduct a system specific study (SSS) to select the Stage 2 DBPR compliance monitoring locations.

The term "40/30" refers to a system that during a specific time period has all individual Stage 1 DBPR compliance samples less than or equal to 0.040 mg/L for TTHM and 0.030 mg/L for HAA5 and no monitoring violations during the same period. These systems have no IDSE monitoring requirements but will still need to conduct Stage 2 DBPR compliance monitoring.

The Very Small System (VSS) Waiver applies to systems that serve fewer than 500 people and have eligible TTHM and HAA5 data. The VSS eligibility does not depend on the actual TTHM and HAA5 sample results. These systems also have no IDSE monitoring requirements but will still need to conduct Stage 2 DBPR compliance monitoring. 40/30 certifications were previously due for systems larger than 10,000 persons.

### 6.3.5 Total Coliform Rule (TCR) and Revised Total Coliform Rule (RTCR)

The total coliform rule was established by the EPA in 1989 to reduce the risk of waterborne illness resulting from disease-causing organisms associated with animal or human waste. This rule was recently revised and effective on April 1, 2016, and is called the Revised Total Coliform Rule. Routine samples collected by Oregon public water suppliers are analyzed for total coliform bacteria. The number of monthly samples required varies based on population served. For Lowell, currently a minimum of two samples per month are required. Once the population exceeds 2,500 then three samples will be required. Monitoring changes pertaining to RTCR are as follows; at non-community water systems operated seasonally, monthly monitoring will now be required.

Compliance is based on the presence or absence of total coliforms in any calendar month. Sample results are reported as “coliform-absent” or “coliform-present”. If any routine sample is coliform-present, a set of at least three repeat samples must be collected within 24 hours. If any repeat sample is total coliform-present, the system must analyze that culture for fecal coliforms or E. coli, and must then collect another set of repeat samples, unless the MCL has been violated and the system has notified the state. Following a positive routine or repeat total coliform result, the system must collect a minimum of three routine samples the following month only for those who monitor quarterly and there is no longer required for those monitoring monthly. Both seasonal and non-community water systems will monitor monthly instead of quarterly.

Systems which collect fewer than 40 samples per month are allowed no more than one coliform-present sample per month including any repeat sample results. Larger systems (40 or more samples per month) are allowed no more than five percent coliform-present samples in any month including any repeat sample results. Confirmed presence of fecal coliform or E. coli presents a potential acute health risk and requires immediate notification of the public to take protective actions such as boiling or using bottled water. Any fecal coliform-positive repeat sample or E. coli-positive repeat sample, or any total coliform-positive repeat sample following a fecal or E. coli-positive routine sample is a violation of the MCL. For more information on the Revised Total Coliform Rule please visit the website below:
http://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/RULES/Pages/revised-coliform.aspx

### 6.3.6 Lead and Copper Rule (LCR)

Excessive levels of lead and copper are harmful, and rules exist to limit exposure through drinking water. Lead and copper enter drinking water mainly from corrosion of plumbing materials containing lead and copper. Lead comes from solder and brass fixtures. Copper comes from copper tubing and brass fixtures. Protection is provided by limiting the corrosivity of water sent to the distribution system. Treatment alternatives include pH adjustment, alkalinity adjustment, or by adding passivating agents such as orthophosphates.

Samples from community systems are collected from homes built prior to the 1985 prohibition of lead solder in Oregon. One-liter samples of standing water (first drawn after 6 hours of non-use) are collected at homes identified in the water system sampling plan. Two rounds of initial sampling are required, collected at 6-month intervals. Subsequent annual sampling from a reduced number of sites is required after demonstration that lead and copper action levels are met. After three rounds of annual sampling, samples are required every 3 years. The number of initial and reduced samples required is dependent on the population served by the water system.

In each sampling round, 90% of samples from homes must have lead levels less than or equal to the Action Level of 0.015 mg/L and copper levels less than or equal to 1.3 mg/L. Water systems with lead above the Action Level must conduct periodic public education, and either install corrosion control treatment, change water sources, or replace plumbing. Testing requirements are as follows:

- Have sampling plan for applicable homes
- Collect required samples
- Meet Action Levels for Lead and Copper (0.015 mg/L for Lead and 1.3 mg/L for Copper)
- Rule out source water as a source of significant lead levels
- If Action Levels not met, provide corrosion control treatment and other steps

On December 22, 2020 EPA published the 2020 Final Revisions to the Lead and Copper Rule. The latest rule notes the following revisions:

- Using science-based testing protocols to find more sources of lead in drinking water
- Establishing a trigger level to jumpstart mitigation earlier and in more communities
- Drive more LSL replacements
- Required testing in schools and childcare facilities
- Requiring water systems to identify and make public the locations of lead service lines

At this time, the City of Lowell needs to sample at 20 sites every 6 months; if the results are below the action level, they may then get a reduction to 10 sites tested every year for two years, and then finally 10 sites every 3 years.

### 6.3.7 Inorganic Contaminants

The level of many inorganic contaminants is regulated for public health protection. These contaminants are both naturally occurring and can result from agriculture or industrial operations. Inorganic contaminants most often come from the source of water supply but can also enter water from contact with materials used for pipes and storage tanks. Regulated inorganic contaminants include arsenic, asbestos, fluoride, mercury, nitrate, nitrite, and others. A possible future MCL for nickel is currently being evaluated by EPA. Manganese may also become a primary drinking water contaminant in the future.

Compliance is achieved by meeting the established MCLs for each contaminant. Systems that cannot meet one or more MCL must either install treatment systems (such as ion exchange or reverse osmosis) or develop alternate sources of water. Various sampling schedules are applicable for inorganic contaminants, but a minimum of annual sampling should be completed.

### 6.3.8 Organic Chemicals

Organic contaminants are regulated to reduce exposure to harmful chemicals through drinking water. Examples include acrylamide, benzene, 2,4-D, styrene, toluene, and vinyl chloride. Major types of organic contaminants are Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs). Organic contaminants are usually associated with industrial or agricultural activities that affect sources of drinking water supply, including industrial and commercial solvents and chemicals, and pesticides. These contaminants can also enter from materials in contact with the water such as pipes, valves and paints and coatings used inside water storage tanks.

At least one test for each contaminant from each water source is required during every 3-year compliance period. Public water systems serving more than 3,300 people must test twice during each 3-year compliance period for SOCs. Public water systems using surface water sources must test for VOCs annually.

Compliance is achieved by meeting the established MCL for each contaminant. Quarterly follow up testing is required for any contaminants that are detected above the specified MCL. Only those systems determined by the State to be at risk must monitor for dioxin. Water systems using polymers containing acrylamide or epichlorohydrin in their water treatment process must keep their dosages below specified levels. Systems that cannot meet one or more MCL must either install or modify water treatment systems (such as activated carbon and aeration) or develop alternate sources of water. A summary of organic chemicals is as follows:

- At least one test for each contaminant (for each water source) every 3-year compliance period
- Sample twice each compliance period for each SOCs when system over 3,300 people
- Test VOCs annually
- Quarterly follow up testing required for any detects above MCL
- Maintain polymer dosages in treatment process below specified levels
- MCLs vary based on contaminant

### 6.3.9 Radiologic Contaminants

Radioactive contaminants, both natural and man-made, can result in an increased risk of cancer from long-term exposure and are regulated to reduce exposure through drinking water. Rules were recently revised to include a new MCL for uranium (30 µg/L), and to clarify and modify monitoring requirements. Initial monitoring tests, quarterly for one year at the entry point from each source, were to be completed by December 31, 2007 for gross alpha, radium-226, radium-228 and uranium. A single analysis for all four contaminants collected between June 2000 and December 2003 will substitute for the four initial samples. Gross alpha may substitute for radium-226 if the gross alpha result does not exceed 5 pCi/L and may substitute for uranium monitoring if the gross alpha result does not exceed 15 pCi/L. Subsequent monitoring is required every three, six, or nine years depending on the initial results, with a return to quarterly monitoring if the MCL is exceeded. Compliance with MCLs is based on the average of the four initial test results, or subsequent quarterly tests. Community water systems than cannot meet MCLs must install treatment (such as ion exchange or reverse osmosis) or develop alternate water sources. The City on Lowell has a history of non-detects for radiologic contaminants, with only one detectable test in the year 2009 at 1.1 pCi/L, well under the 15 pCi/L MCL.

## 6.4 Future Water System Regulations

The 1996 Safe Drinking Water Act (SDWA) requires EPA to review and revise as appropriate each current standard at least every six years. Data is continually collected on contaminants currently unregulated in order to support development of future drinking water standards. Drinking water contaminant candidate lists (CCL) are prepared and revised every five years. The first DWCCL (CCL1) was published on March 2, 1998 which included 51 chemicals and 9 microbials. In 2003, EPA decided not to regulate any of the 9 microbials from the initial list. In 2005 EPA published the second CCL (CCL2) consisting of the remaining 51 contaminants from the first list. The Agency published the preliminary regulatory determinations for 11 of the 51 contaminants listed on the second CCL in April of 2007. In 2008 EPA published the draft third Contaminant Candidate List (CCL3) to help identify unregulated contaminants that may require a national drinking water regulation in the future. The 4th CCL was announced on November 17,2016. Preliminary determinations for CCL4 were announced on February 20, 2020. The EPA must publish a decision on whether to regulate at least five contaminants from the CCL every 5 years. As a result, additional contaminants can become regulated in the future.

In addition, rule revisions and new rules will occur to further address health risks from disinfection byproducts and pathogenic organisms. Rules such as the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and the Stage 2 Disinfectants/Disinfection Byproducts Rule (Stage 2 DBPR) have recently gone into effect at the federal level and require systems to begin planning for compliance. New and revised drinking water quality standards are mandated under the 1996 federal SDWA. Both rules are in effect and administered by the Oregon Health Authority (OHA).

Water suppliers should be aware of and familiar with these mandates and deadlines, and plan strategically to meet them. OHA, under the Primacy Agreement with the EPA, has up to two years to adopt each federal rule after it is finalized. Water suppliers generally have at least three years to comply with each federal rule after it is finalized; however, some of these rules will likely establish a significant number of compliance dates for water suppliers that will occur prior to state adoption of the rules. These "early implementation" dates will likely have to be implemented in Oregon directly by the EPA, because the state program will not yet have the rules in place or the resources to carry them out.

The lead and copper rule is currently in revision. Systems will need to build inventories of lead service lines LSLs. LSLs then must be identified/replaced at a rate of 3% of the total inventory per year. The trigger level will be set at 10 parts per billion. This will likely be a very costly effort for many towns in the western US.

These anticipated rules are described generally below. Additional details will be found in the final EPA rules once they are promulgated.

### 6.4.1 Radon Rule

All community water systems using groundwater sources will conduct quarterly initial sampling at distribution system entry points for one year. Subsequent sampling will occur once every 3 years. The Radon MCL is expected to be 300 pCi/L. An alternative MCL (AMCL) of 4,000 pCi/L is proposed if the State develops and adopts an EPA-approved statewide Multi-Media Mitigation (MMM) program. Local communities may have the option of developing an EPA-approved local MMM program in the absence of a statewide MMM program and meeting the AMCL.

### 6.4.2 RTCR Distribution Rule

In April of 2016, the requirements for coliform bacteria have been revised, emphasizing fecal coliforms and E. coli, and focusing on protection of water within the distribution system. The new rule will apply to all public water systems and will involve identifying and correcting sanitary defects and hazards in water systems and using best management practices for disinfection to control coliform bacteria in the system.

## 6.5 Water Management and Conservation Plans

The Municipal Water Management and Conservation Planning (WMCP) program provides a process for municipal water suppliers to develop plans to meet future water needs. Municipal water suppliers are encouraged to prepare water management and conservation plans but are not required to do so unless a plan is prescribed by a condition of a water use permit; a permit extension; or another order or rule of the Commission. These plans will be used to demonstrate the communities' need for increased diversions of water under the permits as their demands grow. A master plan prepared under the requirements of the Oregon Health Authority, or the water supply element of a public facilities plan prepared under the requirements of the Department of Land Conservation and Development which substantially meets the requirements of OAR 690-086-0125 to 690-086-0170 may be submitted to meet the requirements for WMCP’s. Rules for WMCP’s are detailed in OAR 690, Division 86.

Every municipal water supplier required to submit a WMCP shall exercise diligence in implementing the approved plan and shall update and resubmit a plan consistent with the requirements of the rules as prescribed during plan approval. Progress reports are required showing 5-year benchmarks, water use details, and a description of the progress made in implementing the associated conservation or other measures.

Failure to comply with rules for WMCPs can result in enforcement actions by the Water Resources Department Director. Enforcement actions can include requirements for additional information and planning, water use regulation, cancellation of water use permits, or civil penalties under OAR 690-260-0005 to 690-260-0110.

# 7 EXISTING WATER SYSTEM

The City of Lowell owns and operates a community water system that is comprised of the following primary assets:

- An intake structure east of the covered bridge and associated piping running from the intake structure to the water treatment plant on the north bank of the Dexter Reservoir
- Three inactive wells, LANE 19572, LANE 1637, and L3714
- A conventional water treatment plant
- WTP integrated buried clearwell
- One 440,000-gallon finished water storage reservoir
- One 460,000-gallon finished water storage reservoir
- Distribution pump station
- Booster pump station for high elevation service pumping to a 2,500-gallon storage tank to service the higher elevation pressure zone
- Approximately 30,000’ of distribution main and transmission piping

## 7.1 Water Supply

### 7.1.1 Water Sources

In addition to the raw surface water intake in Dexter Reservoir, the City also has three inactive wells (well #1 - LANE 19572, well #2 - LANE 1637, and well #3 - LANE 51014/L). OHA’s online data from 1986 to 2001 show that the combined output of the three wells averaged 28 parts per billion (ppb) for arsenic. In January of 2001, the EPA proposed that the MCL for arsenic should be lowered from 50 ppb to 10 ppb. The new arsenic standard was delayed until October 2001, when the EPA decided to let the proposed rule stand and that the more stringent standard would help protect public health. The City made the switch from groundwater to surface water in 2002 to comply with the new, more stringent regulation for arsenic. The City currently utilizes a screened raw water intake submerged in Dexter Reservoir for their water supply.

### 7.1.2 Water Rights

GSI Water Solutions Inc. has drafted a Water Conservation and Management Plan for the City of Lowell. Please refer to section 2.9 of the WCMP for further detail on the City of Lowell’s water rights.

### 7.1.3 Raw Water Intake

The source of water supply for the City of Lowell is Dexter Lake Reservoir. The existing raw water intake in Dexter Reservoir is located near the covered bridge on the Lane County causeway. In 1999, a letter was sent from the Army Corps of Engineers specifically indicating that the intake structure was 2 ft wide and deep, and 3 ft high, and that it was securely fastened at a depth of 15 ft to the center pier on the east (upstream) side of the bridge from the city to State Highway 58. The intake is screened on three sides, each side being 36 in by 23 in, with a total screen area of approximately 17 sq ft. The intake screen, which was replaced in 2005, is fabricated from stainless steel (of 3-mesh 14-gauge construction) and has not been inspected in many years. We recommend an annual inspection program be put in place as soon as possible. There are no systems in place to clear the screen of accumulated debris automatically or remotely. The raw water intake transmission line is about 2500 ft in length and comprised of 10-in diameter Schedule 80 PVC pipe.

## 7.2 Water Treatment Plant

### 7.2.1 General

The Lowell WTP is a conventional rapid sand media filter plant. The basic plant processes include chemical coagulation, flocculation, clarification, dual-media filtration, and chemical disinfection. The plant is generally in good condition, although it is not currently capable of producing the volume of water required to meet either the current or projeted demands of the community without extremely long run times. Many times during the warmer summer months the plant is run continuosly in an attempt to keep up with the water demand.

Instrumentation at the plant includes an array of turbidity meters, pH sensors, flow meters, a chlorine analyzer, and other equipment. All data from these instruments is collected and displayed on a central supervisory control and data acquisition (SCADA) system computer that collects and processes data from the entire water system.

When operating normally, the plant operates at 155 gpm with raw water turbidities typically ranging from 2–5 NTU throughout the year.

There are two centrifugal type intake pumps located in the raw water supply room of the WTP. Only one of these pumps (the newer pump) is currently utilized to draw water from Dexter Lake. The older pump, installed prior to 2001, has a 350 gallon per minute (gpm) capacity and is driven by a 10 horsepower (HP) motor. This pump sits idle because of problems with maintaining a proper seal during operation. The newer pump, added after the 2001 plant upgrade, also has a 350 gpm capacity and is driven by a 10 HP motor.

After the raw water supply pump, the raw water enters a 6" chemical injection header. Originally, the upgraded WTP was designed and built with the capability to introduce several chemical conditioners to pre-treat the raw water. However, it was later learned that just coagulant and powdered activated carbon (seasonally) could accomplish the required pre-treatment. Pre-chlorination was also recently discontinued because of the relatively-high total organic carbon (TOC) levels in the raw water and concerns about the formation of potentially-harmful disinfection byproducts (DPBs).

Currently, the only chemical conditioners utilized for pre-treatment are:

- PASS-C (polyaluminum chloride) coagulant
- Powdered Activated Carbon

The PASS-C serves as a coagulant to aid in the flocculation process. It has little impact upon pH levels and offers effective performance even in cold water. The powdered activated carbon (PAC) is used during the summer months to improve taste and odor related to the presence of algae in the raw water. PAC also is also advantageous in it's removal of organics, thus reducing the potential for the formation of disinfection by products (DBPs) after sodium hypochlorite disinfection.

*PHOTO 7.2.1 – PAC MIXING BASIN*

After exiting the static mixer, the pre-treated water leaves the pump room and is delivered into a slow mix chamber for mechanical stirring at approximately 50 rpm in order to promote flocculation. This chamber has a hopper-like shape that, due to gravity and the stirring action, funnels accumulated floc down to collect beneath a redwood baffle. The baffle separates the chamber from the clarifier tank. The passage below the baffle occurs through a restricted opening that entraps the accumulated floc and thereby forms a "sludge blanket", which extends into the clarifier tank and achieves a "straining effect" as the water flows through it. Except for removal due to annual inspections or blanket thickness maintenance, this blanket should remain intact to optimize clarification.

As the pre-treated water travels on into the clarifier tank, the natural uplift causes the water to move upward through tube settlers, promoting sedimentation of heavier impurities onto the tubes. At this stage, the topmost layer of water in the tank is the cleanest. This water is then skimmed by means of fiberglass-reinforced plastic (FRP) weir plates and then flows to the filter cells by means of collection troughs. The weir plates are adjustable and have a typical 90° “V-notch” design.

There are about 220 sq ft of tube settlers and about 45 ft of FRP weir plates (three collection troughs with two weir plates mounted lengthwise along the sides of each trough, each weir plate being 7.5 ft long). Like the slow mix chamber, the clarifier tank has a hopper-like shape. The length of this tank is about 25.5 ft and the cross section of this shape is about 105 sq ft, yielding a volume of approximately 2655 cu ft for the clarifier tank. As a result, for a nominal treated water flow rate of 155 gpm, the theoretical clarifier detention time is about 2 hours.

As water enters the top of the filter bed, gravity pulls the fluid down through the filter media. Larger floc particles are caught higher up by the coarser media grains. Smaller floc particles are caught lower down by the finer media grains. Over time, the effectiveness of the filter will diminish due to trapped particles within the media. As a result, the filter media must be backwashed, during which the water flow direction through the filter is reversed. This flow reversal causes the layers of media to expand, enabling the grains to rub against each other and thereby scour the filter. The particles released from the filter media during backwashing are flushed into an outflow system and flow to the backwash settling basin.

The filter beds have a filtration area of 58 sq ft each and are rated for 3.5 gpm per sq ft, yielding a filtration capacity of about 200 gpm per filter. Both WTP records and communications with the operator have revealed that the plant is ordinarily operated utilizing only a single filter bed at a time and at a nominal flow rate of 155 gpm. The alternating duty cycles for the filters are dictated by the backwash intervals, which occur every two to three days. The WTP records also indicate that the filter’s finished water turbidity performance target of 0.3 NTU or less is consistently and easily met.

Each filter bed is of the dual-media-type and sits upon a Leopold Universal underdrain with an IMS branded cap. The upper and lower media layers are anthracite coal and a sand mixture, respectively. These layers directly rest upon the IMS cap, which is a porous plate fabricated of high density polyethylene (HDPE) beads sintered together. This configuration eliminates the need for supporting gravel, thereby allowing for deeper media depth within the filter cell.

Backwashing and filter-to-waste processes at the WTP are done manually using existing system pressure along with pipes and valves in the piping gallery. Each filter is backwashed at a flowrate of ~1,000 gpm with finished water from the reservoir for 10-15 minutes.

### 7.2.2 Chemical Equipment and Disinfection


*PHOTO 7.2.2 – CHLORINE ANALYZER*

The water treatment system currently only adds three chemicals in the water treatment process, they are in order of application:

- Prior to the WTP powdered activated carbon is added to the raw water to remove organics
- Also prior to the WTP, PASS-C (polyaluminum chloride) coagulant is added to promote flocculation
- Post filtration, sodium hypochlorite is added for disinfection

The PASS-C and powdered activated carbon are dosed into the raw water intake on the effluent side of the raw water intake pump.

The sodium hypochlorite is generated onsite and dosed just prior to the filtered water entering the clearwell beneath the WTP.

### 7.2.3 Clearwell and Effluent Pumps

*PHOTO 7.2.3 – FINISHED WATER PUMPS*

The clearwell is located under the water treatment building. The clearwell includes baffling at the inlet as well as minor intermediate baffling to encourage serpentine flow. The current operating pool in the clearwell varies from 80" down to 75". At 75" of depth, the clearwell volume is estimated to be approximately 35,000 gallons.

Tracer testing in 2021 found the clearwell to have contact time of 81 minutes at a WTP production rate of 155 gpm. A second tracer test was conducted the water treatment plant running at 200 gpm and yielded a contact time of 66 minutes. The result of these two tests indicates a baffle factor for the clearwell of 0.37.

An onsite brine-based sodium hypochlorite generator provides for disinfection and is mixed at a solution strength of 0.80% chlorine. The injection point is on the clearwell influent line. A Hach CL-17 is used to measure residual chlorine levels with continuous samples taken from the outlet piping of the clearwell. Typically, a free chlorine residual level of 0.80-0.90 mg/L is maintained in the clearwell.

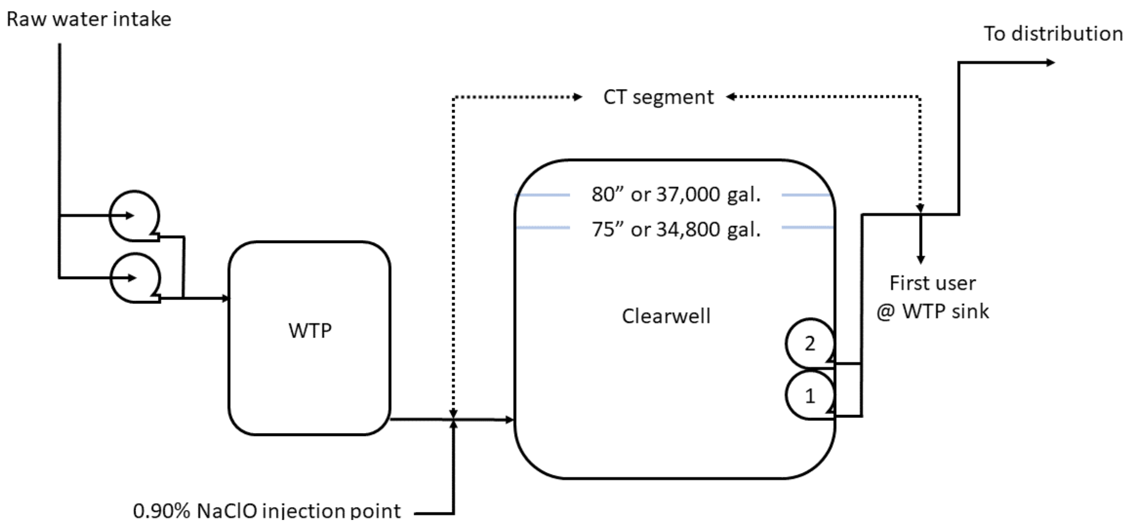



*FIGURE 7.2.3 – CLEARWELL DISINFECTION SEGMENT*

## 7.3 Treated Water Storage

### 7.3.1 Main Reservoirs

The City currently relies on a 440,000 gallon glass-fused to steel tank, and an older 460,000 gallon concrete tank for water storage. The tanks share a base elevation of ~922'. The tanks can both be filled to approximately 952' while leaving two feet available for freeboard. This equates to approximately 845,000 gallons of storage. The two tanks sit adjacent to each other on a lot north of the intersection of East 1st Street and Sunridge Lane. There is also a 2,500 gallon tank that services an upper pressure zone via gravity. A booster pump pumps water from the lower pressure zone to this upper 2,500 gallon tank.

In estimation of required water storage, we consider three criteria:

- Average Daily Demand – To calculate emergency storage
- Maximum Daily Demand – To calculate equalization storage
- Required Fire Storage – Based on building code and venerable structures in town

It is considered prudent to set emergency storage equal to 3 average days of water demand. Equalization storage should be set to 20% of the MDD. Fire storage volume is conservatively calculated of the City of Lowell at 3,500 gpm for 3 hours. In addition to the basic volume calculations, storage locations and hydraulic distribution must be considered to assure each area of the system has enough flow and volume. The storage needs for 2045 are calculated in the chart below.

*TABLE 7.3.1 – REQUIRED WATER STORAGE – CURRENT AND FUTURE*

| | 2020 | 2045 |
|---|---|---|
| Equalization Storage: 20% of the MDD | 49,225 | 64,207 |
| Emergency Storage: 3 times the ADD | 369,191 | 481,553 |
| Fire Reserve Storage: 3,500 gpm for 3 hours | 630,000 | 630,000 |
| **Total Recommended Storage:** | **1,048,416** | **1,175,760** |

The City of Lowell currently has 845,000 gallons of storage. As shown in the table above, the City currently does not have enough storage to provide for equalization, anticipated fire flows, and emergency storage. The existing system is deficient by approximately 330,000 gallons by the end of the planning period for this study.

## 7.4 Distribution System

The major components of the water distribution system for the City are shown on the Water System Map. The distribution system mains vary considerably in both size and material, with 6” and 12” PVC comprising nearly half of the system, with a considerable amount of 6” AC still in service. Please see the table below for further detail.

**Length in feet**

| | 2" | 4" | 6" | 8" | 10" | 12" | TOTAL |
|---|---|---|---|---|---|---|---|
| **PVC** | 2,645 | 1,380 | 10,345 | 4,305 | - | 9,240 | **27,915** |
| **STEEL** | - | 1,830 | 510 | 1,710 | - | - | **4,050** |
| **AC** | - | - | 9,595 | - | 1,745 | - | **11,340** |
| **TOTAL** | **2,645** | **3,210** | **20,450** | **6,015** | **1,745** | **9,240** | **43,305** |

**Percentage of total**

| | 2" | 4" | 6" | 8" | 10" | 12" | TOTAL |
|---|---|---|---|---|---|---|---|
| **PVC** | 6.1% | 3.2% | 23.9% | 9.9% | - | 21.3% | **64.5%** |
| **STEEL** | - | 4.2% | 1.2% | 3.9% | - | - | **9.4%** |
| **AC** | - | - | 22.2% | - | 4.0% | - | **26.2%** |
| **TOTAL** | **6.1%** | **7.4%** | **47.2%** | **13.9%** | **4.0%** | **21.3%** | **100%** |

With a few exceptions at the perimeter, the core layout of the existing water system is geometrically a grid in shape, and adequate to deliver the required flowrates to the community, with most lines being looped back into the system. Looped distribution lines allow the use of smaller diameter pipes and improves both the reliability and the redundancy of the system, as the water can reach the point of demand by more than one path. The water distribution system in the City of Lowell is fairly well laid-out and analysis with WaterCAD modeling has determined that the distribution pipeline network will provide adequate domestic and fire flows for the duration of the planning period. Please see Appendix WCM for the data output detailing the WaterCAD analysis.

### 7.4.1 Pressure Zones

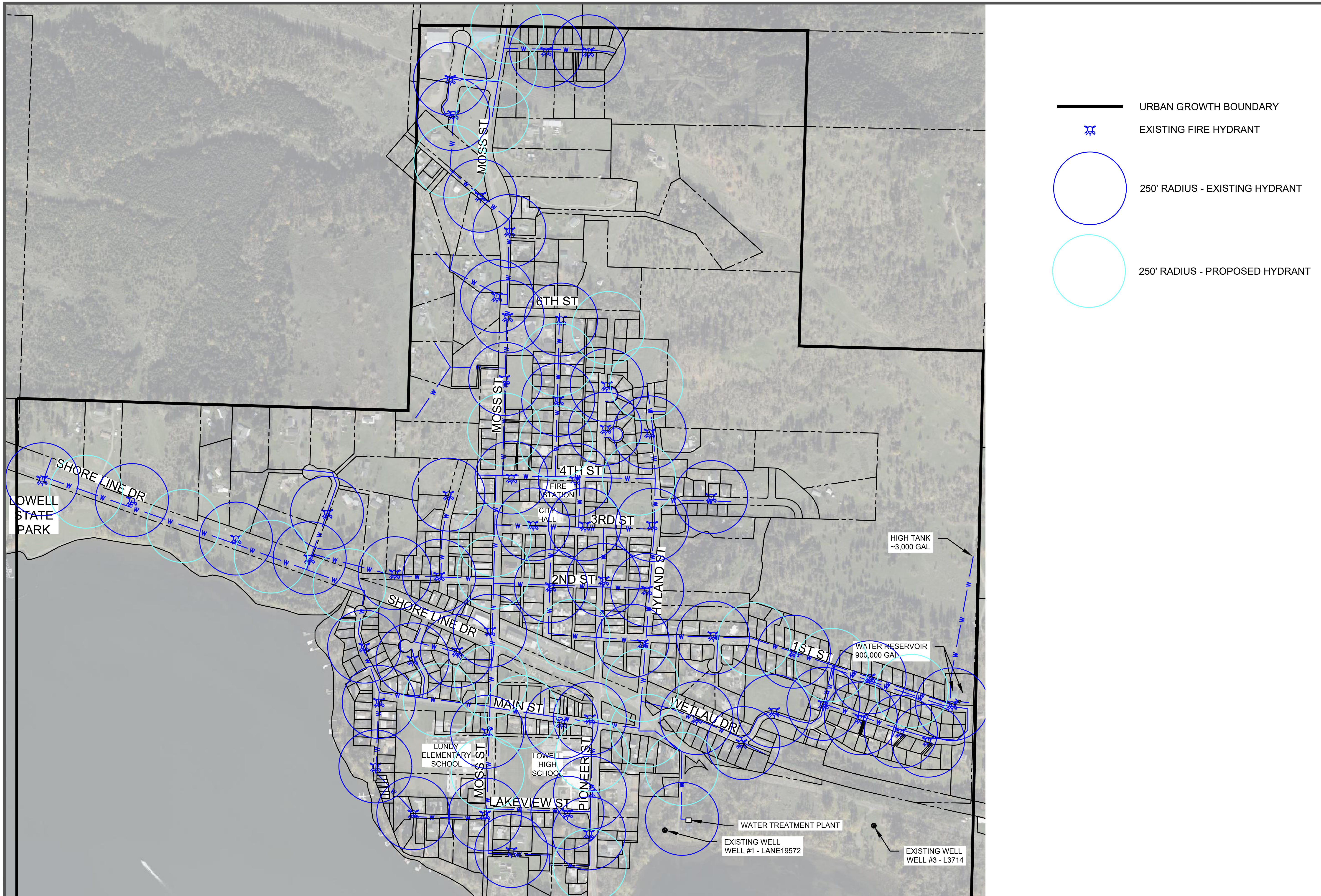
There are two pressure zones in the City, one small upper area north of the twin reservoirs that is pressurized by gravity from a boosted 2,500 gallon tank, and the rest of the City. The upper 2,500 gallon tank normally sits at a hydraulic grade of 1,063’. The two main reservoirs are both are at a hydraulic grade of 952’ when completely full, leaving 2’ available for freeboard.

### 7.4.2 Fire Protection

Per the 2014 Oregon Fire Code, when flows of 1,750 gpm or less are required a single fire hydrant is required to be accessible within 250 feet (200 feet on dead-end streets) resulting in a maximum hydrant spacing of 500 feet (400 feet on dead-end streets).

The largest potential fire protection demand in town is likely at Lowell High/Middle School at 65 South Pioneer Street. Based on the total square footage (20,000+ $ft^2$) and being a Type IIIA building, the required demand is 2,000 gpm for 2 hours. This flow rate requires that two hydrants be within 500’ of each other and the hydrants overlap the structure in question.

Mapping 500’ diameter circles centered on existing fire hydrants throughout the town shows several areas within the city limits that have structures that are not within a 250’ radius of an existing hydrant. Please see figure 7.4.2 on the following page for a map of existing and the proposed 29 additional fire hydrants. Note, dark blue circles are indicating existing fire hydrant coverage, light blue circles are showing proposed hydrants.




Civil West Engineering Services, Inc.

CITY OF LOWELL
LANE COUNTY, OR

HYDRANT MAP

2022 WATER MASTER PLAN

0 1" 600'

DRAWN BY: ERM
DATE: JANUARY, 2022

FIGURE 7.4.2

DATE:6/8/22 FILE:O:\CW_Projects\2101 Lowell\2101-020 Water Master Plan\04 Study\Drawings\Dwg\SYSTEM MAP.dwg

# 8 IMPROVEMENT ALTERNATIVES

## 8.1 Data Collection and Management Needs and Alternatives

### 8.1.1 Water System Data Collection and Management Needs

Although the water system has a functioning SCADA system in place, it is quite old and beyond its useful lifetime. The existing system uses aged software that is cumbersome, difficult to use and costly to maintain/update. We recommend a new SCADA system be installed to replace the old system with a more current/accessible software platform. In addition to the new SCADA system, the City should also consider adding SCADA capability to their reservoir network. This will require some effort and infrastructure improvements, as there is no existing telemetry in place for the reservoirs.

### 8.1.2 Data Collection and Management Recommendations

We recommend that the City investigate upgrading the existing water system SCADA to present technology and also add SCADA to the water storage reservoirs. The new system should at a minimum continue to cover the following parameters/processes:

- Temperature
- pH
- Turbidity (raw and finished)
- Hypochlorite concentrations and dosing
- All process related flowrates
- Clearwell levels – flow in/out
- Reservoir levels – flow in/out

| SCADA - Upgrading Automation and Data Acquisition | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | SCADA Client Computer, Software and Accessories - City Hall/WTP | EA | 2 | $18,500 | $37,000 |
| 2 | City Hall/WTP PLC,Telemetry Radio and Antenna | EA | 2 | $26,700 | $53,400 |
| 3 | Programming and Installation | LS | 1 | $45,000 | $45,000 |
| 4 | 10" Panelview Upgrades - City Hall/WTP | EA | 2 | $9,900 | $19,800 |
| 5 | Remote Control of Raw Water Pump | LS | 1 | $6,500 | $6,500 |
| 6 | Remote Control of WTP | LS | 1 | $11,000 | $11,000 |
| 7 | Reservoir Levels/Meters and Telemetry | EA | 3 | $14,250 | $42,750 |
| 8 | Control Interface Panel Upgrade - City Hall/WTP | EA | 2 | $14,700 | $29,400 |
| 9 | IP Cameras for Reservoir, RWI and WTP Monitoring | EA | 3 | $3,500 | $10,500 |
| | | | ***Estimated Construction Cost:*** | **$** | **255,350.00** |
| | Contingency (20%) | | | $ | 51,070.00 |
| | | | **Estimated Project Total Cost:** | **$** | **306,420.00** |

## 8.2 Water Supply Needs and Alternatives

In addition to the surface water intake in Dexter Reservoir, the City also has three inactive wells (well #1 - LANE 19572, well #2 - LANE 1637, and well #3 - LANE 51014/L). OHA's online data from 1986 to 2001 show that the combined output of the three wells averaged 28 parts per billion (ppb) for arsenic. In January of 2001, the EPA proposed that the MCL for arsenic should be lowered from 50 ppb to 10 ppb. Implementation of the new arsenic standard was delayed until October 2001, when the EPA decided to put the new 10 ppb standard in effect to help protect public health. The City made the switch from groundwater to surface water in 2002 to comply with the new, more stringent regulation for arsenic.

### 8.2.1 Water Supply Needs

To date and through the design period, the current surface water supply is more than adequate to supply the needs of the City. Regarding the surface water source, GSI found in the WMCP that: *"Certificate 23721 authorizes diversions from the Middle Fork of the Willamette River of up to 1.0 cfs, exceeding the City's historical average MDD. With respect to the security of this water right during periods of low flow, the certificate is senior to instream water rights and, due to the abundant flow of the North Fork Willamette River and its tributaries upstream of the City's point of diversion, the City has not experienced and does not anticipate experiencing restrictions on the rate of diversion associated with this certificate."*

### 8.2.2 Water Supply Improvement Alternatives

The Dexter Lake Reservoir raw water intake currently has no means to automatically clean the intake screen. The existing method is either using a diver to clean the screen manually, or by backflushing the intake line with raw water from the WTP. The backflush method does not adequately clean the screen and is typically only employed when the screen is significantly clogged. We recommend an air-burst type screen be installed at the existing raw water intake. This system could be tied into the new SCADA system with telemetry or run on a timer set to operate when the WTP is not in operation. A cost estimate for retrofitting the existing raw water intake with an air burst system is provided below.

| Source - Raw Water Intake - Air Burst Retrofit | | | | | |
|---|---|---|---|---|---|
| **Item** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 7,655.00 | $ 7,655.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 3,600.00 | $ 3,600.00 |
| 3 | Demo and Site Prep | LS | 1 | $ 3,250.00 | $ 3,250.00 |
| 4 | Air Burst System | LS | 1 | $ 28,500.00 | $ 28,500.00 |
| 5 | Piping and Appurtenances | LS | 1 | $ 8,700.00 | $ 8,700.00 |
| 6 | Protective Structure | LS | 1 | $ 12,000.00 | $ 12,000.00 |
| 7 | Electrical Service/Conduit Work | LS | 1 | $ 16,000.00 | $ 16,000.00 |
| 8 | Site Restoration | LS | 1 | $ 4,500.00 | $ 4,500.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **84,205.00** |
| | Administrative/Legal (5%) | | | $ | 4,210.25 |
| | Contingency (20%) | | | $ | 16,841.00 |
| | Engineering (20%) | | | $ | 16,841.00 |
| | | | **Estimated Project Total Cost:** | **$** | **122,097.25** |

## 8.3 Water Treatment Needs and Alternatives

The existing conventional rapid sand media filter plant is quite old, but in generally in good condition. The major issue with the WTP is that it is not currently capable of producing the volume of water required to meet either the current nor projected planning period demands of the community without extremely long run times. The existing water right on Dexter Reservoir is 1.0 cfs, or 450 gpm, and the existing water treatment plant is unable to meet even half of this allotted water right flowrate. Many times, during the warmer summer months, the plant is run continuously to keep up with the water demand. The inability of the plant to meet distribution demands during work hours is the main issue at the WTP.

### 8.3.1 Water Treatment Needs

Currently the water treatment plant is struggling with several issues, mostly related to the limited output. In general, the following are the most notable issues:

- Sedimentation basin is too small to support flowrates exceeding 200 gpm
- Sedimentation wasting system needs upgrades
- Only one filter can be run at a time
- Only one raw water pump can be run at a time
- Only one finished water pump can be run at a time
- Turbidity meters in need of upgrades/relocation
- Control building has no backup power
- Backwash pond is undersized
- Chemical feed pumps lack SCADA control
- Concrete filter wall between filters 1 and 2 is failing

The existing sedimentation basin is only able to support flowrates less than about 200 gpm. Any flowrates through the sedimentation basin that are greater than approximately 200 gpm, cause the sludge blanket in the bottom of the basin to lift, and thus, turbidity issues in the finished water. Further the sedimentation basin has issues with its wasting system that will need to be addressed if the plant is kept online much longer.

The operational issues preventing more than one filter, raw water pump, or finished water pump from running at a time are related to programming issues with the aged existing SCADA system. These issues could be eliminated with the proposed SCADA upgrades, or an all new WTP SCADA system if the City elects to build a new WTP. The turbidity meter and chemical feed issues would also be covered by any SCADA upgrade or outright replacement.

### 8.3.2 Existing Water Treatment Plant Improvement Alternatives

There are two basic approaches to improving the existing water treatment system: rehabilitation and upgrading of the existing plant, and outright replacement of the existing plant with a new water treatment plant. Rehabilitation of the existing plant should be rather straightforward, but many elements of the plant are undersized to meet current production demands, let alone the projected demands at the end of the planning period. The existing water treatment plant is monolithic in construction and would likely be very expensive to upgrade in kind.

The main issue with the existing plant is that the sedimentation basin is too small to support flowrates approaching ~200 gallons per minute. If the plant is pushed beyond this limit, the sludge blanket begins to lift, causing turbidity spikes in filters, shortening run times and increasing the potential for turbidity breakthrough to the clearwell. The filtration basins are not in great condition and there is damage between basins number one and number two, these of course should also be repaired/rehabilitated if the existing plant is expected to be kept online for any further appreciable amount of time. Required major sedimentation basin upgrades and filtration basin rehabilitation cost estimates are included below for reference.

| Treatment - Sedimentation Basin Expansion and Wasting Upgrades | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 25,450.00 | $ 25,450.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 5,500.00 | $ 5,500.00 |
| 3 | Demo, Subgrade, and Site Prep | LS | 1 | $ 22,500.00 | $ 22,500.00 |
| 4 | Construct new 25'x9'x11'deep Sedimentation Basin | LS | 1 | $ 125,000.00 | $ 125,000.00 |
| 5 | Sedimentation Basin Wasting Upgrades | EA | 2 | $ 16,000.00 | $ 32,000.00 |
| 5 | Piping and Appurtenances | EA | 2 | $ 32,500.00 | $ 65,000.00 |
| 6 | Site Restoration | LS | 1 | $ 4,500.00 | $ 4,500.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **279,950.00** |
| | Administrative/Legal (5%) | | | $ | 13,997.50 |
| | Contingency (20%) | | | $ | 55,990.00 |
| | Engineering (20%) | | | $ | 55,990.00 |
| | | | **Estimated Project Total Cost:** | **$** | **405,927.50** |

| Treatment - Filter Basin Rehabilitation | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 11,920.00 | $ 11,920.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 3,200.00 | $ 3,200.00 |
| 3 | Demo and Site Prep | LS | 1 | $ 8,000.00 | $ 8,000.00 |
| 4 | Restorative Concrete Work | EA | 3 | $ 20,000.00 | $ 60,000.00 |
| 5 | Piping, Pumps and Appurtenances | EA | 3 | $ 16,000.00 | $ 48,000.00 |
| 6 | Site Restoration | LS | 1 | $ 2,500.00 | $ 2,500.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **133,620.00** |
| | Administrative/Legal (5%) | | | $ | 6,681.00 |
| | Contingency (20%) | | | $ | 26,724.00 |
| | Engineering (20%) | | | $ | 26,724.00 |
| | | | **Estimated Project Total Cost:** | **$** | **193,749.00** |

Currently, the WTP also suffers from an undersized backwash settling pond. If the plant is upgraded to run at 450 gpm, then the backwash pond will also need to be expanded to a minimum of 2.5 to three times the existing size. Cost estimation for an expanded backwash basin is shown below.

| Treatment - Backwash Basin Expansion | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 4,982.50 | $ 4,982.50 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 3,200.00 | $ 3,200.00 |
| 3 | Demo and Site Prep | LS | 1 | $ 12,000.00 | $ 12,000.00 |
| 4 | Earthen Basin 35'x80'x6' | CY | 625 | $ 25.00 | $ 15,625.00 |
| 5 | Basin Liner System | SF | 2800 | $ 4.00 | $ 11,200.00 |
| 6 | Piping, Pumps and Appurtenances | LS | 1 | $ 7,800.00 | $ 7,800.00 |
| 7 | Site Restoration | LS | 1 | $ 2,500.00 | $ 2,500.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **57,307.50** |
| | Administrative/Legal (5%) | | | $ | 2,865.38 |
| | Contingency (20%) | | | $ | 11,461.50 |
| | Engineering (20%) | | | $ | 11,461.50 |
| | | | **Estimated Project Total Cost:** | **$** | **83,095.88** |

Total costs for rehabilitation and upgrading the exiting plant are approaching $700,000. Although this option is considerably less expensive than building a new treatment plant, there are no guarantees in respect to the longevity of the elements of the existing plant that have not been upgraded/rehabilitated. For this reason, this is not the recommended alternative.

### 8.3.3 New Water Treatment Plant

A new water treatment plant would solve all problems of the existing aged monolithic concrete conventional water treatment plant. Construction of all new infrastructure inherently guarantees longevity of the entire system, rather than relying on 60-year old rehabilitated infrastructure to last another 25 – 40 years.

Two treatment methods for the new plant are considered, conventional treatment and membrane filtration. Both systems will require a new building (40’x80’) that will also incorporate office space for the controls/onsite laboratory. Cost estimates for a conventional packaged plant and a membrane plant are provided below. We strongly recommend running a pilot on both treatment technologies during a period of elevated turbidity to help select the best treatment option using actual worst case raw water conditions from the Dexter reservoir.

| **Treatment - New Conventional Water Treatment Plant - 500 gpm** | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 123,050.00 | $ 123,050.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 38,000.00 | $ 38,000.00 |
| 3 | Demo and Site Prep | LS | 1 | $ 18,000.00 | $ 18,000.00 |
| 4 | 175 gpm Packaged Conventional Treatment System | EA | 3 | $ 205,000.00 | $ 615,000.00 |
| 5 | 50,000 Gallon Subterranean Clearwell | LS | 1 | $ 185,000.00 | $ 185,000.00 |
| 6 | 40'x60' Steel Building | LS | 1 | $ 175,000.00 | $ 175,000.00 |
| 7 | Piping and related Appurtenances | LS | 1 | $ 65,000.00 | $ 65,000.00 |
| 8 | Electrical | LS | 1 | $ 55,000.00 | $ 55,000.00 |
| 9 | 100kW Generator | LS | 1 | $ 63,000.00 | $ 63,000.00 |
| 10 | Site Restoration | LS | 1 | $ 16,500.00 | $ 16,500.00 |
| | ***Estimated Construction Cost:*** | | | **$** | **1,353,550.00** |
| | Administrative/Legal (5%) | | | $ | 67,677.50 |
| | Contingency (20%) | | | $ | 270,710.00 |
| | Engineering (20%) | | | $ | 270,710.00 |
| | **Estimated Project Total Cost:** | | | **$** | **1,962,647.50** |

| Treatment - New Ultrafiltration Water Treatment Plant - 500 gpm | | | | | |
|---|---|---|---|---|---|
| Item No. | Description | Unit | Quantity | Unit Cost | Item Cost |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 115,550.00 | $ 115,550.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 38,000.00 | $ 38,000.00 |
| 3 | Demo and Site Prep | LS | 1 | $ 18,000.00 | $ 18,000.00 |
| 4 | 125 gpm UF Treatment System | EA | 4 | $ 135,000.00 | $ 540,000.00 |
| 5 | 50,000 Gallon Subterranean Clearwell | LS | 1 | $ 185,000.00 | $ 185,000.00 |
| 6 | 40'x60' Steel Building | LS | 1 | $ 175,000.00 | $ 175,000.00 |
| 7 | Piping and related Appurtenances | LS | 1 | $ 65,000.00 | $ 65,000.00 |
| 9 | Electrical | LS | 1 | $ 55,000.00 | $ 55,000.00 |
| 10 | 100kW Generator | LS | 1 | $ 63,000.00 | $ 63,000.00 |
| 11 | Site Restoration | LS | 1 | $ 16,500.00 | $ 16,500.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **1,271,050.00** |
| | Administrative/Legal (5%) | | | $ | 63,552.50 |
| | Contingency (20%) | | | $ | 254,210.00 |
| | Engineering (20%) | | | $ | 254,210.00 |
| | | | **Estimated Project Total Cost:** | **$** | **1,843,022.50** |

## 8.4 Water Storage Needs and Alternatives

### 8.4.1 Water Storage Needs

The City of Lowell currently has 845,000 gallons of storage. The City does not have enough storage to provide for equalization, anticipated fire flows, and emergency storage. The existing system is deficient by approximately 330,000 gallons by the end of the planning period for this study. We estimate that with the projected required storage of 1.2 MG at the end of the planning period, it would be prudent to add a large enough reservoir to provide 1.5 MG of total storage as insurance against the potential for the City building out more rapidly than the projected Lane County rate.

The City has several developable higher elevation areas within the UGB that they would like to be prepared to serve from a new higher elevation reservoir. The new reservoir is intended to serve all buildable lots in within City limits. Two potential sites have already been selected as potential build sites for the high elevation reservoir.

### 8.4.2 Water Storage Improvement Alternatives

To increase capacity and serve the upper undeveloped areas within the City's UGB, we estimate a projected required storage of 1.2 MG at the end of the planning period. The City could either build a new 1.2 MG high elevation reservoir to solely cover the storage needs through the end of the planning period, or build a 0.8 MG high elevation reservoir and rely on the existing, relatively new, glass fused on steel 0.4 MG reservoir to make the total storage of 1.2 MG. Due to its poor condition, we do not recommend relying on the existing concrete reservoir through the planning period, and as such it is not considered in the storage calculation.

| 1.2 MG Reservoir - Upper Pressure Zone | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 150,150.00 | $ 150,150.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 35,000.00 | $ 35,000.00 |
| 3 | 1.2 MG Glass Fused Steel Reservoir | LS | 1 | $ 720,000.00 | $ 720,000.00 |
| 4 | 500 gpm Booster Pump Station | LS | 1 | $ 500,000.00 | $ 500,000.00 |
| 5 | Grading for Access Road | LS | 1 | $ 65,000.00 | $ 65,000.00 |
| 6 | Quarry Run Access Road | LS | 1 | $ 35,000.00 | $ 35,000.00 |
| 7 | Reservoir Venting System | LS | 1 | $ 11,500.00 | $ 11,500.00 |
| 8 | Concrete Slab/Engineeried Sub-base | LS | 1 | $ 135,000.00 | $ 135,000.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **1,651,650.00** |
| | Administrative/Legal (5%) | | | $ | 82,582.50 |
| | Contingency (20%) | | | $ | 330,330.00 |
| | Engineering (20%) | | | $ | 330,330.00 |
| | | | **Estimated Project Total Cost:** | **$** | **2,394,892.50** |

| 0.8 MG Reservoir - Upper Pressure Zone | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 143,150.00 | $ 143,150.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 35,000.00 | $ 35,000.00 |
| 3 | 0.8 MG Glass Fused Steel Reservoir | LS | 1 | $ 650,000.00 | $ 650,000.00 |
| 4 | 500 gpm Booster Pump Station | LS | 1 | $ 500,000.00 | $ 500,000.00 |
| 5 | Grading for Access Road | LS | 1 | $ 65,000.00 | $ 65,000.00 |
| 6 | Quarry Run Access Road | LS | 1 | $ 35,000.00 | $ 35,000.00 |
| 7 | Reservoir Venting System | LS | 1 | $ 11,500.00 | $ 11,500.00 |
| 8 | Concrete Slab/Engineeried Sub-base | LS | 1 | $ 135,000.00 | $ 135,000.00 |
| | | | ***Estimated Construction Cost:*** | **$** | **1,574,650.00** |
| | Administrative/Legal (5%) | | | $ | 78,732.50 |
| | Contingency (20%) | | | $ | 314,930.00 |
| | Engineering (20%) | | | $ | 314,930.00 |
| | | | **Estimated Project Total Cost:** | **$** | **2,283,242.50** |

## 8.5 Distribution System Needs and Alternatives

### 8.5.1 Distribution System Needs

The distribution system mains vary considerably in both size and material, with 6" and 12" PVC comprising nearly half of the system, with a considerable amount of 6" AC still in service. There is still a significant amount of AC pipe in the system (26.2%), that is suspect for potential leakage in the distribution system. We recommend that the City's number one priority should be replacement of all AC pipe in the distribution system with HDPE. Second priority should be installation of a seismically resistant "backbone" as identified in the SRAMP. Thirdly, the distribution system could benefit from looping of dead-end lines. Please see the table below for further detail regarding the size and material composition of the existing distribution system.

**Length in feet**

| | 2" | 4" | 6" | 8" | 10" | 12" | TOTAL |
|---|---|---|---|---|---|---|---|
| **PVC** | 2,645 | 1,380 | 10,345 | 4,305 | - | 9,240 | **27,915** |
| **STEEL** | - | 1,830 | 510 | 1,710 | - | - | **4,050** |
| **AC** | - | - | 9,595 | - | 1,745 | - | **11,340** |
| **TOTAL** | **2,645** | **3,210** | **20,450** | **6,015** | **1,745** | **9,240** | **43,305** |

**Percentage of total**

| | 2" | 4" | 6" | 8" | 10" | 12" | TOTAL |
|---|---|---|---|---|---|---|---|
| **PVC** | 6.1% | 3.2% | 23.9% | 9.9% | - | 21.3% | **64.5%** |
| **STEEL** | - | 4.2% | 1.2% | 3.9% | - | - | **9.4%** |
| **AC** | - | - | 22.2% | - | 4.0% | - | **26.2%** |
| **TOTAL** | **6.1%** | **7.4%** | **47.2%** | **13.9%** | **4.0%** | **21.3%** | **100%** |

With a few exceptions at the perimeter, the core layout of the existing water system is close to a grid in shape, and adequate to deliver the required flowrates to the community, with most lines being looped back into the system. Looped distribution lines allow the use of smaller diameter pipes and improves both the reliability and the redundancy of the system, as the water can reach the point of demand by more than one path. The water distribution system in the City of Lowell is fairly well laid-out and analysis with WaterCAD modeling indicates that the distribution pipeline network will provide adequate domestic and fire flows for the duration of the planning period. We recommend that the City focus on making the AC pipe replacements as soon as possible. The SRAMP upgrades can be done on a 50-year planning horizon per OHA's recommendations. This would average 185' per year, we recommend these SRAMP waterline replacement projects be bundled to every 5 years or so to make them more cost effective vs. replacement of 185’ per year every year. Please see Appendix WCM for the data output detailing the WaterCAD analysis.

| Distribution - AC Water Main Replacements - SRAMP Backbone Upgrades | | | | | |
|---|---|---|---|---|---|
| **Project No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| AC-1 | Replace all 6" AC Pipe with 8" HDPE | LF | 9595 | $ 255.00 | $ 2,446,725.00 |
| AC-2 | Replace all 10" AC Pipe with 12" HDPE | LF | 1745 | $ 295.00 | $ 514,775.00 |
| SR-1 | SRAMP Backbone of 8"-16" HDPE | LF | 9255 | $ 315.00 | $ 2,915,325.00 |
| | | | | **Estimated Total Distribution Projects Cost:** | **$ 5,876,825.00** |

## 8.5.2 Fire Flow Improvement Alternatives

To provide fire protection to all structures within city limits, there are 29 hydrants that will need to be added to maintain a maximum spacing of 500’ between all hydrants on the main lines.

| Distribution - Citywide Fire Protection Upgrade Project | | | | | |
|---|---|---|---|---|---|
| **Item No.** | **Description** | **Unit** | **Quantity** | **Unit Cost** | **Item Cost** |
| 1 | Mobilization - Bonds, Insurance (10%) | LS | 1 | $ 24,260.00 | $ 24,260.00 |
| 2 | Construction Facilities and Temporary Controls | LS | 1 | $ 11,250.00 | $ 11,250.00 |
| 3 | Demo and Site Prep | LS | 1 | $ 9,500.00 | $ 9,500.00 |
| 4 | New Fire Hydrant | EA | 29 | $ 3,800.00 | $ 110,200.00 |
| 5 | Hydrant Piping, Valves, and Fittings | EA | 29 | $ 2,850.00 | $ 82,650.00 |
| 6 | Site Restoration | EA | 29 | $ 1,000.00 | $ 29,000.00 |
| | | | | ***Estimated Construction Cost:*** | **$ 266,860.00** |
| | Administrative/Legal (5%) | | | | $ 13,343.00 |
| | Contingency (20%) | | | | $ 53,372.00 |
| | Engineering (20%) | | | | $ 53,372.00 |
| | | | | **Estimated Project Total Cost:** | **$ 386,947.00** |

# 9 CAPITAL IMPROVEMENT PLAN

## 9.1 Capital Improvement Plan Purpose and Need

This section summarizes the water system capital improvements needed to properly serve the community's needs over the planning period extending to 2045. The Capital Improvement Plan (CIP) consists of various projects to maintain and protect existing water system assets, projects to correct deficiencies, and projects necessary to increase water system capacity to serve the growing population.

The water system CIP is used to help establish funding needs, user rates, system development charges (SDCs), and to plan for and prioritize various project needs. The CIP can change over time as projects are completed and/or new unforeseen needs arise, and an attempt should be made to annually update the CIP and keep the list of needs current.

## 9.2 Capital Improvement Plan Projects

### 9.2.1 CIP Summary

Based on the alternatives developed in Section 8.0, a Capital Improvement Plan has been assembled that is comprised of recommended projects that the City of Lowell should undertake during the planning period to maintain and upgrade their water system. The various water supply, water treatment, water storage and water distribution projects recommended in this Water System Master Plan for the planning period are summarized in Table 9.2.1 below.

*TABLE 9.2.1 – CIP SUMMARY*

| | | |
|---|---|---|
| SCADA - Upgrading Automation and Data Acquisition | $ | 306,420.00 |
| Total SCADA Projects: | $ | 306,420.00 |
| | | |
| | | |
| Source - Raw Water Intake - Air Burst Retrofit | $ | 122,097.25 |
| Total Source Projects: | $ | 122,097.25 |
| | | |
| | | |
| Treatment - New Ultrafiltration Water Treatment Plant - 500 gpm | $ | 1,843,022.50 |
| Total Treatment Projects: | $ | 1,843,022.50 |
| | | |
| | | |
| 0.8 MG Reservoir - Upper Pressure Zone | $ | 2,283,242.50 |
| Total Reservoir Projects: | $ | 2,283,242.50 |
| | | |
| | | |
| Distribution - Citywide Fire Protection Upgrade Project | $ | 386,947.00 |
| Distribution - AC Water Main Replacements - SRAMP Backbone Upgrades | $ | 5,876,825.00 |
| Total Distribution Projects: | $ | 6,263,772.00 |
| | | |
| Total All Projects: | $ | 10,818,554.25 |

## 9.2.2 CIP Priorities

The costs for the City of Lowell's water system improvement needs are great and there may be reason to prioritize the improvements or take projects on in phases. We recommend that the WTP replacement project, SCADA upgrades, and new reservoir projects be classified as priority one, and completed within the next 10 years.

The distribution system AC pipe replacement projects should be completed during the planning period, with the SRAMP backbone distribution projects completed on a 50-year planning horizon. This would take approximately $125,000 per year in 2022 dollars over 50 years. We recommend that both distribution replacement projects be budgeted for at ~5-year intervals to provide a more cost-effective project, rather than replacement of a shorter length of pipe each year.

The Air Burst Retrofit project is not critical and can be done whenever time and budget allows.

*TABLE 9.2.2 – CIP PRIORITIES*

| | | |
|---|---|---|
| **Priority One - Should be completed within the next 10 years** | | |
| Treatment - New Ultrafiltration Water Treatment Plant - 500 gpm | $ | 1,843,022.50 |
| SCADA - Upgrading Automation and Data Acquisition | $ | 306,420.00 |
| 0.8 MG Reservoir - Upper Pressure Zone | $ | 2,283,242.50 |
| **Total Priority One Projects:** | **$** | **4,432,685.00** |
| | | |
| | | |
| **Priority Two - Should be completed within 20 - 50 years** | | |
| Distribution - Citywide Fire Protection Upgrade Project | $ | 386,947.00 |
| Distribution - AC Water Main Replacements - SRAMP Backbone Upgrades | $ | 5,876,825.00 |
| **Total Priority Two Projects:** | **$** | **6,263,772.00** |
| | | |
| | | |
| **Priority Three - Should be completed within the planning period** | | |
| Source - Raw Water Intake - Air Burst Retrofit | $ | 122,097.25 |
| **Total Priorty Three:** | **$** | **122,097.25** |
| | | |
| **Total All Projects:** | **$** | **10,818,554.25** |

## 9.2.3 CIP Updates

Periodically, the Capital Improvement Plan should be updated and evaluated. It is suggested that every 3 to 5 years the CIP be evaluated and modified as necessary to reflect current development trends, system needs, and prior accomplishments. The City may modify the CIP at any time under ORS 223.309(2)

# 10 FINANCING

## 10.1 Existing Water Rates and Charges

### 10.1.1 Existing Rate Structure

The City of Lowell has varying rate structures based on the size and type of meter. There is also a consumption rate that is the same for all users in the city. In this section the single-family rate structure will be analyzed.

The Lowell water rate structure starts with a base rate for all users that does not include any water consumption of $26.87 per month. Therefore, it is a charge that each user pays prior to any consumption rate being charged. For the single-family residential user, the consumption rates are:

- $5.39 per 1,000 gallons for 0 – 5,000 gallons of water
- $6.79 per 1,000 gallons for consumption exceeding 5,000 gallons of water

It was determined (Section 4.0) that the typical single-family residence uses 4,716 gallons per month. Therefore, this translates to 4,716 gallons/EDU. Applying the average usage to the current rate structure, it is determined that the average residential user pays $52.29/month.

Funding agencies and the State of Oregon assume 7,500 gallons per month as the normal residential use. Therefore, in the City of Lowell, the average residential user would pay:

- Base rate = $26.87
- 0-5,000g consumption charge = $5.39/1,000 gallons *5 = $26.95
- >5,000g consumption charge = $6.79/1,000 gallons *2.5 =$16.98

Total charge = $70.80 based on state standard residential consumption according to current city rates. When this is compared with the average water bill in Oregon of $55.33/EDU, we find that the City of Lowell charges approximately 128% of what the average Oregonian pays.

### 10.2.1 Water Fund Budget

Water fund data was obtained from City staff for the fiscal years from 2016 - 2020. This five year period illustrates the condition and state the water fund for the City of Lowell. The costs associated with maintaining and improving the water system are shown in the expenditures section. The revenue that comes in is also shown. Ideally, this table would show that the expenditures and the revenues balance out. It is shown that the city has come out with a slight surplus in recent years. There has also been cash carry over that the city has been able to utilize. As these numbers approach a zero-dollar surplus, other sources of funds will have to be utilized in order to finance the city water system. A more detailed and extensive financial analysis should be done in order to place the city in good standing with regards to the water fund. The table below (Table 10.2 1) summarizes the current water fund for the City.

*TABLE 10.2.1 – CITY OF LOWELL WATER FUND 2016 – 2020*

| Water Fund | | | | | |
|---|---|---|---|---|---|
| | **16-17** | **17-18** | **18-19** | **19-20** | **20-21** |
| | | | | | |
| Beginning Fund Balance | 98,873 | 151,833 | 139,109 | 140,326 | 112,957 |
| | | | | | |
| Revenues | | | | | |
| Charges for Service | 255,472 | 287,577 | 304,983 | 318,845 | 348,437 |
| Misc. | 19,294 | 20,987 | 23,368 | 14,252 | 15,599 |
| Transfers In | 78,179 | 7,715 | 0 | 0 | 6,049 |
| Loan Proceeds | 0 | 0 | 0 | 0 | 185,358 |
| **Total Revenue** | **352,945** | **316,279** | **328,351** | **333,097** | **555,443** |
| | | | | | |
| Expenditures | | | | | |
| Personal Services | 136,494 | 144,507 | 133,453 | 169,295 | 184,403 |
| Material and Services | 87,719 | 89,688 | 109,106 | 101,127 | 174,592 |
| Debt Services | 64,080 | 64,080 | 64,079 | 64,080 | 64,080 |
| Capital Outlay | 6,754 | 24,790 | 14,558 | 16,026 | 188,103 |
| Contingency | 0 | | | | |
| **Total Expenses** | **295,047** | **323,065** | **321,196** | **350,528** | **611,178** |
| | | | | | |
| Transfers Out | 4,938 | 5,938 | 5,938 | 9,938 | 15,740 |
| | | | | | |
| **Ending Fun Balance** | **151,833** | **139,109** | **140,326** | **112,957** | **41,482** |

## 10.2 Revenue Increase Needed

### 10.2.1 Capital Improvement Costs

The Capital Improvement Plan in Section 9.0 has an estimated total cost of $10,818,554.25.

### 10.2.2 Additional Annual Revenue Required

The potential revenue increases needed to fund the CIP based on standard funding terms which include a 3.5% interest rate, and a 20-year payback will be $63,000/month. This is meant to be an example of the worst-case scenario of no grant, no city funds and all the money required from a loan.

## 10.3 Potential Grant and Loan Sources

### 10.3.1 Background Data for Funding

Funding for municipal water system capital improvements can occur with loans, grants, principal forgiveness, bonds or a combination thereof. The following parameters are typically used by funding agencies to evaluate the type and level of funding assistance that can be received by a community:

- Local and State median household income (MHI)
- Existing debt service
- Water use rates
- Low/moderate income level percentages
- Financial stability
- Project need

The calculations for user rates can incorporate fee-equivalents derived from other local funding sources that will be used to pay for the water system. These may include any special levies on taxable property within the system's territory.

### 10.3.2 Infrastructure Finance Authority

State level restructuring has resulted in the creation of the Business Oregon (BO) / Infrastructure Finance Authority (IFA) from what previously was the Oregon Economic and Community Development Department. BO/IFA administers resources aimed at community development activities primarily in the water and wastewater infrastructure areas. The BO/IFA Regional Coordinator for Lane County is Melissa Murphy (503-983-8857) and any application process should begin by contacting her. The funding programs through BO/IFA that are applicable to the City of Lowell include:

- Community Development Block Grants (CDBG)
- Safe Drinking Water Revolving Loan Fund (SDWRLF)
- Special Public Works Funds
- Water/Wastewater Financing

The SDWRLF generally must be used to address a health or compliance issue and could potentially provide a loan up to $6 million per project. To receive a loan the project must be ranked high enough on the Project Priority List developed by the State. The LOI process is now open year-round for submissions. Loan terms are typically 3-4% interest for 20 years, however, "Disadvantaged Communities" can potentially qualify for 1% loans for 30 years as well as some degree of principal forgiveness.

All recipients of SDWRLF awards need to complete an environmental review on every project in accordance with the State Environmental Review Process (SERP), pursuant to federal and state

environmental laws. The Environmental Report typically required can cost $25,000 to $75,000 depending on the specific biological, cultural, waterway, and wetland issues that arise.
Loans and grants are available through the Special Public Works Funds and Water/Wastewater Financing depending on need and financial reviews by BO/IFA.

### 10.3.3 Rural Development / Rural Utilities Service

The United States Department of Agriculture (USDA) Rural Utilities Service (RUS) has a Water Programs Division which provides loans, guaranteed loans, and grants for water infrastructure projects for towns of less than 10,000 persons. Grants are only available when necessary to keep user costs to reasonable levels (very similar to BO/IFA threshold rate). Loans can be made with repayment periods up to 40 years. Interest rates vary but often are around 4% for design/construction loans. Environmental reporting is required similar to that for the SDWRLF but with slightly different criteria.

### 10.3.4 Bond Sales

A brief summary of the two types of available bonds is presented below.

- General Obligation Bonds. General obligation or GO bonds are municipal bonds that are "backed" by the full faith and credit of the issuer. GO bonds are generally repaid through an increase in property taxes. For a community such as Lowell, the GO bonds can be an attractive option as the property tax payments are tax deductible, are not based on water use, and are collected whether a customer occupies the home full or part time. GO bonds guarantee a stable and consistent stream of revenue. As they are considered a lower risk investment, the interest rates on GO bond issues are generally lower than other alternatives. GO bonds require voter approval for issuance. The City of Lowell could benefit from getting a GO bond and raising the property taxes. As most property owners do not want to risk losing their property for unpaid tax bills, they will generally pay their increased taxes and the City will be able to pay back the GO bond. Additionally, the GO bond generally has a low interest rate so the cost of borrowing the money is lessened. A GO bond also does not consider the price of water within the City as compared to the State average.

- Revenue Bonds. Revenue bonds differ from GO bonds in that they are repaid through a municipality's revenue stream or by user rates. The full faith of the issuer is not behind revenue bonds; therefore, the interest rate on revenue bonds is generally higher than GO bonds. One advantage of revenue bonds is that they do not require voter approval.

  A revenue bond is supported by the revenue from a specific project. They are used to finance an income-producing project within a municipality. As most of the projects recommended in Section 8.0 are not income-producing and general improvements to the water system, this source of funding may not be the best for the City of Lowell.

## 10.4 Potential Rate Increases

Because of the various options in funding programs and requirements for contact and communication with the Regional Coordinators prior to applications, the recommended first step in exploring funding options is to attend a “One-Stop” financing meeting. The One-Stop meeting is held in Salem once a month with the goal of gathering the State and federal funding agencies together at one time and one place to discuss all potential funding possibilities and issues. No funding commitments are made at the meeting, but probable funding sources and details are provided to enable the City to choose the best alternatives possible at that time and to initiate funding application steps.

To start this analysis, it was assumed that the existing water rates and the existing expenses are equal to each other. This analysis is only for the Capital Improvement Projects that are presented in this report and does not include any other factors.

Since Lowell’s definition of an EDU uses 4,719 gallons per month per EDU, there are a total of 536 EDUs in the City of Lowell. To be conservative, the same number of EDU’s was used throughout the planning period even though the number will likely increase as time passes. Based upon this information a total cost of $117.54 per EDU per month is needed to fund the entire CIP over a 20-year period.

However, we are recommending this work be done in phases, and the amount of work done in the first 20 years would likely be closer to $4.4M. This estimate removes much of the lower priority distribution system work and focuses on the reservoir and WTP projects. The monthly cost of this would be a payback of $26,000/month, which spread over the 536 EDUs would be an increase of $48.51 per month/EDU.

The City of Lowell would likely be categorized as disadvantaged and could perhaps have a large percentage of the loan forgiven, as well as qualifying for a much better than 3.5% interest rate on the loan.

Rather than raising water rates, a private option or GO bond sale may also be used by Lowell. With a GO bond, the City could keep water rates low, but raise property taxes instead to pay for the bond.

The City may also look to using SDCs to cover the costs of projects that increase the capacity of the system. SDC eligibility may be determined for each project, and in general, the SDC eligible amount is proportional to the amount of system capacity increase created by the project.

# APPENDIX SRAMP
# SEISMIC RISK ASSESSMENT &
# MITIGATION PLAN

# TABLE OF CONTENTS

# 1 INTRODUCTION

The City of Lowell has been identified as having a moderate to moderate/heavy damage potential in the 2013 Oregon Resilience Plan. The City is within the Valley Impact Zone. It is likely that the City's existing water infrastructure would be heavily compromised in the event of an earthquake. This presents the need for the City of Lowell to identify, assess, and plan for upgrading facilities needed to supply the following critical community needs:

- Safe Drinking Water
- General Health and First Aid
- Emergency Response
- Fire Suppression

Based on the current condition and location of the existing infrastructure, the City of Lowell is vulnerable to seismic events, including subsidence, landslides, and power outages. Considerable work must be done to update the City's utility infrastructure to ensure it has the most seismically resilient systems possible. Modification, replacement, and/or relocation of existing infrastructure is critical to ensure that the City can continue to supply water and essential community needs after a major Cascadia Subduction Zone (CSZ) event.

The 2013 ORP has set a target 50-year planning goal for cities to attain the capability to restore critical services within a one-week period after an earthquake, and to be able to restore all services within six months. Valley communities were estimated to take up to a year to restore drinking water services after a major seismic event.  By focusing capital improvement planning toward improving seismic resiliency, the recovery period after such an incident can be significantly reduced.

Although this report focuses primarily on water system resiliency, there are many other infrastructure considerations which should be reviewed by the City to develop a comprehensive resilience plan.  Seismic risk and resiliency should be considered for the following infrastructure:

- Utilities
    - Water System
    - Wastewater System
    - Electricity
    - Communication
    - Natural Gas
- Transportation
    - Local (within the City)
    - Regional (access to the City)
- Administration Buildings
    - Public Safety
    - Fire Department
    - City Hall
    - Schools

# 2 GEOLOGIC AND SEISMIC SETTING

This section outlines the geologic conditions and the potential for seismic activity in the greater area around Lowell. Understanding the geology and seismic potential of the region coupled with the subsurface local conditions outlined in the next section helps to predict possible outcomes local to Lowell. Please see the graphic on the following page detailing fault boundaries.

The area around Lowell was formed by volcanic activity, which began 40 million years ago when the coast ran along what is now the Willamette Valley. Volcanism, caused by intensified subduction, ejected large volumes of ash and lava building up the Western Cascades. Continued volcanic activity occurred along with additional uplift and tilting in the Miocene and Pliocene. In addition, the area has been altered by minor glaciations in the western cascades during the Pleistocene.

Earthquakes in the Pacific Northwest occur in response to active convergence of the Juan de Fuca oceanic plate and the North American continental plate. Plate stresses build with friction between the plates as the Juan de Fuca plate is subducted beneath the continental plate in the Cascadia Subduction Zone (CSZ). Both plates move periodically along fault lines to relieve the stress. This seismic setting generates earthquakes from three primary sources:

- CSZ megathrust events generated along the boundary between the subducting Juan de Fuca plate and the overriding North American plate
- CSZ intraplate or intraslab sources the result of sources within the subducted portion of the Juan de Fuca plate
- Shallow crustal faults

Among these three primary sources, CSZ megathrust events are considered as having the most hazard potential. Recent studies indicate that the CSZ can potentially generate large earthquakes with magnitudes ranging from 8.0 to 9.2 depending on the rupture length. The recurrence intervals for the CSZ events are estimated at approximately 500 years for the mega-magnitude full rupture events (magnitude 9.0 to 9.2), and 200 to 300 years for the large-magnitude partial rupture events (magnitude 8.0 to 8.5).

Current research indicates the region is “past due” based on historic and prehistoric recurrence intervals documented in the ocean sediments. For example, the potential for a CSZ earthquake has an estimated probability of occurrence of 16 to 22 percent over the next 50 years (ORP, 2013).

## 2.1 Ground Shaking


Ground shaking is a hazard created by earthquakes. If the vibrations are strong enough, they may cause damage to buildings, roads, or other structures.

Liquefaction and landslides can be triggered by ground shaking. The rapid and extreme shaking during an earthquake can cause stress and strain in pipelines that can be damaging if the pipe material and joints are not strong enough to withstand the transient ground deformations. Damage from ground shaking occurs even when there is no peak ground displacement (PGD). The intensity of ground shaking can be quantified by measuring the peak ground velocity (PGV) at a site because of an earthquake.

Ground shaking varies depending on the soil, the topography, and the location and orientation of the rupture. Ground shaking is one hazard that causes damage to buried pipes. Most of the City lies on silty clay loams. During an earthquake the City will experience amplified ground shaking due to these soft soils. Soft soil amplifies shear waves, making reservoirs and pipelines at a higher risk for failure. Many pipelines throughout the City are at high risk of damage due to ground shaking.

## 2.2 Liquefaction

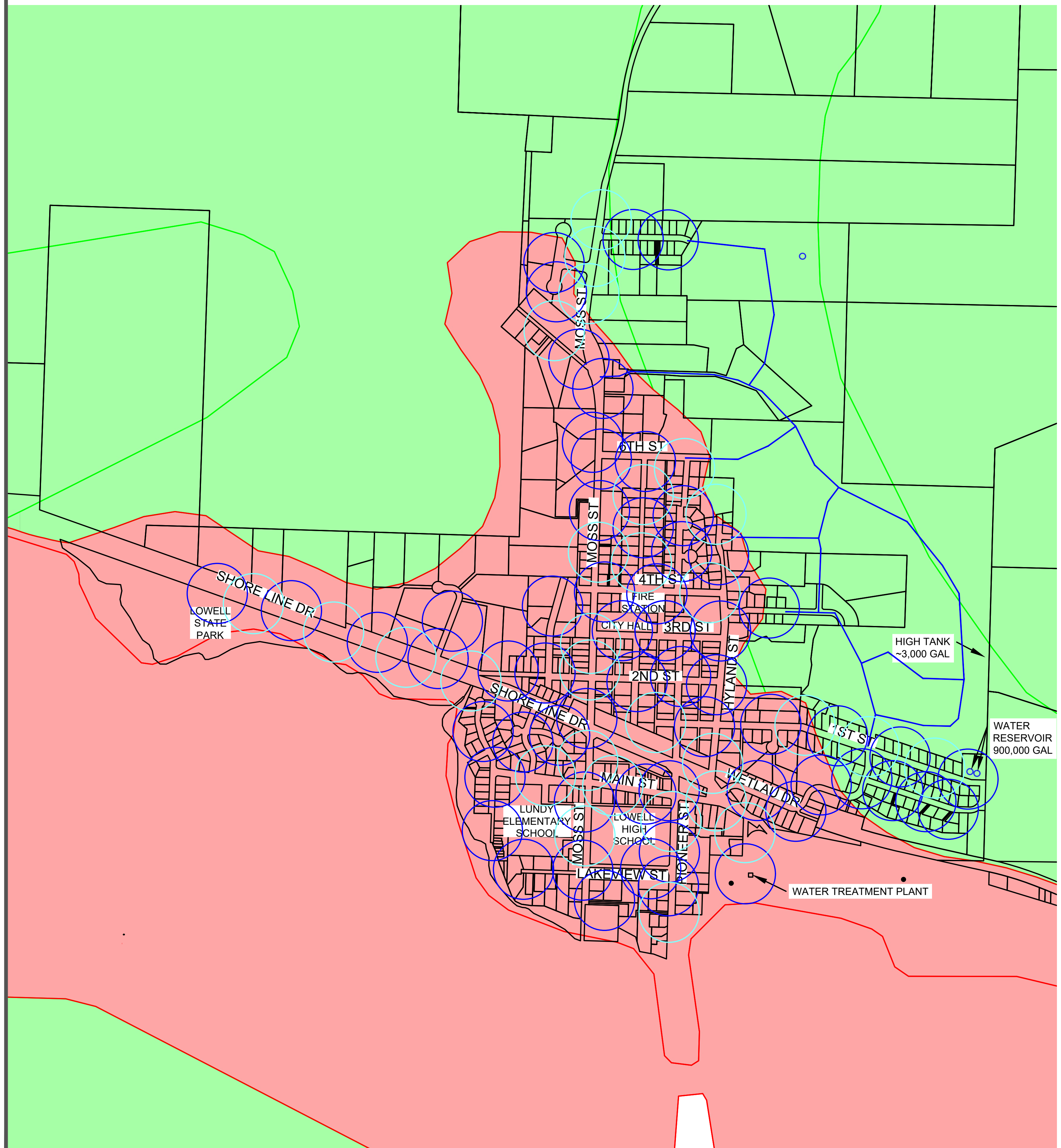
Liquefaction during the 1964 Niigata M7.6 earthquake, Honshu, Japan caused major foundation failure in these apartment blocks.
*Image from WikiCommons.*

Liquefaction occurs in loose, saturated, granular soils during strong, prolonged seismic shaking. During this phenomenon the strength and stiffness of the soil decreases and may cause infrastructure to sink and collapse due to the lack of soil stability. The results of soil liquefaction include loss of shear strength, loss of soil materials through sand boils or flow, flotation of buried chambers/pipes, and post-liquefaction reconsolidation (settlement). During liquefaction silt and sand is compacted and pore water is displaced, causing an upward force. If the soil is saturated this force can push buried pipe upwards out of the soil.

Lateral spreading typically follows liquefaction and causes permanent soil deformation. In combination, these two hazards may push the pipeline upwards while sliding down a slope causing multiple points of failure. It is likely the City will see severe destruction to buried pipes if liquefaction and lateral spreading were to occur.

All water infrastructure in these liquefiable zones are vulnerable to damage resulting from displacement caused by liquefaction. Most of the City is in the highest risk zone for liquefaction, please see Figure 2.2 on the following page.

The burial depth of pipes can also affect how pipes react to hazards in an earthquake situation. The shallower the burial, the less overburdened it is, lowering the frictional resistance from the soil on the pipe. Burial depth should be a factor in any new construction of water mains or water lines in the City to minimize this risk.




LIQUEFACTION SUSCEPTIBILITY - 1

LIQUEFACTION SUSCEPTIBILITY - 3

Civil West Engineering Services, Inc.

CITY OF LOWELL
LANE COUNTY, OR

LIQUEFACTION SUSCEPTIBILITY

2022 WATER MASTER PLAN

0 1"
NTS

DRAWN BY: ERM
DATE: XX 2022

FIGURE
2.2

DATE:6/20/22 FILE:O:\CW_Projects\2101 Lowell\2101-020 Water Master Plan\04 Study\Drawings\Dwg\SRAMP FIGURES.dwg

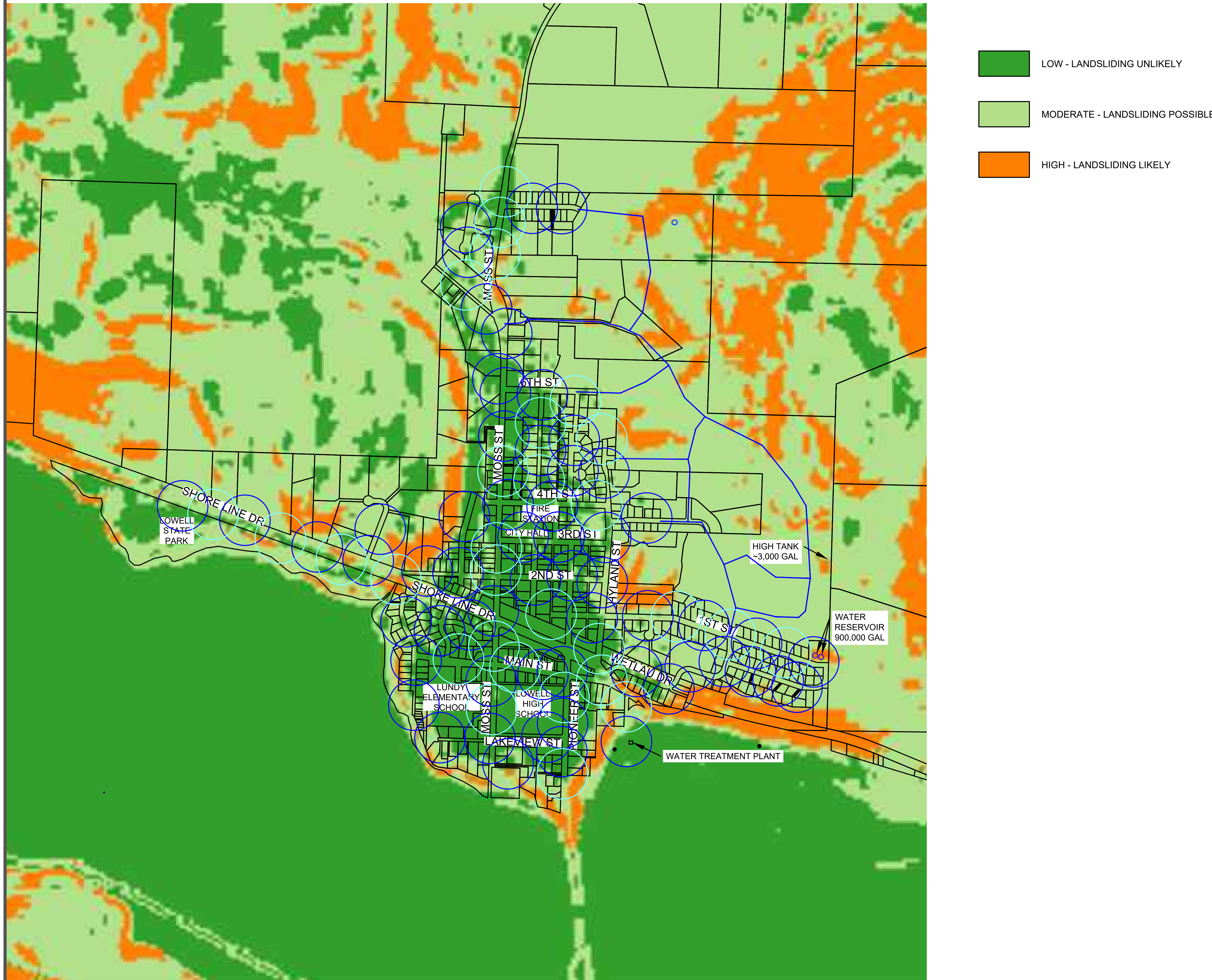
## 2.3 Landslides

Residents of Oregon are familiar with the existing roadway hazards due to rockfalls and landslides. The sheer number of landslides and rockfalls that will be triggered by the strong ground shaking that a M 9.0 seismic event will generate are unimaginable. Landslides permanently deform soil mass, causing severe damage to buried pipes. Most of the City is in a low to moderate landslide hazard area. However, the hills around the City range from moderate to very high.

Landslides occur when ground shaking destabilizes cliffs or slopes causing rock, soil, and any existing infrastructure on the slopes to fall. Earthquake-induced landslides can occur on slopes when inertial forces from an earthquake add dynamic loading to a slope. The ground movement caused by landslides can be extremely large and damaging to pipelines, reservoirs, and other facilities. The areas that are at the highest risk within the City are along the edge of the reservoir to the South and West and the neighborhoods constructed along the hillsides to the East.

## 2.4 Lateral Spread

During earthquake shaking, the ground may move laterally causing blocks of land to move in the same direction. Generally, this occurs near a slope but can occur anywhere there are soils underlain with a weak foundation. Lateral spreading will crack and stretches the ground surface. Liquefaction can result in progressive deformation of the ground known as lateral spreading. The lateral movement of liquefied soil breaks the non-liquefied soil crust into blocks that progressively move downslope or toward a free face in response to the earthquake-generated ground accelerations. Ground accelerations incrementally push these blocks downslope, accumulating displacement with each seismic shear pulse that is large enough to overcome the strength of the liquefied soil column. The potential for lateral spreading depends on the liquefaction potential of the soil, magnitude and duration of earthquake ground accelerations, post-liquefaction or strain softened shear strength of the soil, and site topography. Most of the lateral spreading hazard exists along the lower laying areas in town. The potential for significant lateral spreading displacements in this zone is due primarily to the ground consisting of liquefiable, finer-grained soils.




Civil West Engineering Services, Inc.

CITY OF LOWELL
LANE COUNTY, OR

LANDSLIDE SUSCEPTIBILITY

2022 WATER MASTER PLAN

0 1"

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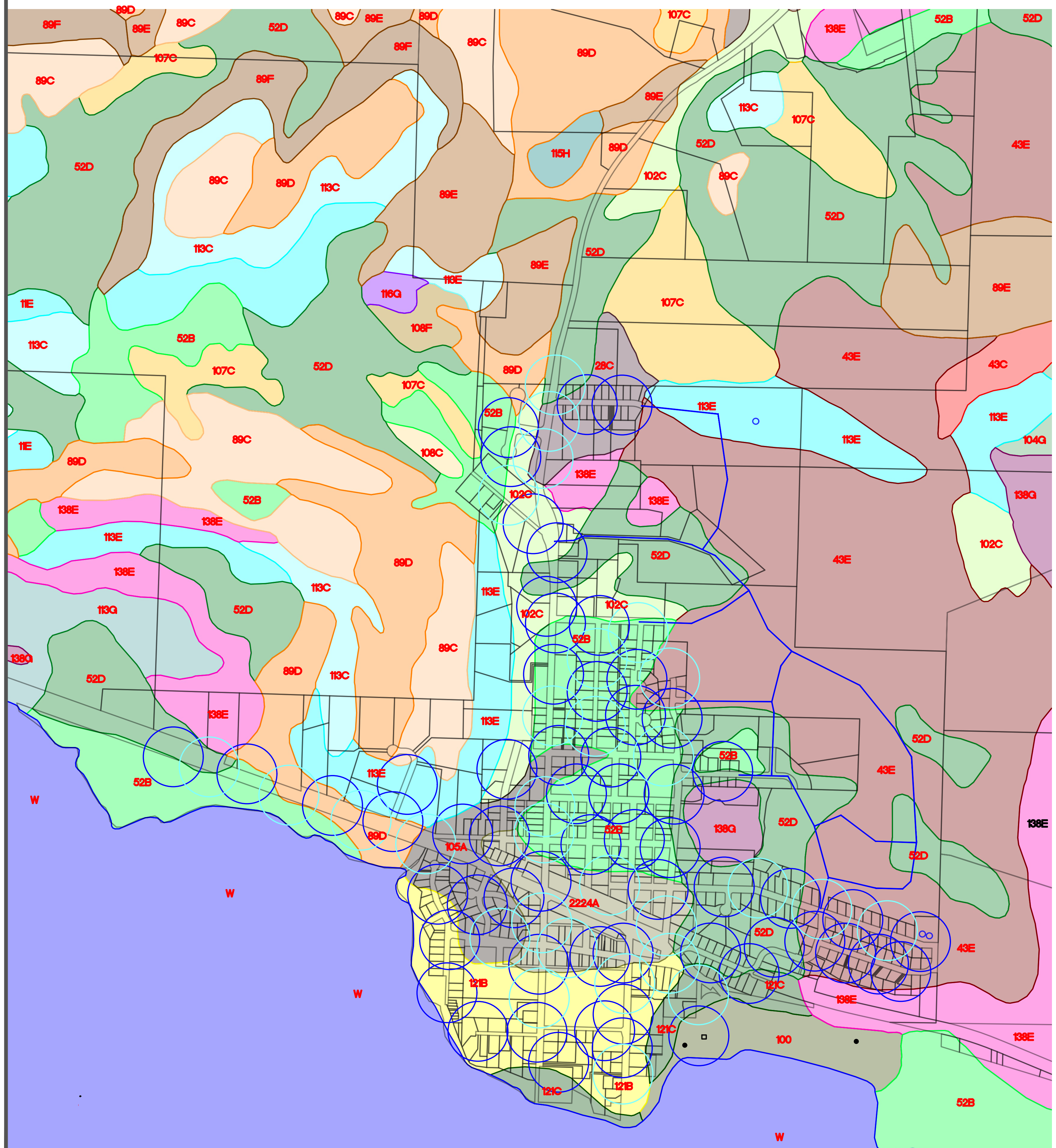
FIGURE 2.4

DATE:6/20/22 FILE:O:\CW_Projects\2101 Lowell\2101-020 Water Master Plan\04 Study\Drawings\Dwg\SRAMP FIGURES.dwg

# 3 SUBSURFACE CONDITIONS

The NRCS Soil Survey shows that the predominant soils in the study area are Dixonville Philomath Hazelhair complex, Hazelhair silty loam, and Nekia Silty clay loam. The subsurface conditions may vary across the alignment of the distribution system but can be grouped into four generalized zones based on the prominent geologic conditions. Groundwater levels are variable and change with the seasons and rainfall. Please see the map and legend on the following pages detailing soil types throughout the City.

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 11E | BELLPINE SILTY CLAY LOAM, 20 TO 30 PERCENT SLOPES | 5 | 0.2% |
| 28C | CHEHULPUM SILT LOAM, 3 TO 12 PERCENT SLOPES | 16 | 0.8% |
| 43C | DIXONVILLE-PHILOMATH-HAZELAIR COMPLEX, 3 TO 12 PERCENT SLOPES | 10 | 0.5% |
| 43E | DIXONVILLE-PHILOMATH-HAZELAIR COMPLEX, 12 TO 35 PERCENT SLOPES | 286 | 13.4% |
| 52B | HAZELAIR SILTY CLAY LOAM, 2 TO 7 PERCENT SLOPES | 150 | 7.0% |
| 52D | HAZELAIR SILTY CLAY LOAM, 7 TO 20 PERCENT SLOPES | 298 | 13.9% |
| 89C | NEKIA SILTY CLAY LOAM, 2 TO 12 PERCENT SLOPES | 91 | 4.2% |
| 89D | NEKIA SILTY CLAY LOAM, 12 TO 20 PERCENT SLOPES | 130 | 6.1% |
| 89E | NEKIA SILTY CLAY LOAM, 20 TO 30 PERCENT SLOPES | 72 | 3.3% |
| 89F | NEKIA SILTY CLAY LOAM, 30 TO 50 PERCENT SLOPES | 59 | 2.7% |
| 100 | OXLEY GRAVELLY SILT LOAM | 18 | 0.9% |
| 102C | PANTHER SILTY CLAY LOAM, 2 TO 12 PERCENT SLOPES | 52 | 2.4% |
| 104G | PEAVINE SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES | 2 | 0.1% |
| 105A | PENGRA SILT LOAM, 1 TO 4 PERCENT SLOPES | 23 | 1.1% |
| 107C | PHILOMATH SILTY CLAY, 3 TO 12 PERCENT SLOPES | 64 | 3.0% |
| 108C | PHILOMATH COBBLY SILTY CLAY, 3 TO 12 PERCENT SLOPES | 3 | 0.1% |
| 108F | PHILOMATH COBBLY SILTY CLAY, 12 TO 45 PERCENT SLOPES | 6 | 0.3% |
| 113C | RITNER COBBLY SILTY CLAY LOAM, 2 TO 12 PERCENT SLOPES | 59 | 2.7% |
| 113E | RITNER COBBLY SILTY CLAY LOAM, 12 TO 30 PERCENT SLOPES | 98 | 4.6% |
| 113G | RITNER COBBLY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES | 219 | 10.2% |
| 115H | ROCK OUTCROP-KILCHIS COMPLEX, 30 TO 90 PERCENT SLOPES | 5 | 0.2% |
| 116G | ROCK OUTCROP-WITZEL COMPLEX, 10 TO 70 PERCENT SLOPES | 3 | 0.1% |
| 121B | SALKUM SILTY CLAY LOAM, 2 TO 8 PERCENT SLOPES | 47 | 2.2% |
| 121C | SALKUM SILTY CLAY LOAM, 8 TO 16 PERCENT SLOPES | 16 | 0.7% |
| 138E | WITZEL VERY COBBLY LOAM, 3 TO 30 PERCENT SLOPES | 78 | 3.6% |
| 138G | WITZEL VERY COBBLY LOAM, 30 TO 75 PERCENT SLOPES | 18 | 0.8% |
| 2224A | COURTNEY GRAVELLY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES | 29 | 1.3% |
| W | WATER | 288 | 13.4% |




| | |
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| W | WATER |

| MAP UNIT SYMBOL | MAP UNIT NAME | ACRES IN AOI | PERCENT OF AOI |
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| W | WATER | 288 | 13.4% |

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CITY OF LOWELL
LANE COUNTY, OR

SOIL TYPE MAP
2022 WATER MASTER PLAN

0 1"
NTS

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DATE: JAN. 2022

FIGURE 3

DATE:6/20/22 FILE:O:\CW_Projects\2101 Lowell\2101-020 Water Master Plan\04 Study\Drawings\Dwg\SRAMP FIGURES.dwg

# 4 PLANNING CRITERIA

Planning criteria was based on the Oregon Resilience Plan Target States of Recovery: Water & Wastewater Sector of the Valley and are as follows:

| DOMESTIC WATER SUPPLY | EVENT OCCURS | 0-24 HOURS | 1-3 DAYS | 3-7 DAYS | 1-2 WEEKS | 2 WEEKS-1 MONTH | 1-3 MONTHS | 3-6 MONTHS | 6 MONTHS - 1 YEAR | 1-3 YEARS | 3 + YEARS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| POTABLE WATER AVAILABLE AT SOURCE (WTP, WELLS, IMPOUNDMENT) | | R | Y | | G | | | X | | | |
| MAIN TRANSMISSION FACILITIES, PIPE, PUMP STATIONS, AND RESERVOIRS (BACKBONE) OPERATIONAL | | G | | | | | X | | | | |
| WATER SUPPLY TO CRITICAL FACILITIES AVAILABLE | | Y | G | | | | X | | | | |
| WATER FOR FIRE SUPPRESSION AT KEY SUPPLY POINTS | | G | | | | | | | | | |
| WATER FOR FIRE SUPPRESSION AT FIRE HYDRANTS | | | | R | Y | G | | | X | | |
| WATER AVAILABLE AT COMMUNITY DISTRIBUTION CENTERS/POINTS | | | Y | G | | | | | | | |
| DISTRIBUTION SYSTEM OPERATIONAL | | | R | Y | G | | | | X | | |
| **WASTEWATER SYSTEMS** | **EVENT OCCURS** | **0-24 HOURS** | **1-3 DAYS** | **3-7 DAYS** | **1-2 WEEKS** | **2 WEEKS-1 MONTH** | **1-3 MONTHS** | **3-6 MONTHS** | **6 MONTHS - 1 YEAR** | **1-3 YEARS** | **3 + YEARS** |
| THREATS TO PUBLIC HEALTH & SAFETY CONTROLLED | | | R | Y | | G | | | X | | |
| RAW SEWAGE CONTAINED & ROUTED AWAY FROM POPULATION | | R | | Y | | | G | | X | | |
| TREATMENT PLANTS OPERATIONAL TO MEET REGULATORY REQUIREMENTS | | | | | R | | | Y | G | | X |
| MAJOR TRUNK LINES AND PUMP STATIONS OPERATIONAL | | | | | R | | Y | G | | | X |
| COLLECTION SYSTEM OPERATIONAL | | | | | | | R | Y | G | X | |

| | |
|---|---|
| DESIRED TIME TO RESTORE COMPONENT TO 80-90% OPERATIONAL | G |
| DESIRED TIME TO RESTORE COMPONENT TO 50-60% OPERATIONAL | Y |
| DESIRED TIME TO RESTORE COMPOENT TO 20-30% OPERATIONAL | R |
| CURRENT STATE (90% OPERATIONAL) | X |

*FIGURE 4 - ORP TARGET STATES OF RECOVERY*

From the 2013 ORP:

*"Re-establishing water and wastewater service will be a crucial element in the overall recovery of communities after a Cascadia subduction zone earthquake.*

*Water for fire suppression, first aid, emergency response, and community use, as well as water for normal health and hygiene, will be required soon after the event.*

*The time required to re-establish water and wastewater services will depend largely on the pre-event condition of the systems, the actual intensity and duration of the event, the size and complexity of the systems, and the availability of staff and the financial and material resources needed to complete repairs.*

*In addition, damage to other infrastructure, such as transportation, communications, fuel, and power systems, may control the time required to restore water and wastewater facilities."*

As stated, the timeline to restore facilities depends on the condition and complexity of the existing system as well as the impact of the seismic event. No amount of preparation or planning can change the characteristics of the seismic event, so every effort must be made to develop infrastructure to be as resilient to the design event (Cascadia subduction zone event) as is feasibly possible. Doing so will address current deficiencies and upgrade the system components to be better able withstand the design event.

# 5 SEISMIC RISK ASSESSMENT AND MITIGATION

The intent of this document is to identify, assess, and plan to upgrade or relocate the existing critical facilities and infrastructure necessary to supply the City post-Cascadia Subduction Zone (CSZ) 9.0 event with:

- Clean Drinking Water
- Fire Suppression
- Health Care and Fire Aid
- Emergency Response

The goal of the risk assessment recommendations is to both maintain the above services and to create a disaster resilient water system infrastructure backbone including:

- Water Supply
- Water Treatment
- Water Distribution
- Water Storage

The backbone components listed above shall be capable of supplying water for essential needs to residents after a seismic event while the larger (non-backbone) system is being addressed. This section will also evaluate the likelihood and consequences of seismic induced failures for critical facilities.

## 5.1 Water System Distribution System Assessment

The water system backbone consists of system components required to provide the most basic of services identified above.  For the City, the backbone of the existing water system includes:

- Water Treatment Plant
- Pipeline from the WTP to the Reservoirs
- Reservoirs

- Pipeline from the Reservoirs to Hyland Ln. and north to 4th St.
- Pipeline from Hyland Ln. to Pioneer St. and south to Lakeview St.
- Supply lines to critical service centers, such as City Hall, the Fire Station, and the Elementary School and High School

The backbone infrastructure is highlighted on the water system map at the end of this section. This section will analyze the ability of the existing backbone infrastructure to withstand a CSZ event. The capacity to withstand a CSZ event is dependent on the system attributes, including:

- Pipeline Material
- Pipeline Diameter
- Pipeline Joint Type
- Depth of bury
- Location and type of valves
- Type of Soil
- Reservoir Size, Shape, and Construction Methods

### 5.1.1 Transmission Pipeline Backbone

The existing water system backbone pipeline is approximately 2 miles long and consists of multiple pipe diameters and materials.

#### *5.1.1.1 Transmission Pipeline Vulnerabilities*

Pipe materials used in the current water distribution system include Asbestos Cement (AC) Pipe, multiple classes of Polyvinyl Chloride (PVC) pipe, cast iron, steel and High-Density Polyethylene (HDPE). Different pipe materials have varying abilities to withstand seismic events. AC pipe is considered a rigid pipe. Rigid pipes are better able to handle loading without deforming, but do not have the capability to flex during ground movement. PVC, while considered a flexible pipe, is generally installed with non-restrained joints, meaning it is susceptible to pulling apart during ground movement. HDPE is the most flexible pipe material commonly used for water transmission and distribution, and is generally welded together, meaning it is a fully restrained pipe. HPDE is widely recognized as the most resistant to ground movement.

Unfortunately, the existing backbone consists of PVC and AC pipe. Both PVC and AC pipe are considered among the least seismically-resistant materials used for transmission pipelines. Some characteristics of a successful and reliable backbone pipeline system include having larger diameters and fewer interconnections (fewer laterals and fewer service connections). The identified backbone does not necessarily reflect these attributes, as many lateral connections and services are connected to the backbone. The current route of the backbone is vulnerable to damage due to its location in the City. The development of the backbone was built as the City grew, and winds through residential areas.

### 5.1.2 Water Sources

The sole source of water for the City is the Middle Fork Willamette River. Water is drawn from the Dexter Reservoir. The water intake pipe is approximately 2500' feet of 10-in PVC and is included as a portion of the backbone for the purposes of this analysis. This the sole source currently being used by the City. The City also has several wells that are not currently used.

#### *5.1.2.1 Source Vulnerabilities*

The water intake is within the original flowline of the river, such that if the reservoir drained the intake should still be able to draw water. However, the intake pipe is 10" PVC and there is a risk that the intake pipe itself could fail.

### 5.1.3 Treatment

The Lowell Water Treatment Plant is a conventional rapid media filter plant. The basic plant processes include chemical coagulation, mechanical flocculation, tube-settler sedimentation, dual-media filtration, and chemical disinfection and conditioning.

#### *5.1.3.1 Treatment Vulnerabilities*

The Water Treatment Plant media filter is a large concrete structure. Since concrete is a rigid structure, it is susceptible to damage during an earthquake and could break apart. Depending on the level of damage, this could render the water treatment plant inoperable. The WTP uses pumps for both water intake and sending water to the reservoirs. These pumps, are vulnerable to electricity loss. The Water Treatment Plant has an onsite generator, but the finite supply of fuel for the generator is not likely to be enough to last until roads are open enough for fuel delivery.

### 5.1.4 Treated Water Storage

The City has two storage tanks as reservoirs for treated water, which have a combined capacity of 0.9 MG. These reservoirs are considered part of the water system backbone.

#### *5.1.4.1 Treated Water Storage Vulnerabilities*

Water from the reservoirs flows via gravity to the distribution system via PVC pipe. If the reservoir supply line was damaged due to a seismic event the reservoirs would drain completely. There are currently no seismically activated shut-off valves on either of the reservoirs to limit water loss.

##### *5.1.4.1.1 Reservoirs*

The City currently uses a 440,000-gallon glass-fused to steel tank, and an older 460,000-gallon concrete tank for water storage. The two tanks sit adjacent to each other on a lot north of the intersection of East 1st Street and Sunridge Lane. The tanks share a base elevation of ~922'. The tanks can both be filled to approximately 952' while leaving two feet available for freeboard.

Neither tank has a seismically activated shut off valve and they are built in an area that was identified to have a high landslide risk.

### 5.1.5 Distribution

Distribution main line pipes range in size from 2-inches to 12-inches in diameter. See the tables below for the various diameters of pipe and the total length of each pipe size in the distribution system. Most of the distribution mainlines are 6-inch diameter pipe or greater.

Approximately 65% of pipes in the distribution system are made of PVC. The remaining 35% of the distribution mains are made up of AC and steel pipe. The AC pipe sections have likely reached the end of their service life, 60 years. Compounding the service life issue, both AC and PVC, even when new, are among the least seismically-resistant piping materials. The table below provides a summary broken down by size and percent of distribution mains composed of the referenced material.

Table 5.1.5 - Pipe *DISTRIBUTION BY* material *AND SIZE* in distribution system

| | | **DIAMETER (IN)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **2** | **4** | **6** | **8** | **10** | **12** | **TOTAL** |
| **PIPE MATERIAL** | **PVC** | 2,645 | 1,380 | 10,345 | 4,305 | - | 9,240 | **27,915** |
| | **STEEL** | - | 1,830 | 510 | 1,710 | - | - | **4,050** |
| | **AC** | - | - | 9,595 | - | 1,745 | - | **11,340** |
| | **TOTAL** | **2,645** | **3,210** | **20,450** | **6,015** | **1,745** | **9,240** | **43,305** |

| | | **DIAMETER (IN)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **2** | **4** | **6** | **8** | **10** | **12** | **TOTAL** |
| **PIPE MATERIAL** | **PVC** | 6.1% | 3.2% | 23.9% | 9.9% | - | 21.3% | **64.5%** |
| | **STEEL** | - | 4.2% | 1.2% | 3.9% | - | - | **9.4%** |
| | **AC** | - | - | 22.2% | - | 4.0% | - | **26.2%** |
| | **TOTAL** | **6.1%** | **7.4%** | **47.2%** | **13.9%** | **4.0%** | **21.3%** | **100%** |

#### 5.1.5.1 Distribution System Vulnerabilities

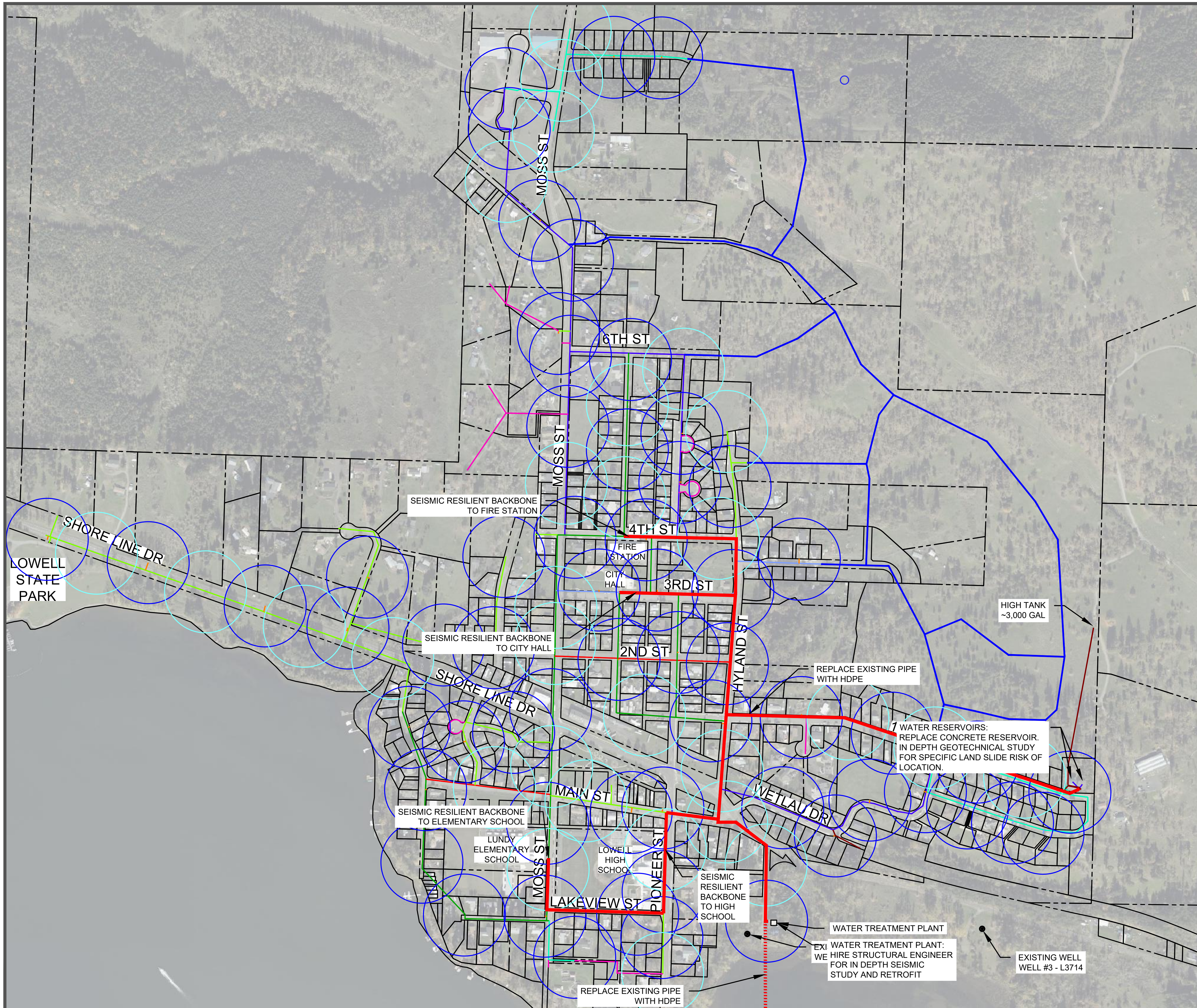
Distribution system vulnerabilities are the same as transmission system vulnerabilities in that rigid or unrestrained pipes are particularly vulnerable to ground movement. Compounding the concern with pipe material is that smaller pipes are more likely to fail during ground movement.

## 5.2 Backbone Risk

The existing backbone has several significant risks. The existing backbone is constructed of AC and PVC pipe, which are both known to be very susceptible to damage in a seismic event. The sole water storage tanks are constructed in or downslope of an area that has been identified as having a high risk of landslide. In addition, the core of the town has a high risk of liquefaction, leading to increased risk and severity of ground displacement, pipe breakage, and general damage.

## 5.3 Fire and EMT Services

The fire station at 389 N Pioneer St. The fire station is in an area with high liquefaction susceptibility and low landslide risk.




- 2 IN GALVANIZED STEEL
- 2 IN PVC
- 4 IN CAST IRON
- 4 IN PVC
- 6 IN AC
- 6 IN STEEL
- 8 IN PVC
- 8 IN STEEL
- 10 IN AC
- 12 IN PVC
- HDPE BACKBONE
- HDPE SOURCE WATER INTAKE

## HDPE PIPE REPLACEMENT

| DESCRIPTION | APPROX. LENGTH (ft) |
|---|---|
| HDPE SOURCE WATER INTAKE | 2500 |
| HDPE BACKBONE | 8500 |

Civil West Engineering Services, Inc.

CITY OF LOWELL
LANE COUNTY, OR

SRAMP CIP
2022 WATER MASTER PLAN

0 — 600' — 1"

DRAWN BY: ERM
DATE: JAN. 2022

FIGURE 5.1

DATE:6/20/22 FILE:O:\CW_Projects\2101 Lowell\2101-020 Water Master Plan\04 Study\Drawings\Dwg\SRAMP FIGURES.dwg

# 6 MITIGATION PLAN

This Mitigation Plan is an effort to reduce loss of life and property by lessening the impact of a seismic disaster. To be effective, mitigation must address difficult realities, and invest in long-term goals. Taking action prior to an event will ensure the community will be safer, financially secure and self-reliant.

This section discusses considerations for mitigating risks of water system damage. Various strategies for mitigating the risks in the water system can be considered. An effort should be made to examine and align strategies with long-term asset management, Capital Improvement Plan (CIP) development, future growth plans, and operations and maintenance.

The goal of mitigation planning should be to:

- Protect life and reduce injuries resulting from natural hazards.
- Minimize public and private property damages and the disruption of essential infrastructure and services from natural hazards.
- Identify capital improvement projects.
- Give recommendations for further study or analysis.
- Schedule when mitigation efforts will be completed.
- Document and evaluate the City's progress in achieving hazard mitigation.

Per OHA requirements, this mitigation plan consists of projects that are recommended to be completed over the next 50 years to upgrade, retrofit, and rebuild facilities so that they will continue to provide water following a Cascadia subduction zone earthquake.

## 6.1 Backbone Pipeline Mitigation

As identified in Section 5.1.1 the existing pipeline backbone is vulnerable due to pipeline materials, connections, and location. To mitigate these vulnerabilities, it is recommended to construct a new backbone pipeline system using HPDE pipe.

The backbone pipeline should have valving strategically placed to allow area isolation in the event of a break. Connections to the distribution system should also be valved. Figure 6, at the end of this section, shows a map of the City with this new backbone identified. Capital Improvement #1, described in additional detail in Section 7.1, facilitates this mitigation recommendation.

## 6.2 Water Source Mitigation

As identified in section 5.1.2 the City has a single water source, the Willamette River within Dexter Reservoir. It is recommended that the city replace the existing intake pipeline with HDPE.

## 6.3 Water Treatment Plant Mitigation

The Water Treatment Plant was constructed in 1969. It is recommended that the City hire a structural engineer to assess the water treatment plant and recommend seismic retrofits. Any further expansion or construction at the Water Treatment Plant should be constructed to seismic code, and include disaster resilience and recovery in the design and construction.

## 6.4 Water Storage Mitigation

Currently only one of the two reservoirs is compliant with seismic code, the newer glass-fused steel reservoir was constructed in 2012, the older concrete reservoir was constructed in 1992. Both reservoirs are considered part of the backbone and are required for storage during and after seismic event. Due to the age and construction of the concrete reservoir, it is unlikely to withstand a minor seismic event let alone the CSZ event. It is recommended that the older concrete reservoir be replaced with a seismic code compliant reservoir. Both reservoirs are sited in a location that is either on or immediately below an area that has been identified as having a high landslide risk. It is recommended that a geotechnical investigation of the tank location be conducted to determine the specific risk. A new water reservoir is recommended in the WMP Capital Improvements Plan. It is recommended that this new tank be constructed and sited with a CSZ level seismic event in mind.

## 6.5 Distribution System Mitigation

Other than infrastructure serving critical facilities, much of the periphery of the distribution system is not identified as part of the backbone of the water system. However, mitigation of non-critical distribution system vulnerabilities will reduce the cost and time to return the full system to full operation. We recommend that non-critical distribution system line replacements be made with seismically resilient materials, such as HDPE.

## 6.6 System redundancy

Redundancy, whether it be parallel water transmission mains, or multiple water sources, has the potential to significantly increase the resiliency of the system. In some cases, it may be beneficial to increase water system reliability by building system redundancy. When future growth may be anticipated, creating parallel pipelines and system “looping” to provide additional pathways around high-hazard areas may provide benefits in planning areas. Redundant, and strategically located valves will allow the City the ability to isolate section of the system where pipe breaks may occur to minimize water loss while also minimizing the services without water.

## 6.7 Repair capability

In cases/areas where pipeline damage is likely, enhancing pipeline repair capabilities will be beneficial to recover efficiently and get critical portions of the water system back in operation quickly. This includes the stockpiling of pipelines, repair clamps, and appurtenances in various sizes, and needed equipment and materials. It is further recommended that the City stock approximately 3% of each size pipe and enough adaptors and repair clamps to repair 30 pipe breaks. This stock can be cycled through the annual pipe replacement as identified above, but additional pipe should be purchased so that there is always approximately 3% of the entire system ready for emergency pipe repairs and replacements.

## 6.8 Geotechnical study

More detailed and localized geotechnical study may help confirm and validate the seismic hazards assumed in this evaluation. High peak ground displacements (PGD), up to 24 inches, are estimated and assumed in some areas. More information on the severity of seismic-related hazards may yield more beneficial mitigation planning.

## 6.9 Critical Services

In previous sections, it was identified that water service which serves critical infrastructure should be as seismically resilient as feasible and included as “backbone” infrastructure. The critical facilities themselves should be improved to increase seismic resiliency.

## 6.10 Earthquake Recovery Operations, Plans, and Procedures

The City of Lowell does not currently have a Natural Hazards Mitigation Plan or an Emergency Management Plan to outline pre-event planning and after-event actions. It is recommended that the City assemble and adopt these planning documents.

## 6.11 Emergency training and exercises

Emergency training and exercises focused on earthquake scenarios may enhance the City's emergency preparedness. Training on National Incident Management System (NIMS) and the Incident Command System (ICS) help ensure compliance with Federal Emergency Management Agency (FEMA) directives. While a range of exercises, from workshops to tabletop exercises to full scale exercises provide forums for staff to share insight, endorse co-ordination, practice emergency response. It is recommended that exercises adhere to the Department of Homeland Security Exercise and Evaluation Guide.

# APPENDIX WMCP

# WATER MANAGEMENT AND CONSERVATION PLAN


DRAFT FOR OWRD REVIEW

# Water Management and Conservation Plan

## City of Lowell

Lowell

Septembe 2022

Prepared by:
**GSI Water Solutions, Inc.**
1600 SW Western Boulevard, Suite 240, Corvallis, OR 97333

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# Contents

## Index of Exhibits



## Appendices

# 1. Municipal Water Supplier Plan Elements

*This section satisfies the requirements of Oregon Administrative Rules (OAR) 690-086-0125.*

*This rule requires a list of affected local government to whom the plan was made available, and a proposed date for submittal of an updated plan.*

## 1.1 Introduction

The City of Lowell (City) is located on the north shore of Dexter Reservoir on the Middle Fork Willamette River in Lane County, Oregon. The City provides public utility services to residents and businesses including the provision of drinking water. The City's Public Water System Identification number is 41-00492.

The purpose of this Water Management and Conservation Plan (WMCP) is to describe the development and implementation of water management and conservation policies and programs that ensure sustainable water use. This Plan also discusses the City's future water needs.

## 1.2 Plan Requirement

This is the City's second WMCP. For the City's first WMCP, the Oregon Water Resources Department (OWRD) required the City to submit a work plan to fully meet the WMCP rule requirements. Following review of the work plan, OWRD issued a final order approving the City's WMCP and associated work plan on December 29, 2004. The final order included a requirement for the City to submit an updated WMCP by October 1, 2009, incorporating the results of the activities in the work plan. This WMCP fulfills the requirement for the City to submit an update of the City's 2004 WMCP.

## 1.3 Plan Organization

This WMCP describes water management, water conservation, and curtailment programs to guide the efficient development and use of the City's water supply to meet its customers' needs. The plan is organized into the following sections, each addressing specific sections of OAR Chapter 690, Division 86. Section 2 is an evaluation of the City's water supply, water use, water rights, and water system. The information developed and provided in Section 2 forms the foundation for the sections that follow. Section 3 discusses the City's current water conservation measures and presents benchmarks for future efforts. Section 4 describes the City's curtailment history and guides future actions when curtailment is necessary. Section 5 draws on information in the preceding sections to outline the City's future water supply needs and how it intends to use available water sources to meet future demand.

This WMCP was developed in tandem with the City's 2022 Water System Master Plan (WSMP) and draws relevant information from the WSMP, in addition to other sources provided or referenced by the City.

| Section | Requirement |
|---|---|
| Section 1 – Municipal Water Supplier Plan Elements | *OAR 690-086-0125* |
| Section 2 – Municipal Water Suppliers Descriptions | *OAR 690-086-0140* |
| Section 3 – Municipal Water Conservation Element | *OAR 690-086-0150* |
| Section 4 – Municipal Water Curtailment Element | *OAR 690-086-0160* |
| Section 5 – Municipal Water Supply Element | *OAR 690-086-0170* |

## 1.4 Affected Local Governments

### *OAR 690-086-0125(5)*

The following governmental agencies may be affected by this WMCP:

- Lane County

The letter requesting comments from the local government agency and any response is found in Appendix A.

## 1.5 Plan Update Schedule

### *OAR 690-086-1025(6)*

The City anticipates submitting an update of this WMCP within 10 years of OWRD's final order approving the plan. As required by OAR Chapter 690, Division 86, a progress report will be submitted within 5 years of the final order.

## 1.6 Time Extension

### *OAR 690-086-0125(7)*

The City is not requesting an extension of time to implement metering or a benchmark established in a previously approved WMCP.

# 2. Municipal Water Supplier Description

*This section satisfies the requirements of OAR 690-086-0140.*

*This rule requires descriptions of the water supplier's water sources, service area and population, water rights, and adequacy and reliability of the existing water supply. The rule also requires descriptions of the water supplier's customers and their water use, the water system, interconnections with other water suppliers, and quantification of water loss.*

## 2.1 Terminology

The following terminology is used in this WMCP.

*Consumption* is equal to metered water use and unmetered, authorized water uses (e.g. system flushing).

*Demand or System Demand* refers to the quantity of treated water produced at the City's water treatment plant (WTP). Production is equivalent to "demand". Demand includes the sum total of metered consumption (for example, residential, commercial, industrial, public, and irrigation customers), unmetered public uses (firefighting, hydrant flushing, other), and water lost to leakage, reservoir overflow, evaporation, and other factors.

Generally, production and consumption in municipal and quasi-municipal systems are expressed in units of mgd, but also may be expressed in cubic feet per second (cfs) or gallons per minute (gpm). One mgd is equivalent to 1.55 cfs or 694 gpm. For annual or monthly values, a quantity of water is typically reported in million gallons (MG). Water use per person (per capita use) is expressed in gallons per capita per day (gpcd).

The following terms are used to describe specific values of system demands:

- Average day demand (ADD) equals the total annual production divided by 365 days.
- Maximum day demand (MDD) equals the highest system demand that occurs on any single day during a calendar year. It is also called the one-day MDD or peak day demand.
- Peaking factors are the ratios of one demand value to another. The most common and important peaking factors are the ratio of the MDD to the ADD and the ratio of peak hour demand to MDD.

## 2.2 Water Sources

### *OAR 690-086-0140(1)*

To meet demand, the City has historically relied on the use of groundwater and surface water. Following a multi-year period in which the City relied on its wells to meet demand, the City discontinued use of these wells in approximately 2008 due to water quality issues and transitioned to the use of surface water from the Middle Fork Willamette River to meet demands. The City has continued to utilize this source to present and the City's wells serve as emergency supply.

## 2.3 Interconnections with Other Systems

### *OAR 690-086-0140(7)*

The City does not have any interconnections with other water systems.

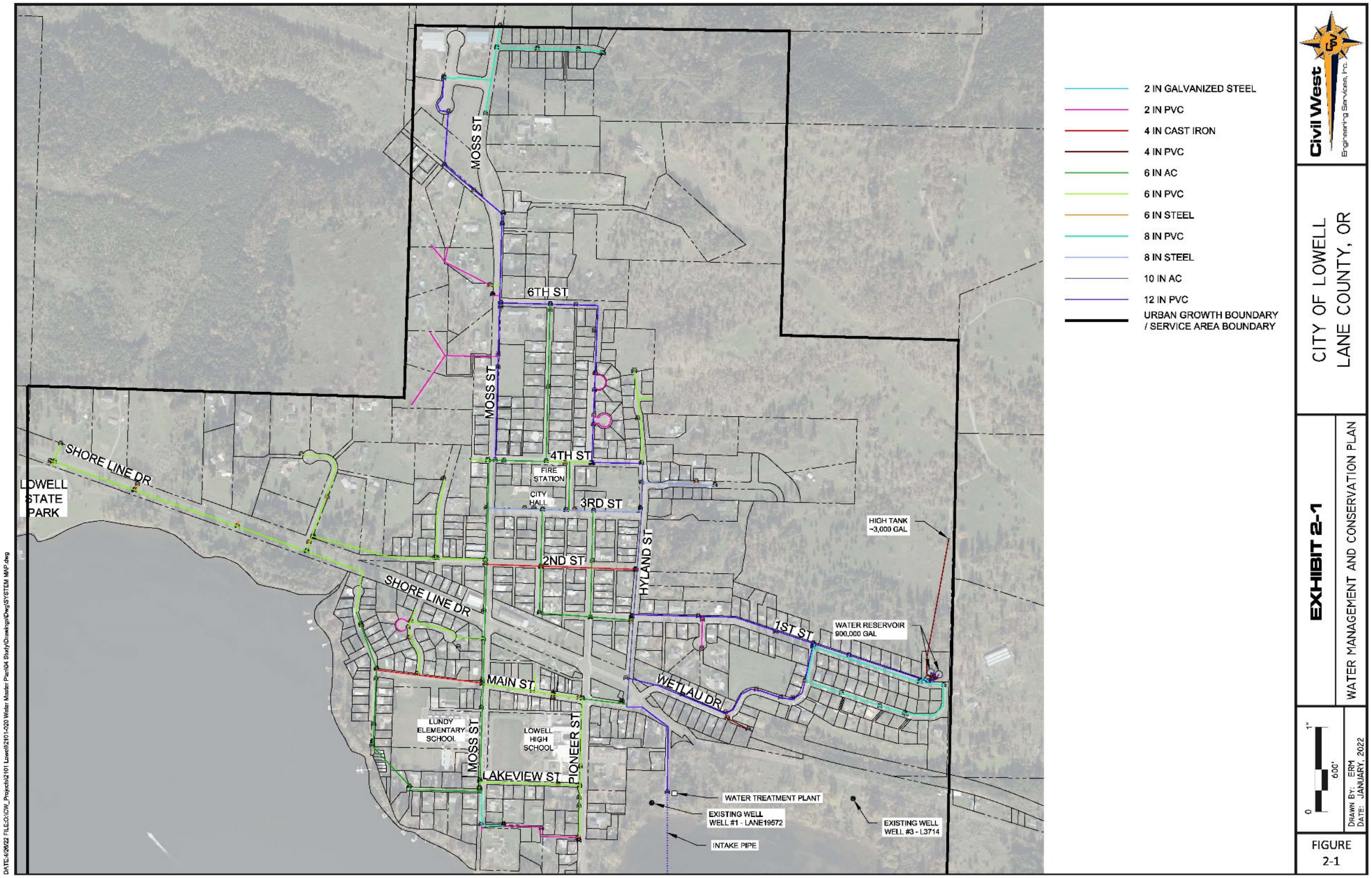
## 2.4 Intergovernmental Agreements

The City does not have any intergovernmental agreements for water supply, exchanges, or delivery.

## 2.5 Water Service Area and Population

Exhibit 2-1 shows the City's water service area. The service area is contiguous with the City's urban growth boundary (UGB). Density of development for residential and commercial customers is greatest in the south central portion of the City, generally surrounding Moss Street, which roughly bisects the City. In 2021, the City served 454 customer accounts and a population of approximately 1,211.

## Exhibit 2-1. City of Lowell Service Area



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# 2.6 Historical Water Demand

## *OAR 690-086-0140(4)*

### 2.6.1 Historical Demand

Historical water demand from 2011 through 2021 is presented in Exhibit 2-2. During this time period, demand was met entirely by the City's surface water source, the Middle Fork Willamette River. Daily production volumes of water treated at the WTP were used to identify the following demand values.

**Exhibit 2-2. Historical Water Demand, Calendar Years 2011 to 2021**

| | Total Demand (MG) | ADD (mgd) | MDD (mgd) | MDD Day | Peaking Factor |
|---|---|---|---|---|---|
| **2011** | 28.9 | 0.08 | 0.29 | 8/17/2011 | 3.62 |
| **2012** | 32.7 | 0.09 | 0.85 | 7/13/2012 | 9.54 |
| **2013** | 31.1 | 0.09 | 0.25 | 7/25/2013 | 2.88 |
| **2014** | 34.2 | 0.10 | 0.21 | 9/2/2014 | 2.21 |
| **2015** | 52.5 | 0.15 | 0.22 | 10/6/2016 | 1.52 |
| **2016** | 44.5 | 0.12 | 0.21 | 8/16/2016 | 1.71 |
| **2017** | 43.9 | 0.12 | 0.22 | 3/14/2017 | 1.86 |
| **2018** | 44.4 | 0.12 | 0.21 | 8/6/2018 | 1.76 |
| **2019** | 47.7 | 0.13 | 0.22 | 7/25/2019 | 1.67 |
| **2020** | 50.7 | 0.14 | 0.24 | 9/1/2020 | 1.71 |
| **2021** | 51.9 | 0.14 | 0.24 | 6/27/2021 | 1.67 |
| **2017-21 Average** | **47.7** | **0.13** | **0.23** | **-** | **1.74** |

Historical total demand for Lowell is characterized by an increasing trend, averaging 31 million gallons from 2011 to 2013 and reaching an average of 50 MG from 2019 to 2021, a 62 percent increase. Total demand and average and maximum day demands (ADD and MDD) are presented graphically in Exhibit 2-3 and 2-4, respectively.

**Exhibit 2-3. Total Demand, 2011-2021**

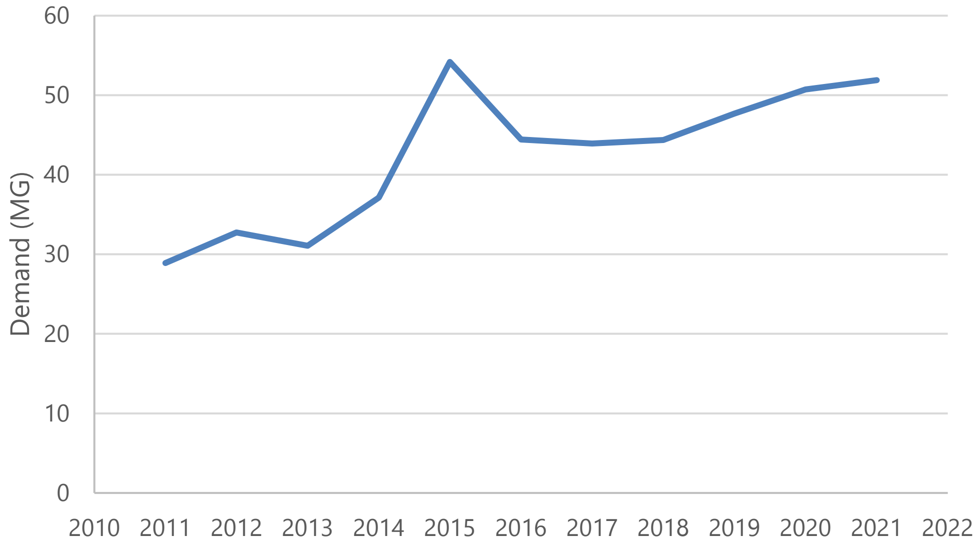
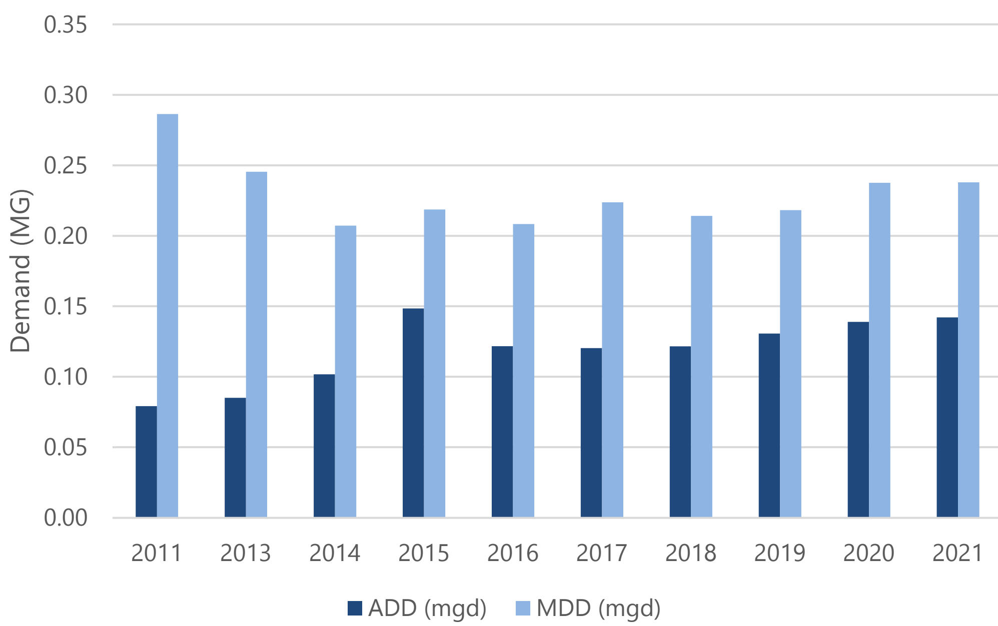



**Exhibit 2-4. ADD and MDD, 2011, 2013-2021[1]**




[1] Data for 2012 was removed because the 2012 MDD was a significant outlier, occurring in March and three to four times greater than any other MDD value, suggesting an error in measurement.

The City explored its demand data to identify potential reasons for the observed increase in annual demand of 62 percent over the ten year period. The City noticed a marked increase in demand starting in 2015, suggesting that one specific factor (versus the aggregation of multiple factors over time) may have elevated demand volumes at that time and helped keep them elevated to present. Population growth, and in turn consumption, will account for some of the increase in total demand, though population increased approximately 4 percent over this period, and therefore was likely a minor contributor. A noticeable increase in water loss occurred starting in 2015 and continued through 2021. The increase in water loss is thought to be attributable to an improved method by which staff track demand.

## 2.7 Customer Characteristics and Use Patterns

### *OAR 690-086-0140(6)*

### 2.7.1 Customer Types

As of December 2021, the City had 457 metered customer accounts. The City's customer categories are residential, commercial, and industrial. The residential category includes single family and multi-family residences, and it accounts for approximately 93 percent of customer accounts. Most of the remaining accounts fall into the commercial category, serving business establishments, schools, churches, and public buildings and parks. The industrial category includes a small number of industrial customers served by City water connections. Exhibit 2-6 presents the number of accounts by customer category as of December 31, 2021.

**Exhibit 2-5. Number of Accounts by Customer Category, as of December 31, 2021**

| Customer Category | Number of Accounts |
|---|---|
| Residential | 423 |
| Commercial | 31 |
| Industrial | 3 |
| **Total** | **457** |

The City's 2004 WMCP included only two customer categories, with residential customers accounting for 89 percent of total water demand and commercial customers comprising the remaining 11 percent. The 2004 WMCP did not list the number of customers in each category.

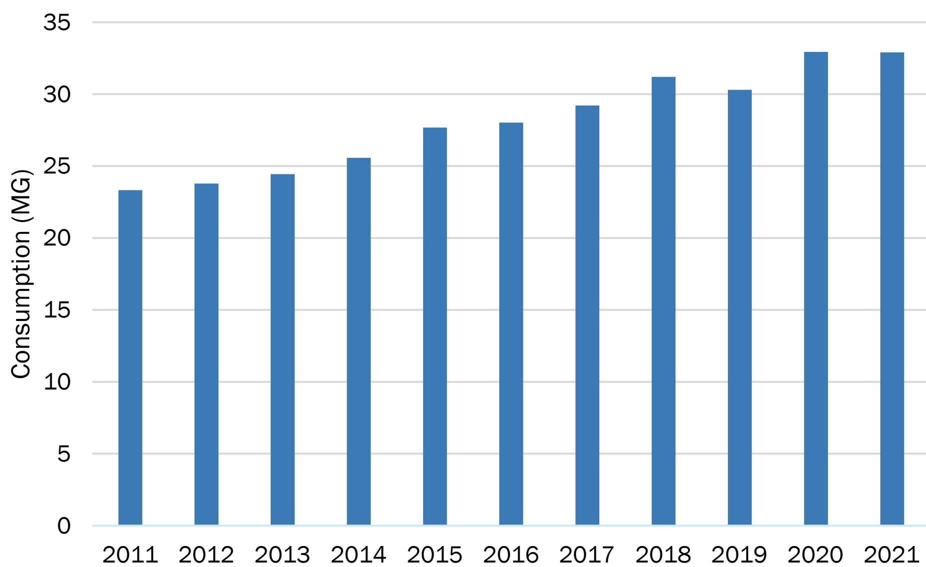
### 2.7.2 Annual Consumption

Total annual billed consumption has gradually risen since 2011, as shown in tabular and graphical form in Exhibits 2-7 and 2-8. This increase coincides with the City's expansion of its customer meter replacement project (which was referenced in the City's 2004 WMCP) to increase the rate of replacement. By 2021, approximately half of the City's customer meters had been replaced. The City estimates that most of these meters were over 20 years old and under-registering usage. As these older meters have been replaced with new meters that are accurately calibrated, the City's observed annual consumption increases are likely explained by the progress made in replacing these meters.

**Exhibit 2-6. Annual Consumption, 2011-2021**

| | Consumption Total (MG) |
|---|---|
| **2011** | 23.3 |
| **2012** | 23.8 |
| **2013** | 24.4 |
| **2014** | 25.6 |
| **2015** | 27.7 |
| **2016** | 28.0 |
| **2017** | 29.2 |
| **2018** | 31.2 |
| **2019** | 30.3 |
| **2020** | 32.9 |
| **2021** | 32.9 |

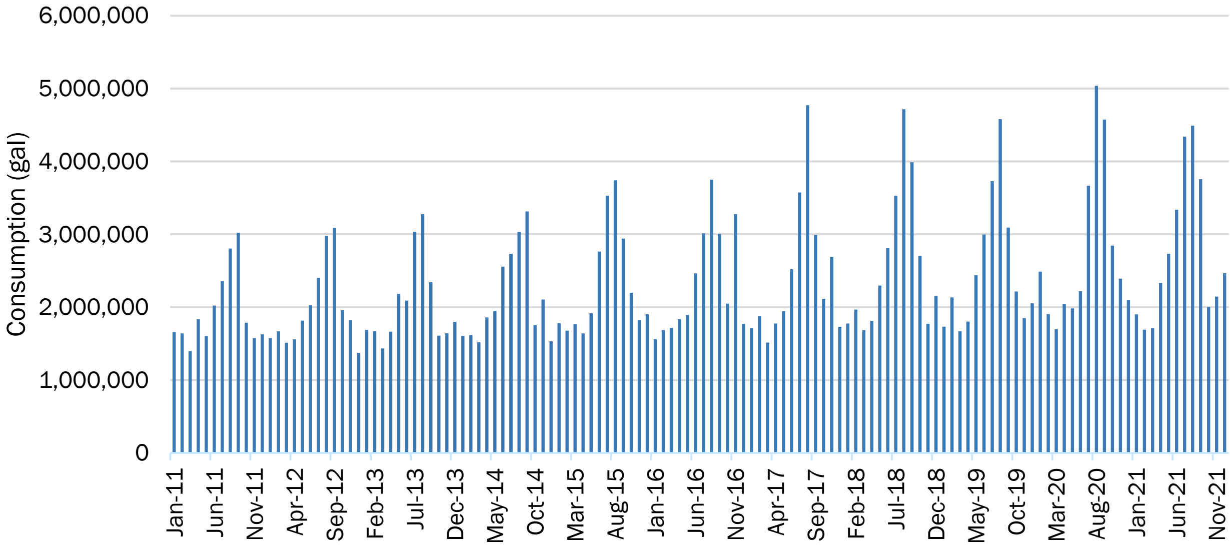
**Exhibit 2-7. Annual Consumption, 2011-2021**




## 2.7.3 Monthly Consumption

Consumption patterns over time show a pronounced seasonal pattern of increasing water use during the warm summer months, much of which may be attributed to increased outdoor use. As the population has grown over time, peak season water use has increased more than winter water use, as shown in Exhibit 2-9.

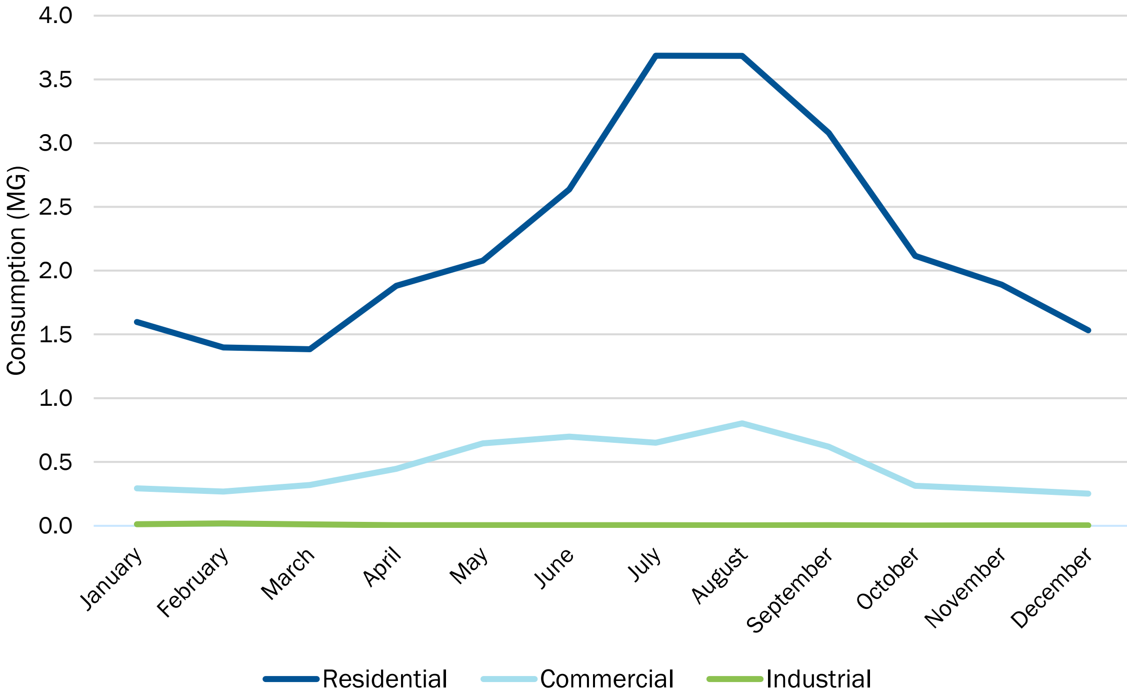
**Exhibit 2-8. Total Monthly Consumption, 2011-2021**




The City's previous WMCP included a graph of water sold monthly from 1997 through 2000, ranging from roughly 1.5 MG per month to nearly 4 MG per month. From 2011 through 2014, monthly consumption fell within this range as well. Increases in consumption starting in 2017 are likely the result of the City's meter replacement program mentioned above and in Section 3.

Monthly consumption by customer class is not available prior to May 2019 due to a change in billing software. Consumption by customer class for 2021 is presented in Exhibit 2-10 and shows increased summer water use for residential customers, with more moderate spring-summer increases for commercial customers. Water conservation programs aimed at reducing outdoor water use in the summer by residential customers could provide substantial reductions in peak day demands. Industrial customers account for a much smaller proportion of total consumption.

**Exhibit 2-9. Monthly Billed Consumption by Customer Category, 2021**




## 2.7.4 Largest Customers

The City identified the ten customers with the highest water consumption during fiscal year 2021, a 12 month period from July 2020 through June 2021. These water users are identified in Exhibit 2-11 by customer class. The City's sewer plant uses significantly more water annually than other user types. As described further in Section 3, the City is evaluating the potential for using reuse water for equipment wash-down operations to reduce the use of treated potable water in this process.

**Exhibit 2-10. Annual Consumption, July 2020–June 2021**

| Customer Category | Annual Consumption, FY 2021 (Gal) |
|---|---|
| Public (Sewer Plant) | 3,352,635 |
| Residential (Multifamily) | 630,043 |
| Public (School) | 593,300 |
| Public (School) | 579,700 |
| Residential (Single Family) | 373,060 |
| Residential (Multifamily) | 356,400 |
| Residential (Single Family) | 332,392 |
| Residential (Single Family) | 273,158 |
| Commercial | 249,400 |
| Public (Library/City Hall) | 239,610 |
| **Total** | **6,979,698** |

Overall, the top water users accounted for 20.3 percent of total billed consumption throughout fiscal year 2021. Excluding the wastewater treatment plant, the remaining nine largest water users accounted for 10.6 percent of total billed consumption.

## 2.8 Water Loss

### *OAR 690-086-0140(9)*

The City calculates water loss as the difference between total annual water demand and the combined value for metered, billed water consumption and other unbilled, authorized consumption. Unbilled authorized consumption includes metered backwash process water generated at the WTP, unmetered distribution system flushing, and estimates of unmetered use by the Lowell Rural Fire Protection District. The City estimates unmetered monthly quantities of water used by its crews for flushing. Exhibit 2-12 shows the City's calculations of water loss from 2011 through 2021.

Loss averaged 29.3 percent of demand over the 11 year period, with the greatest loss occurring in 2015. Since 2015, the City's water losses have remained more consistent year to year as compared to water loss estimates for 2011 through 2014. The City attributes the recent consistency in water loss estimates to the City's improved methods by which demand is calculated. These new methods ensure a consistent approach in measuring the full volume of demand. In turn, the increased volumes of demand translated into higher water losses starting in 2015 since there was not a commensurate increase in water consumption.

**Exhibit 2-11. Water Loss, 2011-2021**

| | Total Production (MG) | Consumption (MG) | | | Water Loss (MG) | Water Loss (%) |
|---|---|---|---|---|---|---|
| | | Billed Consumption | Other Authorized Consumption | Total | | |
| **2011** | 28.9 | 23.3 | 0.8 | 24.1 | 4.8 | 16.5% |
| **2012** | 32.7 | 23.8 | 1.2 | 25.0 | 7.8 | 23.7% |
| **2013** | 31.1 | 24.4 | 0.9 | 25.3 | 5.7 | 18.4% |
| **2014** | 34.2 | 25.6 | 1.5 | 27.1 | 7.1 | 20.7% |
| **2015** | 52.5 | 27.7 | 2.0 | 29.7 | 22.8 | 43.5% |
| **2016** | 44.5 | 28.0 | 1.9 | 29.9 | 14.6 | 32.8% |
| **2017** | 43.9 | 29.2 | 2.3 | 31.5 | 12.5 | 28.3% |
| **2018** | 44.4 | 31.2 | 1.7 | 32.9 | 11.5 | 25.9% |
| **2019** | 47.7 | 30.3 | 1.4 | 31.7 | 16.0 | 33.5% |
| **2020** | 50.7 | 32.9 | 1.4 | 34.3 | 16.4 | 32.4% |
| **2021** | 51.9 | 32.9 | 2.2 | 35.1 | 16.8 | 32.3% |
| **Average** | **41.1** | **27.6** | **1.5** | **29.7** | **12.4** | **29.3%** |

The City's 2004 WMCP indicated that water loss from October 1998 through December 2000 averaged approximately 42 percent, suggesting that the City's efforts to reduce water loss since that time has been successful.

The City's current water losses include both apparent and real losses. Apparent losses include meter inaccuracies and data entry errors. Real losses include system leakage from damaged pipes, valves, service connections, and other infrastructure. Details on the City's efforts to reduce apparent losses through its meter replacement program and real losses in the form of leak detection and line repair are provided in Section 3.

# 2.9 Water Rights

## *OAR 690-086-0140(5)*

### 2.9.1 Summary of Water Rights

Lowell has two groundwater rights and one surface water right.[1] Groundwater Certificate 46884 authorizes up to 0.44 cfs appropriated from a well (Well No. 1) and groundwater Permit G-13499 authorizes the City to appropriate up to 0.45 cfs from a well (Well No. 3). Due to water quality concerns, these wells are held in reserve for emergency use. The City relies wholly on surface water Certificate

[1] The City had an additional water right permit G-8386 that was cancelled in 1983.

23721 to meet demand which authorizes diversions of up to 1.0 cfs from the Middle Fork Willamette River. The City's point of diversion is located within the City on the north shore of Dexter Reservoir. The City's water rights are detailed in Exhibit 2-13.

## 2.9.2 Aquatic Resource Concerns

OAR 690-086-140(5) requires the City to identify the following for each of these water sources: 1) any listing of the source as water quality limited (and the water quality parameters for which the source was listed); 2) any streamflow-dependent species listed by a state or federal agency as sensitive, threatened or endangered that are present in the source; and 3) any designation of the source as being in a critical groundwater area.

Lowell's surface water right authorize diversion from the Middle Fork Willamette River between miles 16 and 17 and groundwater rights authorize appropriation from two wells: Well No. 1, located within City limits and Well No. 3 which is located immediately outside of the City's northern boundary along the shore of Dexter Reservoir (see Exhibit 2-1). The river may support listed streamflow dependent fish species, however the presence of Dexter Dam creates a natural barrier and prevents fish passage above the dam. Note that the Hills Creek Dam is located 26 miles upstream of Dexter Dam and the Hills Creek reservoir (above Hills Creek Dam) was historically stocked with spring Chinook salmon, suggesting some federally-listed species of salmon and other listed fish species may be present in Dexter Reservoir.[2] The species generally thought to occur in the upper Willamette River and their state and federal listing statuses are provided in Exhibit 2-14.

As part of a federal and state effort to protect Oregon streams from pollutants, every two years the Clean Water Act requires Oregon Department of Environmental Quality's (DEQ) to assess or re-assess water quality and report to the Environmental Protection Agency on the condition of Oregon's waters. The Clean Water Act Section 303(d) requires the DEQ to identify waters that do not meet water quality standards and where a Total Maximum Daily Load (TMDL) pollutant load limit needs to be developed for additional regulation.

In 2010, Dexter Reservoir, Assessment Unit OR_SR_1709000107_02_100699, was placed on DEQ's 303(d) list as an impaired water body (for some water quality parameters). In DEQ's 2018/2020 Integrated Report, DEQ categorized this segment as a Category 5 water quality limited stream due to harmful algal blooms.[3]

The City's wells are not located in a critical groundwater area.

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[2] Letter from U.S. Department of the Army, Corps of Engineers, Engineering and Construction Division, to the National Marine Fisheries Service, Habitat Conservation Division (approx. September 21, 1999) regarding the City of Lowell's water treatment plant rehabilitation project.

[3] Source: Oregon Department of Environmental Quality's (DEQ) Assessment Database from DEQ's 2018/20 Integrated Report

**Exhibit 2-12. Listed Fish That May Be Present in Dexter Reservoir**

| Listed Fish Species | State Status | Federal Status |
|---|---|---|
| Upper Willamette and Lower Columbia Rivers Fall Chinook salmon | Sensitive Critical | Threatened |
| Upper Willamette and Lower Columbia Rivers Spring Chinook salmon | Sensitive Critical | Threatened |
| Lower Columbia River Coho salmon | - | Threatened |
| Steelhead - Winter / Coastal Rainbow Trout | Sensitive Critical (Lower Columbia R.)/Sensitive (Willamette/ Upper Willamette) | - |
| Steelhead - Summer / Coastal Rainbow Trout | Sensitive Critical | - |
| Lower Columbia River Steelhead | - | Threatened |
| Pacific Brook Lamprey | Sensitive | - |
| Pacific Lamprey | Sensitive | - |
| Western Brook Lamprey | Sensitive | - |
| Western River Lamprey | Sensitive | - |
| Columbia River Chum Salmon | Sensitive Critical | Threatened |
| Coastal Cutthroat Trout | Sensitive | - |
| Bull Trout | Sensitive | - |
| Oregon Chub | Sensitive | - |
| White Sturgeon | Sensitive | - |

**Exhibit 2-13. Water Rights**

| Common Name | Source(s) | Appl./ Claim/ Limited License | Permit | Certificate | Priority Date | Type of Beneficial Use | Authorized Rate (cfs) | Maximum Rate Diverted to Date (cfs) | Maximum Annual Quantity Diverted to Date (MG)[2] | Completion Date | Average Monthly Diversions 2021 (MG) | Average Daily Diversions 2021 (mgd) | Average Monthly Diversions 2017-2021 (MG) | Average Daily Diversions 2017-2021 (mgd) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well 3 | A well in Middle Fork Willamette R. | G-14204 | G-13499 | - | 11/20/1995 | Municipal | 0.45 | 0.116[1] | 0[3] | 10/1/2003 | 0 | 0 | 0 | 0 |
| Well 1 | A well | G-5520 | G-5408 | 46884 | 5/19/1971 | Municipal | 0.44 | 0.44 | 29.1 | - | 0 | 0 | 0 | 0 |
| - | Middle Fork Willamette River | S-30077 | S-23705 | 23721 | 6/20/1955 | Municipal | 1.0 | 1.0 | 54.2 | - | 4.32 | 0.14 | 3.98 | 0.13 |

[1] The City submitted a claim of beneficial use to OWRD in 2008 for 0.116 cfs; this claim is pending review.
[2] Based on a review of available water use reports on OWRD's website which start in 1988.
[3] The City was unable to find historical records of annual volume earlier than 1988.

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### 2.9.3 Assessment of Water Supply

### *OAR 690-086-0140(3)*

Lowell performed an assessment of its water supplies, evaluating the adequacy and reliability of these supplies. The City has used its groundwater supplies to meet demand periodically. Currently, the City relies groundwater on surface water as its source of supply. The City's surface water has proven to be an adequate source of supply. Certificate 23721 authorizes diversions from the Middle Fork of the Willamette River of up to 1.0 cfs, exceeding the City's historical average MDD. With respect to the security of this water right during periods of low flow, the certificate is senior to instream water rights and, due to the abundant flow of the North Fork Willamette River and its tributaries upstream of the City's point of diversion, the City has not experienced and does not anticipate experiencing restrictions on the rate of diversion associated with this certificate.

Combined, the City's two groundwater rights, Permit G-13499 (0.45 cfs) and Certificate 46884 (0.44 cfs), authorize appropriation up to 0.89 cfs. These rights are adequate to meet the City's average MDD of 0.34 cfs (0.22 mgd), however, water quality issues currently prevent the City from utilizing this source. Concentrations of arsenic exceed the Environmental Protection Agency's maximum contaminant level allowable in drinking water. The City's WTP was not designed to treat for arsenic to meet this standard. Because of this constraint, the City has relied on its surface water source to meet demand. However, the City recently determined that blending of the surface and groundwater sources may reduce arsenic levels below maximum levels. The City would only consider this blending option if its surface water source was not able to fully meet demand.

## 2.10 System Description

### *OAR 690-086-0140(8)*

The City's water system infrastructure includes a surface water intake structure transmission and distribution lines, a WTP, three inline reservoirs, and pump stations.

The City's diverts water from Middle Fork Willamette River via an intake located on the north shore of Dexter Reservoir. Diverted water is pumped to the City's WTP where water is treated prior to distribution. The WTP is located within a quarter mile of the intake and can currently treat up to 160 gallons per minute (gpm). The City uses three distribution system inline reservoirs to store a total of 902,500 gallons and also has a 35,000 clear well below the WTP. Treated water is pumped from the WTP into the distribution system via a distribution system pump station. The City also operates a booster pump used to serve customers located at higher elevations. The City has approximately 30,000 feet of distribution and transmission piping.

The City also has two operable wells, Wells 1 and 3 that are currently capable of producing approximately 100 gpm total.

# 3. Water Conservation Element

*This section addresses the requirements of OAR 690-086-0150(1) – (5). This rule requires a description of specific required conservation measures and benchmarks, and additional conservation measures implemented by the District.*

## 3.1 Progress Report

### *OAR 690-086-0150(1)*

Following submission of the City's first WMCP in 2001, OWRD required the City to develop a work plan to complete the City's Water Conservation and Curtailment Elements. OWRD approved the WMCP and associated work plan in 2004. The work plan identified a date of October 1, 2009 for the City to submit a revised WMCP to OWRD. Intermediate milestones in the work plan included completing revisions to the Water Conservation Element by October 1, 2006 and completing revisions to the Water Curtailment Element by October 1, 2007.

Due to staff turnover and loss of institutional knowledge the City is unable to find records regarding work plan implementation. However, this WMCP fully meets the work plan requirements and latest administrative rule requirements and serves as a fresh start to the City's water management and conservation efforts. Exhibit 3-1 presents a progress report on the benchmarks included in the 2001 WMCP.

## 3.2 Use and Reporting Program

### *OAR 690-086-0150(2)*

The City's water measurement and reporting program complies with the requirements in OAR Chapter 690, Division 85. Flow meters are installed immediately upstream and downstream of the WTP to measure diversions of raw water from Dexter Lake and finished water leaving the plant, respectively. Flow meters are also installed on the City's wells. Monthly water use measurements are compiled and submitted to OWRD on an annual basis. Reporting is for the previous water year (October 1 to September 30). The City's water use records can be found at http://apps.wrd.state.or.us/apps/wr/wateruse_report/.

## 3.3 Required Conservation Measures

### *OAR 690-086-0150(4)(a-f)*

OAR 690-086-050(4) requires that all water suppliers establish 5-year benchmarks for implementing the following water management and conservation measures:

1. Annual water audit
2. System-wide metering
3. Meter testing and maintenance
4. Unit-based billing

5. Water loss analysis
6. Public education

**Exhibit 3-1. 2004 WMPC Conservation Measure Benchmarks Progress**

| Conservation Measure | 2004 WMCP Benchmarks[1] | Benchmark Progress |
|---|---|---|
| Annual water audit | During the annual reporting of consumption to the State, the City calculates the extent of system leakage. | This is completed each year in December. |
| System metering | The City is fully metered at the groundwater pumping sources and records the water use on a daily basis. All customers using City water are metered. | Although the City does not currently use the wells, the wells have functional flow meters. In addition, the City meters diversions from its surface water source at its water treatment plant (WTP). All customers are metered. |
| Meter testing and maintenance | The City hires a consultant to test a representative portion of the City's meters each year. Where required, the City replaces or maintains the meter. For the past four years, the City's ongoing maintenance program has included the replacement of old meters. According to staff, the city replaces an average of ten meters per month. | In 2014 the City moved to a meter replacement program. The City currently is changing out all meters at service connections; roughly 250 of the 454 of customers' meters have been replaced since 2014. |
| Rate structure | To encourage water conservation, the City implemented in 1998 a block water rate structure, which was used to encourage water conservation. | The City continues to use a block rate structure as a means to encourage water conservation. |
| Water loss | A significant increase in pump run time is a reliable indicator of a new leak in the system. When an increase is detected, the leak is located by using a sounding device on randomly selected points on the system. The City's goal is to reduce their leakage to the state's standard of 15% of total consumption through maintenance programs which identify old, leaking pipes and valves. | The City has adopted a more refined tool to identify leaks in the system. Specifically, the City performs system-wide periodic leak detection surveys. In 2015 and in 2021, the City hired a company to perform a leak survey of the entire distribution system. Minor leaks were discovered during these surveys and the City repaired those that more significantly contributed to water loss. |
| Public education | Citizens are notified of the City's water policies by including notices inserted into the monthly water bill. | New residents are given the utility policy when they sign up for service. In addition, the City includes water conservation information on its Consumer Confidence Report annually. Prior to the pandemic, the City provided outreach to third grade students. |

| Conservation Measure | 2004 WMCP Benchmarks[1] | Benchmark Progress |
|---|---|---|
| Leak repair or line replacement | It is the City's goal to reduce the average leakage to less than 15% of the total water consumed from the source. This should be achieved by annually replacing old service lines, AC mains, meters, and valves, and discontinuing the City's regular use of the groundwater pumps and associated piping. | The City tested mains, valves, hydrants, lines, and service laterals for leaks in 2015 and 2021. In November 2021, the City fixed three significant leaks detected. |
| Supplier financed retrofit or replacement of fixtures | No benchmark was provided for supplier financed retrofit or replacement of fixtures. | The City is currently in the progress of a meter replacement CIP. |
| Programs that support and encourage water conservation | The City has implemented programs that encourage low water use landscaping by providing water troughs filled with non-potable water for landscaping as well as alternating allowable landscape-watering days. | The City has not continued these programs. |
| Water reuse, recycling, and non-potable water | Within the next five years, the City should review their opportunities to implement a water reuse plan. For example, the City may use untreated water to backwash their potable water filters and discontinue the use of potable water at the sewage treatment plant for equipment wash-down operations. | The City has not developed a water reuse plan. |

[1] The City's previous WMCP was written in 2001 and received final approval from OWRD in 2004. The City did not provide benchmarks for all the conservation measures required in the current rule.

The following sub-sections describe the City's plans during the next five years to initiate, continue, or expand its conservation measures to meet these requirements.

### 3.3.1 Annual Water Audit

OWRD defines a water audit as an analysis of the water system that includes a thorough accounting of all water entering and leaving the system. Section 2 describes the City's water loss methodology calculation and historical results. In summary, the City calculates water loss by comparing demand (treated water leaving the WTP) to consumption to determine water loss on a monthly and annual basis. The Lowell Rural Fire Protection District provides the Public Works Department with estimates of their monthly water use. As shown in Exhibit 2-8, the City's water loss in 2021 was 32.3 percent. The City attributes losses to real and apparent losses, that is, primarily a combination of losses due to distribution system leakage and meter errors, respectively.

***Five-Year Benchmark***

- Continue to conduct an annual water audit using a systematic and documented methodology that includes estimating unmetered authorized use.

### 3.3.2 System-wide Metering

The City's water system is fully metered, and new meters are installed at all new water service connections.

***Five-Year Benchmark***

- Continue to require installation of meters on all new water connections.

### 3.3.3 Meter Testing and Maintenance

Routine testing of customer meters and staff observations of meter inaccuracies have led the City to begin implementing a customer meter replacement program. In some cases, testing showed that meters that had been in place for over 20 years were under-registering use by up to 75 percent. This program has already resulted in more accurate data collection and billing, and the City anticipates that its water losses will decrease as the meter testing and replacement program continues. Currently, approximately 250 of the 454 customer meters have been replaced and the City will endeavor to replace the remainder over the next five years, averaging approximately 40 meter replacements per year. Following replacement of all targeted meters, the City intends to test a portion of customer meters annually to ensure that inaccuracies are quickly detected and addressed through maintenance or replacement.

In addition to its proactive approach to meter maintenance, the City is alerted to failed or potentially failed customer meters through its billing system or directly from customers. Upon alert, the City inspects these meters and replaces or repairs them immediately, as needed. Inspection may include a test for accuracy relative to the manufacturer's recommended specifications or the City may determine meter failure without a meter test through observation (i.e. the register does not measure any use).

The City has water system master meters at the Dexter Reservoir intake, at the WTP, and on each production well. The meters measuring volumes of untreated and treated water located at the WTP were installed in 2012 and the accuracy of these was verified by an outside contractor in 2016 and 2021.

#### *Five-Year Benchmarks*

- Continue the meter replacement program, replacing any meters older than 20 years of age within the next five years.
- The City will test approximately 5 percent of customer meters for accuracy annually and replace or repair faulty meters following replacement of all meters over 20 years of age.
- Upon alert of a potentially failed meter, the City will inspect meters in question and repair or replace the meters if needed immediately.
- Every 5 years, the City will verify the accuracy of the master meters located at the WTP and repair or replace the meters as needed.

### 3.3.4 Water Rate Structure

The City's water rate structure consists of a Basic Service Charge of $26.87 per month assessed per equivalent dwelling unit (EDU), plus a variable rate based on the quantity of water used.

Single family homes, individual units of a duplex, and multi-family units with three or more bedrooms are considered single EDUs. In all other multi-family residential complexes, each unit is counted as two-thirds of an EDU, and the total EDUs for the complex are calculated by multiplying the number of units by 0.67 and rounding up to the next whole EDU. For commercial and industrial accounts with meters ¾ inches or smaller, monthly water use over a 12-month period is averaged, and each 6,000 gallons of monthly use is considered one EDU. For commercial and industrial accounts with larger meters, the EDU calculations in Exhibit 3-2 apply.

**Exhibit 3-2. Calculation of Commercial and Industrial Equivalent Dwelling Units (EDUs)**

| Meter Size | EDUs |
|---|---|
| **1 inch** | 2.0 |
| **1 ½ inch** | 5.0 |
| **2 inch** | 8.0 |
| **3 inch** | 15.0 |
| **4 inch** | 25.0 |
| **6 inch** | 50.0 |

The quantity-based variable water rate for all customer classes is designed to encourage water conservation by using a tiered volume charge, as shown in Exhibit 3-3.

**Exhibit 3-3. Variable Water Rate Based on Volume Metered**

| Quantity Metered | Charge |
|---|---|
| **0-5,000 gallons per EDU** | $5.39 per 1,000 gallons |
| **Over 5,000 gallons per EDU** | $6.79 per 1,000 gallons |

Within the next two years, the City intends to conduct a rate study to assess whether current rates are appropriate and sufficient to meet the operational, maintenance, and repair costs of the water system.

#### *Five-Year Benchmarks*

- The City will continue to bill customers based, in part, on the volume of water consumed.
- Within the next two years, the City will conduct a water rate study.

### 3.3.5 Water Loss Analysis

As discussed in Section 2.8, the City's water loss in 2021 was 32.3 percent. Because this water loss is greater than 10 percent, OAR 690-086-0150(4)(e)(A) requires the City to provide OWRD with an analysis of potential water loss factors and proposed corrective actions within two years of approval of this WMCP. (The City's analysis and corrective actions are outlined below). If the designated actions do not reduce water loss to less than 10 percent within five years of WMCP approval, OWRD requires the City to develop and implement a regularly scheduled and systematic program to detect and repair leaks in the transmission and distribution system using methods and technology appropriate to the size and capabilities of the water supplier, a line replacement program listing the size and length of pipe to be replaced annually, or to develop and implement a water loss control program consistent with the American Water Works Association's standards.

The City has determined that losses due to inaccurate customer meters and distribution system leakage are the primary contributors to water losses. In response, the City has an ongoing meter replacement program and performs periodic leak detection surveys followed by leak repair. The meter replacement program is described above. Leak detection surveys were conducted by a third party contractor in 2015 and 2021 in the entire distribution system using a sounding device. Based on the results of the surveys, the City has been actively working to repair and replace lines and valves with identified leaks and to upgrade older distribution infrastructure that is more prone to developing leaks over time. In November 2021, the City fixed three significant leaks that were detected during the most recent survey. The City will continue this program in the future, performing line leak detection and repairing leaks as they are discovered. The City's meter replacement program in combination with the leak detection and repair program are anticipated to reduce water loss to 10 percent or less over the next five years.

#### *Five-Year Benchmark*

- Within 5 years of WMCP approval, if water loss still exceeds 10 percent the City will select and implement the required measures consistent with the OWRD rule requirements.

### 3.3.6 Public Education

OWRD requires the City to establish a public education program to encourage efficient indoor and outdoor water use that includes regular communication of the supplier's water conservation activities to its customers. As part of its conservation education program, the City includes information on its annual Consumer Confidence Report (CCR) describing the community's water source and the importance of conservation. The City intends to expand its outreach to include articles on indoor and outdoor water conservation topics in the City newsletter at least twice per year and to post water-saving tips and information on its website. Prior to the pandemic, the City Public Works Department conducted outreach about the water system and conservation to third grade students, including a guided field trip of the water treatment plant. When public health conditions allow, the City intends to continue providing this educational program once per year.

***Five-Year Benchmarks***

- The City will continue including water conservation information in its annual Consumer Confidence Report.
- When conditions allow, the City will conduct annual educational programs and field trips relating to the water system and water conservation for elementary school students.
- Within the next five years, the City will begin including up to two articles on indoor and outdoor water conservation topics in the City newsletter.
- Within the next five years, the City will add a page on its website providing information on efficient indoor and outdoor water uses.

## 3.4 Additional Conservation Measures

### *OAR 690-086-0150(6)*

OAR 690-086-0150(6) requires municipal water suppliers that either: (a) serve a population greater than 1,000 and propose to expand or initiate diversion of water under an extended permit for which resource issues have been identified, or (b) serve a population greater than 7,500, to provide a description of the specific activities, along with a five-year schedule to implement several additional conservation measures. This rule does not apply to the City given that it serves a population of less than 7,500 and is not requesting access to an extended permit within the 20-year planning period of this WMCP. However, the City intends to expand its conservation program to include the following measures as a means to help its customers and the City reduce use of water.

***Five-Year Benchmarks***

- Within the next five years, the City will begin providing leak detection dye tablets to customers upon request so customers can identify leaking toilet tanks.
- Within the next five years, the City will provide 25 low-flow showerheads and 25 faucet aerators annually to customers.
- Within the next five years, the City will explore the potential for using reclaimed water for equipment wash-down operations at the WTP.

# 4. Water Curtailment Element

*This section satisfies the requirements of OAR 690-086-0160. This rule requires a description of past supply deficiencies and current capacity limitation. It also requires inclusion of stages of alert and the associated triggers and curtailment actions for each stage.*

## 4.1 Introduction

Curtailment planning is the development of proactive measures to reduce demand during supply shortages as the result of prolonged drought, or partial or full system failure from unanticipated events including catastrophic events, mechanical or electrical equipment failure, or events not under control of the City.

## 4.2 History of System Curtailment Episodes

### *OAR 690-086-0160(1)*

The City staff are not aware of any system curtailment episodes within the last 10 years.

## 4.3 Capability Assessment

Lowell evaluated its ability to continue to provide water during four emergency events that could cause a supply shortage: a drought, source contamination, power failure, and earthquake. Given the abundant flows of the Middle Fork Willamette River and its tributaries and the priority date of its surface water Certificate 46884 of June 20, 1955, the City does not anticipate a drought impacting the City's ability to divert surface water. Contamination of the river (or reservoir from which the City diverts water) could impair the City's ability to meet demand. The City's WTP can treat for some types of pollutants, however others, such as toxic algae blooms, would prevent the City from using this source. In the event of a power failure the City has the option to utilize auxiliary power from generators located at the WTP (and booster pump station) that will enable the City to operate key water system infrastructure, such as the WTP and pump used for diversion of surface water. Finally, an earthquake could limit the City's ability to meet demand, but the severity of the resulting damage to the City's infrastructure would dictate the City's need to implement curtailment.

During any of these events, the City's two distribution system reservoirs may be able to provide up to six days-worth of water to the City's customers based on historical ADD of 140,000 gpd, assuming the reservoirs are full. The City may also elect to blend surface and groundwater during events in which surface water is still available, but not in the quantities necessary to meet demand. Severe limitations to the City's ability to produce surface water could require the City to seek delivery of water in tanker trucks as a short-term measure to help meet the City's customers' health and safety needs.

If the City cannot produce enough water to meet demand, caused by any of these or other events, the City would rely on its water curtailment plan to stretch supply as long as possible while the City worked to restore normal supply capacities.

While the City does not have capacity constraints at this time to meet demand, the City recognizes that its WTP is at capacity and additional demands originating from growth could exceed WTP capacity. The City is actively studying options to address the future constraint, including expansion of the WTP.

# 4.4 Curtailment Stages and Initiating Conditions

## *OAR 690-086-0160(2) and (3)*

The City's water curtailment ordinance, Ordinance 172, describes three orders of restrictions to be invoked in the event of a water supply shortage. These restrictions are of increasing severity and could be initiated and implemented in progressive steps or a later stage could be implemented directly. The plan includes both voluntary and mandatory measures, depending upon the cause, severity, and anticipated duration of the shortage. This ordinance does not specify initiating conditions. Therefore, the City developed these for this WMCP. The City also added a voluntary stage to the City's three orders of mandatory restrictions found in the ordinance.

Exhibit 4-1 presents the four curtailment stages, as well as their initiating conditions. While initiation of a curtailment stage is based on the specific circumstances of the actual event, the City has established initiating conditions based on demand relative to available system capacity. System capacity is defined as the sum of the capacities of the WTP of 200 gpm and distribution system reservoirs of 935,000 gallons.

The decision to implement curtailment will also consider the knowledge and judgment of City staff members familiar with the water system. Staff members may evaluate the extent of system damage or contamination, duration of repair, costs, fire hazards, and weather forecasts to make this determination.

**Exhibit 4-1. Curtailment Stages of Alert and Initiating Conditions**

| Curtailment Stages | Potential Initiating Conditions |
|---|---|
| Stage 1 (Voluntary) | System demand reaches or expected to reach 90 percent of available capacity. |
| Stage 2 | System demand reaches or is expected to reach 91-100 percent of available capacity for 3 consecutive days. |
| Stage 3 | System demand exceeds or is expected to exceed available capacity and the City anticipates a declining trend in available storage for no more than 3 days. |
| Stage 4 | System demand exceeds or is expected to exceed available capacity and the City anticipates a declining trend in available storage for more than 3 consecutive days. |

# 4.5 Authority and Enforcement

The City Administrator has the authority to order the first or second stages of restrictions of use, as described in Ordinance 172 and the City Council has the authority to declare enactment of any of the stages. The ordinance gives the City Administrator the authority to enforce the last stage by discontinuing use of those customers who do not meet the last stage's curtailment restrictions and Class B violations may be issued by the City.

# 4.6 Curtailment Plan Implementation

## *OAR 690-086-0160(4)*

### 4.6.1 Stage 1 (Voluntary)

The City will issue a general request for a voluntary reduction in water use by all users. The request will include a summary of the current water situation, the reason for the requested reduction in use, suggestions for conserving water, and a warning that mandatory cutbacks will be required if the voluntary measures do not sufficiently reduce water usage. Examples of voluntary reductions include reductions to outdoor water use and/or limiting irrigation of landscape and lawns to specific night and early morning hours and implementation of water conservation measures promoted by the City's conservation program.

### 4.6.2 Stage 2 (Mandatory)

1. Allow irrigation of landscaping and lawns between the hours of 8 PM and 6 AM.
2. Prohibit the use of water for washing motorbikes, motor vehicles, boat trailers, or other vehicles except at a commercial washing facility that recycles wash water.
3. Limit City uses of water and discontinue hydrant flushing, reduce nonessential cleaning using water, and curtail temporary access (e.g., for construction-related activities) to water at hydrants.
4. Prohibit the use of water to wash sidewalks, walkways, driveways, parking lots, tennis court, and other hard-surfaced areas.
5. Prohibit the use of water to wash buildings and structures, except as needed for painting or construction.
6. Prohibit the use of water to fill or top-off a fountain or pond for aesthetic or scenic purposes, except for recalculating systems and where necessary to support fish life.
7. Prohibit the use of water to fill, refill, or add to any indoor or outdoor swimming pools or hot tubs, except if one of the following conditions is met: the pool is used for a neighborhood fire control supply, the pool has a recycling water system, the pool has an evaporative cover, or the pool's use is required by a medical doctor's prescription.
8. Prohibit the use of water for dust control unless absolutely necessary.

### 4.6.3 Stage 3 (Mandatory)

1. Continue activities initiated under Stage 2.

2. Prohibit all outdoor watering (exceptions include new lawn, grass or turf planted after March 1 of the calendar year in which restrictions are imposed, or park and recreation areas specifically designated by the City).
3. Prohibit the use of water from hydrants for construction-related activities (except on a case-by-case basis), fire drills, or any purpose other than firefighting.

### 4.6.4 Stage 4 (Mandatory)

1. Prohibit all outside water use. The only exceptions will be those specifically identified by the City.
2. Prohibit all nonessential water use that does not maintain the health and safety of the public.

Exceptions to these mandatory measures will be authorized by specific consent from the City.

## 4.7 Notifications of Curtailment

The District has several communication channels that it can use to relay important information about a supply shortage, including voluntary or mandatory measures. The District may rely on local media, mailers, bill stuffers, door hangers, social media, strategically-located sandwich boards, and the web sites of the Property Owners' Association of Units 1 and 2 and the Wonderland Water Sanitary District to communicate with its customers on an ongoing basis about a supply shortage. Notices and other forms of communication may include a description of the current water situation, the reason for the requested conservation measures, and a warning that mandatory restrictions will be implemented if voluntary measures are not sufficient to achieve water use reduction goals.

## 4.8 Drought Declaration

If a declaration of a severe drought in Lane County is declared by the Governor per ORS 536.720, the Oregon Water Resources Commission may order political subdivisions within any drainage basin or subbasin to implement a water conservation or curtailment plan or both, approved under ORS 536.780. The conservation and curtailment elements of this WMCP meet these requirements. If the City falls within a severe drought area declared by the Governor, such as Lane County, the City will consider whether curtailment measures are needed to meet system demands. Regardless of whether curtailment is needed, the City will continue to encourage customers to conserve water.

# 5. Municipal Water Supply Element

*This section satisfies the requirements of OAR 690-086-0170.*

*This rule requires descriptions of the City's current and future service area and population projections, demand projections for 10 and 20 years, and the schedule for when the City expects to fully exercise their water rights. The rule also requires comparison of the City's projected water needs and the available sources of supply, an analysis of alternative sources of water, and a description of required mitigation actions.*

## 5.1 Delineation of Service Area

### *OAR 690-086-0170(1)*

Lowell's current service area is shown in Exhibit 2-1. Growth is anticipated to occur in within this service area as infill and as development of vacant land occurs. This growth over the 20 year planning period will add new customers to the City's existing water system. The City's municipal code prohibits expansion of the City's water system to areas beyond city limits, therefore, the City's service area will only grow as a result of annexations of land within the UGB.

## 5.2 Population Projections

### *OAR 690-086-0170(1)*

The City's population is projected to increase from 1,196 in 2020 to 1,408 in 2032 and 1,513 in 2042 as shown in Exhibit 5-1. These future estimates are based on a forecast conducted by PSU's Population Research Center (PRC) and modified by the City to account for population growth resulting from a recently completed large residential development. This development added 94 persons to the City and was not included in PSU's forecast. These additional residents were added to PSU's population forecast starting in 2021 and had the effect of increasing the average annual growth rate (AAGR) relative to the growth rate in PSU's forecast and the AAGR between 2032 and 2042. The methodology and the basis for these population projections are found in an excerpt from the City's 2022 WSMP in Appendix B.

**Exhibit 5-1. Projected Population, 2032 and 2042**

| Year | Population | AAGR |
|---|---|---|
| **2020** | 1,196 | - |
| **2032** | 1,502 | 1.9% |
| **2042** | 1,525 | 0.2% |

# 5.4 Demand Forecast

### *OAR 690-086-0170(3)*

As part of its WSMP, the City conducted a demand forecast for its 2022 WSMP to estimate ADD and MDD by 2042. To project the City's ADDs, the City relied on a per capita water use factor and multiplied this factor by the future populations for 2032 and 2042 (see Section 5.2). The water use factor was estimated to be 103 gallons per capita per day (gpcd) and calculated by dividing the historical average ADD for treated water from 2016 to 2020 by the City's 2020 population of 1,196. MDD was calculated by multiplying ADDs by a peaking factor of two. The City selected this factor based on the historical peaking factor, which trended down from 3.6 in 2011 to 1.7 in 2020 as shown in Section 2.

The City conducted a demand forecast for the WSMP based on water produced at the WTP. However, this WMCP considers the projected rate of water diverted from the Middle Fork Willamette River. As a result, the City refined the WSMP forecast for this WMCP to include water use during the WTP treatment process. This "process water" includes water used to backwash the WTP filters to remove particles that become trapped in the filter media and reduce the filter's effectiveness over time. Incorporating this process water into the demand forecast captures the full amount e of water diverted by the City under its surface water right. The City measures the volume of process water at the WTP via master meters and determined that total process water accounted for 2.8 percent of total diverted water from 2016 to 2020. Therefore, the City increased the forecasts of water demand calculated for the WSMP by 2.8 percent. The resulting future demands are shown in Exhibit 5-2.

MDD is forecast to reach 322,946 gallons per day or 0.50 cfs, an increase of approximately 36 percent from 2020. As previously noted, a majority of this increase is due to the addition of the 94 persons added to the system by 2021.

**Exhibit 5-2. Demand Forecast, 2020-2042**

| | ADD (gal/cfs) | MDD (gal/cfs) |
|---|---|---|
| **2020 (Actual)** | 138,928 / 0.21 | 237,580 / 0.37 |
| **2032** | 159,038 / 0.25 | 318,076 / 0.49 |
| **2042** | 161,473 / 0.25 | 322,946 / 0.50 |

# 5.5 Schedule to Exercise Permits and Comparison of Projected Need to Available Sources

### *OAR 690-086-0170(2) and (4)*

To meet the City's 20 year projected demand of 0.5 cfs, the City will rely on Certificate 46884 (1.0 cfs) which authorizes diversions from the Middle Fork Willamette River as its primary source of supply over this period. Historically, this surface water source has proven to be reliable and available and the City foresees that this source will remain a stable source of supply into the future. Certificate 23721 (0.44 cfs) and Permit G-13499 (0.45 cfs) authorize appropriation from two wells. Due to current water quality constraints these groundwater rights are held in reserve for emergency use when blended with surface water.

The City has developed 0.116 cfs of 0.45 cfs of Permit G-13499 and has a claim of beneficial use and certificate request pending with OWRD. The City intends to submit a request to extend the time line to develop the remaining portion of Permit G-13499; the City understands that following the extension of time, access to water beyond 0.116 cfs will need to be addressed in a subsequent WMCP.

## 5.6 Alternative Sources of Water

### *OAR 690-086-0170(5)*

OAR 690-086-0170(5) requires an analysis of alternative sources of water if any expansion or initial diversion of water allocated under existing permits is necessary to meet future water demand. Expansion of water use under the City's permit will need to be addressed following an extension of time and a subsequent WMCP.

## 5.7 Quantification of Maximum Rate and Monthly Volume

### *OAR 690-086-0170(6)*

OAR 690-086-0170(6) requires a quantification of the maximum rate and maximum monthly volume of water to be diverted if expansion or initial diversion of water allocated under an existing permit is necessary to meet demands in the 20-year planning horizon. Expansion of water use under the City's permit will need to be addressed following an extension of time and a subsequent WMCP.

## 5.8 Mitigation Actions under State and Federal Law

### *OAR 690-086-0170(7)*

Under OAR 690-086-0170(7), for expanded or initial diversion of water under an existing permit, the water supplier is to describe mitigation actions it is taking to comply with legal requirements of the Endangered Species Act (ESA), Clean Water Act, and other applicable state or federal environmental regulations. Expansion of water use under the City's permit will need to be addressed following an extension of time and a subsequent WMCP.

## 5.9 New Water Rights

### *OAR 690-086-0170(8)*

Under OAR 690-086-0170(8), an analysis of alternative sources of additional water is required if acquisition of new water rights will be necessary within the next 20 years to meet the projected water demands. The City does not intend to acquire new water rights to meet its demands within the next 20 years, so the provisions of this section are not applicable.

# Appendix A

# Letter to Affected Local Government

Water Solutions, Inc.

August 19, 2022

Ms. Amber Bell, Planning Director
Lane County
3050 N. Delta Highway
Eugene, OR 97408
Amber.Bell@lanecountyor.gov

Subject: Water Management and Conservation Plan for Lowell

Dear Ms. Bell,

The City of Lowell (City) has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rules Chapter 690, Division 86 of the Oregon Water Resources Department.

Under these rules, the water supplier will make its draft WMCP available for review by any affected local government and seek comments related to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's draft WMCP for your review.

Please provide any comments to me by September 19, 2022. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter or email response to that effect would be appreciated. You may send your comments to me at thenkle@gsiws.com.

If you have any questions, please feel free to contact me at 971-235-2550. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Tim Henkle
Water Resources Consultant

Enclosure

## Tim Henkle

**From:** MILLER Keir C <Keir.MILLER@lanecountyor.gov>
**Sent:** Tuesday, August 23, 2022 10:57 AM
**To:** Tim Henkle
**Cc:** BELL Amber R; EICHNER Lindsey A
**Subject:** RE: City of Lowell Draft WMCP for Review

Hi Tim,

I've reviewed the Draft WMCP for the City of Lowell to assess consistency with the Lane County Rural Comprehensive Plan (RCP). I find no conflicts between the Draft WMCP and the RCP and the plan, as proposed, appears consistent with the polices of the RCP.

Please let me know if you have any additional questions.

Keir

**Keir Miller | Manager**
Lane County | Land Management Division
3050 North Delta Hwy | Eugene, OR 97408
Office: 541-682-4631 | Fax: 541-682-3947
keir.miller@lanecountyor.gov | www.lanecounty.org/lmd

---

**From:** Tim Henkle <thenkle@gsiws.com>
**Sent:** Friday, August 19, 2022 10:01 AM
**To:** MILLER Keir C <Keir.MILLER@lanecountyor.gov>
**Subject:** FW: City of Lowell Draft WMCP for Review

[EXTERNAL ⚠ ]

Hi Keir,

In Amber's and Lindsey's absences, please see below and find the attached documents.

Thank you,

Tim

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**From:** Tim Henkle
**Sent:** Friday, August 19, 2022 9:49 AM
**To:** Amber.Bell@lanecountyor.gov
**Cc:** Max Baker <mbaker@ci.lowell.or.us>
**Subject:** City of Lowell Draft WMCP for Review

Hello Ms. Bell,

Please find a cover letter and draft Water Management and Conservation Plan for the City of Lowell. The City is requesting your review of the WMCP and response. Please note the 30 day requested response time.

Thanks,

Tim

**Tim Henkle**
**Water Resources Consultant**
phone: 971-236-2550
1600 SW Western Boulevard, Suite 240, Corvallis, OR 97333
**GSI Water Solutions, Inc. | www.gsiws.com**

# Appendix B

# Population Projection, Excerpt from Draft 2022 Water System Master Plan

# City of Lowell

**LANE COUNTY, OREGON**

## Water Master Plan

**September 2022**

Civil West
Engineering Services, Inc.

www.civilwest.com | Willamette Valley | North Coast | South Coast | Rogue Valley

# TABLE OF CONTENTS

# 3.3 Population

## 3.3.1 Historical and Existing Population

A population analysis for Lowell was completed using data from the US Census, and PSU Population Resource Center (PRC) on past, present, and projected future population growth for cities within Lane County.

*TABLE 3.3.1 – LANE COUNTY HISTORICAL AND FORECAST POPULATIONS*

**Figure 1. Lane County and Sub-Areas—Historical and Forecast Populations, and Average Annual Growth Rates (AAGR)**

| | Historical | | | Forecast | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | AAGR (2000-2010) | 2019 | 2044 | 2069 | AAGR (2010-2019) | AAGR (2019-2044) | AAGR (2044-2069) |
| **Lane County** | **322,959** | **351,715** | ***0.9%*** | **371,361** | **426,041** | **480,634** | ***0.6%*** | ***0.6%*** | ***0.5%*** |
| Coburg | 969 | 1,032 | *0.6%* | 1,308 | 1,687 | 1,955 | *2.6%* | *1.0%* | *0.6%* |
| Cottage Grove | 8,952 | 10,164 | *1.3%* | 10,284 | 11,677 | 13,172 | *0.1%* | *0.5%* | *0.5%* |
| Creswell | 3,959 | 5,333 | *3.0%* | 5,663 | 7,573 | 9,813 | *0.7%* | *1.2%* | *1.0%* |
| Dunes City | 1,229 | 1,303 | *0.6%* | 1,292 | 1,474 | 1,665 | *-0.1%* | *0.5%* | *0.5%* |
| Eugene | 160,551 | 177,369 | *1.0%* | 192,607 | 232,099 | 273,794 | *0.9%* | *0.7%* | *0.7%* |
| Florence | 8,783 | 10,230 | *1.5%* | 10,579 | 12,518 | 14,635 | *0.4%* | *0.7%* | *0.6%* |
| Junction City | 5,942 | 6,100 | *0.3%* | 6,919 | 9,080 | 11,328 | *1.4%* | *1.1%* | *0.9%* |
| Lowell | 857 | 1,045 | *2.0%* | 1,108 | 1,352 | 1,620 | *0.6%* | *0.8%* | *0.7%* |
| Oakridge | 3,239 | 3,308 | *0.2%* | 3,278 | 3,344 | 3,320 | *-0.1%* | *0.1%* | *0.0%* |
| Springfield | 61,910 | 67,738 | *0.9%* | 70,278 | 76,443 | 81,677 | *0.4%* | *0.3%* | *0.3%* |
| Veneta | 2,737 | 4,561 | *5.2%* | 4,767 | 6,591 | 8,662 | *0.5%* | *1.3%* | *1.1%* |
| Westfir | 287 | 255 | *-1.2%* | 254 | 272 | 288 | *0.0%* | *0.3%* | *0.2%* |
| Outside UGBs | 63,544 | 63,277 | *0.0%* | 63,023 | 61,930 | 58,707 | *0.0%* | *-0.1%* | *-0.2%* |

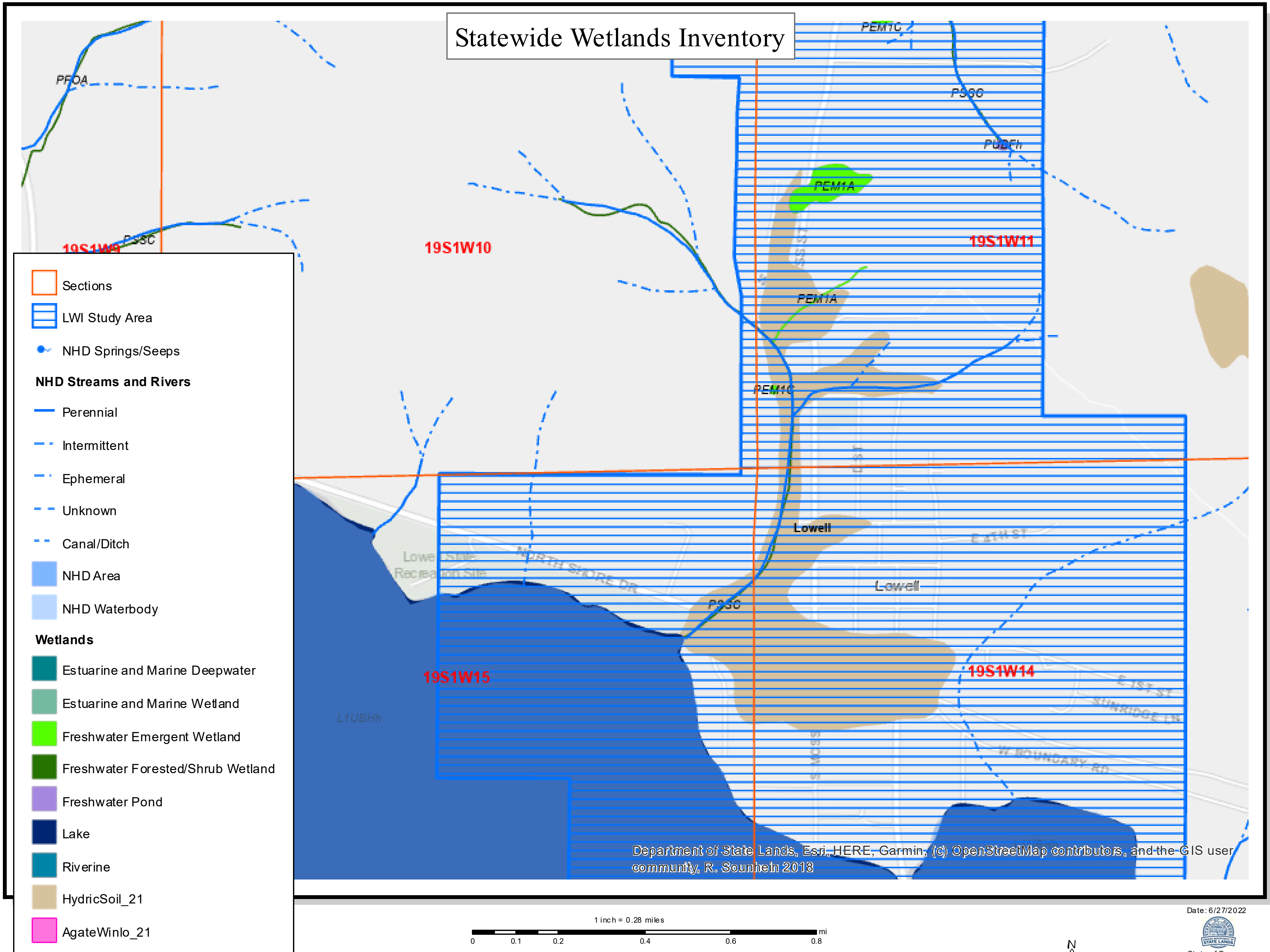
*Sources: U.S. Census Bureau, 2000 and 2010 Censuses; Forecast by Population Research Center (PRC).*

*Note: For simplicity each UGB is referred to by its primary city's name.*

## 3.3.2 Projected Population

According to the 2020 US Census, the population of Lowell was 1,196. Since 2020, there have been several new developments in town that were not accounted for in the PSU estimate. These developments are adding approximately 35 EDUs to the system, which will add approximately 94 persons to the 2020 census number, pushing the population to 1,290. Using the AAGRs (from the table above) beyond this slated bump in population from 2021 onward, the population at the end of this planning period (2045) is projected to be 1,560.

# APPENDIX DAWM
# DEPATMENT OF STATE LANDS
# APPROVED WETLANDS MAP




The Statewide Wetlands Inventory (SWI) represents the best data available at the time this map was published and is updated as new data becomes available. In all cases, actual field conditions determine the presence, absence and boundaries of wetlands and waters (such as creeks and ponds). An onsite investigation by a wetland professional can verify actual field conditions.

https://www.oregon.gov/dsl/WW/Pages/SWI.aspx

Date: 6/27/2022

State of Oregon
Department of State Lands
775 Summer Street, NE, Ste 100
Salem, OR. 97301-1279
(503) 986-5200

# APPENDIX WCM
# WATERCAD MODELING
# FIRE FLOW DATA OUTPUT

| ID | Label | Elevation (ft) | Hydraulic Grade (ft) | Pressure (psi) | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) |
|---|---|---|---|---|---|---|
| 416 | 1 | 724.16 | 949.7 | 98 | 1500 | 1222 |
| 417 | 9 | 728.3 | 949.71 | 96 | 1500 | 1381 |
| 418 | 11 | 730 | 949.71 | 95 | 1500 | 1790 |
| 419 | 13 | 727.17 | 949.72 | 96 | 1500 | 2188 |
| 420 | 16 | 765.93 | 949.71 | 80 | 1500 | 1761 |
| 421 | 22 | 803.61 | 950.46 | 64 | 1500 | 2327 |
| 422 | 23 | 792 | 950.46 | 69 | 1500 | 2395 |
| 423 | 28 | 832.95 | 950.41 | 51 | 1500 | 1597 |
| 424 | 33 | 866.82 | 950.41 | 36 | 1500 | 1471 |
| 425 | 39 | 781.85 | 950.47 | 73 | 1500 | 2557 |
| 426 | 44 | 776.78 | 950.48 | 75 | 1500 | 2655 |
| 427 | 48 | 756 | 950.49 | 84 | 1500 | 2844 |
| 428 | 55 | 769 | 950.5 | 79 | 1500 | 2904 |
| 429 | 56 | 759.13 | 950.48 | 83 | 1500 | 2801 |
| 430 | 58 | 759.38 | 950.5 | 83 | 1500 | 2974 |
| 431 | 60 | 755.82 | 950.59 | 84 | 1500 | 3146 |
| 432 | 64 | 781.3 | 950.55 | 73 | 1500 | 3004 |
| 433 | 65 | 765.77 | 950.58 | 80 | 1500 | 3053 |
| 434 | 70 | 740.78 | 950.49 | 91 | 1500 | 2942 |
| 435 | 80 | 811.11 | 950.72 | 60 | 1500 | 3267 |
| 436 | 82 | 775.25 | 950.83 | 76 | 1500 | 3419 |
| 437 | 88 | 769.18 | 951.24 | 79 | 1500 | 3500 |
| 438 | 94 | 756.04 | 951.66 | 85 | 1500 | 3500 |
| 439 | 97 | 757.96 | 950.87 | 83 | 1500 | 3500 |
| 440 | 99 | 748.19 | 950.64 | 88 | 1500 | 3500 |
| 441 | 106 | 745.61 | 950.54 | 89 | 1500 | 3413 |
| 442 | 112 | 758.7 | 950.71 | 83 | 1500 | 3409 |
| 443 | 120 | 926.57 | 957.95 | 14 | 1500 | 3328 |
| 444 | 122 | 900.95 | 957.92 | 25 | 1500 | 2595 |
| 445 | 128 | 841.35 | 952.27 | 48 | 1500 | 3500 |
| 446 | 129 | 865.41 | 957.91 | 40 | 1500 | 2937 |
| 447 | 133 | 891.12 | 957.92 | 29 | 1500 | 3062 |
| 448 | 139 | 881.68 | 957.92 | 33 | 1500 | 3192 |
| 449 | 149 | 827.13 | 952.21 | 54 | 1500 | 3500 |
| 450 | 151 | 770.36 | 951.91 | 79 | 1500 | 3500 |
| 451 | 156 | 725.5 | 949.86 | 97 | 1500 | 2008 |
| 452 | 161 | 727.48 | 949.87 | 96 | 1500 | 2992 |
| 453 | 162 | 715 | 949.8 | 102 | 1500 | 2599 |
| 454 | 165 | 729.08 | 949.74 | 95 | 1500 | 2712 |
| 455 | 168 | 716.59 | 949.77 | 101 | 1500 | 2703 |
| 456 | 173 | 714.19 | 949.71 | 102 | 1500 | 2630 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 457 | 182 | 738.48 | 949.96 | 91 | 1500 | 3040 |
| 458 | 183 | 732.93 | 949.91 | 94 | 1500 | 2809 |
| 459 | 190 | 740 | 950.05 | 91 | 1500 | 3318 |
| 460 | 195 | 740.57 | 950.01 | 91 | 1500 | 3259 |
| 461 | 199 | 729.43 | 949.84 | 95 | 1500 | 2736 |
| 462 | 201 | 732.43 | 950.01 | 94 | 1500 | 2914 |
| 463 | 203 | 731.3 | 950.02 | 95 | 1500 | 2767 |
| 464 | 204 | 749.19 | 950.11 | 87 | 1500 | 2959 |
| 465 | 210 | 753.82 | 950.11 | 85 | 1500 | 2870 |
| 466 | 212 | 750.38 | 950.24 | 86 | 1500 | 3182 |
| 467 | 216 | 746.03 | 950.58 | 88 | 1500 | 3500 |
| 468 | 219 | 745.09 | 950.4 | 89 | 1500 | 3456 |
| 470 | 227 | 799.1 | 952.09 | 66 | 1500 | 3500 |
| 471 | 230 | 758.57 | 951.97 | 84 | 1500 | 3500 |
| 472 | 233 | 753.22 | 951.87 | 86 | 1500 | 3500 |
| 473 | 236 | 745.03 | 950.05 | 89 | 1500 | 3473 |
| 475 | 361 | 750.87 | 950.49 | 86 | 1500 | 2875 |
| 476 | 437 | 783.16 | 950.64 | 72 | 1500 | 2431 |